PROPOSED NONPARAMETRIC TESTS FOR THE UMBRELLA ALTERNATIVE IN A MIXED DESIGN TESTING FOR LOCATION AND LOCATION-SCALE

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Title

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF PHILOSOPHY

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ABSTRACT

Researchers sometimes use the umbrella alternative when testing for differences in treatment effects, where the parameters increase up to a point and decrease after that point. Sometimes different treatment effects may result in changes to location parameters only, to scale parameters only, or to both. In this study, we considered tests for three distinct scenarios; the tests in each scenario were compared based on estimated power for the different underlying distributions and on different known umbrella peaks that were based on 3, 4, or 5 populations. For all three scenarios, recommendations for which test was better will be given in a variety of cases.

In scenario one, this research investigates existing test statistics proposed by Magel et al. (2010) for detecting umbrella alternatives when the peak is known, and the underlying design consists of a completely randomized design (CRD) and randomized complete block design (RCBD). We investigate the powers of the tests compared to each other when testing for location in this design when the variance of the CRD portion is 2, 4, and 9 times larger than the variance of the RCBD portion. Three underlying distributions, a variety of location shifts, and different ratios between the sample size in the CRD portion compared to the number of blocks in the RCBD portion are considered.

In the second scenario, three nonparametric tests are proposed for a CRD design with k populations to test for the umbrella alternative with known peak, p, for both location and scale parameters. A simulation study was implemented to see if the proposed tests maintained their significance levels. Also, the tests proposed were compared based on estimated powers for sample sizes of 15 and a variety of location and scale shifts.

In the third scenario, we proposed nonparametric test statistics to test for an umbrella pattern testing for location and scale for a mixed design. Powers were estimated for different ratios of sample size in the CRD to the number of blocks in the RCBD and equal variance ratios between a CRD and a RCBD, as well as changes in the location and scale parameters.

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DEDICATION

To my parent's soul, my wife Abeer Alotaibi, and my five children Khalid, Rakan, Rital, Abdulaziz and Wreef.

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CHAPTER 1. INTRODUCTION

Nonparametric methods are generally used in many fields, including biostatistics, business, pharmaceutical statistics, psychology, and social sciences. Nonparametric tests require few assumptions about the underlying populations from which the data are obtained. For many nonparametric tests, it is assumed that the underlying distributions are of the same type, but differ in location or scale only, or possibly both. In our study, we wanted to compare the control population with various levels of treatment populations. It can be assumed that there is one treatment but at various levels and that the treatment may have a good effect up to a point. In that case, we should see increasing effects up to a certain level of the treatment and then decreasing effects. Namely, if the treatment helps at all, may be good up to a point, but could cause harmful effects if it increases too much. So, the expectation is that the treatment effects follow an umbrella alternative if the treatment does help. However, in comparing the control versus various levels of treatment, it is possible that the treatment levels may only result in changes to the location parameters. It is also possible that the treatment may result in changes to the scale parameters or a change to both location and scale parameters.

In this study, we wanted to consider two hypothesis tests: one test for location parameters as in equation (1.1) and one test for location and scale parameters as in equation (1.2). The null hypothesis test for location parameters was:

$$H_0\colon \mu_1 = \mu_2 = \cdots = \mu_k$$

against the alternative

$$H_a\colon \mu_1 \leq \mu_2 \leq \cdots \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq \cdots \geq \mu_k \tag{1.1}$$

with at least one strict inequality, where $\mu_1, \ldots, \mu_k$ are the location parameters of the populations.

The value, p, is called the turning point or the peak of the umbrella. It is believed that on one side of the peak, the parameters are nondecreasing, and on the other side of the peak, the parameters are nonincreasing.

The null hypothesis test for location and scale parameters was:

$$H_0: \mu_1 = \cdots = \mu_k \quad and \quad H_0: \sigma_1 = \cdots = \sigma_k$$

against the alternative umbrella

$$H_a: \mu_1 \leq \mu_2 \leq \cdots \leq \mu_p \geq \cdots \geq \mu_k \; and \; H_a: \sigma_1 \leq \sigma_2 \leq \cdots \leq \sigma_p \geq \cdots \geq \sigma_k \qquad (1.2)$$

with at least one inequality strict, where μ_i and σ_i represent the location and scale parameters, respectively, for i^{th} population. The value, p, is called the turning point or the peak of the umbrella.

1.1. Design Type

The two types of designs were the completely randomized design (CRD) design and a mixed design of the CRD and the randomized complete block design (RCBD).

1.1.1. Scenario One

In the first scenario, the test statistic was testing for location parameters in a mixed design consisting of a CRD and a RCBD; the null and alternative hypothesis was given in (1.1). Our objectives were to extend the work of Magel et al (Magel et al, 2010) to consider cases in which the variance of the CRD is greater than the variance of the RCBD and to ascertain whether the results change as to which test does better as the variance ratio between the CRD and RCBD increases. The test statistics were combinations of the Mack-Wolfe test statistic (Mack-Wolfe, 1981) for a CRD and the Kim-Kim test statistic (Kim-Kim, 1992) for the RCBD. In the case of Magel et al. (2010), all power estimates between the two test statistics were made when the error variance in the RCBD portion was equal to the error variance in the CRD portion. In our research, we wanted to examine the performance of each test when the error variance for the

CRD was larger than the error variance for the RCBD. We considered cases when the ratio of CRD error variance to the RCBD error variance, referred to as CR ratio, was two, four, and nine. Powers were estimated for both tests when the sample size ratio in the CRD portion compared to the number of blocks in the RCBD portion, referred to as SB Ratio, was 1/8, 1/4, 1/3, 1/2, 1, 2, 3, 4, and 8. In all cases in the RCBD portion, we assumed that there was one observation per treatment per block. We assumed equal sample sizes for all treatments in the CRD portion. The SB Ratio was the sample size in CRD to the number of blocks in the RCBD, while the CR Ratio was the CRD portion's variance to the RCBD portion's variance.

1.1.2. Scenario Two

In the second scenario, we developed test statistics for location and scale parameters in a CRD design; the null and alternative hypotheses are given in equation (1.2). We developed tests for these since tests did not exist for these hypotheses under a CRD design as given in equation (1.2). Powers were estimated for three situations. The first situation considered was when the location parameters were different and scale parameters were equal. The second situation considered was when the location parameters were equal and scale parameters were different. The last situation considered was when the location and scale parameters were both different. We estimated the type 1 errors for the tests developed in the second scenario, and we estimated and compare the powers among the three proposed tests.

1.1.3. Scenario Three

In scenario three, test statistics were developed for testing differences in location or scale parameters in a mixed design consisting of a completely randomized design (CRD) and a randomized complete block design (RCBD); the null and alternative hypotheses are given in equation (1.2). We developed tests for these since tests did not exist for this hypothesis under a mixed design of a CRD and a RCBD. The new proposed test statistics were compared on the basis of estimated powers for varies values for the CR ratio (error variances of CRD / error variances of RCBD) and the SB ratio (sample size in CRD to number of blocks in RCBD) under a mixed design of CRD and RCBD. Different types of changes in the parameters were considered to see if these would impact the results as to which test statistics had greater power. Also, the SB Ratio considered were 1/2, 1, 2. A sample size of 12 is used to test for location parameters, and we subsample that into subsamples of three observations per subsample on testing the scale parameters sample sizes. We compared powers when just the location parameters changed, when just the scale parameters changed, and then when both scale and location parameters changed. In all cases in the RCBD portion, we assumed that three observations per treatment per block.

In the following chapters, we present in Chapter 2 the literature review on nonparametric statistics tests for one design and mixed design under a variety of alternative hypotheses. In Chapter 3, we introduce the proposed test statistics under the umbrella hypothesis for known peaks. In Chapter 4, we provide an example to show how the new proposed tests in scenario two are calculated. Details of the simulation study are given in Chapter 5. In Chapter 6, we present the results of the simulation study. Lastly, the conclusion is in Chapter 7.

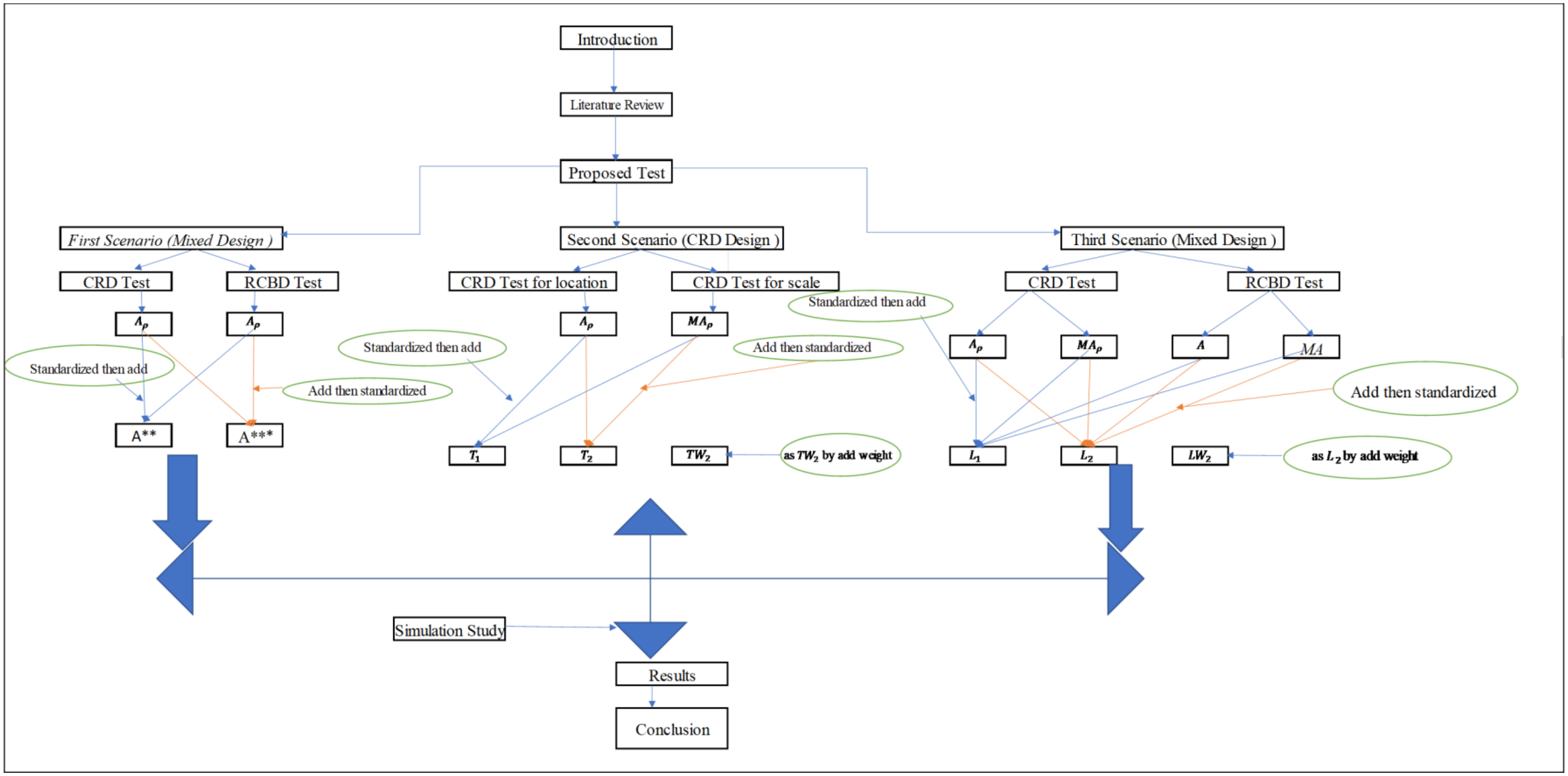

Figure 1.1: Thesis flowchart.

CHAPTER 2. LITERATURE REVIEW

2.1. Tests for Location Based on Independent Samples

2.1.1. Mann-Whitney

The main goal of the Mann-Whitney (MW) test statistic is to test for differences in population location parameters between two treatment effects (Mann-Whitney, 1947). The null and alternative hypothesis are given below:

$$H_0\text{: } \mu_1 = \mu_2 \quad \text{vs} \quad H_1\text{: } \mu_1 \neq \mu_2 \text{ or } \; H_1\text{: } \mu_1 < \mu_2 \; \text{ or } H_1\text{: } \mu_1 > \mu_2,$$

Where, μ_i is the location parameter of the i^{th} population. Let $X_1, .., X_m$ represent a random sample of any m from the first population and let $X_1, .., X_n$ represent a random sample of any n from the second population. This procedure does assume two independent samples. We assume that the two populations differ in location only, if at all.

The U-statistic of Mann-Whitney test statistic can be obtained as follows:

$$U_{12} = \sum_{i=1}^{m} \sum_{j=1}^{n} S(X_i, Y_j) \tag{2.1}$$

$$\text{with } S(X_i, Y_j) = \begin{cases} 1, & if \; X_i < Y_j, \\ 0, & otherwise. \end{cases}$$

The Mann and Whitney test statistic counts the number of the pairs in which the observation from the first sample is smaller.

$$W = U_{12} - \frac{n(n+1)}{2} \tag{2.2}$$

Where:

$$W = \sum_{j=1}^{n} R(Y_j)$$

W is the Wilcoxon (Wilcoxon, 1945) two sample rank sum test statistics and $R(Y_j)$ denotes the rank of Y_j in the joint ranking of $m + n$ X's and Y's. Namely, every observation in the first sample is paired with an observation in the second sample. Under the H_0, the test statistic (W)

has an asymptotic normal distribution with a mean and variance of $\frac{mn}{2}$ and $\frac{mn\,(N+1)}{12}$, respectively, where $N = m + n$.

2.1.2. Fligner-Wolfe

The Fligner and Wolfe test statistic (FW) (Fligner-Wolfe, 1982) is a test to determine if at least one of the treatment location parameters is larger than the control. There are k independent samples with $i = 1$ denoting the control sample and the remaining $2 \leq i \leq k$ indicating treatment samples. The null hypothesis and alternative hypothesis are given below:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k, \text{ versus}$$

$$H_a: \mu_1 \leq [\mu_2, \ldots, \mu_k] \quad \text{with at least one strict inequality.} \tag{2.3}$$

where μ_i is the location parameter if the i^{th} population with $i = 1, 2, \ldots,$ k and k is the total number of populations. Population one is the control ($i = 1$) and the remaining $k - 1$ populations are the combined treatment population.

To compute the FW test statistic as given in equation (2.4), we merge and subsequently rank all the observation from smallest to largest. Letting r_{ij} denote the rank of observation X_{ij} in this joint ranking, where $i = 1, 2, \ldots,$ k, $j = 1, 2, \ldots, n_i$, n_i be the number of observations in each treatment, k be the number of treatments. The Fligner–Wolfe test statistic FW is then the sum of these joint ranks for the noncontrol treatments.

$$T_1 = FW = \sum_{i=2}^{k} \sum_{j=1}^{n_i} r_{ij} \tag{2.4}$$

Under the null distribution, the expected and variance value of FW are outlined below.

$$E(T_1) = E_0(FW) = \frac{n_\text{t}(N+1)}{2} \text{ and } var(T_1) = var_0(FW) = \left\{\frac{n_\text{c} n_\text{t}(N+1)}{12}\right\} \tag{2.5}$$

where, n_c is the number of observations in the control population, and n_t the number of observations in the remaining $k-1$ treatment populations $n_t = N - n_c$. The standardized version of Fligner-Wolfe test FW^* is stated below:

$$FW^* = \frac{FW - E_0(FW)}{\sqrt{var_0(FW)}} \tag{2.6}$$

The null hypothesis is rejected when $FW^* \geq z_\alpha$ at the α level of significance where z_α is the (1-α) 100% of the standard normal distribution.

2.1.3. Jonckheere Terpstra (JT)

Jonckheere and Terpstra (Jonckheere, 1954), (Terpstra, 1952) were among the first nonparametric test used to propose a nondecreasing, ordered alternative for location parameters in the k-sample case where the design is a complete randomized design (CRD). Their test is appropriate to test for nondecreasing effects between the location parameters. The null hypothesis is that all location parameters are equal, and the alternative hypothesis is that all nondecreasing with at least one strict inequality. To use the Jonckheere and Terpstra test, the samples must be independent, it is assumed drawn from a continuous population and the populations differ in location only, if at all.

The null and alternative hypotheses are as follows:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k$$

versus

$$H_a: \mu_1 \leq \mu_2 \leq \cdots \leq \mu_k \qquad \text{with at least one strict inequality,}$$

where μ_i is the location parameter of the i^{th} population.

The Jonckheere and Terpstra test statistic, JT is the sum of these $k(k-1)/2$ Mann-Whitney counts, given in equation (2.7):

$$JT = \sum_{i=1}^{k-1} \sum_{j=i+1}^{k} U_{ij} \tag{2.7}$$

where U_{ij} is the U-statistic of Mann-Whitney, and U_{ij} is defined as the number of pairs of observation (X_{ia}, X_{jb}) in which X_{ia} is less than X_{jb}. Here, X_{ia} is the a^{th} observation in i^{th} treatment sample, a = 1, 2, …, n_i and X_{jb} is the b^{th} observation in j^{th} treatment sample, b = 1, 2, …, n_j . Under the null hypothesis, H_0, the JT statistic follows an asymptotic normal distribution with expected value and variance given in equation (2.8)

$$E_0(JT) = \sum_{i=1}^{k-1} \sum_{j=i+1}^{k} \frac{n_i n_j}{2} = \frac{N^2 - \sum_{i=1}^{k} n_i^2}{4}$$

$$var_0(JT) = \frac{N^2(2N+3) - \sum_{i=1}^{k} n_i^2(2n_i+3)}{72} \tag{2.8}$$

where $N = \sum_{i=1}^{k} n_i$ and where n_i denotes the sample size of the i^{th} treatment, and n_j denotes the sample size of the j^{th} treatment.

The standardized version of the test statistic (JT) is given by

$$Z_{JT} = \frac{JT - E_0(JT)}{\sqrt{var_0(JT)}} \tag{2.9}$$

Z_{JT} has shown an asymptotically standard normal distribution under H_0. The null hypothesis is rejected if $Z_{JT} \geq z_{\propto}$.

2.1.4. Mack-Wolfe

The Mack-Wolfe test statistic was designed for umbrella alternatives as given in (1.1) based on a CRD design (Mack-Wolfe, 1981). Their test is an extension of the Jonckheere-Terpstra test (Jonckheere (1954) and Terpstra (1952)) to test for the umbrella alternative. The umbrella alternative hypothesis with known, p, is given in (1.1). The test statistic, A_p for the case of known peak p, is the sum of Mann-Whitney counts to the left of the peak (Mann-Whitney, 1947) and the reverse Mann-Whitney counts to the right of the peak. Therefore, the test statistic A_p, has the form in equation (2.10).

$$A_p = \sum_{u=1}^{v-1} \sum_{v=2}^{p} U_{uv} + \sum_{u=\mathrm{p}}^{v-1} \sum_{v=p+1}^{k} U_{vu} \tag{2.10}$$

At a significance level of α, we reject H_0 if $A_p \geq A_{p,\alpha}$, where the Mann-Whitney test statistic is U_{vu} . The value, U_{vu}, counts the number of times when the observation in sample v less then observation in the sample u when all sets of paired observation are compared with the first entry coming from v sample and second entry from u sample. The test statistic of Mack-Wolfe (A_p) is approximately normally distributed under H_0 as the number of observations increase. The expected value and variance of A_p are given in equation (2.11):

$$\mathrm{E}_0(\mathrm{A_p}) = \frac{\mathrm{N_1^2 + N_2^2 - \sum_{i=1}^{k} n_i^2 - n_p^2}}{4} \tag{2.11}$$

$$var_0(A_p) = \frac{1}{72}\left\{2(N_1^3 + N_2^3) + 3(N_1^2 + N_2^2) - \sum_{i=1}^{k} n_i^2(2n_i + 3) - n_p^2\big(2n_p + 3\big)\big) + 12n_pN_1N_2 - 12n_p^2N\right\}$$

Where $N_1 = \sum_{i=1}^{p} n_i$,$N_2 = \sum_{i=p}^{k} n_i$, and $N = N_1 + N_2 - n_p$, and n_p= the peak sample size.

Mack-Wolfe used the standardized test statistic A_p^* of the form

$$A_p^* = \frac{A_p - E(A_p)}{\sqrt{Var(A_p)}} \tag{2.12}$$

The null hypothesis is rejected if $A_p^* \geq z_\propto$ where $z_\propto$ is the upper tail value of the standard normal distribution with α probability above this value.

2.2. Tests for Location Based on Dependent Samples

2.2.1. Wilcoxon-Signed

The Wilcoxon Signed Rank (WSR) test (Wilcoxon, 1945) is a nonparametric statistical test that compares two paired groups. The tests essentially calculate the difference between sets of pairs and analyze these differences to establish if they are statistically significantly different from one another. The base assumptions necessary to employ the rank sum test is that the data are from the same population and are paired. The data can be measured on at least an interval scale, and the data were chosen randomly and independently. The null hypothesis and alternative hypothesis are written below:

$$H_0: \mu_D = 0$$

$$H_{a1}: \mu_D \neq 0, H_{a2}: \mu_D < 0, H_{a3}: \mu_D > 0$$

To compute the WSR test, we must first calculate the absolute values of the differences between the paired observations (Namely, either the first minus the second, or the second minus the first). Second, we ordered the absolute differences from smallest to largest and then assign to each rank the sign of the difference. Overall, the WSR test statistic could be the sum of the positive or negative signed ranks. For the two-sided test, we generally take the smallest of those two and reject for small values.

2.2.2. Page

Page's test (denote to as L) (Page, 1963) is a nonparametric test designed to test nondecreasing location parameters in a RCBD. Page's test statistic compares the locations of several treatment groups. The observations comprise n mutually independent blocks of size k. The treatments must follow an ordinal scale pointing in the direction of the alternative hypothesis which is defined prior to the research being implemented. Observations are ranked within each block and the sum of each treatment is computed. Mentioned several assumptions for the validity of this test, including no interaction between blocks and treatments. The hypotheses for the Page test, L, are similar to the hypotheses stated in Jonckheere and Terpstra test where the null hypothesis states that there are no differences among treatments, and the alternative hypothesis state that the treatment affects follow a nondecreasing order with at least one strict inequality. The test statistic is

$$\mathrm{L} = \sum_{j=1}^{k} jR_j \tag{2.13}$$

where, R_j is sum of the ranks received by the j^{th} treatment overall the blocks. Under H_0, the statistic L has an asymptotic normal distribution with mean and variance, $\mathrm{bk}(\mathrm{k}\ +\ 1)^2/4$, $\mathrm{b}(k^3 +\ 1)^2/144(k-1)$, respectively. The standardized version of the statistic L can be defined as

$$\mathrm{Z}_p = \frac{L-[\mathrm{bk}\,(k+1)^2/4]}{\sqrt{b(k^3-k)^2/144(k-1)}} \tag{2.14}$$

where b denotes the number of the blocks and k denotes the number of treatments. Under H_0, the statistic $\mathrm{z}_p$follows an asymptotic standard normal distribution (i.e., N (0,1)) and so the standard normal can be used to obtain the critical values. The null hypothesis is rejected for large values.

2.2.3. Kim-Kim (KK)

The Kim-Kim statistic was proposed in 1992 to test for the umbrella alternative in the RCBD layout with known peak. This statistic is an extension of the Mack-Wolfe test for the CRD. The Kim-Kim test statistic is used on a RCBD with b as blocks and k treatments and assumes no interaction between blocks and treatments. The Kim-Kim test statistic (A) is the sum of the Mack-Wolfe test statistics calculated for each block, and it is given in equation (2.15)

$$A = \sum_{j=1}^{b} A_{jp} \tag{2.15}$$

where, A_{jp} is the Mack-Wolfe test statistic for the j^{th} block. The value b is the number of blocks in the RCBD, p and k are the known treatment peak level and the number of treatments, respectively. Also, A_{ip} can be calculated using equation (2.10) for each block with i= 1, 2, ……., b.

The Kim-Kim (1992) test statistic follows an asymptotic normal distribution when H_0 is true. The mean and variance are given in equation (2.16)

$$E_0(A) = \sum_{j=1}^{b} \left\{ \frac{\left\{N_{j1}^2 + N_{j2}^2 - \sum_{i=1}^{k} n_{ji}^2 - n_{jp}^2\right\}}{4} \right\} \tag{2.16}$$

$$var_0(A) = \frac{1}{72}\sum_{j=1}^{b}\left\{2\left(N_{j1}^3 + N_{j2}^3\right) + 3\left(N_{j1}^2 + N_{j2}^2\right) - \sum_{i=1}^{k} n_{ji}^2\left(2n_{ji} + 3\right) - n_{jp}^2\left(2n_{jp} + 3\right)\right.$$
$$\left. + 12n_{jp}N_{j1}N_{j2} - 12n_{jp}^2 N_j\right\}$$

where, n_{ji} = sample size for i^{th} treatment in j^{th}block, n_{jp} = sample size for p^{th} treatment in j^{th}block, $N_{j1} = \sum_{i=1}^{p} n_{ji}$, $N_{j2} = \sum_{i=p}^{k} n_{ji}$, $N_j = N_{j1} + N_{j2} - n_{jp}$, b is equal to the number of blocks, k is equal to the number of treatments, and p = the known peak. In this research, we consider the case when n_{ji}= 1. The expected value and variance of A when n_{ji}= 1 are given in equation (2.17).

$$E_0(A) = \frac{b\left(p^2 + (k-p+1)^2 - k - 1\right)}{4}$$

and

$$var_0(A) = \frac{b}{72}\begin{bmatrix} 2(p^3 + (k-p+1)^3) + 3(p^2 + (k-p+1)^2) - 5k \\ -5 + 12p(k-p+1) - 12k \end{bmatrix} \tag{2.17}$$

The standardized version of the Kim-Kim test is given in (2.18)

$$A^* = \frac{A - E_0(A)}{\sqrt{var_0(A)}} \tag{2.18}$$

The null hypothesis is rejected when $A^* \geq Z_\alpha$, where Z_α is the upper tail value of a standard normal distribution with α probability above this value.

2.3. Tests for Location Based on a Mixed Design (Independent and Dependent Samples)

2.3.1. Dubnicka, Blair, and Hettmansperger

Dubnicka et al. (Dubnicka et al, 2002) developed a rank-based nonparametric approach to test hypotheses in a mixed, two-sample design. The mixed design was a mixture of paired data and two independent samples. Because the design was a combination of paired data and two independent samples, the Wilcoxon Signed-Rank (WSR) statistic (Wilcoxon, 1945) was applied to the paired data, and the Wilcoxon and Mann-Whitney statistic (Mann-Whitney, 1947) was applied to the independent samples. They proposed test form, T^*, is given in equation (2.19):

$$T^* = WSR + U^+ \tag{2.19}$$

where WSR is the Wilcoxon Signed-Rank statistic and $U^+$is the Mann-Whitney statistic test.

The mean and the variance for their test statistic under the null distribution are as follows:

$$E_0(T^*) = \frac{n(n+1)}{4} + \frac{n_1 n_2}{2}$$

and

$$v_0(T^*) = \frac{n(n+1)(2n+1)}{24} + \frac{n_1 n_2(n_1+n_2+1)}{12} \tag{2.20}$$

The n_1 and n_2 represent sample sizes of the independent samples in the U^+test statistic, and n is the sample size of the paired data within the Wilcoxon Signed-Rank test. It is important to note that the expected value is the sum of the mean for the Wilcoxon Signed-Rank statistic, given by $\frac{n(n+1)}{4}$, and the mean of the Mann-Whitney statistic, $\frac{n_1 n_2}{2}$. Likewise, $\frac{n(n+1)(2n+1)}{24}$ is the variance of the Wilcoxon Signed-Rank statistic while $\frac{n_1 n_2(n_1+n_2+1)}{12}$ is the variance of the Mann-Whitney statistic. The standardized version of Dubnicka et al (2002) is given below:

$$T^+ = \frac{T^* - E_0(T^*)}{\sqrt{var_0(T^*)}} \tag{2.21}$$

T^+ is approximately normally distributed when the null hypothesis is true. We reject the null hypothesis for large values where $T^+ \geq z_\alpha$, and z_α is the upper value of standard normal distribution with α probability above it.

2.3.2. Magel, Tersptra, and Canonizado

Magel et al. (2010) proposed two test statistics for the umbrella alternative mixed design, which consists of a completely randomized design and randomized complete block design. (Magel et al. (2010)) had previously proposed a test for a mixed design, but for the nondecreasing alternative). The null and alternative hypotheses are as in (1.1). The first test, A_p^{**}, given by Magel et al. (2010), consists of the standardized version of the Mack-Wolfe test statistic A_p^* for CRD given in equation (2.12), and the Kim-Kim standardized version test statistic A^* for RCBD given in equation (2.18). A_p^{**} is in equation (2.22):

$$A_p^{**} = A_p^* + A^* \tag{2.22}$$

Under H_0, A_p^{**} will have an asymptotic normal distribution. The expected value and variance of A_p^{**} are given in equations (2.23) and (2.24)

$$E_0\left(A_p^{**}\right) = E_0\left(A_p^*\right) + E_0(A^*) \tag{2.23}$$

and

$$var_0\left(A_p^{**}\right) = var_0\left(A_p^*\right) + var_0(A^*) \tag{2.24}$$

The standardized version of the first proposed test is given by

$$A^{**} = \frac{A_p^{**} - E_0\left(A_p^{**}\right)}{\sqrt{var_0\left(A_p^{**}\right)}} = \frac{A_p^{**} - 0}{\sqrt{2}} \tag{2.25}$$

Under H_0, A^{**} has asymptotic standard normal distribution. The null is rejected for $A^{**} \geq z_\alpha$.

The second test, A_p^{***}, given in Magel et al. (2010) consists of the unstandardized version of the Mack-Wolfe test statistic for a CRD given in equation (2.10), and the Kim-Kim unstandardized version test statistic for a RCBD given in equation (2.15). A_p^{***} is given in equation (2.26)

$$A_p^{***} = A_P + A \tag{2.26}$$

Under H_0, the expected value and variance of A_p^{***} are given in equations (2.27) and (2.28)

$$E_0\left(A_p^{***}\right) = E_0(A_P) + E_0(A) \tag{2.27}$$

and

$$var_0\left(A_p^{***}\right) = var_0(A_P) + var_0(A) \tag{2.28}$$

where, $E_0(A_P)$, $E_0(A), var_0(A_P), and\ var_0(A)$ are the expected values and variances of the Mack-Wolfe (1981) and Kim-Kim (1992) respectively. The standardized version of the second test in Magel et al. (2010) is given in (2.29)

$$A^{***} = \frac{A_p^{***} - E_0\left(A_p^{***}\right)}{\sqrt{var_0\left(A_p^{***}\right)}} \tag{2.29}$$

Under H_0, A^{***} has an asymptotic standard normal distribution. The null hypothesis is rejected for large values. Magel et al. (2010) found the first test statistic A^{**} generally had higher estimated powers. Magel et al. (2010) only considered cases in which the CRD portion was equal to or less than the RCBD portion and when the variance of the CRD portion was equal to the variance of the RCBD portion.

2.3.3. Alnssyan and Magel's

Alnssyan and Magel (Alnssyan-Magel, 2020) introduced two new test statistics to examine the nondecreasing alternative in a mixed design consisting of a CRD portion and an RCBD portion. The authors took random samples from three different types of underlying distributions. They also considered different percentages for the CRD portion and various sample sizes. Estimated powers were based on a sort of location parameter shift. They considered three, four, and five populations. The authors used a variety of situations: when the RCBD portion was larger than, equal to, and smaller than the CRD portion.

In conclusion, when the differences between the last two parameters are large, the two new test statistics performed better. Otherwise, the Magel et al. (2009) test statistics are better. In both cases, it is better to use the combined test statistic that first standardizes the individual statistics for the CRD and RCBD portions before adding them together.

2.3.4. Al-Thubaiti and Magel's

Al-thubaiti and Magel (Al-thubaiti, S., & Magel, R., 2020) proposed test statistics for the umbrella alternative mixed design for RCBD and CRD with the peak known. The authors used a modification of the Mack-Wolfe and Kim-Kim tests to develop the two statistical techniques for the mixed design. Through a simulation study, the proposed test statistics were compared to each other and with an existing test. The null and alternative hypothesis was as follows:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k \text{ treatments effects assumed to be equal}$$

versus

$$H_a: \mu_1 \leq \mu_2 \leq \cdots \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq \cdots \geq \mu_k \text{ with at least one strict inequality,}$$

where $\mu_1, \ldots, \mu_k$ is the location parameters for the i^{th} population.

Al-Thubaiti and Magel added a modification to Magel et al.'s test statistics in order to improve the test's power. The square distance between groups was the utilized modification. The modified Mack-Wolfe test statistic for CRD is as follows:

$$MMW_{pII} = \sum_{i=1}^{p-1} \sum_{j=\mathrm{i}+1}^{p} (j-i)^2 U_{ij} + \sum_{i=1}^{k-1} \sum_{j=i+1}^{k} (j-i)^2 U_{ji} \quad , \qquad (2.30)$$

where U_{ij} is the Mann-Whitney statistic which is applied to observations in the $i^{th}\ and\ \ j^{th}$ groups.

The modified Kim-Kim test statistic for RCBD is the sum of the modified Mack-Wolfe test over blocks, with the peak known, and is given below:

$$MKK = \sum_{s=1}^{b} MMW_{pII}\ . \tag{2.31}$$

The mean and the variance for the modified Mack-Wolfe test are as follows:

$$E_0\left(MMW_{pII}\right) = \frac{n^2}{24}\{\,p^2(p^2-1)+(k-p+1)^2[(k-p+1)^2-1]\}$$

$$var_0\left(MMW_{pII}\right)$$
$$= \frac{n^2p^2(p^2-1)(np+1)+n^2(k-p+1)^2[(k-p+1)^2-1][n(k-p+1)+1]}{144}$$
$$+\frac{n^3p(p-1)(k-p)(k-p+1)}{24} \tag{2.32}$$

The standardized test statistic MMW_{pII}^{*} is given below

$$MMW_{pII}^{*} = \frac{MMW_{pII}-E(MMW_{pII})}{\sqrt{Var(MMW_{pII})}} \tag{2.33}$$

The null hypothesis is rejected if $MMW_{pII}^{*} \geq z_{\propto}$, where $z_{\propto}$ is the critical value of the upper-tail probability for the standard normal distribution.

The mean and variance of the modified Kim-Kim test statistic for the RCBD are given below:

$$E_0(MKK) = \sum_{s=1}^{b} E_0(MMW_{spII}) \tag{2.34}$$

$$Var_0(MKK) = \sum_{s=1}^{b} Var_0(MMW_{spII})$$

The standardized version of MKK is as follows:

$$MKK^{*} = \frac{MKK-E(MKK)}{\sqrt{Var(MKK)}} \tag{2.35}$$

MKK^* has an asymptotic standard normal distribution when H_0 is true. If $MKK^* \geq z_\propto$, we reject H_0 at $\propto$ a significant level.

2.3.4.1. Al-Thubaiti and Magel Test One

Al-thubaiti and Magel first proposed test is the combination of standardized versions of the MMW test statistic and the MKK test statistic, and it is shown in equation (2.36):

$$MD_I = MMW_{pII}^* + MKK^* \tag{2.36}$$

The standardized version of MD_I is given in equation (2.37)

$$MD_I{}^* = \frac{MD_I - 0}{\sqrt{2}} \tag{2.37}$$

Under H_0 , $MD_I{}^*$ has an asymptotic standard normal distribution. If $MD_I{}^* \geq z_\propto$, we reject H_0 at $\propto$a significant level.

2.3.4.2. Al-Thubaiti and Magel Test Two

Al-thubaiti and Magel second proposed test is a combination of modified versions of the Mack-Wolfe and Kim-Kim test statistics, and it is shown in equation (2.38):

$$MD_{II} = MMW_{pII} + MKK \tag{2.38}$$

The mean and the variance of MD_{II} are found as follow

$$E_0(MD_{II}) = E_0(MMW_{pII}) + E_0(MKK)$$

$$Var_0(MD_{II}) = Var_0(MMW_{pII}) + Var_0(MKK)$$

The standardized version of MD_{II} is given in equation (2.39):

$$MD_{II}{}^* = \frac{MD_{II} - E_0(MD_{II})}{\sqrt{Var_0(MD_{II})}} \ . \tag{2.39}$$

Under H_0 , $MD_{II}{}^*$ has an asymptotic standard normal distribution. If $MD_{II}{}^* \geq z_\propto$, we reject H_0 at $\propto$a significant level.

To summarize, the estimated type I error is around 0.05 for the proposed test statistics and the test statistics introduced by Magel et al.(2010). When the distance between the first parameter and the second parameter (peak) is less than or equal to the distance between the second parameter (peak) and the third parameter, the modified test statistics generally have higher powers for all distributions, all sample sizes, and all ratios between the RCBD portion and the CRD portion than the unmodified test statistics which are the tests proposed by Magel et al. The powers are all higher for the modified versions than for the unmodified versions. When the difference between the first parameter and the second parameter (peak) is greater than the distance between the second parameter (peak) and the third parameter, the tests proposed by Magel et al generally have higher powers.

2.3.5. Alsuhabi and Magel's

Alsuhabi and Magel (Alsuhabi, S., & Magel, R, 2020) proposed a test statistic for the umbrella alternative mixed design of RCBD and CRD with the peak known. They developed two test statistics which are a combination of modification of Mack-Wolfe and modification of Kim-Kim tests when the data are mixture of an RCBD and a CRD. The proposed test statistics were compared to each other and with existing tests. The null and alternative hypothesis was as follows:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k \text{ treatment effects assumed to be equal}$$

versus

$$H_a: \mu_1 \leq \mu_2 \leq \cdots \leq \mu_{p-1} \leq \mu_p \geq \mu_{p+1} \geq \cdots \geq \mu_k \text{ with at least one strict inequality,}$$

where $\mu_1, \ldots, \mu_k$ is the location parameters for the i^{th} population.

Alsuhabi and Magel modified an existing test statistic that was proposed by Esra and Fikri (Esra-Fikri, 2016) in order to improve the test's power. The distance between groups was the utilized alteration. The modified Mack-Wolfe test statistic for CRD is given below:

$$mA_p = \sum_{u=1}^{v-1} \sum_{v=2}^{p} (v-u)\, U_{uv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} (u-v) U_{vu} \quad , \qquad (2.40)$$

where U_{uv} is the Mann-Whitney statistic applied to observations in the $u^{th} and\ v^{th}$ groups. The modified Kim-Kim test statistic for RCBD is the sum of the modified Mack-Wolfe test over blocks, with the peak known, and is given below:

$$mA = \sum_{i=1}^{b} mA_{ip}$$

$$mA_{ip} = \sum_{i=1}^{b} \left\{ \sum_{u=1}^{v-1} \sum_{v=2}^{p} (v-u)\, U_{iuv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} (u-v) U_{ivu} \right\} , \qquad (2.41)$$

where mA_{ip} denotes the modified Mack-Wolfe test statistic of the i^{th}block, $(v-u)\ U_{iuv}$ is the weighted Mann and Whitney test statistic applied to the observations in cell (i, u) and (i, v), k is the number of treatments, p is the known peak and the number of blocks is b. At α level of significance, we reject H_0 for the large value of mA. When the sample sizes for each treatment per block are equal to one (n_{11}=⋯=n_{bk}= n = 1) and under the null hypothesis that all population means are equal. The mean and the variance for the modified Mack-Wolfe test are as follows:

$$E_0(mA_p) = \frac{n^2}{2} \left\{ \binom{p+1}{3} + \binom{k-p-1}{3} \right\} \qquad (2.42)$$

$$var_0(mA_p) = \frac{n^2p^2(p^2-1)(np+1) + n^2(k-p+1)^2[(k-p+1)^2-1][n(k-p+1)+1]}{144} + \frac{n^3p(p-1)(k-p)(k-p+1)}{24}$$

The standardized test statistic, mA_p^*, of Modified Mack-Wolfe test the form is given below

$$mA_p^* = \frac{mA_p - E(mA_p)}{\sqrt{Var(mA_p)}} \ . \qquad (2.43)$$

The null hypothesis is rejected if $mA_p^* \geq z_\propto$, where $z_\propto$ is the critical value for the upper-tail probability of the standard normal distribution.

The mean and variance of the modified Kim-Kim test statistic for the RCBD are given below:

$$E_0(mA) = \sum_{i=1}^{b}\{\frac{1}{2}[\binom{p+1}{3} + \binom{k-p-2}{3}]\}$$

$$var_0(mA) = \sum_{i=1}^{b}\{\frac{p^2(p^2-1)(p+1)+(k-p+1)^2[(k-p+1)^2-1][(k-p+1)+1]}{144} + \frac{p(p-1)(k-p)(k-p+1)}{24}\} \quad (2.44)$$

The standardized test statistic, mA^*, of Modified Kim-Kim the form is given below

$$mA^* = \frac{mA-E(mA)}{\sqrt{Var(mA)}} \quad (2.45)$$

The null hypothesis is rejected if $mA^* \geq z_\propto$, where $z_\propto$is the critical value for the upper-tail probability of the standard normal distribution.

The first test of Alsuhabi and Magel is the standardized combined versions of the Modified Mack-Wolfe test statistic and the Modified Kim-Kim test statistic, and it is shown in equation (2.46):

$$mA_p^{**} = mA_p^* + mA^* \quad (2.46)$$

The standardized version of mA_p^{***} is given in equation (2.47):

$$mA^{**} = \frac{mA_p^{**}-0}{\sqrt{2}}\,. \quad (2.47)$$

Under H_0 , the mA^{**} has an asymptotic standard normal distribution. If $mA^{**} \geq z_\propto$we reject H_0 at $\propto$ a significant level.

The second test of Alsuhabi and Magel is the combination of the unstandardized modified versions of the Mack-Wolfe and Kim-Kim test statistics, and it is shown in equation (2.48):

$$mA_p^{***} = mA_p + mA \quad . \tag{2.48}$$

The mean and the variance of mA_p^{***} are as follow:

$$E_0(mA_p^{***}) = E_0(mA_p) + E_0(mA)$$

$$Var_0(mA_p^{***}) = Var_0(mA_p) + Var_0(mA)$$

The standardized version of mA^{***} is given in equation (2.49):

$$mA^{***} = \frac{mA_p^{***} - E_0(mA_p^{***})}{\sqrt{Var_0(mA_p^{***})}} \quad . \tag{2.49}$$

Under H_0 , mA^{***} has an asymptotic standard normal distribution. If $mA^{***} \geq z_{\propto}$, we reject H_0 at $\propto$ a significant level.

Alsuhabi and Magel found that the proposed test in equation (2.47) is generally better than the proposed test in equation (2.49). When the study is comprised of four treatments with a known peak at the second population, the tests were modified by them have more power than Magel et al's in the following situations: there is about the same difference between the peak parameter and the parameters on either side of the peak parameter, or there is a smaller difference between the parameter before the peak and the peak parameter than there is between the parameter after the peak and the peak parameter.

2.3.6. Olet's

Olet (2014) developed test statistics for a simple alternative design in a mixed design that had an RCBD portion and a CRD portion. She conducted the proposed test statistics under five conditions, change the ratio between the RCBD portion and CRD portion. The null and alternative hypothesis was used as given below:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k$$

versus

$$H_a: \mu_1 \leq [\mu_2, \ldots, \mu_k] \qquad \text{(at least one inequality is strict)}$$

The test statistics comprised 1) Olet (2014) first proposed test statistic (Approach I) was the sum of the unstandardized, modified Fligner-Wolfe value (T_1) obtained using equation (2.4), and the unstandardized, modified Page value (T_2) obtained equation (2.13). Olet (2014) first proposed test is given below:

$$L_1 = \frac{T_1 + T_2 - E(T_1 + T_2)}{\sqrt{var(T_1) + var(T_2)}} \tag{2.50}$$

2) Olet (2014) second proposed test statistic (L_2) was the sum of the standardized, modified Fligner-Wolfe value (T_1) obtained using equation (2.6), and the standardized, modified Page value (T_2) obtained equation (2.14). The standardized, modified Fligner-Wolfe test statistics is given by

$$Z_1 = \frac{T_1 - E(T_1)}{\sqrt{var(T_1)}} \tag{2.51}$$

Similarly, Page's standardized, modified test statistics is given by

$$Z_2 = \frac{T_2 - E(T_2)}{\sqrt{var(T_2)}}\ . \tag{2.52}$$

Olet (2014) second proposed test (Approach II), L_2, is given below:

$$L_2 = \frac{Z_1 + Z_2}{\sqrt{2}} \tag{2.53}$$

The asymptotic distribution for the test was used, and the null hypothesis was rejected for a large value, that is, $L_2 \geq z_\propto$, where $z_\propto$ is $(1-\propto)100\%$ of the standard normal distribution. $z_\propto = 1.645$ if the test is performed at the 5% level of significance.

In conclusion, the simulation study results show that standardized first test (Approach II) had the highest powers when the CRD variance was greater than the RCBD variance. Likewise, when the variance of the CRD portion was equal to the variance in the RCBD portion, Approach II exhibited higher power.

2.4. Tests for Variance Based on Independent Samples

2.4.1. Moses

Moses (Moses, 1963) proposed a nonparametric test that was intended to test for the equality of variances in two populations. The null and alternative hypotheses are as follows:

$$H_0: \sigma_1 = \sigma_2 \tag{2.54}$$

$$H_{a1}: \sigma_1 \neq \sigma_2,\ H_{a2}: \sigma_1 < \sigma_2,\ H_{a3}: \sigma_1 > \sigma_2$$

In order to calculate the test statistic for the Moses test, the first and second samples are divided into m_1 and m_2 subsamples of equal size, q. For each of the first m_1 subsets, the sample mean is calculated; the distance between each observation and the sample mean is found and then squared for each of the subsets. These squared values are then added together. The values of $C_1, C_2, \ldots, C_{m1}$ are used to denote the sum of the squared values for each of the m_1 subsets in the first sample. The values of $D_1, D_2, \ldots, D_{m2}$ denote the sum of the squared values for each of the m_2 subsets in the second sample.

Next, the Mann-Whitney test (Mann and Whitney, 1947) is applied. The m_1 C's and the m_2 D's are combined. Following this step, all observations in the combined set are ranked from smallest to largest. The ranks of the observations from the m_2 D's are then added together. The Moses test statistic (M) is this sum and is given in (2.55).

$$M = \sum_{i=1}^{m_2} R(D_i) \tag{2.55}$$

The standardized version of the Moses test is given by

$$M^* = \frac{M - E_0(M)}{\sqrt{var_0(M)}} \quad (2.56)$$

$$E_0(M) = m_2(m_1 + m_2 + 1)/2$$

$$var_0(M) = m_1 m_2(m_1 + m_2 + 1)/12$$

The asymptotic null distribution of M^* is the standard normal distribution.

2.4.2. Ansari-Bradley

The Ansari-Bradley test (Ansari-Bradley, 1960) is a nonparametric test designed to test for equality of variances based on two independent random samples. In calculating the Ansari-Bradley test, all the observations from the two samples will be combined. The combined set of $n_1 + n_2 = N$ observations will be arranged in order from smallest to largest. The ranks will be assigned to the ordered observations as follows:

- The smallest observation and the largest observation will each be given a rank of 1
- The second smallest observation and the second largest observation will each be given a rank of 2

The ordered observations will continue to be ranked in the same way until all observations have been assigned a rank. At this point R_i will be the rank of i^{th} observation in the first sample in the set of ranks. The test statistic Ansari-Bradley (*AB)* is the sum of the ranks of all observations in the first sample:

$$\text{AB} = \sum R_i \quad (2.57)$$

The standardized version of Ansari-Bradley test is:

$$AB^* = \frac{AB - E_0(AB)}{\sqrt{var_0(AB)}} \quad (2.58)$$

If $N = n_1 + n_2$ is an even number:

$$E_0(AB) = \frac{n_1(N+2)}{4}$$

$$var_0(AB) = \left\{\frac{n_1 n_2 (N+2)(N-2)}{48(N-1)}\right\}$$

If $N = n_1 + n_2$ is an odd integer:

$$E_0(AB) = \frac{n_1(N+1)^2}{4N}$$

$$var_0(AB) = \left\{\frac{n_1 n_2 (N+1)(3+N^2)}{48N^2}\right\}$$

The asymptotic null distribution of AB^* is the standard normal distribution.

2.5. Tests for Location and Variance Based on Independent Samples

2.5.1. Lepage's

Lepage's test (Lepage, 1971) is a nonparametric tool that tests for the two-sample location-scale problem. Lepage's aim is to determine if there is a difference for either the location or scale parameters: μ_1 and μ_2, or σ_1 and σ_2. The Lepage's test consists of the Mann-Whitney test (Mann and Whitney, 1947) and the Ansari-Bradley test (Ansari and Bradley, 1960). The Mann-Whitney test is used to detect location changes while the Ansari-Bradley test is utilized to detect scale changes. The null and alternative hypotheses are as follows:

$$H_0: \mu_1 = \mu_2 \text{ and } \sigma_1 = \sigma_2$$

$$H_a: \mu_1 \neq \mu_2 \text{ and/or } \sigma_1 \neq \sigma_2$$

The test statistic for Lepage is given in equation. (2.59):

$$\text{Lepage} = \frac{[(MW - E_0(MW)]^2}{var_0(MW)} + \frac{[(AB - E_0(AB)]^2}{var_0(AB)} = (MW^*)^2 + (AB^*)^2 \quad (2.59)$$

The Lepage test has a chi-square distribution with two degrees of freedom under the null hypothesis. The null hypothesis, H_0, is rejected if Lepage $\geq \chi^2_{2,\alpha}$, where $\chi^2_{2,\alpha}$ is the upper-percentile points of the chi-square distribution with two degrees of freedom.

2.5.2. Alsubie and Magel's

Alsubie and Magel (Alsubie, A., & Magel, R, 2020a), two nonparametric tests were proposed to test the impact when the change in location and scale parameters occurred for the simple tree alternative. The simulation study was executed to specify how well the proposed tests preserve their significance levels. Under various conditions for three and four populations, powers were estimated for the proposed tests. The authors used three different kinds of variable parameters vectors which considered, within each vector, a location and a scale parameter. The first type of parameters vectors had different location parameters and equal scale parameters. The second type had different scale parameters and equal location parameters, and the third type had different location and scale parameters. The null and alternative hypothesis test is given below:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k,$$

$$H_0: \sigma_1 = \sigma_2 = \cdots = \sigma_k, \text{ versus}$$

$$H_a: \mu_1 \leq [\mu_2, \dots, \mu_k] \quad \text{and}$$

$$H_a: \sigma_1 \leq [\sigma_2, \dots, \sigma_k] \text{ (at least one inequality is strict)} \tag{2.60}$$

The Fligner and Wolfe test statistic is as given in equation (2.4), and the expected value and variance of FW under the null distribution are given in equation (2.5).

The standardized Fligner and Wolfe test statistic is given by

$$Z_1 = \frac{T_1 - E(T_1)}{\sqrt{var(T_1)}}. \tag{2.61}$$

Similarly, the (Ansari-Bradley, 1960) AB test statistic is the sum of the ranks for all observations in the control sample:

$$T_2\text{: AB} = \sum R_i \tag{2.62}$$

If N= n_c + n_t is an even number,

$$E(T_2): E_0(AB) = \frac{n_c(N+2)}{4} \tag{2.63}$$

$$var(T_2): var_0(AB) = \left\{\frac{n_c n_t (N+2)(N-2)}{48(N-1)}\right\} \tag{2.64}$$

If $N = n_c + n_t$ is an odd integer,

$$E(T_2): E_0(AB) = \frac{n_c (N+1)^2}{4N} \tag{2.65}$$

$$var(T_2): var_0(AB) = \left\{\frac{n_c n_t (N+1)(3+N^2)}{48N^2}\right\} \tag{2.66}$$

Where, it will be assumed that there is a sample of size n_c from the control population and a sample size n_t of the combined treatment populations.

The standardized, modified Ansari-Bradley test statistic is given by

$$Z_2 = \frac{T_2 - E(T_2)}{\sqrt{var(T_2)}}. \tag{2.67}$$

Alsubie and Magel's first proposed test, L_1, is the sum of the standardized test statistic for two tests. The first test is the Fligner-Wolfe test statistic (T_1), and the second one is the modified Ansari-Bradley test statistic (T_2).

$$L_1 = \frac{Z_1 + Z_2}{\sqrt{2}}. \tag{2.68}$$

Alsubie and Magel's second proposed test is given by

$$L_2 = \frac{T_1 + T_2 - E(T_1 + T_2)}{\sqrt{var(T_1) + var(T_2)}}. \tag{2.69}$$

When the null hypothesis is true, the asymptotic distribution of L_2 is also a standard normal distribution.

The overall conclusion is that L_2 has the highest powers when the change is only for the location parameters. When the change is only with the scale parameters, L_1 has the highest powers. When both the location and scale parameters are different, the test statistic with higher power is depending on the underlying distribution. For both the normal distribution and the t-distribution with three degrees of freedom (symmetric distributions), L_1 has higher power while

L_2 has higher power for the exponential distribution (skewed). If the sampling distribution is assumed to be approximately symmetric, L_1 is recommended to test for both an increasing change in the location and/or scale when treatments are applied. L_1 has lower powers if only the locations (means) are different, but in the other two cases, the power is higher. If the underlying distribution is expected to be relatively skewed, then L_2 is the recommended test statistic to examine both increasing changes with the location and the scale when treatments are applied.

2.5.3. Alsubie and Magel's

Alsubie and Magel (Alsubie, A., & Magel, R., 2020b) proposed three nonparametric tests to examine the change in location and scale parameters for the simple tree alternative. They used a simulation study to specify how well the proposed tests preserve their significance levels. Under a variety of conditions for three and four populations, powers were estimated for the proposed tests. The authors utilized three different kinds of variable parameter vectors that consider a location and a scale parameter within each vector. The first type of parameter vector had different location parameters and equal scale parameters. The second type had different scale parameters and equal location parameters, and the third type had different location and scale parameters. The null and alternative hypothesis was used as given below:

$$H_0: \mu_1 = \mu_2 = \cdots = \mu_k,$$

$$H_0: \sigma_1 = \sigma_2 = \cdots = \sigma_k, \text{ versus}$$

$$H_a: \mu_1 \leq [\mu_2, \ldots, \mu_k] \quad \text{and/or}$$

$$H_a: \sigma_1 \leq [\sigma_2, \ldots, \sigma_k] \text{ (at least one inequality is strict)}$$

The Modified Moses test statistic is given in equation (2.70).

$$T_3: \mathrm{M} = \sum S_i \tag{2.70}$$

The modified Moses test statistic's mean and variance are given by $E(T_3)$ and $var(T_3)$, which is obtained by using equations (2.71).

$$E(T_3): E_0(M) = m_2(m_1 + m_2 + 1)/2$$

$$var(T_3): var_0(M) = m_1 m_2(m_1 + m_2 + 1)/12 \qquad (2.71)$$

The asymptotic null distribution of M^* is the standard normal distribution (Moses, 1963).

The standardized, modified Moses's test statistic is given by

$$Z_3 = \frac{T_3 - E(T_3)}{\sqrt{var(T_3)}}. \qquad (2.72)$$

Alsubie and Magel's first proposed test, M_1, is the sum of the standardized test statistic for two tests. The first test is Fligner and Wolfe test statistic (T_1), and the second one is the modified Moses test statistic (T_3).

$$M_1 = \frac{Z_1 + Z_3}{\sqrt{2}} \qquad (2.73)$$

Alsubie and Magel's second proposed test is given by

$$M_2 = \frac{T_1 + T_3 - E(T_1 + T_3)}{\sqrt{var(T_1) + var(T_3)}}. \qquad (2.74)$$

When the null hypothesis is true, the asymptotic distribution of M_2 is also a standard normal distribution.

Alsubie and Magel's third proposed test is given by

$$M_3 = \frac{T_1 + 3T_3 - E(T_1 + 3T_3)}{\sqrt{var(T_1 + 3T_3)}}. \qquad (2.75)$$

When the null hypothesis is true, the asymptotic distribution of M_3 is also a standard normal distribution.

The overall conclusion is that M_2 has the highest powers when the only change is for the location parameters. When the change is only for the scale parameters, L_1 has the highest powers. When both the location and scale parameters are different, the test statistic with higher powers changes, depending on the underlying distribution. For both the normal distribution and the t-distribution with three degrees of freedom (symmetric distributions), L_1 has higher powers while M_2 has higher powers for the exponential distribution (skewed). If the distribution that one is sampling from is assumed to be approximately symmetric, L_1 is recommended to test for an increasing change in the location and/or scale when treatments are applied. L_1 only has lower powers if the locations (means) are different but do have higher powers in the other two cases. If one expects the underlying distribution to be relatively skewed, then M_2 is the recommended test statistic to measure both increasing changes in the location and scale when the treatments are applied.

CHAPTER 3. PROPOSED TESTS

Our research is divided into three scenarios. In the first scenario, we extend the work of Magel et al. (2010) for the umbrella alternative based on location parameters in a mixed design. In the second scenario, we propose three test statistics to test an umbrella alternative in a complete randomized design (CRD) to test for location and scale parameters. Finally, in the third scenario, we propose three test statistics to test the umbrella alternative in a mixed design of a complete randomized design (CRD) and a randomized complete block design (RCBD) testing for location and scale parameters.

3.1. First Scenario: Case of Umbrella Alternative Mixed Design for Location

Extending the work in Magel et al. (2010), we are investigating the powers of the two tests proposed for umbrella alternatives with peak p known for 3 or more samples in a mixed design (RCBD and CRD) when the variance in the CRD portion is greater than the variance in the RCBD portion. The authors assumed equal variance for both the RCBD and CRD and we considered different CR ratios where the ratios define as the ratio of the error variances in the CRD to the error variance in the RCBD. We defined the SB ratios as the sample size in CRD to the number of blocks in the RCBD and consider different SB ratios. These tests are for location only with the hypotheses given in equation (1.1).

Magel et al (2010) proposed a test statistic, A_p^{**}, as given in equation (2.22), and the standardized version, A^{**} , for that test is given in equation (2.25). Under H_0, A^{**} has an asymptotic standard normal distribution. The null hypothesis is rejected if $A^{**} \geq z_\propto$, where $z_\propto$ is the upper-tail value of the standard normal distribution with $\propto$ probability above it.

The second test statistic Magel et al. (2010) proposed, A_p^{***}, as shown in equation (2.26). The standardized version of that statistic, A^{***} , is given by equation (2.29). where, A_P is the usual Mack-Wolfe (Mack-Wolfe, 1981) test for CRD and A is the Kim-Kim (Kim-Kim ,1992) test for RCBD. Under H_0, the expected value and variance of A_p^{***} are the sum of the means and variances for the Mack-Wolfe and the Kim-Kim tests. Under H_0, A^{***} has an asymptotic standard normal distribution. The null hypothesis is rejected for large values.

3.2. Second Scenario: Case of CRD Design Testing for Location and Scale

Mack-Wolfe (Mack-Wolfe, 1981) proposed nonparametric tests for the umbrella alternative based on simple random samples. These tests were for cases when the peak was known and unknown. In this research, we consider tests for the umbrella alternative for both location and scale parameters together with the peak known. The proposed test statistics are for a CRD design. In developing these tests, we use the Mack-Wolfe test and then use a technique developed by Moses (Moses, 1963) to transform a scale test to a location test on different set of data and use the Mack-Wolfe test again on this new data set.

3.2.1. Moses Mack-Wolfe Test

The Moses Mack-Wolfe test statistic for an umbrella alternative based on simple random samples for testing scale parameters for (CRD) portion that has a null hypothesis as shown in equation (3.1).

$$H_0: \sigma_1 = \sigma_2 = \cdots = \sigma_k$$

The alternative hypothesis is as follows:

$$H_a: \sigma_1 \le \sigma_2 \le \cdots \le \sigma_{p-1} \le \sigma_p \ge \sigma_{p+1} \ge \cdots \ge \sigma_k \qquad (3.1)$$

where at least one inequality is strict and $\sigma_1, \dots, \sigma_k$ are the scale parameters of the i samples, i =1, 2,…,n.

Initial sample sizes of $n_1, n_2, \ldots n_k$ are taken from the k populations. The Moses technique is applied to this data so that a test for scale becomes a test for location by transforming the data. To do so, each treatment sample was randomly divided into m_i subsamples of equal size, q, $i = 1,2,..,k$. For the m_i subsets of each treatment $i = 1,2,..,k$, the sample variance was calculated based on the observations in each of the m_i of the subsets for each treatment. The new data set became the m_1 sample variances based on subgroups from the first treatment sample, the m_2 sample variances based on subgroups from the second treatment sample, etc. The Mack-Wolfe test statistic was calculated based on this transformed set of data.

The Moses Mack-Wolfe test statistic, MA_p, for this case with a known peak, p, was the sum of the Mann-Whitney counts to the left of the peak and the reverse of the Mann-Whitney counts to the right of the peak. Therefore, the test statistic, MA_p, had the following form.

$$MA_p = \sum_{u=1}^{v-1} \sum_{v=2}^{p} U_{uv} + \sum_{u=\mathrm{p}}^{v-1} \sum_{v=p+1}^{k} U_{vu} \tag{3.2}$$

under the null hypothesis where all population variances are equal. The expected value, $E_0\left(MA_p\right)$, and variance, $var_0(MA_p)$, respectively, are given in equation (3.3), and these are derived from the mean and variance formula for the Mack-Wolfe test given in (Mack-Wolfe, 1981).

$$E_0\left(MA_p\right) = \frac{M_1^2 + M_2^2 - \sum_{i=1}^{k} m_i^2 - m_p^2}{4} \tag{3.3}$$

$$var_0(MA_p) = \frac{1}{72}\left\{2(M_1^3 + M_2^3) + 3(M_1^2 + N_2^2) - \sum_{i=1}^{k} m_i^2(2m_i + 3) - m_p^2\left(2m_p + 3\right)\right) + 12m_p M_1 M_2 - 12m_p^2 M\right\}$$

where $M_1 = \sum_{i=1}^{p} m_i$, $M_2 = \sum_{i=p}^{k} m_i$, and $M = \sum_{i=1}^{k} m_i = M_1 + M_2 - m_p$; m_i = the number of subsamples; and m_p= the number of subsamples in the peak.

The Moses Mack-Wolfe test statistic utilizes the standardized test statistic, MA_p^*, with the form in (3.4).

$$MA_p^* = \frac{MA_p - E(MA_p)}{\sqrt{Var(MA_p)}} \tag{3.4}$$

The null hypothesis is rejected if $MA_p^* \geq z_\propto$, where $z_\propto$ is the critical value for the upper-tail probability of the standard normal distribution. We proposed three test statistics to test for the umbrella alternative on location and scale parameters simultaneously in a CRD which use the Mack-Wolfe test and the Moses Mack-Wolfe test.

3.2.2. Proposed Test One

The first proposed test for the hypothesis in (1.2), is given in equation (3.5):

$$Z_1 = A_p^* + MA_p^* \tag{3.5}$$

where A_p^* is the standardized Mack-Wolfe test based on the original data given in equation (2.12), and MA_p^* is the Moses Mack-Wolfe standardized version test of scale as given in equation (3.4). Because MA_p^* and A_p^* have asymptotic standard normal distributions under H_0, the asymptotic distribution of Z_1 is normal with a mean of zero and a variance of 2. Therefore, the first proposed standardized version test, T_1, is given below in equation (3.6):

$$T_1 = \frac{Z_1 - 0}{\sqrt{2}} \tag{3.6}$$

Under H_0, T_1 has an asymptotic standard normal distribution. The null hypothesis is rejected if $T_1 \geq z_\propto$, where $z_\propto$is the upper-tail probability of the standard normal distribution with $\propto$ probability above it.

3.2.3. Proposed Test Two

The second proposed test, Z_2 , for testing the hypotheses in equation (1.2) for a CRD is given in equation (3.7):

$$Z_2 = A_P + MA_P \tag{3.7}$$

where A_P is the Mack-Wolfe test (CRD) for location as given in equation (2.10), and MA_P is the Moses Mack-Wolfe test (CRD) for scale, as shown in equation (3.2). The mean and variance are given in (3.8) and (3.9)

$$E_0(Z_2) = E_0(A_P) + E_0(MA_P) \tag{3.8}$$

and

$$var_0(Z_2) = var_0(A_P) + var_0(MA_P) \tag{3.9}$$

The standardized version of the second proposed test is given in equation (3.10)

$$T_2 = \frac{Z_2 - E_0(Z_2)}{\sqrt{var_0(Z_2)}} \tag{3.10}$$

Under H_0, T_2 has an asymptotic standard normal distribution. The null hypothesis is rejected for large values.

3.2.4. Proposed Test Three

The weighted standardized version of the second proposed test is proposed test three given by (3.11)

$$TW_2 = \frac{(A_P + 3 * MA_P) - E_0(A_P + 3 * MA_P)}{\sqrt{var_0(A_P + 9 * MA_P)}} \tag{3.11}$$

Under H_0, TW_2 has an asymptotic standard normal distribution. The null hypothesis is rejected for large values.

The idea behind proposing this test is that the sample sizes of the Moses Mack-Wolfe test are smaller than the sample sizes of the Mack-Wolfe test and therefore, more weight is applied to the Moses Mack-Wolfe test. In this study, we used subsamples of size 3 in calculating the Moses Mack-Wolfe test and thus, reducing the sample sizes to 1/3 of the sample sizes of the original data.   Hence, a weight of 3 was applied to the Moses Mack-Wolfe test.

3.3. Third Scenario: Case of Umbrella Alternative Mixed Design Testing for Location and Scale

In this scenario, we introduce new tests to test an umbrella alternative mixed design as given in (1.2), at the same time, with the peak known. We consider the three tests for the mixed design of a CRD and RCBD, we assume equal variance between the CRD portion and RCBD portion. We will fist apply the same technique as in Moses to introduce a test for scale parameter for the umbrella alternative by transforming the data and applying a test for location to the transformed data.

3.3.1. Moses Kim-Kim Test

The Moses Kim-Kim test for the umbrella alternative based on simple random samples for testing a scale for (RCBD) portion that has a null hypothesis is shown in equation (3.12):

$$H_0: \sigma_1 = \sigma_2 = \cdots = \sigma_k$$

Verses:

$$H_a: \sigma_1 \leq \sigma_2 \leq \cdots \leq \sigma_{p-1} \leq \sigma_p \geq \sigma_{p+1} \geq \cdots \geq \sigma_k \tag{3.12}$$

where at least one inequality is strict and $\sigma_1, \ldots, \sigma_k$ are the scale parameters of the i samples, i= 1, 2, …, n.

Initial sample sizes of $n_1, \ldots\ldots, n_k$ are taken from the k populations. The Moses technique is applied to this data so that a test for scale becomes a test for location by transforming the data. To do so, each sample in the treatment was divided into m_i subsamples of equal size, q=3, i= 1, 2, …, k. For each m_i subset of each treatment i= 1, 2, …, k, the sample variance was calculated on the observations in each of the m_i subsets for each treatment. The new data set became the m_1 sample variances based on the subgroups from the first treatment sample, the m_2 sample variances based on the subgroups from the second treatment sample, etc. The Kim-Kim test statistic was calculated based on this transformed set data. The Moses Kim-Kim test statistic, MA, for this case with a known peak, p, was the sum of the Mann-Whitney counts to the left of the peak and the reverse of the Mann-Whitney counts to the right of the peak. Therefore, the test statistic, MA, had the following form.

$$MA = \sum_{j=1}^{b} MA_{jp} \tag{3.13}$$

$$MA_{jp} = \left\{ \sum_{u=1}^{v-1} \sum_{v=2}^{p} U_{juv} + \sum_{u=p}^{v-1} \sum_{v=p+1}^{k} U_{jvu} \right\}$$

where, b is the number of blocks in the RCBD, and p and k are the known treatment peak level and the number of treatments, respectively. Also, MA_{jp} denotes the Moses Mack-Wolfe test statistic of the j^{th} block. The U_{juv} and U_{jvu} are the U statistics associated with the j^{th} block. In proposing this test statistic, we assume no interaction between blocks and treatments.

The Moses Kim-Kim test statistic follows an asymptotic normal distribution when H_0 is true, with the mean and variance are derived from the mean and variance formula for the Kim-Kim test given in (Kim-Kim, 1992).

$$E_0(MA) = \sum_{j=1}^{b} \left\{ \frac{\left\{ M_1^2 + M_2^2 - \sum_{i=1}^{k} m_i^2 - m_p^2 \right\}}{4} \right\}$$

$$var_0(MA) = \frac{1}{72}\sum_{j=1}^{b}\left\{2\left(M_{j1}^3 + M_{j2}^3\right) + 3\left(M_{j1}^2 + M_{j2}^2\right) - \sum_{i=1}^{k} m_{ij}^2\left(2m_{ij} + 3\right) - m_{jp}^2\left(2m_{jp} + 3\right)\right.$$

$$\left. + 12m_{jp}M_{j1}M_{j2} - 12m_{jp}^2 M_j\right\}$$

where, $M_1 = \sum_{i=1}^{p} m_i,\ M_2 = \sum_{i=p}^{k} m_i$, $M = M_1 + M_2 - m_p$, $b =$ the number of blocks, $k =$ the number of treatments, $p =$ the known peak, m_i = the number of subsamples, and m_p= the number of subsamples in the peak. When $m_i = 1$, the expected value and the variance are reduced to the form given by

$$E_0(MA) = \frac{b\left(p^2 + (k-p+1)^2 - k - 1\right)}{4} \tag{3.14}$$

and

$$var_0(MA) = \frac{b}{72}[2(p^3 + (k-p+1)^3) + 3(p^2 + (k-p+1)^2) - 5k - 5 + 12p(k-p+1)$$

$$- 12k]$$

When H_0 is true, the standardized version of the Moses Kim-Kim test has an asymptotic standard normal distribution and is given by

$$MA^* = \frac{MA - E_0(MA)}{\sqrt{var_0(MA)}} \tag{3.15}$$

The null hypothesis is rejected when $MA^* \geq z_\propto$, where $z_\propto$ is the upper-tail probability of the standard normal distribution with $\propto$ probability above it.

In this scenario, three statistical tests are proposed to conduct a mixed-design umbrella alternative when the peak (p) is known with a situation of 3 or more samples of mixed design (RCBD and CRD) for the location and scale together.

3.3.2. Proposed Test One

The first test statistic for the hypothesis in (1.2), is given in equation (3.16):

$$TK_1 = A_p^* + MA_p^* + A^* + MA^* \tag{3.16}$$

where A_p^* is the standardized Mack-Wolfe test based on the original data given in equation (2.12), and MA_p^* is the Moses Mack-Wolfe standardized version test of scale as given in equation (3.2). Also, A^* is the standardized Kim-Kim test based on the original data for RCBD given in equation (2.18), and MA^* is the Moses Kim-Kim standardized version test of scale for RCBD as given in equation (3.15). Therefore, the first proposed standardized version test, L_1, is given below in equation (3.17)

$$L_1 = \frac{TK_1 - 0}{\sqrt{4}} \tag{3.17}$$

Under H_0, the L_1 has an asymptotic standard normal distribution. The null hypothesis is rejected if $L_1 \geq z_\propto$, where $z_\propto$ is the critical value for the upper-tail probability of the standard normal distribution. If the test is performed at a 5% level of significance, then $z_\propto = 1.645$.

3.3.3. Proposed Test Two

The second test statistic, TK_2, for testing the hypotheses in equation (1.2) is given in equation (3.18)

$$TK_2 = A_p + MA_p + A + MA \tag{3.18}$$

where, A_P is the Mack-Wolfe test (CRD) for location parameters, as shown in equation (2.10), and MA_P is the Moses Mack-Wolfe test (CRD) for scale as given in equation (3.2). Also, A is the Kim-Kim test statistic (RCBD) for location parameters, as shown in equation (2.15), and MA is the Moses Kim-Kim test statistic (RCBD) for scale as given in equation (3.13). The expected value and variance of TK_2 are the sum of the means and variances for the Mack-Wolfe tests for location, the Moses Mack-Wolfe test for scale, and the Kim-Kim tests for location, and the Moses Kim-Kim test for scale. The mean and variance are given in equations (3.19) and (3.20)

$$E_0(\,TK_2) = E_0(A_P) + E_0(MA_P) + \; E_0(A) + \; E_0(MA) \tag{3.19}$$

and

$$var_0(\,TK_2) = \; var_0(A_P) + var_0(MA_P) + var_0(A) + var_0(MA) \tag{3.20}$$

The standardized version of the second proposed test is given in equation (3.21):

$$L_2 \; = \frac{TK_2 - E_0(\,TK_2)}{\sqrt{var_0(\,TK_3)}} \tag{3.21}$$

Under H_0, L_2 has an asymptotic standard normal distribution. The null hypothesis is rejected for large values, $Z_\propto$.

3.3.4. Proposed Test Three

The weighted standardized version of the second proposed test is the third proposed test and is given in equation (3.22):

$$LW_2 \; = \frac{((A_p + 3*MA_p\,) + (A + 3*MA)) - E_0\big((A_p + 3*MA_p\,)) + (A + 3*MA)\big)}{\sqrt{var_0\big(A_p + 9*MA_p\,\big) + var_0(A + 9*MA)}} \tag{3.22}$$

Under H_0, LW_2 has an asymptotic standard normal distribution. The null hypothesis is rejected for large values, $z_\propto$.

The idea behind proposing this test is that the sample size of the Moses Kim-Kim test is smaller than the sample size of the Kim-Kim test and therefore, more weight is applied to the Moses Kim-Kim test. In order to find Moses Kim-Kim test, the original sample must be divided into subsamples and the sum of the squared deviations found within each subsample. Since subsamples of size 3 were used in this study, the sample size used for the Moses Kim-Kim test was only 1/3 the sample size used for the Kim-Kim test. Hence, a weight of 3 was applied to the Moses Kim-Kim test.

CHAPTER 4. EXAMPLE

4.1. Example: Case of Umbrella Alternative CRD Design for Location and Scale

This example demonstrates how to calculate the test statistics in scenario two to test for location and scale parameters at the same time. Sometimes different treatment effects may result in changes to location parameters only (means), to scale parameters only (variance), or to both location and scale parameters. Part of the data used in this example is taken from the literature in Mack-Wolfe (1981) and the rest of it is generated to explain how to apply the proposed test statistics. In addition, for this example we will make use of the widespread belief that the ability to comprehend ideas and learn is an increasing function of age up to a certain point at which that function then declines with increasing age. Then, suppose researchers would like to test to see if the mean and the variance of the intelligence of adult males in different age ranges (or treatments) does follow an umbrella alternative with turning point at the 20-34 year old group. Namely, the mean and the variance of the intelligence for males is nondecreasing up to this age group and nonincreasing after this age group with at least one strict inequality between the mean and the variance intelligence scores. For this, the researchers used a completely randomized design in the data and randomly assign adults males based on their ages to one of the four age groups. In 4.1, these values are the values taken from random samples of twelve adult males from each of four age groups. We first calculate the test statistic to test for differences in location parameters based on the original data. We next take the same data set and transform the data by using the Moses technique in order to test for differences in scale parameters. 4.1 contains the original data set used to test for differences in location parameters; 4.2 contains the transformed data set to test for differences in scale parameters.

Table 4.1: Wechsler adult intelligence scale score.

		Age Group		
Adult Male	16-19	20-34	35-54	> 55
1	10.26	13.63	12.85	11.25
2	12.86	13.29	13.24	13.24
3	8.75	8.65	8.29	8.13
4	13.03	15.92	14.99	13.05
5	13.11	13.12	13.01	13.01
6	8.23	9.99	9.67	9.67
7	9.58	12.31	11.09	10.31
8	10.28	13.75	12.76	11.75
9	7.51	8.51	7.56	7.50
10	12.36	12.41	12.15	12.15
11	10.50	10.40	9.70	9.60
12	11.26	14.63	13.85	12.25

Table 4.2: The Transform Wechsler adult intelligence scale score.

		Age Group		
Subgroups	16-19	20-34	35-54	> 55
1	4.32	7.74	7.56	6.63
2	7.81	8.80	7.23	3.76
3	2.08	7.33	7.05	4.67
4	1.08	4.48	4.35	2.26

In this example, we supposed that there were twelve adult males participating from each of four age groups. We hypothetically assume that IQ is a function of age, and the average IQ of males is nondecreasing up to age (20-34), and then it is nonincreasing after that point with increasing age. The intelligence of adult males was measured in the four different age ranges for only twelve adult males on the original data, researchers also assume that the variance of the IQ scores of males is nonincreasing up to age 20-34 and then nondecreasing after that age. In order to test for the scale parameter, we first need to transform the original data set using the Moses's technique then apply the Mack-Wolfe to test for scale parameters. To get the transformed dataset as in 4.2 and obtain the Mack-Wolfe test statistic for the scale parameters, the steps are as follows; a) we divided the original data into four subgroups of three observations each; b) then we computed the variance for each subgroup to obtain the transformed dataset (see 4.2); c) we applied the Mack-Wolfe test statistics to the transform dataset to test for scale parameters. To illustrate the calculation of the Moses Mack-Wolfe test statistic, assume the three observations in the first subgroup are 10.26, 12.86, and 8.75 in age group (16-19) from the original data. The variance for that group is equal to 4.32. In the same manner, we obtain the variances for all the subgroups in each age group. We then apply the Mack-Wolfe test statistic on this transformed data set. Suppose the researchers wish to test the following hypothesis:

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 \quad and \quad H_0: \sigma_1 = \sigma_2 = \sigma_3 = \sigma_4$$

$$H_a: \mu_1 \leq \mu_2 \geq \mu_3 \geq \mu_4 \; and \; H_a: \sigma_1 \leq \sigma_2 \geq \sigma_3 \geq \sigma_4 \tag{4.1}$$

with at least one strict inequality. In this case, there are 4 age groups with an assumed peak at 2 if they are different, and equal sample sizes of 12 for each treatment. To test for location parameters, the sample size $n = n_1 = n_2 = n_3 = n_4 = 12$ and the peak is $p = 2$. Also, $N = n + n_1 + n_2 + n_3 + n_4 = 48, N_1 = n_1 + n_2 = 24, N_2 = n_2 + n_3 + n_4 = 36$. Using equation (2.2), the U-test statistic values for testing location are as given: $U_{12} = 103$, $U_{32} = 86$, $U_{42} = 102$, and $U_{43} = 86$. Using equations (2.10), (2.11), and (2.12), the Mack-Wolfe test statistic and its expected and variance values are as followed:

$$A_2 = U_{12} + U_{32} + U_{42} + U_{43} = 377$$

$$E(A_2) = \frac{24^2 + 36^2 - [12^2 + 12^2 + 12^2 + 12^2 + 12^2]}{4} = \frac{1872 - 720}{4} = 288$$

And

$$var(A_2) = \frac{120960+5616- 15552-3888+124416-82944}{72} = \frac{148608}{72} = 2064$$

The standardized Mack-Wolfe test statistic A_2^* of the form

$$A_2^* = \frac{A_2 - E(A_2)}{\sqrt{Var(A_2)}} = \frac{377-288}{45.43} = 1.96$$

To test for scale parameters, the sample sizes are $m = m_1 = m_2 = m_3 = m_4 = 4$ and the peak is $p = 2$. Also, $M = m + m_1 + m_2 + m_3 + m_4 = 16, M_1 = m_1 + m_2 = 8, M_2 = m_2 + m_3 + m_4 = 12$. Using equation (2.2), the U-test statistics value for testing location are as given: $U_{12} = 13$, $U_{32} = 12$, $U_{42} = 14$, and $U_{43} = 14$. Using equations (3.2) and (3.3), the Moses Mack-Wolfe test statistic and its expected and variance values are as follows:

$$MA_2 = U_{12} + U_{32} + U_{42} + U_{43} = 53$$

$$E(MA_2) = \frac{8^2+12^2-[4^2+4^2+4^2+4^2+4^2]}{4} = \frac{208-80}{4} = 32,$$

And

$$var(MA_2) = \frac{4480+624-704-176+4608-3072}{72} = \frac{5760}{72} = 80$$

The standardized Moses Mack-Wolfe test statistic MA_2^* of the form using equations (3.4) as given below:

$$MA_2^* = \frac{MA_2 - E(MA_2)}{\sqrt{Var(MA_2)}} = \frac{53-32}{8.94} = 2.35$$

Using equation (3.5), the value of the first proposed test for the hypothesis in (4.1), is given in equation (4.2):

$$Z_1 = A_2^* + MA_2^* = 1.96 + 2.35 = 4.31 \qquad (4.2)$$

where A_2^* is the standardized Mack-Wolfe test based on the original data, and MA_2^* is the Moses Mack-Wolfe standardized version test of scale. Because MA_2^* and A_2^* have asymptotic standard normal distributions under H_0, the asymptotic distribution of Z_1 is normal with a mean of zero and a variance of 2. Therefore, using equation (3.6), the value of the first proposed standardized version test, T_1, is given below in equation (4.3):

$$T_1 = \frac{Z_1 - 0}{\sqrt{2}} = \frac{4.31 - 0}{\sqrt{2}} = 3.05 \quad (4.3)$$

Under H_0, T_1 has an asymptotic standard normal distribution. The null hypothesis is rejected if $T_1 \geq z_\propto$, where $z_\propto$is the upper-tail probability of the standard normal distribution with $\propto$ probability above it.

Using equation (3.7), the value of the second proposed test, Z_2 , for testing the hypotheses in equation (4.1) for a CRD is given in equation (4.4):

$$Z_2 = A_2 + MA_2 = 377 + 53 = 430 \quad (4.4)$$

Where, A_2 is the Mack-Wolfe test (CRD) for location, and MA_2 is the Moses Mack-Wolfe test (CRD) for scale. The mean and variance using equation (3.8) and (3.9) are given in (4.5) and (4.6)

$$E_0(Z_2) = E_0(A_2) + E_0(MA_2) = 288 + 32 = 320 \quad (4.5)$$

and

$$var_0(Z_2) = var_0(A_2) + var_0(MA_2) = 2064 + 80 = 2144 \quad (4.6)$$

The value of the standardized version of the second proposed test using equation (3.10), is given in equation (4.7)

$$T_2 = \frac{Z_2 - E_0(Z_2)}{\sqrt{var_0(Z_2)}} = \frac{430 - 320}{\sqrt{2144}} = 2.38 \quad (4.7)$$

Under H_0, T_2 has an asymptotic standard normal distribution. The null hypothesis is rejected for large values.

Using equation (3.11), the value of the weighted standardized version of the second proposed test is proposed test three given by (4.8)

$$TW_2 = \frac{(A_2 + 3 * MA_2) - E_0(A_2 + 3 * MA_2)}{\sqrt{var_0(A_2 + 9 * MA_2)}} = \frac{(536) - 384}{\sqrt{2784}} = 2.88 \quad (4.8)$$

Under H_0, TW_2 has an asymptotic standard normal distribution. The null hypothesis is rejected for large values.

In this example, the first proposed test statistic value, Z_1, is 4.31, and the standardized value, T_1, is 3.05 (p-value= 0.001). Moreover, the second proposed test statistic value, Z_2, is 430 and the standardized value, T_2, is 2.38 (p- value=0.009). Lastly, the third proposed test statistic value is 536 and the standardized value, TW_2, is 2.88 (p- value=0.002). Clearly, all proposed test statistics in this example reject the null hypothesis at α = 0:05 level. For this particular example, we can see that first proposed test statistic has the lowest p-value.

CHAPTER 5. DESCRIPTION OF SIMULATION STUDY

5.1. Introduction

A simulation study was conducted to compare the estimated powers of the tests for each of the three scenarios under a variety of conditions. The type one errors were estimated for all the tests to make sure and the significant levels were being maintained. The distribution type is always the same for all populations when evaluating powers, but the parameters are changed. For all three scenarios, powers were estimated when the observations followed three different underlying distributions: normal, exponential and t-distribution with three degrees of freedom. It is assumed that the peak, p, is known and the designs used are CRD design (for scenario 2) and a mixed design consisting of a CRD and an RCBD portion (for scenario 1 and 3). Powers were estimated for three, four, and five populations. For three populations, the peak was assumed to be 2. For four populations, the peaks considered were at the second and third populations. In the case of five populations, the peaks considered were at the second, third and fourth populations. For all simulations, replications of 5,000 sets of samples were used. To begin with, the alpha levels of the tests were estimated for all different situations. The estimated alpha values were compared to the stated alpha value which was always at 0.05 for this study. The alpha values were estimated by counting the number of times the null hypothesis was rejected and then dividing by 5,000. The second part of the simulation study was to compare powers of the test statistics under various conditions. Powers were estimated by counting the number of times the null hypothesis was rejected by each of the tests for a given situation divided by 5,000

5.2. Distribution Consideration

For all three scenarios, we implemented the simulation study in SAS version 9.4, and the observations are assumed to follow three different underlying distributions, as mentioned earlier.

The DO function is used to determine the sample size and the subsample to generate the random sample data. In order to generate data from the normal distribution, exponential distribution, and T-distribution with three degrees of freedom, respectively, the function RAND was used in SAS. This requires the user to state the starting point "seed". This can be done using the Call streaminit function before using the RAND function. The syntax for this function is

Call streaminit (seed)

In this research, seed = 0 is used that instructs RAND to use the system clock. This means each run of the code will produce a different set of data (Bailer, 2010).

5.2.1. Generate a Random Sample when Testing for Different Means Only (for Scenario 1)

The call function for the normal distribution is

$$F=RAND\,(\text{'Normal'},\ \mu,\ \sigma)$$

$$X=F+a$$

where μ and σ are the mean (μ) and the standard deviation (σ), respectively, and a was the change location. In this study, we set initially the values of μ and a to be equal to 0, and the value of σ was set to be 1. We used the above function to generate a single stream of random numbers for samples from a normal distribution. If we wanted to test for a change with the location parameters only, we added the location (a) onto each value in the random sample. For example, if we had a equal to 0.5, then the new mean would be 0.5, and the standard deviation would equal 1.

The call function for the exponential distribution is

$$F=RAND\,(\text{'Exponential'},\mu)$$

$$X=F+a$$

This function generated a random number from an exponential distribution with a mean (μ) and variance (μ^2), and a was the change in location parameter. Initially, we set μ equal to 1 and a equal to 0. If we wanted to change the location parameter only, the value a was added onto each value in the random sample to change the mean (μ). For example, if the mean (μ) was equal 1, then the variance was 1^2. If we added a = 0.5 onto each value, then the new mean would be 1.5, and the variance would equal 1^2.

The call function for the t-distribution is

$$F\text{=}RAND\ (\text{'}T\text{'},\ df)\ +a$$

$$X\text{=}F + a$$

This function generated a random number from a T-distribution, we set the degree of freedom, df, to 3. Initially, the value of mean (μ) and a were equal to 0, and the variance (σ^2) was $\sigma^2 = \frac{df}{df-2}$; a was the change for the location parameter. If we wanted to change the location parameter only, we added a onto each value in the random sample. For example, the mean (μ) was equal to 0, and the standard deviation was equal to σ^2. So, if we added a equal to 0.5 onto each value in the sample; then, the new mean was 0.5, and the standard deviation was σ^2.

5.2.2. Generate a Random Sample when Changing the Mean and Variance (Scenario 2 and 3)

The call function for the standard normal distribution is

$$F\text{=}RAND\ (\text{'}Normal\text{'},\ \mu,\ \sigma)$$

$$X\text{=}F\ {*}b + a$$

The function (F) generated a random number from a normal distribution with the mean (μ) and the standard deviation (σ), respectively, and a and b were the change in the location parameters and the change in the scale parameters. The values of a and b were initially set to 0 and 1, respectively if we wanted to estimate the powers of these tests if just the location parameters changed only, we altered the location (a) onto each value in the random sample and put b to one. if we wanted to estimate the powers of these tests if just the scale parameter changed only, we multiply the b value onto each value in the random sample and put a as zero. if we wanted to estimate the powers of these tests if both the location and scale parameters change, we added onto each value in the random sample by a and multiplied onto each value in the random sample by b at the same time, then the new mean and standard deviation would be $\mu * a$ and $\sigma * b$. For example, if we set a equal to 0.5 and b equal to 1.5, then the new mean would be 0.5, and the new standard deviation would be 1.5.

The call function for the standard exponential distribution is

F=RAND (‘Exponential’, μ*)*

X=F +a

The function (*F*) generated a random number from an exponential distribution. The value a was used to adjust the location and scale parameters appropriately. Initially, the value of a was set to 0. If we wanted to change the location parameter only, the value a was added onto each value in the random sample to change the mean (μ). For example, if the mean (μ) was equal 1, then the variance was 1^2. If we added a = 0.5 onto all the observations, then the new mean would be 1.5, and the variance would equal 1^2. If we change μ, both the mean and the variance change. So, then we had to adjust the mean back to original mean by adding ($-a$). For example, if μ was 1.5, the mean was 1.5, and the variance was $(1.5)^2$. Therefore, we set a = - 0.5; then, the new mean and the new variance were 1 and $(1.5)^2$, respectively. If we change μ and set a equal to zero, then both the mean and the variance change. For example, if μ and a were 3 and zero respectively, the mean was 3, and the variance was $(9)^2$.

The call function for the t-distribution is

$$F=RAND\ ('T',\ 3)$$

$$X=F * b + a$$

This function generated a random number from a T-distribution with 3 degrees of freedom. Initially, the value of mean (μ) and a were equal to 0, and the value of b was 1, respectively. The mean refers as (μ) and the variance (σ^2) was $\sigma^2 = \frac{df}{df-2}$; a and b were the change for the location and scale parameters. If we wanted to change the location parameter only, we added onto the a value onto each value in the random sample and set b equal 1. If we wanted to change only the scale parameter, we multiplied onto each of the values in the random samples by b and set a to zero. If all the values in the random sample were multiplied by b and then a was added, this changed both the location and scale parameters. For example, if we set a equal to 0.5 and b as 2, then the new mean was 0.5, and the variance was $4 * \sigma^2$.

5.3. Power Calculations

5.3.1. First Scenario

Recall that, in the first scenario, a simulation study was conducted to compare the two tests based on estimated powers for differences in means when the variance of the CRD portion was greater than the variance of the RCBD portion. It is assumed that the peak, p, is known and the design used is a mixed design consisting of a CRD and an RCBD portion. We are interested in investigating testing for location in this mixed design case when the variance of the CRD portion is larger than the variance of the RCBD portion. We considered one observation per block per treatment for the RCBD. We defined the CR ratio to be the variance of the CRD portion divided by the variance of the RCBD portion. We considered three different CR proportions of 2, 4, and 9 under three different distributions; standard normal distribution, t-distribution, and exponential distribution. We defined the SB ratio to be the ratio of the sample size in the CRD for each treatment (assuming equal sample sizes) divided by the number of blocks in the RCBD. The SB ratios considered in this study were 1/8,1/4, 1/3, 1/2, 1, 2, 3, 4, 8. The SB ratios were obtained under the following conditions:

1) RCBD portion: Block = 40; CRD portion: n = 5
2) RCBD portion: Block = 40; CRD portion: n = 10
3) RCBD portion: Block = 30; CRD portion: n = 10
4) RCBD portion: Block = 30; CRD portion: n = 15
5) RCBD portion: Block = 10; CRD portion: n = 10
6) RCBD portion: Block = 15; CRD portion: n = 30
7) RCBD portion: Block = 10; CRD portion: n = 30
8) RCBD portion: Block = 10; CRD portion: n = 40
9) RCBD portion: Block = 5; CRD portion: n = 40

5.3.1.1. Location Parameter Configurations Considered

For the proposed tests, the powers were estimated and examined for a variety of location parameter configurations (treatment effects), assuming the three underlying distributions. For all distributions on both a CRD and RCBD, we use the (do function) to specify the random sample from 1 to sample size needed and then generate the data from the underlying distribution by using the RAND function as shown in (5.2) section. We consider unequal variance between the CRD portion and RCBD portion, so we multiply the RAND function by the variance we consider (2, 4, and 9). After we get the generated data values for the CRD portion, we generated the RCBD portion assuming one observation per block per treatment. One test was applied to the CRD portion, and another was applied to the RCBD portion and these tests were combined. In the cases of three, four, and five populations with the peak, p, assumed to be known, power was estimated for the following location parameter configurations $(\mu_1, \mu_2, \ldots, \mu_k)$ were considered as discussed in the following sections.

5.3.1.1.1. Three Populations with Peak at 2

The powers were estimated in the following cases μ_1, μ_2, μ_3):

1.The peak was distinct, and there was equal spacing between parameters. For example (0.0, 0.5, 0.0).

2.The peak was distinct, and there was the unequal spacing between parameters. For example (0.8, 1.0, 0.5).

3.One additional parameter equaled the peak. For example (0.5, 0.5, 0.0) and (0.0, 0.5, 0.5).

5.3.1.1.2. Four Populations with Peak at 2

The powers were estimated in the following cases $(\mu_1, \mu_2, \mu_3, \mu_4)$:

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.5, 0.0, 0.0).

2. The peak was distinct and there was unequal spacing between parameters. For example (0.2, 1.0, 0.8, 0.0).

3. One additional parameter equaled the peak. For example (0.5, 0.5, 0.0, 0.0) and (0.0, 0.5, 0.5, 0.0).

5.3.1.1.3. Four Populations with Peak at 3

The powers were estimated in the following cases $(\mu_1, \mu_2, \mu_3, \mu_4)$:

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.0, 0.5, 0.0).

2. The peak was distinct and there was unequal spacing between parameters. For example (0.5, 0.8, 1.0, 0.2).

3. One additional parameter equaled the peak. For example (0.0, 0.5, 0.5, 0.0) and (0.0, 0.0, 0.5, 0.5).

5.3.1.1.4. Five Populations with Peak at 2

The powers were estimated in the following cases $(\mu_1, \mu_2, \mu_3, \mu_4, \mu_5)$:

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.5, 0.0, 0.0, 0.0).

2. The peak was distinct and there was unequal spacing between parameters. For example (0.4, 1.0, 0.8, 0.5, 0.2).

3. One additional parameter equaled the peak. For example (0.5, 0.5, 0.0, 0.0, 0.0) and (0.0, 0.5, 0.5, 0.0, 0.0).

5.3.1.1.5. Five Populations with Peak at 3

The powers were estimated in the following cases $(\mu_1, \mu_2, \mu_3, \mu_4, \mu_5)$:

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.0, 0.5, 0.0, 0.0).

2. The peak was distinct and there was unequal spacing between parameters. For example (0.2, 0.4, 1.0, 0.8, 0.5).

3. One additional parameter equaled the peak. For example (0.0, 0.5, 0.5, 0.0, 0.0) and (0.0, 0.0, 0.5, 0.5, 0.0).

5.3.1.1.6. Five Populations with Peak at 4

The powers were estimated in the following cases $(\mu_1, \mu_2, \mu_3, \mu_4, \mu_5)$:

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 0.5, 0.0).

2. The peak was distinct and there was unequal spacing between parameters. For example (0.2, 0.5, 0.8, 1.0, 0.4).

3. One additional parameter equaled the peak. For example (0.0, 0.0, 0.5, 0.5, 0.0) and (0.0, 0.0, 0.0, 0.5, 0.5).

5.3.2. Second Scenario

In the second scenario, we introduced three test statistics for the umbrella alternative in a CRD to test for differences in both location and scale parameters with the same known peak. A simulation study conducted comparing these test statistics under a variety of distributions with sample sizes of 15 for all populations. When applying the Moses technique, data was transformed into subsamples of size 3. Power was estimated for three different conditions. First, the location parameters were different, and the scale parameters were equal. Second, the location parameters were equal, and the scale parameters were different. Last, the location and scale parameters were both different. The umbrella alternative hypothesis for testing location and scale was given in (1.2), and we considered k= 3, 4, and 5 populations in our simulation study.

5.3.2.1. Location Parameter Configurations Considered

For the proposed tests statistics, the powers were estimated and examined for a variety of location and scale parameter configurations (treatment effects), assuming a normal, exponential, and T Distribution with three degrees of freedom. Equal samples of size 15 were taken from each of the k populations ($n_1=n_2=\ldots=n_k=n=15$). Five subsets of 3 observations each were randomly formed from the 15 observations from each population, the sample variance of each of the subsets was calculated, and the Mack-Wolfe test was then calculated on these sample variances as well as on the original data. When generating values from any distribution for the CRD portion, we use the (do function) to specify the random sample from 1 to sample size needed and then generated the data from the underlying distribution by using the RAND function as shown on (5.2) section. Power was estimated based on the following location and scale parameter configurations (means and variances) considered as the following ($\mu_1, \mu_2, .., \mu_k$), (σ_1^2, σ_2^2, …,σ_k^2).

5.3.2.1.1. Three Populations with Peak at 2

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and there was equal spacing between parameters among location parameters only. For example (0.0, 1.5, 0.0) and (1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (0.4, 1.8, 0.9) and (1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (1.5, 1.5, 0.0) and (0.0, 1.5, 1.5). (1.0, 1.0, 1.0) and (1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and there was equal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0) and (1.0, 9.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0) and (2.0, 9.0, 4.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0) and (0.0, 0.0, 0.0). (9.0, 9.0, 1.0) and (1.0, 9.0, 9.0).

The powers were estimated in the following case (all treatments have the different location-Scale parameters):

1. The peak was distinct, and there was equal spacing between parameters among location and scale parameters. For example (0.0, 1.5, 0.0) and (1.0, 9.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and scale parameters. For example (0.4, 1.8, 0.9) and (3.0, 9.0, 5.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (1.5, 1.5, 0.0) and (0.0, 1.5, 1.5). (9.0, 9.0, 1.0) and (1.0, 9.0, 9.0).

5.3.2.1.2. Four Populations with Peak at 2

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 1.5, 0.0, 0.0) and (1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (0.3, 1.8, 0.8, 0.5) and (1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (1.5, 1.5, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0). (1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 0.0) and (1.0, 9.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0) and (3.0, 9.0, 8.0, 5.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0). (9.0, 9.0, 1.0, 1.0) and (1.0, 9.0, 9.0, 1.0).

The powers were estimated in the following case (all treatments have the different location-Scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before and after the peak. For example (0.0, 1.5, 0.0, 0.0) and (1.0, 9.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and scale parameters. For example (0.3, 1.8, 0.8, 0.5) and (3.0, 9.0, 8.0, 5.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (1.5, 1.5, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0). (9.0, 9.0, 1.0, 1.0) and (1.0, 9.0, 9.0, 1.0).

5.3.2.1.3. Four Populations with Peak at 3

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.0, 1.5, 0.0) and (1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (0.5, 0.8, 1.8, 0.3) and (1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 1.5, 1.5). (1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 0.0) and (1.0, 1.0, 9.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0) and (5.0, 8.0, 9.0, 3.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0). (1.0, 9.0, 9.0, 1.0) and (1.0, 1.0, 9.0, 9.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before and after the peak. For example (0.0, 0.0, 1.5, 0.0) and (1.0, 1.0, 9.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and scale parameters. For example (0.5, 0.8, 1.8, 0.3) and (5.0, 8.0, 9.0, 3.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 1.5, 1.5). (1.0, 9.0, 9.0, 1.0) and (1.0, 1.0, 9.0, 9.0).

5.3.2.1.4. Five Populations with Peak at 2

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 1.5, 0.0, 0.0, 0.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location parameters only. For example (0.4, 1.8, 0.8, 0.5, 0.3) and (1.0, 1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (1.5, 1.5, 0.0, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0, 0.0). (1.0, 1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (1.0, 9.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (4.0, 9.0, 8.0, 5.0, 3.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0, 0.0). (9.0, 9.0, 1.0, 1.0, 1.0) and (1.0, 9.0, 9.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the different location-Scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before and after the peak. For example (0.0, 1.5, 0.0, 0.0, 0.0) and (1.0, 9.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location and scale parameters. For example (0.4, 1.8, 0.8, 0.5, 0.3) and (4.0, 9.0, 8.0, 5.0, 3.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (1.5, 1.5, 0.0, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0, 0.0). (9.0, 9.0, 1.0, 1.0, 1.0) and (1.0, 9.0, 9.0, 1.0, 1.0).

5.3.2.1.5. Five Populations with Peak at 3

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.0, 1.5, 0.0, 0.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location parameters only. For example (0.3, 0.6, 1.2, 0.8, 0.5) and (1.0, 1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (0.0, 1.5, 1.5, 0.0, 0.0) and (0.0, 0.0, 1.5, 1.5, 0.0). (1.0, 1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (1.0, 1.0, 9.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (3.0, 5.0, 9.0, 8.0, 4.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0, 0.0). (1.0, 9.0, 9.0, 1.0, 1.0) and (1.0, 1.0, 9.0, 9.0, 1.0).

The powers were estimated in the following case (all treatments have the different location-Scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before and after the peak. For example (0.0, 0.0, 1.5, 0.0, 0.0) and (1.0, 1.0, 9.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location and scale parameters. For example (0.3, 0.6, 1.2, 0.8, 0.5) and (3.0, 5.0, 9.0, 8.0, 4.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (0.0, 1.5, 1.5, 0.0, 0.0) and (0.0, 0.0, 1.5, 1.5, 0.0). (1.0, 9.0, 9.0, 1.0, 1.0) and (1.0, 1.0, 9.0, 9.0, 1.0).

5.3.2.1.6. Five Populations with Peak at 4

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 1.5, 0.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location parameters only. For example (0.3, 0.5, 0.8, 1.8, 0.4) and (1.0, 1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (0.0, 0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 0.0, 1.5, 1.5). (1.0, 1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 0.0) and (1.0, 1.0, 1.0, 9.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (4.0, 5.0, 8.0, 9.0, 3.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0, 0.0). (1.0, 1.0, 9.0, 9.0, 1.0) and (1.0, 1.0, 1.0, 9.0, 9.0).

The powers were estimated in the following case (all treatments have the different location-Scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before and after the peak. For example (0.0, 0.0, 0.0, 1.5, 0.0) and (1.0, 1.0, 1.0, 9.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location and scale parameters. For example (0.3, 0.5, 0.8, 1.8, 0.4) and (3.0, 5.0, 8.0, 9.0, 4.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (0.0, 0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 0.0, 1.5, 1.5). (1.0, 1.0, 9.0, 9.0, 1.0) and (1.0, 1.0, 1.0, 9.0, 9.0).

5.3.3. Third Scenario

We proposed three test statistics for the umbrella alternative mixed design with a peak known to test for differences in location and scale parameters for every considered distribution. The interest was in estimating and comparing the powers of the proposed tests. It was assumed three different conditions. First, the location parameters were different, and the scale parameters were equal. Second, the location parameters were equal, and the scale parameters were different. Last, the location and scale parameters were both different. We compared these test statistics under a variety of distributions, with the number of blocks of the RCBD half, equal, and twice sample sizes number of CRD at the size of 12. The hypothesis testing of umbrella alternative mixed design testing for location and scale was given in (1.2), and we considered k= 3, 4, and 5 populations in our simulation study.

5.3.3.1. Location Parameter Configurations Considered

For the proposed tests statistics, the powers were estimated and examined for a variety of location and scale parameter configurations (treatment effects) assuming a normal, exponential, and T-distribution with three degrees of freedom. Equal samples of size 12 were taken from each of the k populations ($n_1=n_2=\ldots=n_k=n=12$). Four subsets of 3 observations each were randomly formed from the 12 observations from each population, the sample variance of each of the subsets was calculated, and the Mack-Wolfe test and the Kim-Kim test were then calculated on these sample variances as well as on the original data. When generating values from any distribution for both a CRD and an RCBD, we use the (do function) to specify the random sample from 1 to sample size needed and then generated the data from the underlying distribution by using the RAND function as shown on (5.2) section. We consider equal variance between the CRD portion and RCBD portion, and we divided the sample size to subsamples with three observations to test for scale. After we get the generated data values for a CRD portion, we considered three observation per block per treatment for an RCBD portion then apply the test that need to be applied. Power was estimated based on the following location and scale parameter configurations (means and variances) considered as the following $(\mu_1, \mu_2, .., \mu_k)$, ($\sigma_1^2$, σ_2^2, …,σ_k^2).

5.3.3.1.1. Three Populations with Peak at 2

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and there was equal spacing between parameters among location parameters only. For example (0.0, 1.5, 0.0), (1.0, 1.0, 1.0).
2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (1.5, 2.0, 1.8), (1.0, 1.0, 1.0).
3. One additional parameter equaled the peak among location parameters only. For example (1.5, 1.5, 0.0) and (0.0, 1.5, 1.5). (1.0, 1.0, 1.0) and (1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and there was equal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0), (1.0, 5.0, 1.0).
2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0), (5.0, 9.0, 8.0).
3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0) and (0.0, 0.0, 0.0). (5.0, 5.0, 1.0), (1.0, 5.0, 5.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and there was equal spacing between parameters among location and scale parameters. For example (0.0, 1.5, 0.0), (1.0, 5.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and scale parameters. For example (1.5, 2.0,1.8), (5.0, 9.0, 8.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (1.5, 1.5, 0.0) and (0.0, 1.5, 1.5). (5.0, 5.0, 1.0), (0.0, 5.0, 5.0).

5.3.3.1.2. Four Populations with Peak at 2

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before the peak and after. For example (0.0, 1.5, 0.0, 0.0), (1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (1.2, 2.0, 1.8, 1.5), (1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (1.5, 1.5, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0). (1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 0.0), (1.0, 5.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0), (2.0, 9.0, 8.0, 5.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0). (5.0, 5.0, 1.0, 1.0) and (1.0, 5.0, 5.0, 1.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before the peak and after. For example (0.0,1.5, 0.0, 0.0), (1.0, 5.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and scale parameters. For example (1.2, 2.0, 1.8, 1.5), (2.0, 9.0, 8.0, 5.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (1.5, 1.5, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0). (5.0, 5.0, 1.0, 1.0) and (1.0, 5.0, 5.0, 1.0).

5.3.3.1.3. Four Populations with Peak at 3

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before the peak and after. For example (0.0, 0.0, 1.5, 0.0), (1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (1.5, 1.8, 2.0, 1.2), (1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 1.5, 1.5). (1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 0.0), (1.0, 1.0, 5.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0), (5.0, 8.0, 9.0, 2.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0). (1.0, 5.0, 5.0, 1.0), (1.0, 1.0, 5.0, 5.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before the peak and after. For example (0.0, 0.0, 1.5, 0.0), (1.0, 1.0, 5.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and/or scale parameters. For example (1.5, 1.8, 2.0, 1.2), (5.0, 8.0, 9.0, 2.0).

3. One additional parameter equaled the peak among location and/or scale parameters. For example (0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 1.5, 1.5). (1.0, 5.0, 5.0, 1.0) and (1.0, 1.0, 5.0, 5.0).

5.3.3.1.4. Five Populations with Peak at 2

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before the peak and after. For example (0.0, 1.5, 0.0, 0.0, 0.0), (1.0, 1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location parameters only. For example (1.4, 2.0, 1.8, 1.5, 1.2), (1.0, 1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (1.5, 1.5, 0.0, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0, 0.0). (1.0, 1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 0.0, 0.0), (1.0, 5.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0), (4.0, 9.0, 8.0, 5.0, 2.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0, 0.0). (5.0, 5.0, 1.0, 1.0, 1.0) and (1.0, 5.0, 5.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before the peak and after. For example (0.0, 1.5, 0.0, 0.0, 0.0), (1.0, 5.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and/or scale parameters, for example (1.4, 2.0, 1.8, 1.5, 1.2), (4.0, 9.0, 8.0, 5.0, 2.0).

3. One additional parameter equaled the peak among location and/or scale parameters, for example (1.5, 1.5, 0.0, 0.0, 0.0) and (0.0, 1.5, 1.5, 0.0, 0.0). (5.0, 5.0, 1.0, 1.0, 1.0) and (1.0, 5.0, 5.0, 1.0, 1.0).

5.3.3.1.5. Five Populations with Peak at 3

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before the peak and after. For example (0.0, 0.0, 1.5, 0.0, 0.0), (1.0, 1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among location parameters only. For example (1.2, 1.5, 2.0, 1.8, 1.4), (1.0, 1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (0.0, 1.5, 1.5, 0.0, 0.0) and (0.0, 0.0, 1.5, 1.5, 0.0). (1.0, 1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the scale parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 0.0, 0.0), (1.0, 1.0, 5.0, 1.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0), (2.0, 5.0, 9.0, 8.0, 5.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0, 0.0). (1.0, 5.0, 5.0, 1.0, 1.0) and (1.0, 1.0, 5.0, 5.0, 1.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before the peak and after. For example (0.0, 0.0, 1.5, 0.0, 0.0), (1.0, 1.0, 5.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and/or scale parameters. For example (1.2, 1.5, 2.0, 1.8, 1.4), (2.0, 5.0, 9.0, 8.0, 5.0).

3. One additional parameter equaled the peak among location and/or scale parameters. For example (0.0, 1.5, 1.5, 0.0, 0.0) and (0.0, 0.0, 1.5, 1.5, 0.0). (1.0, 5.0, 5.0, 1.0, 1.0) and (1.0, 1.0, 5.0, 5.0, 1.0).

5.3.3.1.6. Five Populations with Peak at 4

The powers were estimated in the following case (all treatments have the same scale parameters):

1. The peak was distinct, and the location parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 1.5, 0.0), (1.0, 1.0, 1.0, 1.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location parameters only. For example (1.2, 1.5, 0.8, 1.8, 1.4), (1.0, 1.0, 1.0, 1.0, 1.0).

3. One additional parameter equaled the peak among location parameters only. For example (0.0, 0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 0.0, 1.5, 1.5). (1.0, 1.0, 1.0, 1.0, 1.0) and (1.0, 1.0, 1.0, 1.0, 1.0).

The powers were estimated in the following case (all treatments have the same location parameters):

1. The peak was distinct, and the location parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 0.0), (1.0, 1.0, 1.0, 5.0, 1.0).

2. The peak was distinct, and there was unequal spacing between parameters among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0), (2.0, 5.0, 8.0, 9.0, 4.0).

3. One additional parameter equaled the peak among scale parameters. For example (0.0, 0.0, 0.0, 0.0, 0.0) and (0.0, 0.0, 0.0, 0.0, 0.0). (1.0, 1.0, 5.0, 5.0, 1.0) and (1.0, 1.0, 1.0, 5.0, 5.0).

The powers were estimated in the following case (all treatments have the different location and scale parameters):

1. The peak was distinct, and the location and scale parameters were equal before the peak and after. For example (0.0, 0.0, 0.0, 1.5, 0.0), (1.0, 1.0, 1.0, 5.0, 1.0).

2. The peak was distinct, and there was the unequal spacing between parameters among location and scale parameters. For example (1.2, 1.5, 0.8, 1.8, 1.4), (2.0, 5.0, 8.0, 9.0, 4.0).

3. One additional parameter equaled the peak among location and scale parameters. For example (0.0, 0.0, 1.5, 1.5, 0.0) and (0.0, 0.0, 0.0, 1.5, 1.5). (1.0, 1.0, 5.0, 5.0, 1.0) and (1.0, 1.0, 1.0, 5.0, 5.0).

CHAPTER 6. RESULTS

In this chapter, the simulation study, as defined in the previous Chapter, compared the estimated rejection percentages of the tests' statistics within each of the following three scenarios, as shown below in Tables 6.1.1 – 6.3.54. The distributions we used were normal distribution, t-distribution with 3 degrees of freedom, and exponential distribution. This chapter is divided to three parts.

6.1. First Scenario Results

The results were separated by the CR ratio in the first scenario. The SB Ratio was the sample size in CRD to the number of blocks in the RCBD, while the CR Ratio was the variance of the CRD portion to the variance of the RCBD portion.

6.1.1. Three Treatment Results

Under the three distributions, when the SB ratio is equal to 1/8, 1/4 1/3, 1/2, 1, 2, 3, and 4, and the CR ratio is equal to 2,4, and 9, A^{**} has higher powers than A^{***} as presented in Tables 6.1.1-6.1.24. However, when the SB ratio is equal to 8, and the CR ratio is equal to 2 or greater A^{***} has slightly higher powers than A^{**} for the normal and exponential distributions as shown in Tables 6.1.25-6.1.27. The test statistics have about the same powers for the normal distribution. These results are in contrast to Magel et al.'s (2010) results, which had the A^{**} better than the A^{***} in all situations.

Table 6.1.1: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0494	0.0576
0	0.5	0	0.7016	0.6236
0	0.5	0.5	0.2902	0.2610
0.5	0.5	0	0.2794	0.2508
0.8	1	0.5	0.4418	0.3876

*SB ratio= 1/8, CR ratio= 2

Table 6.1.2: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0580	0.0590
0	0.5	0	0.4774	0.4046
0	0.5	0.5	0.1910	0.1708
0.5	0.5	0	0.1946	0.1766
0.8	1	0.5	0.2964	0.2526

*SB ratio= 1/8, CR ratio= 2

Table 6.1.3: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0524	0.0534
0	0.5	0	0.8320	0.7786
0	0.5	0.5	0.3430	0.3152
0.5	0.5	0	0.3474	0.3152
0.8	1	0.5	0.5742	0.5316

*SB ratio= 1/8, CR ratio= 2

Table 6.1.4: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0476	0.0482
0	0.5	0	0.7786	0.5098
0	0.5	0.5	0.3226	0.2084
0.5	0.5	0	0.3264	0.2048
0.8	1	0.5	0.5212	0.3176

*SB ratio= 1/4, CR ratio= 2

Table 6.1.5: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0474	0.0516
0	0.5	0	0.5498	0.2984
0	0.5	0.5	0.2268	0.1436
0.5	0.5	0	0.2242	0.1336
0.8	1	0.5	0.3354	0.1882

*SB ratio= 1/4, CR ratio= 2

Table 6.1.6: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0486	0.0502
0	0.5	0	0.9432	0.6412
0	0.5	0.5	0.4604	0.2386
0.5	0.5	0	0.4638	0.2404
0.8	1	0.5	0.7526	0.4130

*SB ratio= 1/4, CR ratio= 2

Table 6.1.7: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0502	0.0466
0	0.5	0	0.7030	0.4560
0	0.5	0.5	0.2920	0.1932
0.5	0.5	0	0.2790	0.1832
0.8	1	0.5	0.4618	0.2938

*SB ratio= 1/3, CR ratio= 2

Table 6.1.8: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0524	0.0484
0	0.5	0	0.4866	0.2556
0	0.5	0.5	0.1922	0.1246
0.5	0.5	0	0.1940	0.1184
0.8	1	0.5	0.2918	0.1678

*SB ratio= 1/3, CR ratio= 2

Table 6.1.9: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0442	0.0430
0	0.5	0	0.9082	0.5774
0	0.5	0.5	0.4024	0.2158
0.5	0.5	0	0.4154	0.2186
0.8	1	0.5	0.6682	0.3490

*SB ratio= 1/3, CR ratio= 2

Table 6.1.10: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0482	0.0482
0	0.5	0	0.7804	0.5338
0	0.5	0.5	0.3212	0.2150
0.5	0.5	0	0.3146	0.2060
0.8	1	0.5	0.5076	0.3164

*SB ratio= 1/2, CR ratio= 2

Table 6.1.11: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0472	0.0458
0	0.5	0	0.5256	0.2760
0	0.5	0.5	0.2102	0.1280
0.5	0.5	0	0.2068	0.1208
0.8	1	0.5	0.3228	0.1834

*SB ratio= 1/2, CR ratio= 2

Table 6.1.12: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0440	0.0514
0	0.5	0	0.9364	0.6166
0	0.5	0.5	0.4444	0.2314
0.5	0.5	0	0.4376	0.2330
0.8	1	0.5	0.7188	0.3828

*SB ratio= 1/2, CR ratio= 2

Table 6.1.13: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0496	0.0494
0	0.5	0	0.5022	0.3878
0	0.5	0.5	0.1972	0.1606
0.5	0.5	0	0.2012	0.1660
0.8	1	0.5	0.3052	0.2530

*SB ratio= 1, CR ratio= 2

Table 6.1.14: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0490	0.0484
0	0.5	0	0.2894	0.1944
0	0.5	0.5	0.1328	0.1038
0.5	0.5	0	0.1388	0.1172
0.8	1	0.5	0.1992	0.1436

*SB ratio= 1, CR ratio= 2

Table 6.1.15: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0482	0.0504
0	0.5	0	0.6786	0.6182
0	0.5	0.5	0.2512	0.2208
0.5	0.5	0	0.2498	0.2180
0.8	1	0.5	0.4326	0.2784

*SB ratio= 1, CR ratio= 2

Table 6.1.16: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0462	0.0518
0	0.5	0	0.8016	0.7076
0	0.5	0.5	0.3182	0.2796
0.5	0.5	0	0.3338	0.2820
0.8	1	0.5	0.5206	0.4428

*SB ratio= 2, CR ratio= 2

Table 6.1.17: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under T (3) *sqrt (2) for Both Mixed design*.:

MU1	MU2	MU 3	A**	A***
0	0	0	0.0484	0.0514
0	0.5	0	0.4926	0.3548
0	0.5	0.5	0.2016	0.1502
0.5	0.5	0	0.1988	0.1550
0.8	1	0.5	0.3102	0.2286

*SB ratio= 2, CR ratio= 2

Table 6.1.18: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0482	0.0464
0	0.5	0	0.9282	0.7840
0	0.5	0.5	0.4274	0.3096
0.5	0.5	0	0.4290	0.3128
0.8	1	0.5	0.7012	0.5268

*SB ratio= 2, CR ratio= 2

Table 6.1.19: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0476	0.0518
0	0.5	0	0.7302	0.6944
0	0.5	0.5	0.3082	0.2830
0.5	0.5	0	0.3064	0.2930
0.8	1	0.5	0.4818	0.4556

*SB ratio= 3, CR ratio= 2

Table 6.1.20: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0474	0.0512
0	0.5	0	0.4460	0.3526
0	0.5	0.5	0.1738	0.1518
0.5	0.5	0	0.1822	0.1506
0.8	1	0.5	0.2784	0.2246

*SB ratio= 3, CR ratio= 2

Table 6.1.21: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0488	0.0520
0	0.5	0	0.9318	0.9470
0	0.5	0.5	0.4386	0.4562
0.5	0.5	0	0.4326	0.4572
0.8	1	0.5	0.7238	0.7544

*SB ratio= 3, CR ratio= 2

Table 6.1.22: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0516	0.0492
0	0.5	0	0.8214	0.8150
0	0.5	0.5	0.3544	0.3444
0.5	0.5	0	0.3404	0.3456
0.8	1	0.5	0.5492	0.5360

*SB ratio= 4, CR ratio= 2

Table 6.1.23: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0522	0.0502
0	0.5	0	0.3150	0.2684
0	0.5	0.5	0.1348	0.1400
0.5	0.5	0	0.1462	0.1278
0.8	1	0.5	0.1986	0.1754

*SB ratio= 4, CR ratio= 2

Table 6.1.24: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0468	0.0478
0	0.5	0	0.9356	0.8850
0	0.5	0.5	0.4332	0.3766
0.5	0.5	0	0.4294	0.3782
0.8	1	0.5	0.7094	0.6326

*SB ratio= 4, CR ratio= 2

Table 6.1.25: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0488	0.0526
0	0.5	0	0.7424	0.7942
0	0.5	0.5	0.3168	0.3396
0.5	0.5	0	0.3040	0.3382
0.8	1	0.5	0.4904	0.5550

*SB ratio= 8, CR ratio= 2

Table 6.1.26: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0504	0.0456
0	0.5	0	0.4266	0.4230
0	0.5	0.5	0.1762	0.1744
0.5	0.5	0	0.1726	0.1612
0.8	1	0.5	0.2654	0.2646

*SB ratio= 8, CR ratio= 2

Table 6.1.27: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0534	0.0502
0	0.5	0	0.8746	0.8776
0	0.5	0.5	0.3584	0.3676
0.5	0.5	0	0.3710	0.3822
0.8	1	0.5	0.6188	0.6270

*SB ratio= 8, CR ratio= 2

6.1.2. Four Treatment Results

6.1.2.1. Treatment Four Peak 2 Result

Under the three distributions, when the SB ratio is equal to 1/8, 1/4 1/3, 1/2, 1, 2, 3, and 4, and the CR ratio is equal to 2,4, and 9, A^{**} has higher powers than A^{***} as presented in Tables 6.1.28-6.1.51. However, when the SB ratio is equal to 8, and the CR ratio is equal to 2 or greater A^{***} has slightly higher powers than A^{**} for the normal and exponential distributions as shown in Tables 6.1.52-6.1.54. The test statistics have about the same powers for the normal distribution. These results are in contrast to Magel et al.'s (2010) results, which had the A^{**} better than the A^{***} in all situations.

Table 6.1.28: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0532	0.0488
0	0.5	0	0	0.6804	0.5780
0	0.5	0.5	0	0.6870	0.5756
0.5	0.5	0	0	0.4146	0.3368
0.2	1	0.8	0.5	0.8234	0.7278

*SB ratio= 1/8, CR ratio= 2

Table 6.1.29: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0510	0.0500
0	0.5	0	0	0.4748	0.3662
0	0.5	0.5	0	0.5312	0.2836
0.5	0.5	0	0	0.2766	0.2182
0.2	1	0.8	0.5	0.5980	0.4786

*SB ratio= 1/8, CR ratio= 2

Table 6.1.30: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0550	0.0522
0	0.5	0	0	0.9036	0.7936
0	0.5	0.5	0	0.8820	0.7656
0.5	0.5	0	0	0.6004	0.4690
0.2	1	0.8	0.5	0.9666	0.8948

*SB ratio= 1/8, CR ratio= 2

Table 6.1.31: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0520	0.0474
0	0.5	0	0	0.7716	0.5134
0	0.5	0.5	0	0.7682	0.4966
0.5	0.5	0	0	0.4874	0.2976
0.8	1	0.5	0.5	0.8836	0.6274

*SB ratio= 1/4, CR ratio= 2

Table 6.1.32: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0498	0.0480
0	0.5	0	0	0.5214	0.2806
0	0.5	0.5	0	0.4872	0.3838
0.5	0.5	0	0	0.3118	0.1736
0.2	1	0.8	0.5	0.6674	0.3456

*SB ratio= 1/4, CR ratio= 2

Table 6.1.33: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0544
0	0.5	0	0	0.9476	0.6282
0	0.5	0.5	0	0.9374	0.6320
0.5	0.5	0	0	0.6668	0.3364
0.2	1	0.8	0.5	0.9866	0.7562

*SB ratio= 1/4, CR ratio= 2

Table 6.1.34: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0434	0.0480
0	0.5	0	0	0.7092	0.4630
0	0.5	0.5	0	0.7036	0.4452
0.5	0.5	0	0	0.4198	0.2560
0.2	1	0.8	0.5	0.8314	0.5818

*SB ratio= 1/3, CR ratio= 2

Table 6.1.35: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0486	0.0500
0	0.5	0	0	0.5260	0.2718
0	0.5	0.5	0	0.5082	0.2630
0.5	0.5	0	0	0.2820	0.1618
0.2	1	0.8	0.5	0.6526	0.3382

*SB ratio= 1/3, CR ratio= 2

Table 6.1.36: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0460	0.0466
0	0.5	0	0	0.9080	0.5630
0	0.5	0.5	0	0.8848	0.5464
0.5	0.5	0	0	0.5998	0.3052
0.2	1	0.8	0.5	0.9662	0.6834

*SB ratio= 1/3, CR ratio= 2

Table 6.1.37: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0488	0.0458
0	0.5	0	0	0.7732	0.5158
0	0.5	0.5	0	0.7712	0.5158
0.5	0.5	0	0	0.4698	0.2890
0.2	1	0.8	0.5	0.8834	0.6452

*SB ratio= 1/2, CR ratio= 2

Table 6.1.38: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0502	0.0504
0	0.5	0	0	0.5522	0.2838
0	0.5	0.5	0	0.5422	0.2876
0.5	0.5	0	0	0.3166	0.1758
0.2	1	0.8	0.5	0.6874	0.3684

*SB ratio= 1/2, CR ratio= 2

Table 6.1.39: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0488	0.0492
0	0.5	0	0	0.9376	0.6088
0	0.5	0.5	0	0.9226	0.5996
0.5	0.5	0	0	0.6410	0.3366
0.2	1	0.8	0.5	0.9816	0.7378

*SB ratio= 1/2, CR ratio= 2

Table 6.1.40: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0430	0.0434
0	0.5	0	0	0.4918	0.3800
0	0.5	0.5	0	0.4880	0.3660
0.5	0.5	0	0	0.2746	0.2084
0.2	1	0.8	0.5	0.6128	0.4654

*SB ratio= 1, CR ratio= 2

Table 6.1.41: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0566	0.0548
0	0.5	0	0	0.2956	0.1882
0	0.5	0.5	0	0.3086	0.1942
0.5	0.5	0	0	0.1746	0.1266
0.2	1	0.8	0.5	0.3666	0.2366

*SB ratio= 1, CR ratio= 2

Table 6.1.42: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0544	0.0528
0	0.5	0	0	0.6618	0.4136
0	0.5	0.5	0	0.6498	0.4348
0.5	0.5	0	0	0.3650	0.2316
0.2	1	0.8	0.5	0.7920	0.5356

*SB ratio= 1, CR ratio= 2

Table 6.1.43: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0480	0.0462
0	0.5	0	0	0.7914	0.6896
0	0.5	0.5	0	0.7892	0.6930
0.5	0.5	0	0	0.4800	0.4132
0.2	1	0.8	0.5	0.8896	0.8156

*SB ratio= 2, CR ratio= 2

Table 6.1.44: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0534	0.0514
0	0.5	0	0	0.4884	0.3424
0	0.5	0.5	0	0.4756	0.3340
0.5	0.5	0	0	0.2844	0.2012
0.2	1	0.8	0.5	0.6266	0.4478

*SB ratio= 2, CR ratio= 2

Table 6.1.45: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0482	0.0474
0	0.5	0	0	0.9276	0.7848
0	0.5	0.5	0	0.9060	0.7596
0.5	0.5	0	0	0.6204	0.4454
0.2	1	0.8	0.5	0.9746	0.8788

*SB ratio= 2, CR ratio= 2

Table 6.1.46: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0506	0.0428
0.5	0.5	0	0	0.4430	0.4074
0	0.5	0	0	0.7372	0.7016
0.2	1	0.8	0.5	0.8590	0.8226
0	0.5	0.5	0	0.7334	0.6932

*SB ratio= 3, CR ratio= 2

Table 6.1.47: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0514	0.0514
0	0.5	0	0	0.4364	0.3396
0	0.5	0.5	0	0.4436	0.3548
0.5	0.5	0	0	0.2534	0.2076
0.2	1	0.8	0.5	0.5522	0.4526

*SB ratio= 3, CR ratio= 2

Table 6.1.48: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0480	0.0500
0	0.5	0	0	0.8824	0.7724
0	0.5	0.5	0	0.8536	0.7446
0.5	0.5	0	0	0.5598	0.4512
0.2	1	0.8	0.5	0.9584	0.8886

*SB ratio= 3, CR ratio= 2

Table 6.1.49: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0488	0.0452
0	0.5	0	0	0.8012	0.7950
0	0.5	0.5	0	0.8124	0.8088
0.5	0.5	0	0	0.4960	0.4884
0.2	1	0.8	0.5	0.9074	0.9014

*SB ratio= 4, CR ratio= 2

Table 6.1.50: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0450	0.0454
0	0.5	0	0	0.4168	0.4146
0	0.5	0.5	0	0.4238	0.4148
0.5	0.5	0	0	0.2396	0.2362
0.2	1	0.8	0.5	0.5312	0.5062

*SB ratio= 4, CR ratio= 2

Table 6.1.51: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0448	0.0514
0	0.5	0	0	0.9314	0.8660
0	0.5	0.5	0	0.9110	0.8540
0.5	0.5	0	0	0.6218	0.5410
0.2	1	0.8	0.5	0.9772	0.9430

*SB ratio= 4, CR ratio= 2

Table 6.1.52: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0488
0	0.5	0	0	0.7384	0.8004
0	0.5	0.5	0	0.7308	0.7874
0.5	0.5	0	0	0.4416	0.4834
0.2	1	0.8	0.5	0.8522	0.8988

*SB ratio= 8, CR ratio= 2

Table 6.1.53: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0518	0.0502
0	0.5	0	0	0.4972	0.4104
0	0.5	0.5	0	0.4938	0.4166
0.5	0.5	0	0	0.2986	0.2510
0.2	1	0.8	0.5	0.6222	0.5256

*SB ratio= 8, CR ratio= 2

Table 6.1.54: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0456
0	0.5	0	0	0.8726	0.8756
0	0.5	0.5	0	0.8448	0.8432
0.5	0.5	0	0	0.5434	0.5476
0.2	1	0.8	0.5	0.9414	0.9454

*SB ratio= 8, CR ratio= 2

6.1.2.2. Four Treatment Peak 3 Results

Under the three distributions, when the SB ratio was 1/8, 1/4 1/3, 1/2, 1, 2, 3, and 4 and the CR ratio was 2, 4, and 9, then the A^{**} has higher powers than A^{***} as presented in Tables 6.1.55-6.1.75. However, if SB ratio was 8 and the CR ratio was 2,4, and 8 under the normal distribution only, then the A^{***} has slightly higher powers than A^{**} as shown in Tables 6.1.76-

6.1.78. These results are in contrast to Magel et al.'s (2010) results, which had the A^{**} better than the A^{***} in all situations.

Table 6.1.55: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0480
0	0	0.5	0	0.6890	0.5790
0	0	0.5	0.5	0.4120	0.3358
0	0.5	0.5	0	0.6904	0.5838
0.5	0.8	1	0.2	0.8152	0.7084

*SB ratio= 1/8, CR ratio= 2

Table 6.1.56: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0472	0.0412
0	0	0.5	0	0.4794	0.3786
0	0	0.5	0.5	0.2796	0.2218
0	0.5	0.5	0	0.4774	0.3708
0.5	0.8	1	0.2	0.5898	0.4652

*SB ratio= 1/8, CR ratio= 2

Table 6.1.57: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0508	0.0492
0	0	0.5	0	0.9034	0.7904
0	0	0.5	0.5	0.5940	0.4606
0	0.5	0.5	0	0.8834	0.7636
0.5	0.8	1	0.2	0.9618	0.8944

*SB ratio= 1/8, CR ratio= 2

Table 6.1.58: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0502	0.0468
0	0	0.5	0	0.7748	0.5028
0	0	0.5	0.5	0.4840	0.2952
0	0.5	0.5	0	0.7712	0.4918
0.5	0.8	1	0.2	0.8876	0.6350

*SB ratio= 1/4, CR ratio= 2

Table 6.1.59: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0436	0.0470
0	0	0.5	0	0.5362	0.2830
0	0	0.5	0.5	0.3020	0.1702
0	0.5	0.5	0	0.5298	0.2732
0.5	0.8	1	0.2	0.6722	0.3594

*SB ratio= 1/4, CR ratio= 2

Table 6.1.60: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0470
0	0	0.5	0	0.9438	0.6254
0	0	0.5	0.5	0.6762	0.3506
0	0.5	0.5	0	0.9352	0.6204
0.5	0.8	1	0.2	0.9866	0.7690

*SB ratio= 1/4, CR ratio= 2

Table 6.1.61: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0518	0.0448
0	0	0.5	0	0.7626	0.5040
0	0	0.5	0.5	0.4678	0.2960
0	0.5	0.5	0	0.7716	0.5176
0.5	0.8	1	0.2	0.8988	0.6488

*SB ratio= 1/2, CR ratio= 2

Table 6.1.62: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0498	0.0536
0	0	0.5	0	0.5176	0.2648
0	0	0.5	0.5	0.2952	0.1654
0	0.5	0.5	0	0.5090	0.2690
0.5	0.8	1	0.2	0.6360	0.3314

*SB ratio= 1/2, CR ratio= 2

Table 6.1.63: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0492	0.0496
0	0	0.5	0	0.9418	0.6076
0	0	0.5	0.5	0.6538	0.3222
0	0.5	0.5	0	0.9184	0.5936
0.5	0.8	1	0.2	0.9828	0.7282

*SB ratio= 1/2, CR ratio= 2

Table 6.1.64: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0514	0.0482
0	0	0.5	0	0.4936	0.3798
0	0	0.5	0.5	0.2838	0.2156
0	0.5	0.5	0	0.4810	0.3650
0.5	0.8	1	0.2	0.6222	0.4740

*SB ratio= 1, CR ratio= 2

Table 6.1.65: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0460	0.0464
0	0	0.5	0	0.2996	0.2040
0	0	0.5	0.5	0.1904	0.1294
0	0.5	0.5	0	0.2842	0.1784
0.5	0.8	1	0.2	0.3798	0.2404

*SB ratio= 1, CR ratio= 2

Table 6.1.66: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0500	0.0478
0	0	0.5	0	0.6528	0.4120
0	0	0.5	0.5	0.3638	0.2320
0	0.5	0.5	0	0.6500	0.4290
0.5	0.8	1	0.2	0.7830	0.5378

*SB ratio= 1, CR ratio= 2

Table 6.1.67: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0510	0.0504
0	0	0.5	0	0.7924	0.6962
0	0	0.5	0.5	0.4952	0.4218
0	0.5	0.5	0	0.7984	0.6992
0.5	0.8	1	0.2	0.9026	0.8302

*SB ratio= 2, CR ratio= 2

Table 6.1.68: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under T (3)*sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0490	0.0490
0	0	0.5	0	0.4982	0.3438
0	0	0.5	0.5	0.2946	0.2044
0	0.5	0.5	0	0.5054	0.3400
0.5	0.8	1	0.5	0.4944	0.3468

*SB ratio= 2, CR ratio= 2

Table 6.1.69: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0486	0.0548
0	0	0.5	0	0.9270	0.7812
0	0	0.5	0.5	0.6454	0.4674
0	0.5	0.5	0	0.9130	0.7530
0.5	0.8	1	0.2	0.9790	0.8820

*SB ratio= 2, CR ratio= 2

Table 6.1.70: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0482	0.0520
0	0	0.5	0	0.7286	0.6852
0	0	0.5	0.5	0.4430	0.4098
0	0.5	0.5	0	0.7390	0.7024
0.5	0.8	1	0.2	0.8556	0.8192

*SB ratio= 3, CR ratio= 2

Table 6.1.71: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0506	0.0562
0	0	0.5	0	0.4280	0.3384
0	0	0.5	0.5	0.2562	0.1984
0	0.5	0.5	0	0.4470	0.3464
0.5	0.8	1	0.2	0.5502	0.4278

*SB ratio= 3, CR ratio= 2

Table 6.1.72: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0508
0	0	0.5	0	0.8836	0.7744
0	0	0.5	0.5	0.5738	0.4606
0	0.5	0.5	0	0.8592	0.7536
0.5	0.8	1	0.2	0.9528	0.8782

*SB ratio= 3, CR ratio= 2

Table 6.1.73: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0496	0.0450
0	0	0.5	0	0.8132	0.7918
0	0	0.5	0.5	0.4980	0.4838
0	0.5	0.5	0	0.7944	0.7940
0.5	0.8	1	0.2	0.9146	0.9054

*SB ratio= 4, CR ratio= 2

Table 6.1.74: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0548	0.0480
0	0	0.5	0	0.4898	0.4094
0	0	0.5	0.5	0.2870	0.2486
0	0.5	0.5	0	0.4782	0.4090
0.5	0.8	1	0.2	0.6270	0.5264

*SB ratio= 4, CR ratio=2

Table 6.1.75: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0488	0.0556
0	0	0.5	0	0.9270	0.8662
0	0	0.5	0.5	0.6310	0.5492
0	0.5	0.5	0	0.9154	0.8572
0.5	0.8	1	0.2	0.9786	0.9472

*SB ratio= 4, CR ratio=2

Table 6.1.76: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0470	0.0514
0	0	0.5	0	0.7412	0.7852
0	0	0.5	0.5	0.4388	0.5014
0	0.5	0.5	0	0.7342	0.7964
0.5	0.8	1	0.2	0.8598	0.9054

*SB ratio= 8, CR ratio= 2

Table 6.1.77: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0504
0	0	0.5	0	0.4186	0.4104
0	0	0.5	0.5	0.2424	0.2380
0	0.5	0.5	0	0.4206	0.4012
0.5	0.8	1	0.2	0.5334	0.5308

*SB ratio= 8, CR ratio= 2

Table 6.1.78: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0490	0.0516
0	0	0.5	0	0.8714	0.8658
0	0	0.5	0.5	0.5420	0.5340
0	0.5	0.5	0	0.8514	0.8532
0.5	0.8	1	0.2	0.9456	0.9458

*SB ratio= 8, CR ratio= 2

6.1.3. Five Treatment Results

6.1.3.1. Five Treatment Peak 2 Results

Under the three distributions, when SB ratio was 1/8, 1/4 1/3, 1/2, 1, 2, 3, and 4, and the CR ratio was 2,4, and 9 then the A^{**} was better than the A^{***} as presented in Tables 6.1.79-6.1.102. However, if the SB ratio was 8 and the CR ratio was 2,4, and 8 under the normal distribution only, then the A^{***} was slightly better than the A^{**} as shown in Tables 6.1.103-6.1.105. These results are in contrast to Magel et al.'s (2010) results, which had the A^{**} better than the A^{***} in all situations.

Table 6.1.79: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0512	0.0520
0	0.5	0	0	0	0.6674	0.5582
0	0.5	0.5	0	0	0.8160	0.7150
0.5	0.5	0	0	0	0.4446	0.3638
0.4	1	0.8	0.5	0.2	0.9538	0.8902

*SB ratio= 1/8, CR ratio= 2

Table 6.1.80: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0432	0.0450
0	0.5	0	0	0	0.4594	0.3660
0	0.5	0.5	0	0	0.5900	0.4722
0.5	0.5	0	0	0	0.3042	0.2384
0.4	1	0.8	0.5	0.2	0.8024	0.6608

*SB ratio= 1/8, CR ratio= 2

Table 6.1.81: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under exp (1) * sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0500	0.0478
0	0.5	0	0	0	0.8772	0.7512
0	0.5	0.5	0	0	0.9632	0.8884
0.5	0.5	0	0	0	0.6494	0.5124
0.4	1	0.8	0.5	0.2	0.9982	0.9862

*SB ratio= 1/8, CR ratio= 2

Table 6.1.82: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0490	0.0538
0	0.5	0	0	0	0.7434	0.4764
0	0.5	0.5	0	0	0.8906	0.6312
0.5	0.5	0	0	0	0.5278	0.3038
0.4	1	0.8	0.5	0.2	0.9818	0.8214

*SB ratio= 1/4, CR ratio= 2

Table 6.1.83: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0490
0	0.5	0	0	0	0.5040	0.2650
0	0.5	0.5	0	0	0.6678	0.3412
0.5	0.5	0	0	0	0.3538	0.1974
0.4	1	0.8	0.5	0.2	0.8626	0.4966

*SB ratio= 1/4, CR ratio= 2

Table 6.1.84: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0528	0.0484
0	0.5	0	0	0	0.9310	0.5852
0	0.5	0.5	0	0	0.9862	0.7450
0.5	0.5	0	0	0	0.7364	0.3928
0.4	1	0.8	0.5	0.2	0.9996	0.9160

*SB ratio= 1/4, CR ratio= 2

Table 6.1.85: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0440	0.0476
0	0.5	0	0	0	0.6674	0.4286
0	0.5	0.5	0	0	0.8378	0.5686
0.5	0.5	0	0	0	0.4662	0.2888
0.4	1	0.8	0.5	0.2	0.9636	0.7844

*SB ratio= 1/3, CR ratio= 2

Table 6.1.86: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0442	0.0492
0	0.5	0	0	0	0.4438	0.2366
0	0.5	0.5	0	0	0.5994	0.3164
0.5	0.5	0	0	0	0.2996	0.1732
0.4	1	0.8	0.5	0.2	0.7942	0.4556

*SB ratio= 1/3, CR ratio= 2

Table 6.1.87: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0500	0.0522
0	0.5	0	0	0	0.8792	0.5144
0	0.5	0.5	0	0	0.9596	0.6932
0.5	0.5	0	0	0	0.6444	0.3366
0.4	1	0.8	0.5	0.2	0.9980	0.8822

*SB ratio= 1/3, CR ratio= 2

Table 6.1.88: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0472	0.0496
0	0.5	0	0	0	0.7374	0.4720
0	0.5	0.5	0	0	0.8818	0.6280
0.5	0.5	0	0	0	0.4964	0.3068
0.4	1	0.8	0.5	0.2	0.9834	0.8394

*SB ratio= 1/2, CR ratio= 2

Table 6.1.89: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0506	0.0522
0	0.5	0	0	0	0.4904	0.2486
0	0.5	0.5	0	0	0.6338	0.3342
0.5	0.5	0	0	0	0.3214	0.1662
0.4	1	0.8	0.5	0.2	0.8458	0.4732

*SB ratio= 1/2, CR ratio= 2

Table 6.1.90: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0510	0.0486
0	0.5	0	0	0	0.9184	0.5474
0	0.5	0.5	0	0	0.9836	0.7288
0.5	0.5	0	0	0	0.7018	0.3634
0.4	1	0.8	0.5	0.2	0.9992	0.8976

*SB ratio= 1/2, CR ratio= 2

Table 6.1.91: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0554
0	0.5	0	0	0	0.4544	0.3402
0	0.5	0.5	0	0	0.6110	0.4768
0.5	0.5	0	0	0	0.2996	0.2332
0.4	1	0.8	0.5	0.2	0.8236	0.6720

*SB ratio= 1, CR ratio= 2

Table 6.1.92: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0526	0.0500
0	0.5	0	0	0	0.2820	0.1944
0	0.5	0.5	0	0	0.3790	0.2322
0.5	0.5	0	0	0	0.1964	0.1434
0.4	1	0.8	0.5	0.2	0.5428	0.3522

*SB ratio= 1, CR ratio= 2

Table 6.1.93: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0506	0.0490
0	0.5	0	0	0	0.6212	0.3926
0	0.5	0.5	0	0	0.7840	0.5456
0.5	0.5	0	0	0	0.3900	0.2524
0.4	1	0.8	0.5	0.2	0.9434	0.7428

*SB ratio= 1, CR ratio= 2

Table 6.1.94: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0526	0.0502
0	0.5	0	0	0	0.7468	0.6434
0	0.5	0.5	0	0	0.8974	0.8200
0.5	0.5	0	0	0	0.5390	0.4466
0.4	1	0.8	0.5	0.2	0.9860	0.9574

*SB ratio= 2, CR ratio= 2

Table 6.1.95: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under T (3) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0472	0.0478
0	0.5	0	0	0	0.4068	0.3096
0	0.5	0.5	0	0	0.5532	0.4396
0.5	0.5	0	0	0	0.2868	0.2226
0.4	1	0.8	0.5	0.2	0.7486	0.6140

*SB ratio= 2, CR ratio= 2

Table 6.1.96: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0464	0.0474
0	0.5	0	0	0	0.9092	0.7486
0	0.5	0.5	0	0	0.9754	0.8800
0.5	0.5	0	0	0	0.6856	0.4962
0.4	1	0.8	0.5	0.2	0.9984	0.9804

*SB ratio= 2, CR ratio= 2

Table 6.1.97: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0506
0	0.5	0	0	0	0.6730	0.6256
0	0.5	0.5	0	0	0.8496	0.8060
0.5	0.5	0	0	0	0.4714	0.4376
0.4	1	0.8	0.5	0.2	0.9712	0.9606

*SB ratio= 3, CR ratio= 2

Table 6.1.98: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under T(3) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0506
0	0.5	0	0	0	0.6730	0.6256
0	0.5	0.5	0	0	0.8496	0.8060
0.5	0.5	0	0	0	0.4714	0.4376
0.4	1	0.8	0.5	0.2	0.9712	0.9606

*SB ratio= 3, CR ratio= 2

Table 6.1.99: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0482	0.0468
0	0.5	0	0	0	0.8516	0.7270
0	0.5	0.5	0	0	0.9486	0.8640
0.5	0.5	0	0	0	0.6236	0.5008
0.4	1	0.8	0.5	0.2	0.9960	0.9774

*SB ratio= 3, CR ratio= 2

Table 6.1.100: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0506
0	0.5	0	0	0	0.6730	0.6256
0	0.5	0.5	0	0	0.8496	0.8060
0.5	0.5	0	0	0	0.4714	0.4376
0.4	1	0.8	0.5	0.2	0.9712	0.9606

*SB ratio= 4, CR ratio= 2

Table 6.1.101: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0494	0.0476
0	0.5	0	0	0	0.4592	0.3894
0	0.5	0.5	0	0	0.6152	0.5150
0.5	0.5	0	0	0	0.3120	0.2638
0.4	1	0.8	0.5	0.2	0.8128	0.7268

*SB ratio= 4, CR ratio= 2

Table 6.1.102: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0470
0	0.5	0	0	0	0.8238	0.8328
0	0.5	0.5	0	0	0.9396	0.9326
0.5	0.5	0	0	0	0.6002	0.5962
0.4	1	0.8	0.5	0.2	0.9952	0.9936

*SB ratio= 4, CR ratio= 2

Table 6.1.103: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0514
0	0.5	0	0	0	0.7602	0.7642
0	0.5	0.5	0	0	0.9068	0.8980
0.5	0.5	0	0	0	0.5398	0.5234
0.4	1	0.8	0.5	0.2	0.9886	0.9890

*SB ratio= 8, CR ratio= 2

Table 6.1.104: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0552	0.0500
0	0.5	0	0	0	0.3952	0.3776
0	0.5	0.5	0	0	0.5232	0.4988
0.5	0.5	0	0	0	0.2624	0.2674
0.4	1	0.8	0.5	0.2	0.7312	0.7150

*SB ratio= 8, CR ratio= 2

Table 6.1.105: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under exp (1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0522	0.0544
0	0.5	0	0	0	0.9032	0.8328
0	0.5	0.5	0	0	0.9750	0.9472
0.5	0.5	0	0	0	0.6854	0.6076
0.4	1	0.8	0.5	0.2	0.9998	0.9944

*SB ratio= 8, CR ratio= 2

6.1.3.2. Five Treatment Peak 3 Results

Under the three distributions, when SB ratio was 1/8, 1/4 1/3, 1/2, 1, 2, 3, 4, and 8 and the CR ratio was 2, 4, and 9, then the A^{**} was better than the A^{***} as presented in Tables 6.1.106-6.1.129. However, if the SB ratio was 8 and the CR ratio was 2 under the normal distribution and some cases under Exponential distribution, then the A^{***} was better than the A^{**} as shown in Tables 6.1.130-6.1.132. Again, this is in contrast to Magel et al.'s (2010) results, which had the A^{**} better than the A^{***} in all situations.

Table 6.1.106: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0498
0	0	0.5	0	0	0.7122	0.6104
0	0	0.5	0.5	0	0.7124	0.6058
0	0.5	0.5	0	0	0.6986	0.6026
0.2	0.5	1	0.8	0.4	0.9612	0.7598

*SB ratio= 1/8, CR ratio= 2

Table 6.1.107: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0478	0.0484
0	0	0.5	0	0	0.4970	0.3924
0	0	0.5	0.5	0	0.5056	0.4012
0	0.5	0.5	0	0	0.4948	0.3944
0.2	0.4	1	0.8	0.5	0.6864	0.5526

*SB ratio= 1/8, CR ratio= 2

Table 6.1.108: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0554	0.0542
0	0	0.5	0	0	0.9260	0.8230
0	0	0.5	0.5	0	0.9144	0.8070
0	0.5	0.5	0	0	0.9138	0.8050
0.2	0.4	1	0.8	0.5	0.9904	0.9514

*SB ratio= 1/8, CR ratio= 2

Table 6.1.109: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0470
0	0	0.5	0	0	0.7972	0.5198
0	0	0.5	0.5	0	0.8014	0.5204
0	0.5	0.5	0	0	0.7928	0.5206
0.2	0.5	1	0.8	0.4	0.9234	0.8476

*SB ratio= 1/4, CR ratio= 2

Table 6.1.110: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0502	0.0522
0	0	0.5	0	0	0.5644	0.2960
0	0	0.5	0.5	0	0.5534	0.2898
0	0.5	0.5	0	0	0.5572	0.2892
0.2	0.4	1	0.8	0.5	0.7598	0.4044

*SB ratio= 1/4, CR ratio= 2

Table 6.1.111: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0452	0.0474
0	0	0.5	0	0	0.9634	0.6486
0	0	0.5	0.5	0	0.9506	0.6278
0	0.5	0.5	0	0	0.9556	0.6396
0.2	0.4	1	0.8	0.5	0.9970	0.8412

*SB ratio= 1/4, CR ratio= 2

Table 6.1.112: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0572
0	0	0.5	0	0	0.7236	0.4668
0	0	0.5	0.5	0	0.7164	0.4792
0	0.5	0.5	0	0	0.7210	0.4782
0.2	0.5	1	0.8	0.4	0.9308	0.7066

*SB ratio= 1/3, CR ratio= 2

Table 6.1.113: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0536	0.0574
0	0	0.5	0	0	0.4846	0.2520
0	0	0.5	0.5	0	0.4866	0.2518
0	0.5	0.5	0	0	0.4852	0.2646
0.2	0.4	1	0.8	0.5	0.6684	0.3668

*SB ratio= 1/3, CR ratio= 2

Table 6.1.114: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0494	0.0498
0	0	0.5	0	0	0.9220	0.5890
0	0	0.5	0.5	0	0.9070	0.5760
0	0.5	0.5	0	0	0.9104	0.5656
0.2	0.4	1	0.8	0.5	0.9896	0.7734

*SB ratio= 1/3, CR ratio= 2

Table 6.1.115: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0546	0.0476
0	0	0.5	0	0	0.7910	0.5152
0	0	0.5	0.5	0	0.7844	0.5232
0	0.5	0.5	0	0	0.7872	0.5264
0.2	0.5	1	0.8	0.4	0.9650	0.7684

*SB ratio= 1/2, CR ratio= 2

Table 6.1.116: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0494	0.0506
0	0	0.5	0	0	0.5300	0.2688
0	0	0.5	0.5	0	0.5324	0.2666
0	0.5	0.5	0	0	0.5306	0.2740
0.2	0.4	1	0.8	0.5	0.7250	0.3712

*SB ratio= 1/2, CR ratio= 2

Table 6.1.117: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0516
0	0	0.5	0	0	0.9544	0.6168
0	0	0.5	0.5	0	0.9344	0.6022
0	0.5	0.5	0	0	0.9366	0.6074
0.2	0.4	1	0.8	0.5	0.9970	0.8184

*SB ratio= 1/2, CR ratio= 2

Table 6.1.118: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0452	0.0532
0	0	0.5	0	0	0.5134	0.3822
0	0	0.5	0.5	0	0.5112	0.3920
0	0.5	0.5	0	0	0.5150	0.4048
0.2	0.5	1	0.8	0.4	0.7482	0.6026

*SB ratio= 1, CR ratio= 2

Table 6.1.119: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0538	0.0536
0	0	0.5	0	0	0.3098	0.1982
0	0	0.5	0.5	0	0.3156	0.2084
0	0.5	0.5	0	0	0.2960	0.1940
0.2	0.4	1	0.8	0.5	0.4328	0.2850

*SB ratio= 1, CR ratio= 2

Table 6.1.120: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0484
0	0	0.5	0	0	0.6958	0.4408
0	0	0.5	0.5	0	0.6820	0.4450
0	0.5	0.5	0	0	0.6780	0.4406
0.2	0.4	1	0.8	0.5	0.8708	0.6312

*SB ratio= 1, CR ratio= 2

Table 6.1.121: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0490	0.0524
0	0	0.5	0	0	0.7986	0.6970
0	0	0.5	0.5	0	0.7926	0.6994
0	0.5	0.5	0	0	0.8106	0.7080
0.2	0.5	1	0.8	0.4	0.9686	0.9280

*SB ratio= 2, CR ratio= 2

Table 6.1.122: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0470
0	0	0.5	0	0	0.4996	0.3468
0	0	0.5	0.5	0	0.5038	0.3498
0	0.5	0.5	0	0	0.5092	0.3562
0.2	0.4	1	0.8	0.5	0.6946	0.5012

*SB ratio= 2, CR ratio= 2

Table 6.1.123: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0474	0.0518
0	0	0.5	0	0	0.9408	0.7964
0	0	0.5	0.5	0	0.9334	0.7828
0	0.5	0.5	0	0	0.9298	0.7860
0.2	0.4	1	0.8	0.5	0.9942	0.9396

*SB ratio= 2, CR ratio= 2

Table 6.1.124: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0432	0.0470
0	0	0.5	0	0	0.7454	0.7192
0	0	0.5	0.5	0	0.7510	0.7096
0	0.5	0.5	0	0	0.7416	0.7042
0.2	0.5	1	0.8	0.4	0.9484	0.9250

*SB ratio= 3, CR ratio= 2

Table 6.1.125: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0512	0.0490
0	0	0.5	0	0	0.4482	0.3530
0	0	0.5	0.5	0	0.4470	0.3466
0	0.5	0.5	0	0	0.4468	0.3478
0.2	0.4	1	0.8	0.5	0.6350	0.5030

*SB ratio= 3, CR ratio= 2

Table 6.1.126: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0548	0.0558
0	0	0.5	0	0	0.8994	0.7842
0	0	0.5	0.5	0	0.8928	0.7748
0	0.5	0.5	0	0	0.8828	0.7782
0.2	0.4	1	0.8	0.5	0.9832	0.9394

*SB ratio= 3, CR ratio= 2

Table 6.1.127: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0474	0.0472
0	0	0.5	0	0	0.8212	0.8086
0	0	0.5	0.5	0	0.8216	0.8086
0	0.5	0.5	0	0	0.8194	0.8058
0.2	0.5	1	0.8	0.4	0.9738	0.9702

*SB ratio= 4, CR ratio= 2

Table 6.1.128: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0486
0	0	0.5	0	0	0.4344	0.4234
0	0	0.5	0.5	0	0.4310	0.4020
0	0.5	0.5	0	0	0.4268	0.4202
0.2	0.4	1	0.8	0.5	0.5938	0.5938

*SB ratio= 4, CR ratio= 2

Table 6.1.129: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0466	0.0466
0	0	0.5	0	0	0.9490	0.8886
0	0	0.5	0.5	0	0.9384	0.8808
0	0.5	0.5	0	0	0.9306	0.8720
0.2	0.4	1	0.8	0.5	0.9922	0.9812

*SB ratio= 4, CR ratio= 2

Table 6.1.130: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0462	0.0476
0	0	0.5	0	0	0.7468	0.7986
0	0	0.5	0.5	0	0.7464	0.7994
0	0.5	0.5	0	0	0.7384	0.8030
0.2	0.5	1	0.8	0.4	0.9480	0.9682

*SB ratio= 8, CR ratio= 2

Table 6.1.131: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0464	0.0450
0	0	0.5	0	0	0.5068	0.4262
0	0	0.5	0.5	0	0.5066	0.4214
0	0.5	0.5	0	0	0.5180	0.4338
0.2	0.4	1	0.8	0.5	0.7028	0.6042

*SB ratio= 8, CR ratio= 2

Table 6.1.132: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0536
0	0	0.5	0	0	0.8818	0.8794
0	0	0.5	0.5	0	0.8648	0.8738
0	0.5	0.5	0	0	0.8772	0.8726
0.2	0.4	1	0.8	0.5	0.9758	0.9770

*SB ratio= 8, CR ratio= 2

6.1.3.3. Five Treatment Peak 4 Results

Under the three distributions, when SB ratio was1/8, 1/4 1/3, 1/2, 1, 2, and 3 and the CR ratio was 2,4, and 9 then the A** was high power than the A*** as presented in Tables 6.1.133-6.1.153. However, the A*** had high power than the A** in two situations as shown in Tables 6.1.154-6.1.156: a) when the SB ratio was 4 and 8 and the CR ratio was 2 under the normal and exponential distribution only; and b) when the SB ratio was 4 and 8 and the CR ratio was 4 or 9 under the normal distribution only. These results are in contrast to Magel et al.'s (2010) results, which had the A** high power than the A*** in all situations.

Table 6.1.133: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0506	0.0504
0	0	0	0.5	0	0.5078	0.4360
0	0	0	0.5	0.5	0.3102	0.2794
0	0	0.5	0.5	0	0.8242	0.7108
0.2	0.5	0.8	1	0.4	0.9434	0.8802

*SB ratio= 1/8, CR ratio= 2

Table 6.1.134: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0498	0.0514
0	0	0	0.5	0	0.3394	0.2844
0	0	0	0.5	0.5	0.2080	0.1790
0	0	0.5	0.5	0	0.6098	0.4838
0.2	0.5	0.8	1	0.4	0.7684	0.6434

*SB ratio= 1/8, CR ratio= 2

Table 6.1.135: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0466	0.0470
0	0	0	0.5	0	0.7244	0.6188
0	0	0	0.5	0.5	0.4322	0.3600
0	0	0.5	0.5	0	0.9710	0.8982
0.2	0.5	0.8	1	0.4	0.9968	0.9772

*SB ratio= 1/8, CR ratio= 2

Table 6.1.136: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0490	0.0488
0	0	0	0.5	0	0.6016	0.4168
0	0	0	0.5	0.5	0.3670	0.2622
0	0	0.5	0.5	0	0.8810	0.6226
0.2	0.5	0.8	1	0.4	0.9772	0.8146

*SB ratio= 1/4, CR ratio= 2

Table 6.1.137: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0476	0.0500
0	0	0	0.5	0	0.3854	0.2328
0	0	0	0.5	0.5	0.2356	0.1658
0	0	0.5	0.5	0	0.6656	0.3426
0.2	0.5	0.8	1	0.4	0.8340	0.4924

*SB ratio= 1/4, CR ratio= 2

Table 6.1.138: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0514
0	0	0	0.5	0	0.8022	0.5140
0	0	0	0.5	0.5	0.5300	0.3254
0	0	0.5	0.5	0	0.9842	0.7536
0.2	0.5	0.8	1	0.4	0.9990	0.9100

*SB ratio= 1/4, CR ratio= 2

Table 6.1.139: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0496	0.0528
0	0	0	0.5	0	0.5526	0.3880
0	0	0	0.5	0.5	0.3276	0.2616
0	0	0.5	0.5	0	0.8406	0.5762
0.2	0.5	0.8	1	0.4	0.9544	0.7714

*SB ratio= 1/3, CR ratio= 2

Table 6.1.140: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0462	0.0480
0	0	0	0.5	0	0.3416	0.2188
0	0	0	0.5	0.5	0.2180	0.1590
0	0	0.5	0.5	0	0.5888	0.3124
0.2	0.5	0.8	1	0.4	0.7620	0.4414

*SB ratio= 1/3, CR ratio= 2

Table 6.1.141: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0466	0.0486
0	0	0	0.5	0	0.7366	0.4742
0	0	0	0.5	0.5	0.4544	0.2902
0	0	0.5	0.5	0	0.9636	0.7016
0.2	0.5	0.8	1	0.4	0.9968	0.8698

*SB ratio= 1/3, CR ratio= 2

Table 6.1.142: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0462	0.0522
0	0	0	0.5	0	0.6246	0.4594
0	0	0	0.5	0.5	0.3986	0.2968
0	0	0.5	0.5	0	0.8894	0.6240
0.2	0.5	0.8	1	0.4	0.9808	0.8368

*SB ratio= 1/2, CR ratio= 2

Table 6.1.143: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0478	0.0518
0	0	0	0.5	0	0.3678	0.2340
0	0	0	0.5	0.5	0.2328	0.1630
0	0	0.5	0.5	0	0.6442	0.3254
0.2	0.5	0.8	1	0.4	0.8252	0.4722

*SB ratio= 1/2, CR ratio= 2

Table 6.1.144: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0476	0.0488
0	0	0	0.5	0	0.8126	0.5458
0	0	0	0.5	0.5	0.5148	0.3286
0	0	0.5	0.5	0	0.9812	0.7220
0.2	0.5	0.8	1	0.4	0.9992	0.9024

*SB ratio= 1/2, CR ratio= 2

Table 6.1.145: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0470	0.0548
0	0	0	0.5	0	0.3818	0.3412
0	0	0	0.5	0.5	0.2476	0.2334
0	0	0.5	0.5	0	0.5964	0.4634
0.2	0.5	0.8	1	0.4	0.8006	0.6606

*SB ratio= 1, CR ratio= 2

Table 6.1.146: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0530
0	0	0	0.5	0	0.2248	0.1832
0	0	0	0.5	0.5	0.1538	0.1374
0	0	0	0.5	0.5	0.2200	0.2162
0.2	0.5	0.8	1	0.4	0.5160	0.3376

*SB ratio= 1, CR ratio= 2

Table 6.1.147: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0510	0.0496
0	0	0	0.5	0	0.4998	0.3628
0	0	0	0.5	0.5	0.2888	0.2374
0	0	0.5	0.5	0	0.7872	0.5342
0.2	0.5	0.8	1	0.4	0.9324	0.7448

*SB ratio= 1, CR ratio= 2

Table 6.1.148: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0442	0.0442
0	0	0	0.5	0	0.6666	0.6440
0	0	0	0.5	0.5	0.4408	0.4358
0	0	0.5	0.5	0	0.8868	0.8070
0.2	0.5	0.8	1	0.4	0.9856	0.9574

*SB ratio= 2, CR ratio= 2

Table 6.1.149: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0440	0.0464
0	0	0	0.5	0	0.3866	0.3102
0	0	0	0.5	0.5	0.2340	0.2178
0	0	0.5	0.5	0	0.6156	0.4378
0.2	0.5	0.8	1	0.4	0.7994	0.6248

*SB ratio= 2, CR ratio= 2

Table 6.1.150: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0510
0	0	0	0.5	0	0.8196	0.7252
0	0	0	0.5	0.5	0.5460	0.4920
0	0	0.5	0.5	0	0.9810	0.8754
0.2	0.5	0.8	1	0.4	0.9986	0.9768

*SB ratio= 2, CR ratio= 2

Table 6.1.151: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0502
0	0	0	0.5	0	0.6056	0.6388
0	0	0	0.5	0.5	0.3980	0.4400
0	0	0.5	0.5	0	0.8522	0.8078
0.2	0.5	0.8	1	0.4	0.9710	0.9552

*SB ratio= 3, CR ratio= 2

Table 6.1.152: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0478	0.0472
0	0	0	0.5	0	0.3494	0.3216
0	0	0	0.5	0.5	0.2280	0.2134
0	0	0.5	0.5	0	0.5502	0.4212
0.2	0.5	0.8	1	0.4	0.7356	0.6074

*SB ratio= 3, CR ratio= 2

Table 6.1.153: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0508
0	0	0	0.5	0	0.7634	0.7236
0	0	0	0.5	0.5	0.6592	0.7198
0	0	0.5	0.5	0	0.9512	0.8740
0.2	0.5	0.8	1	0.4	0.9964	0.9764

*SB ratio= 3, CR ratio= 2

Table 6.1.154: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0436	0.0478
0	0	0	0.5	0	0.7060	0.7534
0	0	0	0.5	0.5	0.4664	0.5326
0	0	0.5	0.5	0	0.9092	0.8952
0.2	0.5	0.8	1	0.4	0.9872	0.9876

*SB ratio= 4, CR ratio= 2

Table 6.1.155: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0496	0.0518
0	0	0	0.5	0	0.3860	0.3786
0	0	0	0.5	0.5	0.2520	0.2556
0	0	0.5	0.5	0	0.6126	0.5140
0.2	0.5	0.8	1	0.4	0.7948	0.7166

*SB ratio= 4, CR ratio= 2

Table 6.1.156: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0516
0	0	0	0.5	0	0.7702	0.8356
0	0	0	0.5	0.5	0.5134	0.6018
0	0	0.5	0.5	0	0.9416	0.9364
0.2	0.5	0.8	1	0.4	0.9926	0.9948

*SB ratio= 4, CR ratio= 2

Table 6.1.157: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =5 under N (0.1) *sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0454	0.0522
0	0	0	0.5	0	0.6486	0.7474
0	0	0	0.5	0.5	0.4254	0.5308
0	0	0.5	0.5	0	0.8574	0.9032
0.2	0.5	0.8	1	0.4	0.9722	0.9866

*SB ratio= 8, CR ratio= 2

Table 6.1.158: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =5 under T(3)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0446	0.0492
0	0	0	0.5	0	0.3388	0.3648
0	0	0	0.5	0.5	0.2318	0.2576
0	0	0.5	0.5	0	0.5236	0.5094
0.2	0.5	0.8	1	0.4	0.7090	0.7048

*SB ratio= 8, CR ratio= 2

Table 6.1.159: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =5 under exp (1)*sqrt(2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0516	0.0504
0	0	0	0.5	0	0.8340	0.8210
0	0	0	0.5	0.5	0.5666	0.5910
0	0	0.5	0.5	0	0.9780	0.9386
0.2	0.5	0.8	1	0.4	0.9986	0.9958

*SB ratio= 8, CR ratio= 2

6.2. Second Scenario Results

The result will be separated by the three situations we considered estimating the powers of the tests. The first situation considered is when the location parameters are different, and the scale parameters are equal. The second type considered is when the location parameters are equal, and the scale parameters are different. The third type considered is when the location and scale parameters are both different. We have a third test in the comparison among the tests proposed which is the second test proposed weighted in order to get high power.

In second scenario, under three distributions considered with n= 15, and the treatment 3 with peak 2, treatment 4 with peak 2 or 3, or treatment 5 with peak 2, 3, and 4. The T_2 is better than T_1 or TW_2 if we change the location parameters only, also The T_1 is better than T_2 or TW_2 if the scale parameters change and the location parameters constant. Lastly, under normal and t with three degrees of freedom, the T_1 is better than T_2 or TW_2 if the location parameters and scale parameters change, while the TW_2 is better than T_2 or T_1 if the distribution exponential. The amazing part is that when we add the weight to second proposed test, it rises the power if the change on scale parameters only or on both location and scale parameters together. However, if the change on location parameters only, the power on the third test goes down on the power. Tables 6.2.1-3 show the results for 3 different types of populations when the means were different and the variances were equal. Tables 6.2.4-6 show estimated powers when the means are the same and the variances are different. Tables 6.2.7-9 show estimated powers when both the means and the variances are different.

Table 6.2.1: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and equal variance when the sample size n= 15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
0	1	0	1	0	1	0.0512	0.0496	0.0460
0	1	1.5	1	0	1	0.8984	0.9976	0.9832
0	1	1.5	1	1.5	1	0.3976	0.6404	0.5084
1.5	1	1.5	1	0	1	0.3836	0.6152	0.5122
0.4	1	1.8	1	0.9	1	0.7328	0.9574	0.8896

Table 6.2.2: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and equal variance when the sample size n=15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0534	0.0494	0.0496
0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7454	0.9634	0.8950
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.2896	0.4668	0.3852
1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.2920	0.4742	0.3958
0.4	1 σ^2	1.8	1 σ^2	0.9	1 σ^2	0.5820	0.8408	0.7412

Table 6.2.3: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and equal variance when the sample size n=15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
1	1	1	1	1	1	0.0484	0.0450	0.0430
1	1	1.5	1	1	1	0.6532	0.9190	0.8186
1	1	1.5	1	1.5	1	0.2328	0.3690	0.2996
1.5	1	1.5	1	1	1	0.2488	0.3928	0.3192
1.5	1	1.8	1	1.2	1	0.4366	0.7002	0.5746

Table 6.2.4: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with same means and different variance when the sample size n= 15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
0	1	0	1	0	1	0.0518	0.0482	0.0506
0	1	0	9	0	1	0.6882	0.2146	0.4700
0	1	0	9	0	9	0.2626	0.1164	0.1974
0	9	0	9	0	1	0.2580	0.1104	0.1988
0	2	0	9	0	4	0.5348	0.1680	0.2714

Table 6.2.5: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with same means and different variance when the sample size n= 15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0566	0.0560	0.0550
0	$1\ \sigma^2$	0	$9\ \sigma^2$	0	$1\ \sigma^2$	0.7118	0.1308	0.4208
0	$1\ \sigma^2$	0	$9\ \sigma^2$	0	$9\ \sigma^2$	0.2356	0.0946	0.1696
0	$9\ \sigma^2$	0	$9\ \sigma^2$	0	$1\ \sigma^2$	0.2396	0.0802	0.1636
0	$3\ \sigma^2$	0	$9\ \sigma^2$	0	$5\ \sigma^2$	0.3494	0.0964	0.2256

Table 6.2.6: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with same means and different variance when the sample size n=15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	0.0414	0.0454	0.0414
1	1^2	1	9^2	1	1^2	0.7028	0.1372	0.4134
1	1^2	1	9^2	1	9^2	0.2400	0.0842	0.1660
1	9^2	1	9^2	1	1^2	0.2238	0.0840	0.1538
1	3^2	1	9^2	1	3^2	0.2968	0.0880	0.1962

Table 6.2.7: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and different variance when the sample size n=15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
0	1	0	1	0	1	0.0516	0.0548	0.0492
0	1	1.5	9	0	1	0.8584	0.4040	0.6800
0	1	1.5	9	1.5	9	0.3556	0.1764	0.2788
1.5	9	1.5	9	0	1	0.3634	0.1962	0.2872
0.4	5	1.8	9	0.9	3	0.5756	0.2644	0.3936

Table 6.2.8: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and different variance when the sample size n=15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0532	0.0504	0.0494
0	$1\ \sigma^2$	1.2	$5\ \sigma^2$	0	$1\ \sigma^2$	0.9968	0.9566	0.9910
0	$1\ \sigma^2$	1.5	$9\ \sigma^2$	1.5	$9\ \sigma^2$	0.7482	0.5946	0.7128
1.5	$9\ \sigma^2$	1.5	$9\ \sigma^2$	0	$1\ \sigma^2$	0.7462	0.5982	0.7132
0.4	$3\ \sigma^2$	1.8	$9\ \sigma^2$	0.9	$5\ \sigma^2$	0.9512	0.9176	0.9528

Table 6.2.9: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and different variance when the sample size n=15 under CRD.

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	0.0500	0.0484	0.0482
1	1^2	3	3^2	1	1^2	0.9756	0.9388	0.9726
1	1^2	3	3^2	3	3^2	0.5274	0.4598	0.5250
3	3^2	3	3^2	1	1^2	0.5156	0.4636	0.5220
2	2^2	4	4^2	3	3^2	0.5196	0.4484	0.5092

6.3. Third Scenario Results

The result will be separated by the SB ratio in the third scenario. The SB Ratio is the sample size in CRD portion to the number of blocks in the RCBD portion, and we take into count that the number of blocks in RCBD half, equal, and twice the sample size in the CRD. The first situation considered is when the location parameters are different, and the scale parameters are equal. The second type considered is when the location parameters are equal, and the scale parameters are different. The third type considered is when the location and scale parameters are both different. We have a third test in the comparison among the tests proposed which is the second test proposed weighted in order to get high power.

In Third scenario, Equal samples of size 12 are taken from each of the k populations (n_1=n_2=…=n_k =n=12). Four subsets of 3 observations each were randomly formed from the 12 observations from each population, and the RCBD portion is assumed that there are three observations for each treatment in each block. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio. The amazing part is that when we add the weight to second proposed test, it rises the power if the change on scale only or on both together. However, if the change on location parameters only, the power on the third test goes down on the power. Some exception is when location change only or scale only under treatment 4 peak 2 and n=12 blocks =6, then we get different result.

6.3.1. Three Treatment Results

6.3.1.1. Three Treatment Peak 2 Results

Tables below show the result for three treatments at peak two under the three underlying distributions. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio as presented in Tables 6.3.1- 6.3.3. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio as presented in Tables 6.3.3-6.3.6. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio as shown in Tables 6.3.7-6.3.9.

Table 6.3.1: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0.0518	0.0474	0.0534
0	1	1.5	1	0	1	0.9096	0.9922	0.9656
0	1	1.5	1	1.5	1	0.3978	0.5596	0.4600
1.5	1	1.5	1	0	1	0.3956	0.5672	0.4528
1.5	1	2	1	1.8	1	0.1816	0.2382	0.2048

Table 6.3.2: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0534	0.0496	0.0506
0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7686	0.9256	0.8414
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.3066	0.4268	0.3518
1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.3056	0.4238	0.3386
1.5	1 σ^2	2	1 σ^2	1.8	1 σ^2	0.1534	0.1948	0.1648

Table 6.3.3: Percentage of Rejection for k=3 Populations p=2; Exponential (1).-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
1	1	1	1	1	1	0.0526	0.0472	0.0450
1	1	1.5	1	1	1	0.8682	0.9758	0.9254
1	1	1.5	1	1.5	1	0.3824	0.5092	0.4304
1.5	1	1.5	1	1	1	0.3854	0.5246	0.4400
1.5	1	2	1	1.8	1	0.6412	0.8152	0.7090

Table 6.3.4: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0.0502	0.0486	0.0494
0	1	0	5	0	1	0.6752	0.1882	0.4222
0	1	0	5	0	5	0.2494	0.1036	0.1832
0	5	0	5	0	1	0.2578	0.1106	0.1862
0	5	0	9	0	8	0.1788	0.0750	0.1282

Table 6.3.5: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0502	0.0548	0.0514
0	1 σ^2	0	5 σ^2	0	1 σ^2	0.6554	0.1292	0.1478
0	1 σ^2	0	5 σ^2	0	5 σ^2	0.2320	0.0886	0.0958
0	5 σ^2	0	5 σ^2	0	1 σ^2	0.2222	0.0734	0.0878
0	5 σ^2	0	9 σ^2	0	5 σ^2	0.2408	0.0810	0.0850

Table 6.3.6: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	0.0510	0.0424	0.0436
1	1^2	1	5^2	1	1^2	0.9772	0.1966	0.6924
1	1^2	1	5^2	1	5^2	0.5050	0.1002	0.2710
1	5^2	1	5^2	1	1^2	0.9236	0.9072	0.9624
1	5^2	1	9^2	1	8^2	0.2284	0.0810	0.1502

Table 6.3.7: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0.0460	0.0444	0.0422
0	1	1.5	5	0	1	0.9206	0.5014	0.7510
0	1	1.5	5	1.5	5	0.4404	0.2284	0.3370
1.5	5	1.5	5	0	1	0.4324	0.2348	0.3308
1.5	5	2	9	1.8	8	0.2080	0.1066	0.1610

Table 6.3.8: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0496	0.0522	0.0518
0	1 σ^2	1.5	5 σ^2	0	1 σ^2	0.9994	0.9818	0.9916
0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0.7144	0.5274	0.5856
1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0.7272	0.5338	0.5910
1.5	5 σ^2	2	9 σ^2	1.5	8 σ^2	0.4458	0.3554	0.3954

Table 6.3.9: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	0.0462	0.0464	0.0492
1	1^2	2	2^2	1	1^2	0.9938	0.9482	0.9786
1	1^2	2	2^2	2	2^2	0.6612	0.4996	0.5796
2	2^2	2	2^2	1	1^2	0.6570	0.4874	0.5624
2	2^2	4	4^2	3	3^2	0.9066	0.7548	0.8412

6.3.2. Four Treatment Results

6.3.2.1. Four Treatment Peak 2 Results

Tables below show the result for four treatments at peak two under the three underlying distributions. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio as presented in Tables 6.3.10-6.3.12. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio as presented in Tables 6.3.13-6.3.15. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio as shown in Tables 6.3.16-6.3.18.

Table 6.3.10: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0.0450	0.0468	0.0436
0	1	1.5	1	0	1	0	1	0.8912	0.9876	0.9504
0	1	1.5	1	1.5	1	0	1	0.8944	0.9902	0.9528
1.5	1	1.5	1	0	1	0	1	0.5838	0.7988	0.6604
1.2	1	2	1	1.8	1	1.5	1	0.3584	0.4872	0.3978

Table 6.3.11: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0484	0.0484	0.0528
0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0	1 σ^2	0.7490	0.9190	0.8344
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7640	0.9238	0.8320
1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0	1 σ^2	0.4428	0.6336	0.5088
1.2	1 σ^2	2	1 σ^2	1.8	1 σ^2	1.5	1 σ^2	0.2666	0.3588	0.2982

Table 6.3.12: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0516	0.0464	0.0500
1	1^2	1.5	1^2	1	1^2	1	1^2	0.4600	0.6286	0.5188
1	1^2	1.5	1^2	1.5	1^2	1	1^2	0.4454	0.6122	0.5068
1.5	1^2	1.5	1^2	1	1^2	1	1^2	0.2450	0.3366	0.2750
1.2	1^2	2	1^2	1.8	1^2	1.5	1^2	0.5692	0.7554	0.6412

Table 6.3.13: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0.0522	0.0510	0.0492
0	1	0	5	0	1	0	1	0.6496	0.1976	0.2160
0	1	0	5	0	5	0	1	0.6790	0.1564	0.1774
0	5	0	5	0	1	0	1	0.3796	0.1350	0.1470
0	2	0	9	0	8	0	5	0.4292	0.1236	0.1398

Table 6.3.14: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0478	0.0510	0.0504
0	$1\ \sigma^2$	0	$5\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.6476	0.1204	0.1440
0	$1\ \sigma^2$	0	$5\ \sigma^2$	0	$5\ \sigma^2$	0	$1\ \sigma^2$	0.6388	0.1170	0.1384
0	$5\ \sigma^2$	0	$5\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.3288	0.0916	0.1036
0	$2\ \sigma^2$	0	$9\ \sigma^2$	0	$8\ \sigma^2$	0	$5\ \sigma^2$	0.3458	0.0906	0.1012

Table 6.3.15: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6)..

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0520	0.0536	0.0542
1	1^2	1	5^2	1	1^2	1	1^2	0.9700	0.1998	0.2166
1	1^2	1	5^2	1	5^2	1	1^2	0.9726	0.1994	0.2178
1	5^2	1	5^2	1	1^2	1	1^2	0.7268	0.1354	0.1438
1	2^2	1	9^2	1	8^2	1	5^2	0.6834	0.1256	0.1350

Table 6.3.16: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6)

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0.0452	0.0508	0.0498
0	1	1.5	5	0	1	0	1	0.9100	0.5076	0.5604
0	1	1.5	5	1.5	5	0	1	0.9356	0.5122	0.5726
1.5	5	1.5	5	0	1	0	1	0.6278	0.3254	0.3552
1.2	2	2	9	1.8	8	1.5	5	0.5106	0.1770	0.1960

Table 6.3.17: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0474	0.0462	0.0458
0	1 σ^2	1.5	5 σ^2	0	1 σ^2	0	1 σ^2	0.9994	0.9788	0.9886
0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0.9996	0.9768	0.9902
1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0	1 σ^2	0.9322	0.7654	0.8160
1.2	2 σ^2	2	9 σ^2	1.8	8 σ^2	1.5	5 σ^2	0.7706	0.5038	0.5538

Table 6.3.18: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0524	0.0504	0.0510
1	1^2	1.5	1.5^2	1	1^2	1	1^2	0.7866	0.6126	0.6338
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8006	0.6182	0.6436
1.5	1^2	1.5	1.5^2	1	1^2	1	1^2	0.5454	0.3454	0.3622
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	0.9134	0.7618	0.7828

6.3.2.2. Four Treatment Peak 3 Results

Tables below show the result for four treatments at peak three under the three underlying distributions. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio as presented in Tables 6.3.19-6.3.21. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio as presented in Tables 6.3.22-6.3.25. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio as shown in Tables 6.3.26-6.3.27.

Table 6.3.19: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0.0504	0.0510	0.0492
0	1	0	1	1.5	1	0	1	0.8998	0.9898	0.9490
0	1	0	1	1.5	1	1.5	1	0.5796	0.7864	0.6634
0	1	1.5	1	1.5	1	0	1	0.8942	0.9916	0.9516
1.5	1	1.8	1	2	1	1.2	1	0.3590	0.4802	0.4028

Table 6.3.20: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0470	0.0518	0.0528
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7626	0.9252	0.8386
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.4572	0.6240	0.5144
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7550	0.9178	0.8310
1.5	1 σ^2	1.8	1 σ^2	2	1 σ^2	1.2	1 σ^2	0.2776	0.3782	0.3070

Table 6.3.21: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0522	0.0558	0.0572
1	1^2	1	1^2	1.5	1^2	1	1^2	0.4458	0.6254	0.5112
1	1^2	1	1^2	1.5	1^2	1.5	1^2	0.2512	0.3310	0.2786
1	1^2	1.5	1^2	1.5	1^2	1	1^2	0.4482	0.6148	0.5150
1.5	1^2	1.8	1^2	1	1^2	1.2	1^2	0.5772	0.7666	0.6536

Table 6.3.22: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0.0482	0.0500	0.0466
0	1	0	1	0	5	0	1	0.6612	0.1962	0.2144
0	1	0	1	0	5	0	5	0.3864	0.1416	0.1500
0	1	0	5	0	5	0	1	0.6718	0.1568	0.1768
0	5	0	8	0	9	0	2	0.4250	0.1170	0.1282

Table 6.3.23: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0460	0.0484	0.0482
0	1 σ^2	0	1 σ^2	0	5 σ^2	0	1 σ^2	0.6338	0.1254	0.1454
0	1 σ^2	0	1 σ^2	0	5 σ^2	0	5 σ^2	0.3280	0.0938	0.1054
0	1 σ^2	0	5 σ^2	0	5 σ^2	0	1 σ^2	0.6404	0.1246	0.1440
0	5 σ^2	0	8 σ^2	0	9 σ^2	0	2 σ^2	0.3446	0.0960	0.1016

Table 6.3.24: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0526	0.0478	0.0474
1	1^2	1	1^2	1	5^2	1	1^2	0.9666	0.1914	0.2060
1	1^2	1	1^2	1	5^2	1	5^2	0.7290	0.1326	0.1414
1	1^2	1	5^2	1	5^2	1	1^2	0.9696	0.1848	0.2002
1	5^2	1	8^2	1	9^2	1	2^2	0.6854	0.1370	0.1424

Table 6.3.25: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0.0466	0.0486	0.0474
0	1	0	1	1.5	5	0	1	0.9090	0.5102	0.5570
0	1	0	1	1.5	5	1.5	5	0.6466	0.3260	0.3608
0	1	1.5	5	1.5	5	0	1	0.9304	0.5174	0.5708
1.5	5	1.8	8	2	9	1.2	2	0.5032	0.1812	0.2034

Table 6.3.26: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0522	0.0556	0.0558
0	1 σ^2	0	1 σ^2	1.5	5 σ^2	0	1 σ^2	0.9996	0.9766	0.9888
0	1 σ^2	0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0.9274	0.7584	0.8134
0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0.9996	0.9764	0.9884
1.5	5 σ^2	1.8	8 σ^2	2	9 σ^2	1.2	2 σ^2	0.7804	0.5060	0.5618

Table 6.3.27: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0458	0.0538	0.0530
1	1^2	1	1^2	1.5	1.5^2	1	1^2	0.7910	0.6226	0.6468
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	0.5086	0.3682	0.3830
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.7934	0.6158	0.6394
2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.9126	0.7516	0.7736

6.3.3. Five Treatment Results

6.3.3.1. Five Treatment Peak 2 Results

Tables below show the result for Five treatments at peak two under the three underlying distributions. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio as presented in Tables 6.3.28-6.3.30. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio as presented in Tables 6.3.31-6.3.33. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio as shown in Tables 6.3.34-6.3.36.

Table 6.3.28: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0512	0.0524	0.0506
0	1	1.5	1	0	1	0	1	0	1	0.8600	0.9786	0.9282
0	1	1.5	1	1.5	1	0	1	0	1	0.9670	0.9982	0.9888
1.5	1	1.5	1	0	1	0	1	0	1	0.6442	0.8462	0.7224
1.4	1	2	1	1.8	1	1.5	1	1.2	1	0.4942	0.6882	0.5712

Table 6.3.29: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0480	0.0532	0.0480
0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.7136	0.8900	0.7946
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0	1 σ^2	0.8658	0.9754	0.9270
1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.4952	0.6836	0.5670
1.4	1 σ^2	2	1 σ^2	1.8	1 σ^2	1.5	1 σ^2	1.2	1 σ^2	0.3852	0.5152	0.4272

Table 6.3.30: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0534	0.0534	0.0532
1	1^2	1.5	1^2	1	1^2	1	1^2	1	1^2	0.4160	0.5824	0.4694
1	1^2	1.5	1^2	1.5	1^2	1	1^2	1	1^2	0.5750	0.7612	0.6400
1.5	1^2	1.5	1^2	1	1^2	1	1^2	1	1^2	0.2770	0.3724	0.3124
1.4	1^2	2	1^2	1.8	1^2	1.5	1^2	1.2	1^2	0.7728	0.9164	0.8378

Table 6.3.31: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0478	0.0540	0.0498
0	1	0	5	0	1	0	1	0	1	0.6106	0.1800	0.1956
0	1	0	5	0	5	0	1	0	1	0.8074	0.1962	0.2240
0	5	0	5	0	1	0	1	0	1	0.4168	0.1474	0.1586
0	4	0	9	0	8	0	5	0	2	0.7354	0.1664	0.1902

Table 6.3.32: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0516	0.0530	0.0500
0	1 σ^2	0	5 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.5966	0.1224	0.1426
0	1 σ^2	0	5 σ^2	0	5 σ^2	0	1 σ^2	0	1 σ^2	0.7820	0.1498	0.1752
0	5 σ^2	0	5 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.3880	0.1062	0.1168
0	4 σ^2	0	9 σ^2	0	8 σ^2	0	5 σ^2	0	2 σ^2	0.6520	0.1318	0.1516

Table 6.3.33: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0504	0.0458	0.0448
1	1^2	1	5^2	1	1^2	1	1^2	1	1^2	0.9484	0.1740	0.1886
1	1^2	1	5^2	1	5^2	1	1^2	1	1^2	0.9952	0.2408	0.2642
1	5^2	1	5^2	1	1^2	1	1^2	1	1^2	0.7676	0.1422	0.1496
1	4^2	1	9^2	1	8^2	1	5^2	1	2^2	0.9530	0.1880	0.1996

Table 6.3.34: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0520	0.0500	0.0522
0	1	1.5	5	0	1	0	1	0	1	0.8710	0.4800	0.5326
0	1	1.5	5	1.5	5	0	1	0	1	0.9810	0.6100	0.6804
1.5	5	1.5	5	0	1	0	1	0	1	0.6860	0.3500	0.3934
1.4	4	2	9	1.8	8	1.5	5	1.2	2	0.8400	0.2500	0.2894

Table 6.3.35: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0526	0.0500	0.0504
0	$1\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9970	0.9590	0.9750
0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9998	0.9960	0.9990
1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9446	0.7990	0.8428
1.4	$4\sigma^2$	2	9 σ^2	1.8	$8\sigma^2$	1.5	$5\sigma^2$	1.2	2 σ^2	0.9712	0.7280	0.7902

Table 6.3.36: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0480	0.0534	0.0528
1	1^2	1.5	1.5^2	1	1^2	1	1^2	1	1^2	0.7588	0.5754	0.5956
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	1	1^2	0.8968	0.7366	0.7590
1.5	1.5^2	1.5	1.5^2	1	1^2	1	1^2	1	1^2	0.5410	0.3848	0.4000
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	1.8	1.8^2	0.9712	0.8632	0.8804

6.3.3.2. Five Treatment Peak 3 Results

Tables below show the result for Five treatments at peak three under the three underlying distributions. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio as presented in Tables 6.3.37-6.3.39. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio as presented in Tables 6.3.40-6.3.42. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio as shown in Tables 6.3.43-6.3.45.

Table 6.3.37: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0516	0.0558	0.0530
0	1	0	1	1.5	1	0	1	0	1	0.9036	0.9906	0.9550
0	1	0	1	1.5	1	1.5	1	0	1	0.9092	0.9930	0.9556
0	1	1.5	1	1.5	1	0	1	0	1	0.9108	0.9890	0.9568
1.2	1	1.5	1	2	1	1.8	1	1.4	1	0.4548	0.6112	0.5000

Table 6.3.38: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1σ^2	0	1σ^2	0	1σ^2	0	1σ^2	0	1σ^2	0.0500	0.0544	0.0516
0	1σ^2	0	1σ^2	1.5	1σ^2	0	1σ^2	0	1σ^2	0.7662	0.9314	0.8464
0	1σ^2	0	1σ^2	1.5	1σ^2	1.5	1σ^2	0	1σ^2	0.7664	0.9264	0.8392
0	1σ^2	1.5	1σ^2	1.5	1σ^2	0	1σ^2	0	1σ^2	0.7764	0.9348	0.8552
1.2	1σ^2	1.5	1σ^2	2	1σ^2	1.8	1σ^2	1.4	1σ^2	0.3392	0.4744	0.3978

Table 6.3.39: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0532	0.0494	0.0474
1	1^2	1	1^2	1.5	1^2	1	1^2	1	1^2	0.4794	0.6504	0.5318
1	1^2	1	1^2	1.5	1^2	1.5	1^2	1	1^2	0.4724	0.6440	0.5216
1	1^2	1.5	1^2	1.5	1^2	1	1^2	1	1^2	0.4762	0.6458	0.5382
1.2	1^2	1.5	1^2	2	1^2	1.8	1^2	1.4	1^2	0.7064	0.8876	0.7840

Table 6.3.40: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0486	0.0510	0.0504
0	1	0	1	0	5	0	1	0	1	0.6670	0.1988	0.2238
0	1	0	1	0	5	0	5	0	1	0.6834	0.1780	0.2008
0	1	0	5	0	5	0	1	0	1	0.6796	0.1700	0.1968
0	2	0	5	0	9	0	8	0	5	0.5938	0.1482	0.1692

Table 6.3.41: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1σ^2	0	1σ^2	0	1σ^2	0	1σ^2	0	1σ^2	0.0492	0.0538	0.0514
0	1σ^2	0	1σ^2	0	5 σ^2	0	1σ^2	0	1σ^2	0.6640	0.1268	0.1482
0	1σ^2	0	1σ^2	0	5 σ^2	0	5 σ^2	0	1σ^2	0.6582	0.1294	0.1536
0	1σ^2	0	5 σ^2	0	5 σ^2	0	1σ^2	0	1σ^2	0.6552	0.1224	0.1470

Table 6.3.42: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0532	0.0550	0.0532
1	1^2	1	1^2	1	5^2	1	1^2	1	1^2	0.9736	0.1988	0.2154
1	1^2	1	1^2	1	5^2	1	5^2	1	1^2	0.9722	0.2030	0.2228
1	1^2	1	5^2	1	5^2	1	1^2	1	1^2	0.9756	0.1972	0.2148
1	2^2	1	4^2	1	9^2	1	8^2	1	5^2	0.8488	0.1554	0.1656

Table 6.3.43: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0476	0.0476	0.0478
0	1	0	1	1.5	5	0	1	0	1	0.9142	0.5166	0.5712
0	1	0	1	1.5	5	1.5	5	0	1	0.9292	0.5228	0.5796
0	1	1.5	5	1.5	5	0	1	0	1	0.9362	0.5204	0.5774
1.2	2	1.5	5	2	9	1.8	8	1.4	4	0.7396	0.2428	0.2780

Table 6.3.44: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0506	0.0512	0.0512
0	1 σ^2	0	1 σ^2	1.5	5 σ^2	0	1 σ^2	0	1 σ^2	0.9998	0.9800	0.9928
0	1 σ^2	0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0.9997	0.9804	0.9908
0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0	1 σ^2	0.9990	0.9762	0.9902
1.2	2 σ^2	1.5	5 σ^2	2	9 σ^2	1.8	8 σ^2	1.4	4 σ^2	0.9336	0.6602	0.7194

Table 6.3.45: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0522	0.0510	0.0520
1	1^2	1	1^2	1.5	1.5^2	1	1^2	1	1^2	0.8084	0.6274	0.6490
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8124	0.6304	0.6550
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8092	0.6302	0.6532
1.2	1.2^2	1.5	1.5^2	3	3^2	2	2^2	1.8	1.8^2	0.9966	0.9542	0.9632

6.3.3.3. Five Treatment Peak 4 Results

Tables below show the result for Five treatments at peak four under the three underlying distributions. The L_2 is better than L_1 or LW_2 if we change only the location parameters under all distributions and all different SB ratio as presented in Tables 6.3.46-6.3.48. Also, the L_1 is better than L_2 or LW_2 if the scale parameters change and the location parameters constant under all distribution and all different SB ratio as presented in Tables 6.3.49-6.3.51. Lastly, the L_1 is better than L_2 or LW_2 if the location parameters and scale parameters change under all distribution and all different SB ratio as shown in Tables 6.3.52-6.3.54.

Table 6.3.46: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0460	0.0518	0.0508
0	1	0	1	0	1	1.5	1	0	1	0.7872	0.9750	0.9210
0	1	0	1	0	1	1.5	1	1.5	1	0.5304	0.8302	0.7062
0	1	0	1	1.5	1	1.5	1	0	1	0.9670	0.9986	0.9906
1.2	1	1.5	1	1.8	1	2	1	1.4	1	0.4910	0.6814	0.5674

Table 6.3.47: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0520	0.0506	0.0536
0	1 σ^2	0	1 σ^2	0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.6254	0.8774	0.7778
0	1 σ^2	0	1 σ^2	0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.4056	0.6722	0.5492
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.8780	0.9780	0.9350
1.2	1 σ^2	1.5	1 σ^2	1.8	1 σ^2	2	1 σ^2	1.4	1 σ^2	0.3770	0.5312	0.4378

Table 6.3.48: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and equal variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0482	0.0538	0.0522
1	1^2	1	1^2	1	1^2	1.5	1^2	1	1^2	0.3622	0.5694	0.4658
1	1^2	1	1^2	1	1^2	1.5	1^2	1.5	1^2	0.2312	0.3632	0.2966
1	1^2	1	1^2	1.5	1^2	1.5	1^2	1	1^2	0.5588	0.7592	0.6356
1.2	1^2	1.5	1^2	1.8	1^2	2	1^2	1.4	1^2	0.7676	0.9248	0.8370

Table 6.3.49: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0442	0.0478	0.0464
0	1	0	1	0	1	0	5	0	1	0.5320	0.1910	0.1986
0	1	0	1	0	1	0	5	0	5	0.3668	0.1440	0.1506
0	1	0	1	0	5	0	5	0	1	0.8140	0.1996	0.2250
0	2	0	5	0	8	0	9	0	4	0.7482	0.1532	0.1786

Table 6.3.50: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0438	0.0488	0.0470
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$5\ \sigma^2$	0	$1\ \sigma^2$	0.4938	0.1166	0.1280
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$5\ \sigma^2$	0	$5\ \sigma^2$	0.3120	0.0958	0.1000
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$5\ \sigma^2$	0	$5\ \sigma^2$	0	$1\ \sigma^2$	0.7838	0.1592	0.1856
0	$2\ \sigma^2$	0	$5\ \sigma^2$	0	$8\ \sigma^2$	0	$9\ \sigma^2$	0	$4\ \sigma^2$	0.6548	0.1296	0.1506

Table 6.3.51: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with equal means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0492	0.0526	0.0524
1	1^2	1	1^2	1	1^2	1	5^2	1	1^2	0.9060	0.1842	0.1952
1	1^2	1	1^2	1	1^2	1	5^2	1	5^2	0.6588	0.1266	0.1308
1	1^2	1	1^2	1	5^2	1	5^2	1	1^2	0.9962	0.2330	0.2610
1	2^2	1	5^2	1	8^2	1	9^2	1	4^2	0.9638	0.2084	0.2254

Table 6.3.52: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n=12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1	0	1	0	1	0	1	0	1	0.0470	0.0472	0.0474
0	1	0	1	0	1	1.5	5	0	1	0.8008	0.4798	0.5126
0	1	0	1	0	1	1.5	5	1.5	5	0.5832	0.3460	0.3652
0	1	0	1	1.5	5	1.5	5	0	1	0.9850	0.6130	0.6796
1.2	2	1.5	5	1.8	8	2	9	1.4	4	0.8382	0.2520	0.2908

Table 6.3.53: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0492	0.0492	0.0494
0	1 σ^2	0	1 σ^2	0	1 σ^2	1.5	5 σ^2	0	1 σ^2	0.7488	0.6452	0.6660
0	1 σ^2	0	1 σ^2	0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0.5176	0.4556	0.4682
0	1 σ^2	0	1 σ^2	1.5	5 σ^2	1.5	5 σ^2	0	1 σ^2	0.9514	0.8162	0.8396
1.2	2 σ^2	1.5	5 σ^2	1.8	8 σ^2	2	9 σ^2	1.4	4 σ^2	0.9572	0.9358	0.9464

Table 6.3.54: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and different variance when number of blocks half the sample size under mixed design. (n= 12, Blk=6).

μ_1	${\sigma_1}^2$	μ_2	${\sigma_2}^2$	μ_3	${\sigma_3}^2$	μ_4	${\sigma_4}^2$	μ_5	${\sigma_5}^2$	L_1	L_2	LW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.3422	0.0562	0.0620
1	1^2	1	1^2	1	1^2	1.5	1.5^2	1	1^2	0.9248	0.5686	0.5988
1	1^2	1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	0.8296	0.3936	0.4236
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9822	0.7422	0.7768
1.8	1.8^2	2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.9600	0.8556	0.8726

CHAPTER 7. CONCLUSION

We conducted a simulation study in all three scenarios, and the comparison estimation power between the proposed tests either existed proposal test or new were done within the scenarios, and assuming random samples follows a normal distribution, a t-distributions with 3 degrees of freedom and an exponential distribution.

7.1. First Scenario

Two nonparametric tests testing for location parameters under the umbrella alternative mixed design consist of a CRD and a RCBD were proposed by Magel et al. (2010). Magel et al. (2010) compared powers of the tests when the SB ratios were 1/8,1/4, 1/3, 1/2, and 1, and when the CR ratio was always 1. We further investigated how the two tests compared for when the CR ratios were 2, 4, and 9 and when the SB ratios were 2, 3, 4, and 8 in addition to the SB ratios considered by Magel et al. (2010). As in Magel et al. (2010), all tests maintained their stated alpha value of 0.05 under all conditions considered. The results as to which test had the higher powers were the same as in Magel et al. (2010) even though the variance of the CRD portion went up to 9 times the variance of the RCBD portion. Namely, A^{**} had the highest powers. We did consider SB ratios greater than 1 which were not considered in Magel et al. (2010). We found A^{**} had the highest powers except for when the SB ratio was 8 and the CR ratio was 2 or greater for the normal and exponential distributions. In some of these cases, the powers for A^{***} was slightly higher. We did not notice this for the t-distribution. The powers were close, but A^{**} had slightly higher powers. Overall, it is recommended that A^{**} be used to test for the umbrella alternative for location in a mixed design when the variance ratio of the CRD to the RCBD and the underlying distributions are unknown. The test has worked well for a variety of variance ratios, sample size ratios, and in both symmetric and asymmetric distributions. Below we have summarized the best test for scenario for each combination of underlying distribution, SB Ratio and CR Ratio in Tables 7.1-7.3.

Table 7.1: Result summary for scenario one.

SB Ratio	CR Ratio	Best Test	Distribution
(1/8,1/4, 1/3, 1/2, 1)	2	A**	All Three
(2,3,4)	2	A**	All Three
8	2	A**	T
8	2	A***	Normal, Exponential

Table 7.2: Result summary for scenario one.

SB Ratio	CR Ratio	Best Test	Distribution
(1/8,1/4, 1/3, 1/2, 1)	4	A**	All Three
(2,3,4)	4	A**	All Three
8	4	A**	T
8	4	A***	Normal, Exponential

Table 7.3: Result summary for scenario one.

SB Ratio	CR Ratio	Best Test	Distribution
(1/8,1/4, 1/3, 1/2, 1)	9	A**	All Three
(2,3,4)	9	A**	All Three
8	9	A**	T
8	9	A***	Normal, Exponential

7.2. Second Scenario

We proposed and then compared three nonparametric tests for location and scale umbrella alternative complete randomized designs. We had three situations: a) means differ and variances constant; b) means constant and variances differ; and c) both means and variances differ. We checked the power comparison between the three proposed tests as follows: a) under standard normal distribution; b) t- distribution with (degree of freedom 3); and c) standard exponential distribution. We used the treatment 3 with peak 2, treatment 4 with peaks 2 and 3, and treatment 5 with peaks 2, 3, and 4.

All tests maintained their significance levels. For the three distributions considered with sample sizes equal to 15, and number of populations, and various peaks, T_2 has the largest powers if only the location parameters change. T_1 has the higher powers if only the scale parameters change. T_1 has the highest powers if the location parameters and scale parameters change for the normal and t-distributions. In the case of the exponential distribution, the powers of TW_2 and T_1 are close and both higher than the powers for T_2.Overall, when researchers want to test for differences in either location or scale, T_1 is recommended. Below we have summarized the best test for scenario for each combination of underlying distribution, SB Ratio and CR Ratio in Tables 7.4.

Table 7.4: Result summary for scenario two.

Parameter Change	Best Test	Distribution
Location Only	T_2	All Three
Scale Only	T_1	All Three
Both	T_1	All Three

7.3. Third Scenario

Three nonparametric tests for location and scale parameters were proposed for the umbrella alternative mixed design. In this scenario, we considered the sample sizes n=12 and the number of blocks as half, equal, and twice the sample size. For all the three situations within scenario three, the three proposed tests had significance levels of approximately 0.05. The power comparison between the three nonparametric tests were run under a standard normal distribution, t- distribution with (degree of freedom 3), and standard exponential distribution. This power comparison between the three nonparametric tests were also run for treatment 3 with peak 2, treatment 4 with peaks 2 and 3, and treatment 5 with peaks 2, 3, and 4.

When the populations had unequal location parameters and equal scale parameters with the sample size for the CRD portion half, equal, or twice to the number of blocks for the RCBD portion for all distributions, then the L_2 test was better than L_1 or LW_2 tests. When the populations had equal location parameters and unequal scale parameters with sample size for the CRD portion half, equal, and twice to number of blocks for the RCBD portion, then the L_1 test had a higher estimated power than the L_2 or LW_2 tests. When the populations had unequal location parameters and unequal scale parameters with sample size for the CRD portion half, equal, and twice to the number of blocks for RCBD portion, then the L_1 test has higher estimated powers than the L_2 or LW_2 tests. Overall, when researchers want to test for differences in either both location and scale or scale, L_1 test is recommended. Below we have summarized the best test for scenario for each combination of underlying distribution, SB Ratio and CR Ratio in Tables 7.5-7.7.

Table 7.5: Result summary when location parameters change only for scenario three.

SB Ratio	Best Test	Distribution
1/2	L_2	All Three
1	L_2	All Three
2	L_2	All Three

Table 7.6: Result summary when scale parameters change only for scenario three.

SB Ratio	Best Test	Distribution
1/2	L_1	All Three
1	L_1	All Three
2	L_1	All Three

Table 7.7: Result summary when both parameters change only for scenario three.

SB Ratio	Best Test	Distribution
1/2	L_1	All Three
1	L_1	All Three
2	L_1	All Three

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APPENDIX A. SCENARIO ONE

Table A.1: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0502	0.0536
0	0.5	0	0.6976	0.6168
0	0.5	0.5	0.2800	0.2502
0.5	0.5	0	0.2774	0.2556
0.8	1	0.5	0.4466	0.3956

*SB ratio= 1/8, CR ratio= 4

Table A.2: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0512	0.0576
0	0.5	0	0.4438	0.3578
0	0.5	0.5	0.1800	0.1612
0.5	0.5	0	0.1838	0.1646
0.8	1	0.5	0.2736	0.2336

*SB ratio= 1/8, CR ratio= 4

Table A.3: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0500	0.0564
0	0.5	0	0.8632	0.7434
0	0.5	0.5	0.3684	0.3036
0.5	0.5	0	0.3646	0.2982
0.8	1	0.5	0.6154	0.5052

*SB ratio= 1/8, CR ratio= 4

Table A.4: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0516	0.0528
0	0.5	0	0.7732	0.5070
0	0.5	0.5	0.3148	0.2002
0.5	0.5	0	0.3228	0.2102
0.8	1	0.5	0.5034	0.3070

*SB ratio=1/4, CR ratio= 4

Table A.5: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0526	0.0490
0	0.5	0	0.4878	0.2210
0	0.5	0.5	0.1910	0.1158
0.5	0.5	0	0.1912	0.1112
0.8	1	0.5	0.3070	0.1512

*SB ratio= 1/4, CR ratio= 4

Table A.6: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0602	0.0588
0	0.5	0	0.9038	0.4992
0	0.5	0.5	0.4014	0.1916
0.5	0.5	0	0.4268	0.1958
0.8	1	0.5	0.6812	0.3180

*SB ratio= ¼, CR ratio= 4

Table A.7: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0.0	0.0	0.0	0.0496	0.0502
0.0	0.5	0.0	0.7188	0.4686
0.0	0.5	0.5	0.2790	0.1764
0.5	0.5	0.0	0.2818	0.1818
0.8	1.0	0.5	0.4590	0.2924

*SB ratio= 1/3, CR ratio= 4

Table A.8: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0.0	0.0	0.0	0.0474	0.0442
0.0	0.5	0.0	0.4186	0.1978
0.0	0.5	0.5	0.1854	0.1070
0.5	0.5	0.0	0.1768	0.1046
0.8	1.0	0.5	0.2542	0.1340

*SB ratio= 1/3, CR ratio= 4

Table A.9: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0.0	0.0	0.0	0.0534	0.0536
0.0	0.5	0.0	0.8370	0.4284
0.0	0.5	0.5	0.3398	0.1566
0.5	0.5	0.0	0.3542	0.1728
0.8	1.0	0.5	0.5988	0.2610

*SB ratio= 1/3, CR ratio= 4

Table A.10: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0498	0.0534
0	0.5	0	0.7834	0.5326
0	0.5	0.5	0.3150	0.2086
0.5	0.5	0	0.3324	0.2140
0.8	1	0.5	0.4978	0.3254

*SB ratio= 1/2, CR ratio= 4

Table A.11: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0472	0.0498
0	0.5	0	0.8888	0.4436
0	0.5	0.5	0.3728	0.1666
0.5	0.5	0	0.3866	0.1794
0.8	1	0.5	0.6406	0.2776

*SB ratio= 1/2, CR ratio= 4

Table A.12: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =20 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0508	0.0524
0	0.5	0	0.6870	0.6316
0	0.5	0.5	0.2520	0.2264
0.5	0.5	0	0.2602	0.2290
0.8	1	0.5	0.4452	0.3926

*SB ratio= 1/2, CR ratio= 4

Table A.13: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0508	0.0526
0	0.5	0	0.4968	0.3876
0	0.5	0.5	0.1928	0.1604
0.5	0.5	0	0.1926	0.1532
0.8	1	0.5	0.3006	0.2378

*SB ratio= 1, CR ratio= 4

Table A.14: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0504	0.0492
0	0.5	0	0.2482	0.1510
0	0.5	0.5	0.1174	0.0900
0.5	0.5	0	0.1218	0.0878
0.8	1	0.5	0.1620	0.1052

*SB ratio= 1, CR ratio= 4

Table A.15: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0560	0.0522
0	0.5	0	0.5738	0.3114
0	0.5	0.5	0.2164	0.1386
0.5	0.5	0	0.2072	0.1342
0.8	1	0.5	0.3568	0.2038

*SB ratio= 1, CR ratio= 4

Table A.16: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0530	0.0472
0	0.5	0	0.8052	0.7172
0	0.5	0.5	0.3304	0.2864
0.5	0.5	0	0.3346	0.2862
0.8	1	0.5	0.5402	0.4624

*SB ratio= 2, CR ratio= 4

Table A.17: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0440	0.0474
0	0.5	0	0.4064	0.2344
0	0.5	0.5	0.1648	0.1142
0.5	0.5	0	0.1628	0.1164
0.8	1	0.5	0.2502	0.1628

*SB ratio= 2, CR ratio= 4

Table A.18: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0530	0.0472
0	0.5	0	0.8052	0.7172
0	0.5	0.5	0.3304	0.2864
0.5	0.5	0	0.3346	0.2862
0.8	1	0.5	0.5402	0.4624

*SB ratio= 2, CR ratio= 4

Table A.19: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0516	0.0534
0	0.5	0	0.7466	0.7148
0	0.5	0.5	0.3024	0.2774
0.5	0.5	0	0.3068	0.2842
0.8	1	0.5	0.4874	0.4450

*SB ratio= 3, CR ratio= 4

Table A.20: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0482	0.0486
0	0.5	0	0.3520	0.2372
0	0.5	0.5	0.1444	0.1114
0.5	0.5	0	0.1554	0.1200
0.8	1	0.5	0.2202	0.1486

*SB ratio= 3, CR ratio= 4

Table A.21: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0486	0.0486
0	0.5	0	0.7648	0.5476
0	0.5	0.5	0.3026	0.2162
0.5	0.5	0	0.2888	0.2114
0.8	1	0.5	0.5072	0.3414

*SB ratio= 3, CR ratio= 4

Table A.22: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0430	0.0476
0	0.5	0	0.5578	0.5654
0	0.5	0.5	0.3504	0.3464
0.5	0.5	0	0.3474	0.3490
0.8	1	0.5	0.5532	0.5482

*SB ratio= 4, CR ratio= 4

Table A.23: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0570	0.0524
0	0.5	0	0.3790	0.2684
0	0.5	0.5	0.1686	0.1292
0.5	0.5	0	0.1686	0.1304
0.8	1	0.5	0.2456	0.1810

*SB ratio= 4, CR ratio= 4

Table A.24: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0548	0.0536
0	0.5	0	0.8324	0.6540
0	0.5	0.5	0.3378	0.2500
0.5	0.5	0	0.3396	0.2582
0.8	1	0.5	0.5722	0.4196

*SB ratio= 4, CR ratio= 4

Table A.25: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0510	0.0492
0	0.5	0	0.7444	0.7994
0	0.5	0.5	0.3092	0.3380
0.5	0.5	0	0.3064	0.3384
0.8	1	0.5	0.4898	0.5334

*SB ratio= 8, CR ratio= 4

Table A.26: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0448	0.0496
0	0.5	0	0.3022	0.2698
0	0.5	0.5	0.1456	0.1250
0.5	0.5	0	0.1514	0.1352
0.8	1	0.5	0.1980	0.1710

*SB ratio= 8, CR ratio= 4

Table A.27: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0470	0.0518
0	0.5	0	0.7210	0.6564
0	0.5	0.5	0.2812	0.2502
0.5	0.5	0	0.2752	0.2454
0.8	1	0.5	0.4690	0.4116

*SB ratio= 8, CR ratio= 4

Table A.28: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0504	0.0558
0	0.5	0	0.6986	0.6206
0	0.5	0.5	0.2814	0.2534
0.5	0.5	0	0.2740	0.2454
0.8	1	0.5	0.4472	0.3892

*SB ratio= 1/8, CR ratio= 9

Table A.29: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0486	0.0534
0	0.5	0	0.4010	0.3230
0	0.5	0.5	0.1764	0.1542
0.5	0.5	0	0.1696	0.1490
0.8	1	0.5	0.2536	0.2120

*SB ratio= 1/8, CR ratio= 9

Table A.30: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=5 Blk =40 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0514	0.0552
0	0.5	0	0.8228	0.6796
0	0.5	0.5	0.3384	0.2732
0.5	0.5	0	0.3422	0.2790
0.8	1	0.5	0.5756	0.4480

*SB ratio= 1/8, CR ratio= 9

Table A.31: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0496	0.0476
0	0.5	0	0.7772	0.5086
0	0.5	0.5	0.3064	0.1946
0.5	0.5	0	0.3200	0.1996
0.8	1	0.5	0.4932	0.2968

*SB ratio= 1/4, CR ratio= 9

Table A.32: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0510	0.0516
0	0.5	0	0.4320	0.1794
0	0.5	0.5	0.1798	0.0976
0.5	0.5	0	0.1824	0.0942
0.8	1	0.5	0.2730	0.1264

*SB ratio= 1/4, CR ratio= 9

Table A.33: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk = 40 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0528	0.0522
0	0.5	0	0.8640	0.3678
0	0.5	0.5	0.3638	0.1590
0.5	0.5	0	0.3608	0.1542
0.8	1	0.5	0.6066	0.2368

*SB ratio= 1/4, CR ratio= 9

Table A.34: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0452	0.0446
0	0.5	0	0.7022	0.4624
0	0.5	0.5	0.2832	0.1794
0.5	0.5	0	0.2864	0.1804
0.8	1	0.5	0.4466	0.2852

*SB ratio= 1/3, CR ratio= 9

Table A.35: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0432	0.0440
0	0.5	0	0.3600	0.1492
0	0.5	0.5	0.1494	0.0858
0.5	0.5	0	0.1470	0.0826
0.8	1	0.5	0.2416	0.1092

*SB ratio= 1/3, CR ratio= 9

Table A.36: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =30 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0476	0.0462
0	0.5	0	0.7790	0.3074
0	0.5	0.5	0.3132	0.1318
0.5	0.5	0	0.3188	0.1424
0.8	1	0.5	0.5172	0.2058

*SB ratio= 1/3, CR ratio= 9

Table A.37: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0500	0.0504
0	0.5	0	0.7790	0.5324
0	0.5	0.5	0.3264	0.2176
0.5	0.5	0	0.3226	0.2182
0.8	1	0.5	0.5100	0.3318

*SB ratio= 1/2, CR ratio= 9

Table A.38: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under T (3) *(3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0466	0.0494
0	0.5	0	0.3910	0.1408
0	0.5	0.5	0.1630	0.0886
0.5	0.5	0	0.1676	0.0884
0.8	1	0.5	0.2438	0.1092

*SB ratio= 1/2, CR ratio= 9

Table A.39: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=15 Blk =30 under exp(1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0492	0.0474
0	0.5	0	0.8220	0.2898
0	0.5	0.5	0.3424	0.1352
0.5	0.5	0	0.3362	0.1298
0.8	1	0.5	0.5558	0.1886

*SB ratio= 1/2, CR ratio= 9

Table A.40: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0520	0.0540
0	0.5	0	0.5110	0.3864
0	0.5	0.5	0.1974	0.1664
0.5	0.5	0	0.1948	0.1626
0.8	1	0.5	0.3058	0.2328

*SB ratio= 1, CR ratio= 9

Table A.41: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0422	0.0450
0	0.5	0	0.2138	0.1112
0	0.5	0.5	0.1168	0.0830
0.5	0.5	0	0.1058	0.0736
0.8	1	0.5	0.1378	0.0870

*SB ratio= 1, CR ratio= 9

Table A.42: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=10 Blk =10 under exp(1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0498	0.0544
0	0.5	0	0.4696	0.2052
0	0.5	0.5	0.1770	0.1052
0.5	0.5	0	0.1738	0.1058
0.8	1	0.5	0.2860	0.1372

*SB ratio= 1, CR ratio= 9

Table A.43: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0472	0.0460
0	0.5	0	0.7998	0.7020
0	0.5	0.5	0.3302	0.2848
0.5	0.5	0	0.3402	0.2860
0.8	1	0.5	0.5316	0.4540

*SB ratio= 2, CR ratio= 9

Table A.44: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under T(3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0516	0.0470
0	0.5	0	0.3174	0.1502
0	0.5	0.5	0.1422	0.0900
0.5	0.5	0	0.1436	0.0938
0.8	1	0.5	0.2044	0.1090

*SB ratio= 2, CR ratio= 9

Table A.45: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =15 under exp(1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0480	0.0462
0	0.5	0	0.7194	0.3312
0	0.5	0.5	0.2818	0.1468
0.5	0.5	0	0.2816	0.1548
0.8	1	0.5	0.4738	0.2126

*SB ratio= 2, CR ratio= 9

Table A.46: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0472	0.0460
0	0.5	0	0.7998	0.7020
0	0.5	0.5	0.3302	0.2848
0.5	0.5	0	0.3402	0.2860
0.8	1	0.5	0.5316	0.4540

*SB ratio= 3, CR ratio= 9

Table A.47: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under T(3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0508	0.0470
0	0.5	0	0.2698	0.1458
0	0.5	0.5	0.1220	0.0886
0.5	0.5	0	0.1272	0.0904
0.8	1	0.5	0.1756	0.1134

*SB ratio= 3, CR ratio= 9

Table A.48: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=30 Blk =10 under exp(1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0472	0.0532
0	0.5	0	0.6128	0.3210
0	0.5	0.5	0.2294	0.1376
0.5	0.5	0	0.2350	0.1390
0.8	1	0.5	0.3972	0.2062

*SB ratio= 3, CR ratio= 9

Table A.49: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0566	0.0568
0	0.5	0	0.8108	0.8072
0	0.5	0.5	0.3388	0.3516
0.5	0.5	0	0.3482	0.3460
0.8	1	0.5	0.5454	0.5412

*SB ratio= 4, CR ratio= 9

Table A.50: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0520	0.0522
0	0.5	0	0.3042	0.1674
0	0.5	0.5	0.1322	0.0958
0.5	0.5	0	0.1296	0.0970
0.8	1	0.5	0.1934	0.1270

*SB ratio= 4, CR ratio= 9

Table A.51: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =10 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0466	0.0458
0	0.5	0	0.6822	0.4092
0	0.5	0.5	0.2596	0.1682
0.5	0.5	0	0.2556	0.1676
0.8	1	0.5	0.4286	0.2408

*SB ratio= 4, CR ratio= 9

Table A.52: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0566	0.0548
0	0.5	0	0.7488	0.8086
0	0.5	0.5	0.3076	0.3388
0.5	0.5	0	0.3048	0.3302
0.8	1	0.5	0.4978	0.5448

*SB ratio= 8, CR ratio= 9

Table A.53: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0534	0.0528
0	0.5	0	0.2452	0.1656
0	0.5	0.5	0.1132	0.0918
0.5	0.5	0	0.1118	0.0864
0.8	1	0.5	0.1556	0.1184

*SB ratio= 8, CR ratio= 9

Table A.54: Estimated rejection percentages for the two proposed tests for trt=3 p=2 n=40 Blk =5 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	A**	A***
0	0	0	0.0448	0.0446
0	0.5	0	0.5528	0.3898
0	0.5	0.5	0.2110	0.1632
0.5	0.5	0	0.1984	0.1590
0.8	1	0.5	0.3382	0.2418

*SB ratio= 8, CR ratio= 9

Table A.55: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under N (0.1) *sqrt (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0532	0.0488
0	0.5	0	0	0.6804	0.5780
0	0.5	0.5	0	0.6870	0.5756
0.5	0.5	0	0	0.4146	0.3368
0.2	1	0.8	0.5	0.8234	0.7278

*SB ratio= 1/8, CR ratio= 2

Table A.56: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0456	0.0462
0	0.5	0	0	0.6976	0.5910
0	0.5	0.5	0	0.6848	0.5742
0.5	0.5	0	0	0.4038	0.3294
0.2	1	0.8	0.5	0.8116	0.7066

*SB ratio= 1/8, CR ratio= 4

Table A.57: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0504	0.0468
0	0.5	0	0	0.4300	0.3226
0	0.5	0.5	0	0.4374	0.3312
0.5	0.5	0	0	0.2394	0.1846
0.2	1	0.8	0.5	0.5388	0.4080

*SB ratio= 1/8, CR ratio= 4

Table A.58: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0536	0.0494
0	0.5	0	0	0.8666	0.7270
0	0.5	0.5	0	0.8476	0.7070
0.5	0.5	0	0	0.5550	0.4046
0.2	1	0.8	0.5	0.9380	0.8254

*SB ratio= 1/8, CR ratio= 4

Table A.59: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0532	0.0502
0	0.5	0	0	0.7702	0.5138
0	0.5	0.5	0	0.7700	0.5032
0.5	0.5	0	0	0.4716	0.2864
0.2	1	0.8	0.5	0.8888	0.6276

*SB ratio= 1/4, CR ratio= 4

Table A.60: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0542	0.0548
0	0.5	0	0	0.4636	0.2152
0	0.5	0.5	0	0.4624	0.2132
0.5	0.5	0	0	0.2776	0.1480
0.2	1	0.8	0.5	0.5948	0.2642

*SB ratio= 1/4, CR ratio= 4

Table A.61: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0496	0.0482
0	0.5	0	0	0.9138	0.4818
0	0.5	0.5	0	0.8876	0.4758
0.5	0.5	0	0	0.6092	0.2742
0.2	1	0.8	0.5	0.9660	0.6130

*SB ratio= 1/4, CR ratio= 4

Table A.62: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0500	0.0452
0	0.5	0	0	0.6988	0.4434
0	0.5	0.5	0	0.7058	0.4536
0.5	0.5	0	0	0.4238	0.2638
0.2	1	0.8	0.5	0.8410	0.5870

*SB ratio= 1/3, CR ratio= 4

Table A.63: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0542	0.0532
0	0.5	0	0	0.4134	0.1936
0	0.5	0.5	0	0.4124	0.1980
0.5	0.5	0	0	0.2410	0.1252
0.2	1	0.8	0.5	0.5274	0.2292

*SB ratio= 1/3, CR ratio= 4

Table A.64: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0436	0.0460
0	0.5	0	0	0.8432	0.4072
0	0.5	0.5	0	0.8270	0.4184
0.5	0.5	0	0	0.5204	0.2266
0.2	1	0.8	0.5	0.9340	0.5246

*SB ratio= 1/3, CR ratio= 4

Table A.65: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0490	0.0522
0	0.5	0	0	0.7738	0.5094
0	0.5	0.5	0	0.7706	0.5198
0.5	0.5	0	0	0.4762	0.2814
0.2	1	0.8	0.5	0.8816	0.6450

*SB ratio= 1/2, CR ratio= 4

Table A.66: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0504	0.0488
0	0.5	0	0	0.4518	0.1986
0	0.5	0.5	0	0.4430	0.1946
0.5	0.5	0	0	0.2572	0.1232
0.2	1	0.8	0.5	0.5392	0.2286

*SB ratio= 1/2, CR ratio= 4

Table A.67: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0486	0.0460
0	0.5	0	0	0.8876	0.4164
0	0.5	0.5	0	0.8672	0.4282
0.5	0.5	0	0	0.5698	0.2406
0.2	1	0.8	0.5	0.9580	0.5416

*SB ratio= 1/2, CR ratio= 4

Table A.68: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0534	0.0550
0	0.5	0	0	0.4872	0.3622
0	0.5	0.5	0	0.4804	0.3668
0.5	0.5	0	0	0.2830	0.2112
0.2	1	0.8	0.5	0.6236	0.4792

*SB ratio= 1, CR ratio= 4

Table A.69: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0496	0.0448
0	0.5	0	0	0.2504	0.1420
0	0.5	0.5	0	0.2968	0.1770
0.5	0.5	0	0	0.1752	0.1134
0.2	1	0.8	0.5	0.3098	0.1658

*SB ratio= 1, CR ratio= 4

Table A.70: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0418	0.0484
0	0.5	0	0	0.5546	0.2754
0	0.5	0.5	0	0.5548	0.2890
0.5	0.5	0	0	0.3164	0.1700
0.2	1	0.8	0.5	0.6900	0.3700

*SB ratio= 1, CR ratio= 4

Table A.71: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0518	0.0522
0	0.5	0	0	0.8028	0.6990
0	0.5	0.5	0	0.7830	0.6858
0.5	0.5	0	0	0.4848	0.4190
0.2	1	0.8	0.5	0.9008	0.8250

*SB ratio= 2, CR ratio= 4

Table A.72: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0578	0.0554
0	0.5	0	0	0.3972	0.2178
0	0.5	0.5	0	0.3908	0.2238
0.5	0.5	0	0	0.2448	0.1516
0.2	1	0.8	0.5	0.4956	0.2896

*SB ratio= 2, CR ratio= 4

Table A.73: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0540	0.0530
0	0.5	0	0	0.8360	0.5350
0	0.5	0.5	0	0.8138	0.5366
0.5	0.5	0	0	0.5202	0.3070
0.2	1	0.8	0.5	0.9240	0.6644

*SB ratio= 2, CR ratio= 4

Table A.74: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0464	0.0480
0	0.5	0	0	0.7372	0.6932
0.5	0.5	0	0	0.4326	0.4042
0.2	1	0.8	0.5	0.8552	0.8184
0	0.5	0.5	0	0.7278	0.6980

*SB ratio= 3, CR ratio= 4

Table A.75: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0484
0	0.5	0	0	0.3494	0.2230
0	0.5	0.5	0	0.3424	0.2370
0.5	0.5	0	0	0.2090	0.1426
0.2	1	0.8	0.5	0.4282	0.2766

*SB ratio= 3, CR ratio= 4

Table A.76: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0546	0.0528
0	0.5	0	0	0.7574	0.5308
0	0.5	0.5	0	0.7454	0.5330
0.5	0.5	0	0	0.4600	0.3026
0.2	1	0.8	0.5	0.8692	0.6516

*SB ratio= 3, CR ratio= 4

Table A.77: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0496	0.0510
0	0.5	0	0	0.8014	0.7910
0	0.5	0.5	0	0.8020	0.7876
0.5	0.5	0	0	0.4940	0.4892
0.2	1	0.8	0.5	0.9040	0.9004

*SB ratio= 4, CR ratio= 4

Table A.78: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0436	0.0450
0	0.5	0	0	0.3690	0.2434
0	0.5	0.5	0	0.3746	0.2674
0.5	0.5	0	0	0.2338	0.1678
0.2	1	0.8	0.5	0.4854	0.3274

*SB ratio= 4, CR ratio= 4

Table A.79: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0486	0.0532
0	0.5	0	0	0.8212	0.6374
0	0.5	0.5	0	0.7972	0.6220
0.5	0.5	0	0	0.5126	0.3706
0.2	1	0.8	0.5	0.9084	0.7640

*SB ratio= 4, CR ratio= 4

Table A.80: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0524	0.0468
0	0.5	0	0	0.7202	0.7816
0	0.5	0.5	0	0.7324	0.7820
0.5	0.5	0	0	0.4360	0.4846
0.2	1	0.8	0.5	0.8608	0.8988

*SB ratio= 8, CR ratio= 4

Table A.81: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0472	0.0462
0	0.5	0	0	0.3120	0.2642
0	0.5	0.5	0	0.3116	0.2496
0.5	0.5	0	0	0.1790	0.1676
0.2	1	0.8	0.5	0.3884	0.3312

*SB ratio= 8, CR ratio= 4

Table A.82: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0504	0.0528
0	0.5	0	0	0.7164	0.6330
0	0.5	0.5	0	0.7070	0.6272
0.5	0.5	0	0	0.4096	0.3668
0.2	1	0.8	0.5	0.8320	0.7520

*SB ratio= 8, CR ratio= 4

Table A.83: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0518	0.0490
0	0.5	0	0	0.7720	0.4978
0	0.5	0.5	0	0.6926	0.5872
0.5	0.5	0	0	0.4018	0.3270
0.2	1	0.8	0.5	0.8148	0.7114

*SB ratio= 1/8, CR ratio= 9

Table A.84: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0520	0.0472
0	0.5	0	0	0.4100	0.2950
0	0.5	0.5	0	0.4052	0.2942
0.5	0.5	0	0	0.2276	0.1656
0.2	1	0.8	0.5	0.5136	0.3688

*SB ratio= 1/8, CR ratio= 9

Table A.85: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=5 Blk =40 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0514	0.0478
0	0.5	0	0	0.8340	0.6544
0	0.5	0.5	0	0.8100	0.6412
0.5	0.5	0	0	0.5088	0.3716
0.2	1	0.8	0.5	0.9264	0.7836

*SB ratio= 1/8, CR ratio= 9

Table A.86: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0522	0.0488
0	0.5	0	0	0.6950	0.5832
0	0.5	0.5	0	0.7638	0.4986
0.5	0.5	0	0	0.4758	0.2908
0.2	1	0.8	0.5	0.8926	0.6320

*SB ratio= 1/4, CR ratio= 9

Table A.87: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0502	0.0530
0	0.5	0	0	0.4314	0.1748
0	0.5	0.5	0	0.4254	0.1826
0.5	0.5	0	0	0.2440	0.1226
0.2	1	0.8	0.5	0.5442	0.2088

*SB ratio= 1/4, CR ratio= 9

Table A.88: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk = 40 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0524	0.0454
0	0.5	0	0	0.8656	0.3574
0	0.5	0.5	0	0.8494	0.3762
0.5	0.5	0	0	0.5534	0.2062
0.2	1	0.8	0.5	0.9390	0.4674

*SB ratio= 1/4, CR ratio= 9

Table A.89: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0458	0.0484
0	0.5	0	0	0.7084	0.4566
0	0.5	0.5	0	0.7002	0.4476
0.5	0.5	0	0	0.4166	0.2522
0.2	1	0.8	0.5	0.8320	0.5820

*SB ratio= 1/3, CR ratio= 9

Table A.90: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0480	0.0450
0	0.5	0	0	0.3638	0.1482
0	0.5	0.5	0	0.3708	0.1470
0.5	0.5	0	0	0.2106	0.1050
0.2	1	0.8	0.5	0.4650	0.1832

*SB ratio= 1/3, CR ratio= 9

Table A.91: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =30 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0536	0.0454
0	0.5	0	0	0.7882	0.3046
0	0.5	0.5	0	0.7596	0.3080
0.5	0.5	0	0	0.4602	0.1788
0.2	1	0.8	0.5	0.8848	0.3844

*SB ratio= 1/3, CR ratio= 9

Table A.92: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0510	0.0456
0	0.5	0	0	0.7734	0.4948
0	0.5	0.5	0	0.7656	0.5232
0.5	0.5	0	0	0.4786	0.2954
0.2	1	0.8	0.5	0.8854	0.6498

*SB ratio= 1/2, CR ratio= 9

Table A.93: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under T (3) *(3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0466	0.0478
0	0.5	0	0	0.3884	0.1388
0	0.5	0.5	0	0.3750	0.1394
0.5	0.5	0	0	0.2358	0.1104
0.2	1	0.8	0.5	0.4940	0.1772

*SB ratio= 1/2, CR ratio= 9

Table A.94: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=15 Blk =30 under exp(1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0450	0.0466
0	0.5	0	0	0.8230	0.2792
0	0.5	0.5	0	0.7994	0.3012
0.5	0.5	0	0	0.4890	0.1592
0.2	1	0.8	0.5	0.9052	0.3640

*SB ratio= 1/2, CR ratio= 9

Table A.95: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0556	0.0506
0	0.5	0	0	0.4866	0.3722
0	0.5	0.5	0	0.4990	0.3816
0.5	0.5	0	0	0.2804	0.2166
0.2	1	0.8	0.5	0.6094	0.4664

*SB ratio= 1, CR ratio= 9

Table A.96: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under T (3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0564	0.0468
0	0.5	0	0	0.2158	0.1150
0	0.5	0.5	0	0.2186	0.1118
0.5	0.5	0	0	0.1350	0.0896
0.2	1	0.8	0.5	0.2638	0.1268

*SB ratio= 1, CR ratio= 9

Table A.97: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=10 Blk =10 under exp(1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0534	0.0568
0	0.5	0	0	0.4814	0.2036
0	0.5	0.5	0	0.4724	0.2078
0.5	0.5	0	0	0.2632	0.1266
0.2	1	0.8	0.5	0.5806	0.2434

*SB ratio= 1, CR ratio= 9

Table A.98: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0456	0.0506
0	0.5	0	0	0.7898	0.7002
0	0.5	0.5	0	0.7700	0.6744
0.5	0.5	0	0	0.4778	0.4060
0.2	1	0.8	0.5	0.8992	0.8264

*SB ratio= 2, CR ratio= 9

Table A.99: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0568	0.0558
0	0.5	0	0	0.3048	0.1548
0	0.5	0.5	0	0.3124	0.1510
0.5	0.5	0	0	0.1956	0.1100
0.2	1	0.8	0.5	0.3852	0.1696

*SB ratio= 2, CR ratio= 9

Table A.100: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =15 under exp(1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0496	0.0500
0	0.5	0	0	0.7120	0.3154
0	0.5	0.5	0	0.7004	0.3428
0.5	0.5	0	0	0.4052	0.1812
0.2	1	0.8	0.5	0.8296	0.4064

*SB ratio= 2, CR ratio= 9

Table A.101: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0542
0	0.5	0	0	0.7402	0.7076
0	0.5	0.5	0	0.7270	0.6764
0.5	0.5	0	0	0.4374	0.4028
0.2	1	0.8	0.5	0.8558	0.8284

*SB ratio= 3, CR ratio= 9

Table A.102: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0438	0.0538
0	0.5	0	0	0.2626	0.1436
0	0.5	0.5	0	0.2548	0.1474
0.5	0.5	0	0	0.1706	0.1108
0.2	1	0.8	0.5	0.3352	0.1784

*SB ratio= 3, CR ratio= 9

Table A.103: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=30 Blk =10 under exp(1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0452	0.0516
0	0.5	0	0	0.6272	0.3162
0	0.5	0.5	0	0.5982	0.3268
0.5	0.5	0	0	0.3494	0.1896
0.2	1	0.8	0.5	0.7416	0.4100

*SB ratio= 3, CR ratio= 9

Table A.104: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0470	0.0424
0	0.5	0	0	0.8056	0.8072
0	0.5	0.5	0	0.8076	0.7914
0.5	0.5	0	0	0.5028	0.4950
0.2	1	0.8	0.5	0.9098	0.9098

*SB ratio= 4, CR ratio= 9

Table A.105: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0526	0.0536
0	0.5	0	0	0.2802	0.1620
0	0.5	0.5	0	0.2834	0.1662
0.5	0.5	0	0	0.1788	0.1228
0.2	1	0.8	0.5	0.3544	0.1916

*SB ratio= 4, CR ratio= 9

Table A.106: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =10 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0454	0.0500
0	0.5	0	0	0.6626	0.3716
0	0.5	0.5	0	0.6596	0.3778
0.5	0.5	0	0	0.3826	0.2220
0.2	1	0.8	0.5	0.7926	0.4940

*SB ratio= 4, CR ratio= 9

Table A.107: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0464	0.0508
0	0.5	0	0	0.7352	0.7952
0	0.5	0.5	0	0.7238	0.7822
0.5	0.5	0	0	0.4404	0.4954
0.2	1	0.8	0.5	0.8554	0.9020

*SB ratio= 8, CR ratio= 9

Table A.108: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0446
0	0.5	0	0	0.2304	0.1604
0	0.5	0.5	0	0.2264	0.1586
0.5	0.5	0	0	0.1502	0.1212
0.2	1	0.8	0.5	0.2884	0.2078

*SB ratio= 8, CR ratio= 9

Table A.109: Estimated rejection percentages for the two proposed tests for trt=4 p=2 n=40 Blk =5 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0478	0.0502
0	0.5	0	0	0.5238	0.3734
0	0.5	0.5	0	0.5234	0.3856
0.5	0.5	0	0	0.3002	0.2172
0.2	1	0.8	0.5	0.6714	0.4834

*SB ratio= 8, CR ratio= 9

Table A.110: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0536	0.0492
0	0	0.5	0	0.6738	0.5656
0	0	0.5	0.5	0.3952	0.3232
0	0.5	0.5	0	0.6842	0.5688
0.5	0.8	1	0.2	0.8238	0.7168

*SB ratio= 1/8, CR ratio= 4

Table A.111: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0462	0.0436
0	0	0.5	0	0.4366	0.3372
0	0	0.5	0.5	0.2544	0.1934
0	0.5	0.5	0	0.4364	0.3302
0.5	0.8	1	0.5	0.4290	0.3216

*SB ratio= 1/8, CR ratio= 4

Table A.112: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0462
0	0	0.5	0	0.8662	0.7180
0	0	0.5	0.5	0.5370	0.4046
0	0.5	0.5	0	0.8504	0.7076
0.5	0.8	1	0.2	0.9442	0.8374

*SB ratio= 1/8, CR ratio= 4

Table A.113: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0530
0	0	0.5	0	0.7712	0.5040
0	0	0.5	0.5	0.4580	0.2790
0	0.5	0.5	0	0.7628	0.4898
0.5	0.8	1	0.2	0.8886	0.6252

*SB ratio= 1/4, CR ratio= 4

Table A.114: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0544	0.0528
0	0	0.5	0	0.4768	0.2252
0	0	0.5	0.5	0.2830	0.1464
0	0.5	0.5	0	0.4742	0.2184
0.5	0.8	1	0.5	0.4836	0.2186

*SB ratio= 1/4, CR ratio= 4

Table A.115: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0522	0.0530
0	0	0.5	0	0.9160	0.4956
0	0	0.5	0.5	0.6154	0.2732
0	0.5	0.5	0	0.9012	0.4814
0.5	0.8	1	0.2	0.9658	0.6146

*SB ratio= 1/4, CR ratio= 4

Table A.116: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0526	0.0482
0	0	0.5	0	0.7008	0.4498
0	0	0.5	0.5	0.4040	0.2538
0	0.5	0.5	0	0.7098	0.4512
0.5	0.8	1	0.2	0.8308	0.5776

*SB ratio= 1/3, CR ratio= 4

Table A.117: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =30 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0524	0.0476
0	0	0.5	0	0.4132	0.1820
0	0	0.5	0.5	0.2392	0.1250
0	0.5	0.5	0	0.4098	0.1850
0.5	0.8	1	0.2	0.5260	0.2236

*SB ratio= 1/3, CR ratio= 4

Table A.118: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =30 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0476	0.0500
0	0	0.5	0	0.8512	0.4132
0	0	0.5	0.5	0.5162	0.2224
0	0.5	0.5	0	0.8194	0.4264
0.5	0.8	1	0.2	0.9298	0.5352

*SB ratio= 1/3, CR ratio= 4

Table A.119: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0488	0.0510
0	0	0.5	0	0.7730	0.5130
0	0	0.5	0.5	0.4748	0.2980
0	0.5	0.5	0	0.7712	0.5242
0.5	0.8	1	0.2	0.8862	0.6412

*SB ratio= 1/2, CR ratio= 4

Table A.120: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0466	0.0484
0	0	0.5	0	0.4418	0.2006
0	0	0.5	0.5	0.2576	0.1410
0	0.5	0.5	0	0.4396	0.1880
0.5	0.8	1	0.2	0.5614	0.2444

*SB ratio= 1/2, CR ratio= 4

Table A.121: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0486	0.0494
0	0	0.5	0	0.8788	0.4194
0	0	0.5	0.5	0.5608	0.2358
0	0.5	0.5	0	0.8754	0.4334
0.5	0.8	1	0.2	0.9562	0.5326

*SB ratio= 1/2, CR ratio= 4

Table A.122: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0536	0.0534
0	0	0.5	0	0.4868	0.3694
0	0	0.5	0.5	0.2912	0.2206
0	0.5	0.5	0	0.4956	0.3640
0.5	0.8	1	0.2	0.6168	0.4638

*SB ratio= 1, CR ratio=4

Table A.123: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0456	0.0462
0	0	0.5	0	0.2494	0.1466
0	0	0.5	0.5	0.1606	0.1032
0	0.5	0.5	0	0.2506	0.1468
0.5	0.8	1	0.2	0.3084	0.1678

*SB ratio= 1, CR ratio=4

Table A.124: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0562	0.0538
0	0	0.5	0	0.5634	0.2834
0	0	0.5	0.5	0.3110	0.1620
0	0.5	0.5	0	0.5512	0.3056
0.5	0.8	1	0.2	0.6798	0.3630

*SB ratio= 1, CR ratio=4

Table A.125: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0534	0.0546
0	0	0.5	0	0.7964	0.7062
0	0	0.5	0.5	0.4930	0.4122
0	0.5	0.5	0	0.7846	0.6998
0.5	0.8	1	0.2	0.9002	0.8278

*SB ratio= 2, CR ratio= 4

Table A.126: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0460	0.0446
0	0	0.5	0	0.4018	0.2286
0	0	0.5	0.5	0.2280	0.1518
0	0.5	0.5	0	0.3870	0.2274
0.5	0.8	1	0.2	0.4912	0.2882

*SB ratio= 2, CR ratio= 4

Table A.127: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0466	0.0502
0	0	0.5	0	0.8336	0.5324
0	0	0.5	0.5	0.5170	0.3054
0	0.5	0.5	0	0.8162	0.5292
0.5	0.8	1	0.2	0.9232	0.6808

*SB ratio= 2, CR ratio= 4

Table A.128: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0482	0.0520
0	0	0.5	0	0.7286	0.6852
0	0	0.5	0.5	0.4430	0.4098
0	0.5	0.5	0	0.7390	0.7024
0.5	0.8	1	0.2	0.8556	0.8192

*SB ratio= 3, CR ratio=4

Table A.129: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0446	0.0466
0	0	0.5	0	0.3306	0.2228
0	0	0.5	0.5	0.2088	0.1520
0	0.5	0.5	0	0.3378	0.2240
0.5	0.8	1	0.2	0.4316	0.2706

*SB ratio= 3, CR ratio= 4

Table A.130: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0516	0.0498
0	0	0.5	0	0.7706	0.5386
0	0	0.5	0.5	0.4498	0.3022
0	0.5	0.5	0	0.7386	0.5458
0.5	0.8	1	0.5	0.7692	0.5412

*SB ratio= 3, CR ratio= 4

Table A.131: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0530	0.0562
0	0	0.5	0	0.8062	0.8016
0	0	0.5	0.5	0.5082	0.5000
0	0.5	0.5	0	0.7946	0.7920
0.5	0.8	1	0.2	0.9160	0.9070

*SB ratio= 4, CR ratio= 4

Table A.132: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0470	0.0462
0	0	0.5	0	0.3894	0.2726
0	0	0.5	0.5	0.2068	0.1494
0	0.5	0.5	0	0.3742	0.2592
0.5	0.8	1	0.2	0.4708	0.3446

*SB ratio= 4, CR ratio= 4

Table A.133: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0522	0.0490
0	0	0.5	0	0.8112	0.6406
0	0	0.5	0.5	0.5056	0.3722
0	0.5	0.5	0	0.8038	0.6312
0.5	0.8	1	0.5	0.8228	0.6424

*SB ratio= 4, CR ratio= 4

Table A.134: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0522	0.0526
0	0	0.5	0	0.7354	0.7938
0	0	0.5	0.5	0.4310	0.4850
0	0.5	0.5	0	0.7238	0.7842
0.5	0.8	1	0.2	0.8588	0.9096

*SB ratio= 8, CR ratio= 4

Table A.135: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under T (3) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0546	0.0568
0	0	0.5	0	0.3114	0.2620
0	0	0.5	0.5	0.1908	0.1740
0	0.5	0.5	0	0.3060	0.2598
0.5	0.8	1	0.2	0.3960	0.3334

*SB ratio= 8, CR ratio= 4

Table A.136: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under exp (1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0520	0.0474
0	0	0.5	0	0.7142	0.6364
0	0	0.5	0.5	0.4010	0.3528
0	0.5	0.5	0	0.7062	0.6396
0.5	0.8	1	0.2	0.8252	0.7624

*SB ratio= 8, CR ratio= 4

Table A.137: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0432
0	0	0.5	0	0.6930	0.5864
0	0	0.5	0.5	0.4098	0.3384
0	0.5	0.5	0	0.6890	0.5662
0.5	0.8	1	0.2	0.8234	0.7188

*SB ratio= 1/8, CR ratio= 9

Table A.138: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0494	0.0466
0	0	0.5	0	0.4094	0.2962
0	0	0.5	0.5	0.2368	0.1766
0	0.5	0.5	0	0.4072	0.3054
0.5	0.8	1	0.2	0.5132	0.3746

*SB ratio= 1/8, CR ratio= 9

Table A.139: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=5 Blk =40 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0482	0.0440
0	0	0.5	0	0.8234	0.6498
0	0	0.5	0.5	0.4920	0.3520
0	0.5	0.5	0	0.8058	0.6424
0.5	0.8	1	0.2	0.9144	0.7776

*SB ratio= 1/8, CR ratio= 9

Table A.140: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0500
0	0	0.5	0	0.7698	0.5084
0	0	0.5	0.5	0.4854	0.2984
0	0.5	0.5	0	0.7752	0.4982
0.5	0.8	1	0.2	0.8860	0.6378

*SB ratio= 1/4, CR ratio= 9

Table A.141: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0500	0.0496
0	0	0.5	0	0.4368	0.1692
0	0	0.5	0.5	0.2488	0.1210
0	0.5	0.5	0	0.4382	0.1766
0.5	0.8	1	0.2	0.5442	0.2034

*SB ratio= 1/4, CR ratio= 9

Table A.142: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =40 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0500	0.0488
0	0	0.5	0	0.8602	0.3596
0	0	0.5	0.5	0.5554	0.2124
0	0.5	0.5	0	0.8520	0.3726
0.5	0.8	1	0.2	0.9366	0.4764

*SB ratio= 1/4, CR ratio= 9

Table A.143: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0528	0.0524
0	0	0.5	0	0.7024	0.4534
0	0	0.5	0.5	0.4198	0.2584
0	0.5	0.5	0	0.7030	0.4538
0.5	0.8	1	0.2	0.8330	0.5872

*SB ratio= 1/3, CR ratio= 9

Table A.144: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =30 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0516	0.0550
0	0	0.5	0	0.3600	0.1558
0	0	0.5	0.5	0.2186	0.1090
0	0.5	0.5	0	0.3674	0.1518
0.5	0.8	1	0.2	0.4732	0.1750

*SB ratio= 1/3, CR ratio= 9

Table A.145: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =30 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0466	0.0450
0	0	0.5	0	0.7794	0.3048
0	0	0.5	0.5	0.4664	0.1830
0	0.5	0.5	0	0.7704	0.3078
0.5	0.8	1	0.2	0.8904	0.3892

*SB ratio= 1/3, CR ratio= 9

Table A.146: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0484	0.0512
0	0	0.5	0	0.7578	0.5094
0	0	0.5	0.5	0.4764	0.2974
0	0.5	0.5	0	0.7716	0.5124
0.5	0.8	1	0.2	0.8866	0.6356

*SB ratio= 1/2, CR ratio= 9

Table A.147: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0456	0.0434
0	0	0.5	0	0.3958	0.1398
0	0	0.5	0.5	0.2338	0.1074
0	0.5	0.5	0	0.3808	0.1338
0.5	0.8	1	0.2	0.4978	0.1708

*SB ratio= 1/2, CR ratio= 9

Table A.148: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=15 Blk =30 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0486	0.0480
0	0	0.5	0	0.8234	0.2870
0	0	0.5	0.5	0.4904	0.1726
0	0.5	0.5	0	0.8090	0.2936
0.5	0.8	1	0.2	0.9132	0.3608

*SB ratio= 1/2, CR ratio= 9

Table A.149: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0462	0.0528
0	0	0.5	0	0.4952	0.3700
0	0	0.5	0.5	0.2818	0.2174
0	0.5	0.5	0	0.4768	0.3632
0.5	0.8	1	0.2	0.6102	0.4612

*SB ratio= 1, CR ratio= 9

Table A.150: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0550	0.0530
0	0	0.5	0	0.2176	0.1170
0	0	0.5	0.5	0.1388	0.0808
0	0.5	0.5	0	0.2162	0.1088
0.5	0.8	1	0.2	0.2672	0.1268

*SB ratio= 1, CR ratio= 9

Table A.151: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=10 Blk =10 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0508	0.0492
0	0	0.5	0	0.4586	0.1968
0	0	0.5	0.5	0.2628	0.1266
0	0.5	0.5	0	0.4730	0.2030
0.5	0.8	1	0.2	0.5816	0.2506

*SB ratio= 1, CR ratio= 9

Table A.152: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0534	0.0546
0	0	0.5	0	0.7964	0.7062
0	0	0.5	0.5	0.4930	0.4122
0	0.5	0.5	0	0.7846	0.6998
0.5	0.8	1	0.2	0.9002	0.8278

*SB ratio= 2, CR ratio= 9

Table A.153: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0512	0.0480
0	0	0.5	0	0.3114	0.1450
0	0	0.5	0.5	0.1878	0.1136
0	0.5	0.5	0	0.3162	0.1464
0.5	0.8	1	0.2	0.3914	0.1740

*SB ratio= 2, CR ratio= 9

Table A.154: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =15 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0468	0.0504
0	0	0.5	0	0.7096	0.3158
0	0	0.5	0.5	0.4096	0.1940
0	0.5	0.5	0	0.7036	0.3242
0.5	0.8	1	0.2	0.8258	0.4088

*SB ratio= 2, CR ratio= 9

Table A.155: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0484	0.0506
0	0	0.5	0	0.7358	0.6910
0	0	0.5	0.5	0.4344	0.4100
0	0.5	0.5	0	0.7416	0.7014
0.5	0.8	1	0.2	0.8554	0.8192

*SB ratio= 3, CR ratio= 9

Table A.156: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0506	0.0506
0	0	0.5	0	0.2610	0.1454
0	0	0.5	0.5	0.1742	0.0986
0	0.5	0.5	0	0.2608	0.1448
0.5	0.8	1	0.2	0.3572	0.2000

*SB ratio= 3, CR ratio=9

Table A.157: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=30 Blk =10 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0474	0.0514
0	0	0.5	0	0.6182	0.3118
0	0	0.5	0.5	0.3458	0.1910
0	0.5	0.5	0	0.6212	0.3262
0.5	0.8	1	0.2	0.7418	0.3960

*SB ratio= 3, CR ratio=9

Table A .158: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0506	0.0552
0	0	0.5	0	0.8012	0.7974
0	0	0.5	0.5	0.5030	0.4800
0	0.5	0.5	0	0.7992	0.7976
0.5	0.8	1	0.2	0.9144	0.9086

*SB ratio= 4, CR ratio= 9

Table A.159: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0480	0.0500
0	0	0.5	0	0.2950	0.1658
0	0	0.5	0.5	0.1870	0.1196
0	0.5	0.5	0	0.2902	0.1706
0.5	0.8	1	0.2	0.2042	0.3608

*SB ratio= 4, CR ratio= 9

Table A.160: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =10 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0516	0.0508
0	0	0.5	0	0.6676	0.3824
0	0	0.5	0.5	0.3900	0.2228
0	0.5	0.5	0	0.6674	0.3922
0.5	0.8	1	0.2	0.7990	0.4922

*SB ratio= 4, CR ratio= 9

Table A.161: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0526	0.0478
0	0	0.5	0	0.7394	0.7894
0	0	0.5	0.5	0.4520	0.4894
0	0.5	0.5	0	0.7306	0.7876
0.5	0.8	1	0.2	0.8646	0.9108

*SB ratio= 8, CR ratio= 9

Table A.162: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under T (3) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0496	0.0528
0	0	0.5	0	0.2264	0.1570
0	0	0.5	0.5	0.1442	0.1086
0	0.5	0.5	0	0.2360	0.1752
0.5	0.8	1	0.2	0.2876	0.1968

*SB ratio= 8, CR ratio= 9

Table A.163: Estimated rejection percentages for the two proposed tests for trt=4 p=3 n=40 Blk =5 under exp (1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	A**	A***
0	0	0	0	0.0482	0.0496
0	0	0.5	0	0.5414	0.3918
0	0	0.5	0.5	0.3040	0.2162
0	0.5	0.5	0	0.5296	0.3778
0.5	0.8	1	0.2	0.6520	0.4914

*SB ratio= 8, CR ratio= 9

Table A.164: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0524	0.0530
0	0.5	0	0	0	0.6446	0.5438
0	0.5	0.5	0	0	0.8190	0.7196
0.5	0.5	0	0	0	0.4330	0.3534
0.4	1	0.8	0.5	0.2	0.9596	0.9022

*SB ratio= 1/8, CR ratio= 4

Table A.165: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0570	0.0548
0	0.5	0	0	0	0.4094	0.3134
0	0.5	0.5	0	0	0.5628	0.4228
0.5	0.5	0	0	0	0.2784	0.2136
0.4	1	0.8	0.5	0.2	0.7578	0.6066

*SB ratio= 1/8, CR ratio= 4

Table A.166: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0462	0.0474
0	0.5	0	0	0	0.8328	0.6762
0	0.5	0.5	0	0	0.9414	0.8374
0.5	0.5	0	0	0	0.6028	0.4576
0.4	1	0.8	0.5	0.2	0.9962	0.9686

*SB ratio= 1/8, CR ratio= 4

Table A.167: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0546	0.0534
0	0.5	0	0	0	0.7384	0.4618
0	0.5	0.5	0	0	0.8942	0.6182
0.5	0.5	0	0	0	0.5236	0.3164
0.4	1	0.8	0.5	0.2	0.9810	0.8292

*SB ratio= 1/4, CR ratio= 4

Table A.168: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0528	0.0530
0	0.5	0	0	0	0.4528	0.2070
0	0.5	0.5	0	0	0.6036	0.2724
0.5	0.5	0	0	0	0.3060	0.1562
0.4	1	0.8	0.5	0.2	0.8098	0.3972

*SB ratio= 1/4, CR ratio= 4

Table A.169: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0496	0.0498
0	0.5	0	0	0	0.8858	0.4458
0	0.5	0.5	0	0	0.9740	0.6036
0.5	0.5	0	0	0	0.6494	0.2930
0.4	1	0.8	0.5	0.2	0.9988	0.8010

*SB ratio= 1/4, CR ratio= 4

Table A.170: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0522	0.0504
0	0.5	0	0	0	0.6580	0.4208
0	0.5	0.5	0	0	0.8260	0.5696
0.5	0.5	0	0	0	0.4644	0.2922
0.4	1	0.8	0.5	0.2	0.9628	0.7818

*SB ratio= 1/3, CR ratio= 4

Table A.171: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0482	0.0522
0	0.5	0	0	0	0.3766	0.1818
0	0.5	0.5	0	0	0.5132	0.2394
0.5	0.5	0	0	0	0.2662	0.1412
0.4	1	0.8	0.5	0.2	0.7118	0.3198

*SB ratio= 1/3, CR ratio= 4

Table A.172: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0464	0.0464
0	0.5	0	0	0	0.7976	0.3790
0	0.5	0.5	0	0	0.9306	0.5342
0.5	0.5	0	0	0	0.5760	0.2562
0.4	1	0.8	0.5	0.2	0.8000	0.5788

*SB ratio= 1/3, CR ratio= 4

Table A.173: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0496	0.0426
0	0.5	0	0	0	0.7320	0.4812
0	0.5	0.5	0	0	0.8858	0.6208
0.5	0.5	0	0	0	0.5192	0.3142
0.4	1	0.8	0.5	0.2	0.9836	0.8368

*SB ratio= 1/2, CR ratio= 4

Table A.174: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0510	0.0550
0	0.5	0	0	0	0.4248	0.1836
0	0.5	0.5	0	0	0.5646	0.2256
0.5	0.5	0	0	0	0.2844	0.1324
0.4	1	0.8	0.5	0.2	0.7654	0.3354

*SB ratio= 1/2, CR ratio= 4

Table A.175: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0478	0.0490
0	0.5	0	0	0	0.8498	0.3866
0	0.5	0.5	0	0	0.9504	0.5350
0.5	0.5	0	0	0	0.6224	0.2464
0.4	1	0.8	0.5	0.2	0.8618	0.6486

*SB ratio= 1/2, CR ratio= 4

Table A.176: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0568	0.0496
0	0.5	0	0	0	0.4676	0.3568
0	0.5	0.5	0	0	0.6124	0.4732
0.5	0.5	0	0	0	0.3110	0.2302
0.4	1	0.8	0.5	0.2	0.8226	0.6768

*SB ratio= 1, CR ratio= 4

Table A.177: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0530	0.0524
0	0.5	0	0	0	0.2338	0.1382
0	0.5	0.5	0	0	0.2976	0.1702
0.5	0.5	0	0	0	0.1668	0.1112
0.4	1	0.8	0.5	0.2	0.4676	0.2374

*SB ratio= 1, CR ratio= 4

Table A.178: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0520	0.0540
0	0.5	0	0	0	0.6450	0.3306
0	0.5	0.5	0	0	0.7016	0.4166
0.5	0.5	0	0	0	0.5706	0.2540
0.4	1	0.8	0.5	0.2	0.7896	0.5756

*SB ratio= 1, CR ratio= 4

Table A.179: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0526	0.0502
0	0.5	0	0	0	0.7468	0.6434
0	0.5	0.5	0	0	0.8974	0.8200
0.5	0.5	0	0	0	0.5390	0.4466
0.4	1	0.8	0.5	0.2	0.9860	0.9574

*SB ratio= 2, CR ratio= 4

Table A.180: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0558	0.0550
0	0.5	0	0	0	0.3538	0.2054
0	0.5	0.5	0	0	0.4846	0.2788
0.5	0.5	0	0	0	0.2470	0.1592
0.4	1	0.8	0.5	0.2	0.6836	0.4032

*SB ratio= 2, CR ratio= 4

Table A.181: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0480	0.0462
0	0.5	0	0	0	0.7936	0.4852
0	0.5	0.5	0	0	0.9196	0.6578
0.5	0.5	0	0	0	0.5626	0.3242
0.4	1	0.8	0.5	0.2	0.9914	0.8538

*SB ratio= 2, CR ratio= 4

Table A.182: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0452
0	0.5	0	0	0	0.7102	0.6712
0	0.5	0.5	0	0	0.8568	0.8178
0.5	0.5	0	0	0	0.4872	0.4520
0.4	1	0.8	0.5	0.2	0.9730	0.9564

*SB ratio= 3, CR ratio= 4

Table A.183: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0452
0	0.5	0	0	0	0.7102	0.6712
0	0.5	0.5	0	0	0.8568	0.8178
0.5	0.5	0	0	0	0.4872	0.4520
0.4	1	0.8	0.5	0.2	0.9730	0.9564

*SB ratio= 3, CR ratio= 4

Table A.184: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0508
0	0.5	0	0	0	0.8216	0.5078
0	0.5	0.5	0	0	0.8842	0.6676
0.5	0.5	0	0	0	0.7192	0.3328
0.4	1	0.8	0.5	0.2	0.9538	0.8616

*SB ratio= 3, CR ratio= 4

Table A.185: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0474	0.0508
0	0.5	0	0	0	0.7664	0.7474
0	0.5	0.5	0	0	0.9072	0.9054
0.5	0.5	0	0	0	0.5566	0.5318
0.4	1	0.8	0.5	0.2	0.9858	0.9872

*SB ratio= 4, CR ratio= 4

Table A.186: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0548	0.0554
0	0.5	0	0	0	0.2944	0.2482
0	0.5	0.5	0	0	0.3852	0.3142
0.5	0.5	0	0	0	0.1988	0.1688
0.4	1	0.8	0.5	0.2	0.5472	0.4642

*SB ratio= 4, CR ratio= 4

Table A.187: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0482
0	0.5	0	0	0	0.6704	0.5872
0	0.5	0.5	0	0	0.8308	0.7542
0.5	0.5	0	0	0	0.4434	0.3834
0.4	1	0.8	0.5	0.2	0.9604	0.9198

*SB ratio= 4, CR ratio= 4

Table A.188: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0508
0	0.5	0	0	0	0.7014	0.7594
0	0.5	0.5	0	0	0.8482	0.8932
0.5	0.5	0	0	0	0.4818	0.5324
0.4	1	0.8	0.5	0.2	0.9702	0.9844

*SB ratio= 8, CR ratio= 4

Table A.189: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0496
0	0.5	0	0	0	0.3390	0.2426
0	0.5	0.5	0	0	0.4728	0.3288
0.5	0.5	0	0	0	0.2308	0.1752
0.4	1	0.8	0.5	0.2	0.6676	0.4784

*SB ratio= 8, CR ratio= 4

Table A.190: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0572	0.0492
0	0.5	0	0	0	0.7826	0.5914
0	0.5	0.5	0	0	0.9186	0.7654
0.5	0.5	0	0	0	0.5354	0.4004
0.4	1	0.8	0.5	0.2	0.988	0.9318

*SB ratio= 8, CR ratio= 4

Table A.191: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0500	0.0486
0	0.5	0	0	0	0.6404	0.5510
0	0.5	0.5	0	0	0.8230	0.7150
0.5	0.5	0	0	0	0.4502	0.3676
0.4	1	0.8	0.5	0.2	0.9568	0.9000

*SB ratio= 1/8, CR ratio= 9

Table A.192: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0488
0	0.5	0	0	0	0.3762	0.2688
0	0.5	0.5	0	0	0.5218	0.3802
0.5	0.5	0	0	0	0.2674	0.2018
0.4	1	0.8	0.5	0.2	0.7218	0.5444

*SB ratio= 1/8, CR ratio= 9

Table A.193: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=5 Blk =40 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0510	0.0482
0	0.5	0	0	0	0.7886	0.6068
0	0.5	0.5	0	0	0.9150	0.7668
0.5	0.5	0	0	0	0.5554	0.4082
0.4	1	0.8	0.5	0.2	0.9868	0.9318

*SB ratio= 1/8, CR ratio= 9

Table A.194: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0574	0.0526
0	0.5	0	0	0	0.7390	0.4768
0	0.5	0.5	0	0	0.8866	0.625
0.5	0.5	0	0	0	0.5172	0.3094
0.4	1	0.8	0.5	0.2	0.9844	0.8240

*SB ratio= 1/4, CR ratio= 9

Table A.195: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0498
0	0.5	0	0	0	0.4076	0.1656
0	0.5	0.5	0	0	0.5362	0.2184
0.5	0.5	0	0	0	0.2698	0.1302
0.4	1	0.8	0.5	0.2	0.7440	0.2864

*SB ratio= 1/4, CR ratio= 9

Table A.196: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =40 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0478	0.0458
0	0.5	0	0	0	0.8288	0.3298
0	0.5	0.5	0	0	0.9430	0.4756
0.5	0.5	0	0	0	0.6048	0.2376
0.4	1	0.8	0.5	0.2	0.9940	0.6526

*SB ratio= 1/4, CR ratio= 9

Table A.197: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0468	0.0484
0	0.5	0	0	0	0.6518	0.4116
0	0.5	0.5	0	0	0.8328	0.5782
0.5	0.5	0	0	0	0.4774	0.2920
0.4	1	0.8	0.5	0.2	0.9600	0.7888

*SB ratio= 1/3, CR ratio= 9

Table A.198: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0518	0.0518
0	0.5	0	0	0	0.3342	0.1314
0	0.5	0.5	0	0	0.4608	0.1836
0.5	0.5	0	0	0	0.2388	0.1144
0.4	1	0.8	0.5	0.2	0.6532	0.2434

*SB ratio= 1/3, CR ratio= 9

Table A.199: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =30 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0530	0.0528
0	0.5	0	0	0	0.7472	0.2774
0	0.5	0.5	0	0	0.8802	0.3832
0.5	0.5	0	0	0	0.5066	0.1886
0.4	1	0.8	0.5	0.2	0.9828	0.5576

*SB ratio= 1/3, CR ratio= 9

Table A.200: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0488
0	0.5	0	0	0	0.7358	0.4840
0	0.5	0.5	0	0	0.8876	0.6414
0.5	0.5	0	0	0	0.5024	0.3050
0.4	1	0.8	0.5	0.2	0.9808	0.8434

*SB ratio= 1/2, CR ratio= 9

Table A.201: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0424	0.0524
0	0.5	0	0	0	0.3560	0.1360
0	0.5	0.5	0	0	0.4868	0.1754
0.5	0.5	0	0	0	0.2548	0.1064
0.4	1	0.8	0.5	0.2	0.6846	0.2124

*SB ratio= 1/2, CR ratio= 9

Table A.202: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=15 Blk =30 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0498	0.0458
0	0.5	0	0	0	0.7830	0.2678
0	0.5	0.5	0	0	0.9114	0.3620
0.5	0.5	0	0	0	0.5468	0.1708
0.4	1	0.8	0.5	0.2	0.9906	0.5266

*SB ratio= 1/2, CR ratio= 9

Table A.203: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0516
0	0.5	0	0	0	0.4468	0.3474
0	0.5	0.5	0	0	0.6090	0.4620
0.5	0.5	0	0	0	0.2952	0.2350
0.4	1	0.8	0.5	0.2	0.8216	0.6710

*SB ratio= 1, CR ratio= 9

Table A.204: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0484
0	0.5	0	0	0	0.2000	0.1120
0	0.5	0.5	0	0	0.2626	0.1266
0.5	0.5	0	0	0	0.1474	0.0936
0.4	1	0.8	0.5	0.2	0.3718	0.1648

*SB ratio= 1, CR ratio= 9

Table A.205: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=10 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0458	0.0478
0	0.5	0	0	0	0.4442	0.1900
0	0.5	0.5	0	0	0.5844	0.2506
0.5	0.5	0	0	0	0.2826	0.1362
0.4	1	0.8	0.5	0.2	0.7872	0.3512

*SB ratio= 1, CR ratio= 9

Table A.206: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0522	0.0542
0	0.5	0	0	0	0.7494	0.6478
0	0.5	0.5	0	0	0.8966	0.8284
0.5	0.5	0	0	0	0.5306	0.4452
0.4	1	0.8	0.5	0.2	0.9862	0.9584

*SB ratio= 2, CR ratio= 9

Table A.207: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0490	0.0470
0	0.5	0	0	0	0.2872	0.1380
0	0.5	0.5	0	0	0.3950	0.1784
0.5	0.5	0	0	0	0.2058	0.1124
0.4	1	0.8	0.5	0.2	0.5712	0.2490

*SB ratio= 2, CR ratio= 9

Table A.208: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =15 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0464
0	0.5	0	0	0	0.6782	0.2950
0	0.5	0.5	0	0	0.8352	0.4152
0.5	0.5	0	0	0	0.4378	0.1992
0.4	1	0.8	0.5	0.2	0.9662	0.5860

*SB ratio= 2, CR ratio= 9

Table A.209: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0452
0	0.5	0	0	0	0.7102	0.6712
0	0.5	0.5	0	0	0.8568	0.8178
0.5	0.5	0	0	0	0.4872	0.4520
0.4	1	0.8	0.5	0.2	0.9730	0.9564

*SB ratio= 3, CR ratio= 9

Table A.210: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0524
0	0.5	0	0	0	0.2528	0.1380
0	0.5	0.5	0	0	0.3396	0.1688
0.5	0.5	0	0	0	0.1790	0.1054
0.4	1	0.8	0.5	0.2	0.4838	0.2324

*SB ratio= 3, CR ratio= 9

Table A.211: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=30 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0536	0.0540
0	0.5	0	0	0	0.5714	0.2848
0	0.5	0.5	0	0	0.7506	0.4116
0.5	0.5	0	0	0	0.3874	0.2006
0.4	1	0.8	0.5	0.2	0.9216	0.5798

*SB ratio= 3, CR ratio= 9

Table A.212: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0524	0.0548
0	0.5	0	0	0	0.7584	0.7510
0	0.5	0.5	0	0	0.9024	0.8926
0.5	0.5	0	0	0	0.5414	0.5460
0.4	1	0.8	0.5	0.2	0.9890	0.9880

*SB ratio= 4, CR ratio= 9

Table A.213: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0508
0	0.5	0	0	0	0.2741	0.1632
0	0.5	0.5	0	0	0.3722	0.2116
0.5	0.5	0	0	0	0.1878	0.1242
0.4	1	0.8	0.5	0.2	0.5274	0.2744

*SB ratio= 4, CR ratio= 9

Table A.214: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0526	0.0536
0	0.5	0	0	0	0.4998	0.3548
0	0.5	0.5	0	0	0.6602	0.4910
0.5	0.5	0	0	0	0.3282	0.2384
0.4	1	0.8	0.5	0.2	0.8572	0.6814

*SB ratio= 4, CR ratio= 9

Table A.215: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0490	0.0486
0	0.5	0	0	0	0.6864	0.7354
0	0.5	0.5	0	0	0.8554	0.8974
0.5	0.5	0	0	0	0.4804	0.5344
0.4	1	0.8	0.5	0.2	0.9722	0.9862

*SB ratio= 8, CR ratio= 9

Table A.216: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0476	0.0448
0	0.5	0	0	0	0.2174	0.1594
0	0.5	0.5	0	0	0.2964	0.2068
0.5	0.5	0	0	0	0.1566	0.1212
0.4	1	0.8	0.5	0.2	0.4180	0.2804

*SB ratio= 8, CR ratio= 9

Table A.217: Estimated rejection percentages for the two proposed tests for trt=5 p=2 n=40 Blk =5 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0584	0.0506
0	0.5	0	0	0	0.6252	0.3556
0	0.5	0.5	0	0	0.7908	0.4938
0.5	0.5	0	0	0	0.4082	0.2258
0.4	1	0.8	0.5	0.2	0.9438	0.6834

*SB ratio= 8, CR ratio= 9

Table A.218: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0522	0.0498
0	0	0.5	0	0	0.7112	0.6000
0	0	0.5	0.5	0	0.7100	0.6034
0	0.5	0.5	0	0	0.7096	0.6054
0.2	0.5	1	0.8	0.4	0.9202	0.8446

*SB ratio= 1/8, CR ratio= 4

Table A.219: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0482	0.0492
0	0	0.5	0	0	0.4556	0.3450
0	0	0.5	0.5	0	0.4356	0.3242
0	0.5	0.5	0	0	0.4468	0.3374
0.2	0.4	1	0.8	0.5	0.6280	0.4826

*SB ratio= 1/8, CR ratio= 4

Table A.220: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0456	0.0494
0	0	0.5	0	0	0.8884	0.7476
0	0	0.5	0.5	0	0.8834	0.7420
0	0.5	0.5	0	0	0.8794	0.7410
0.2	0.4	1	0.8	0.5	0.9758	0.9086

*SB ratio= 1/8, CR ratio= 4

Table A.221: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0524	0.0512
0	0	0.5	0	0	0.8004	0.5124
0	0	0.5	0.5	0	0.7974	0.5208
0	0.5	0.5	0	0	0.7904	0.5230
0.2	0.5	1	0.8	0.4	0.9650	0.7590

*SB ratio= 1/4, CR ratio= 4

Table A.222: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0518
0	0	0.5	0	0	0.4794	0.2208
0	0	0.5	0.5	0	0.4934	0.2220
0	0.5	0.5	0	0	0.5046	0.2278
0.2	0.4	1	0.8	0.5	0.6836	0.3120

*SB ratio= 1/4, CR ratio= 4

Table A.223: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0506	0.0502
0	0	0.5	0	0	0.9272	0.4966
0	0	0.5	0.5	0	0.9132	0.4954
0	0.5	0.5	0	0	0.9140	0.4934
0.2	0.4	1	0.8	0.5	0.9902	0.6868

*SB ratio= 1/4, CR ratio= 4

Table A.224: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0450	0.0482
0	0	0.5	0	0	0.7304	0.4752
0	0	0.5	0.5	0	0.7228	0.4690
0	0.5	0.5	0	0	0.7326	0.4776
0.2	0.5	1	0.8	0.4	0.9300	0.7060

*SB ratio= 1/3, CR ratio= 4

Table A.225: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0482	0.0522
0	0	0.5	0	0	0.4334	0.1966
0	0	0.5	0.5	0	0.4368	0.1986
0	0.5	0.5	0	0	0.4278	0.2064
0.2	0.4	1	0.8	0.5	0.5892	0.2600

*SB ratio= 1/3, CR ratio= 4

Table A.226: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0520
0	0	0.5	0	0	0.8662	0.4318
0	0	0.5	0.5	0	0.8538	0.4284
0	0.5	0.5	0	0	0.8626	0.4254
0.2	0.4	1	0.8	0.5	0.9750	0.6176

*SB ratio= 1/3, CR ratio= 4

Table A.227: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0446	0.0506
0	0	0.5	0	0	0.7792	0.5222
0	0	0.5	0.5	0	0.7902	0.5102
0	0.5	0.5	0	0	0.7824	0.5260
0.2	0.5	1	0.8	0.4	0.9638	0.7732

*SB ratio= 1/2, CR ratio= 4

Table A.228: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0500
0	0	0.5	0	0	0.4756	0.2018
0	0	0.5	0.5	0	0.4546	0.1912
0	0.5	0.5	0	0	0.4562	0.1862
0.2	0.4	1	0.8	0.5	0.6514	0.2656

*SB ratio= 1/2, CR ratio= 4

Table A.229: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0500	0.0462
0	0	0.5	0	0	0.9020	0.4212
0	0	0.5	0.5	0	0.8870	0.4356
0	0.5	0.5	0	0	0.8872	0.4204
0.2	0.4	1	0.8	0.5	0.9822	0.6196

*SB ratio= 1/2, CR ratio= 4

Table A.230: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0496
0	0	0.5	0	0	0.5174	0.3896
0	0	0.5	0.5	0	0.5202	0.3908
0	0.5	0.5	0	0	0.4984	0.3802
0.2	0.5	1	0.8	0.4	0.7530	0.6146

*SB ratio= 1, CR ratio= 4

Table A.231: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0534	0.0484
0	0	0.5	0	0	0.2612	0.1586
0	0	0.5	0.5	0	0.2540	0.1514
0	0.5	0.5	0	0	0.2484	0.1474
0.2	0.4	1	0.8	0.5	0.3528	0.1936

*SB ratio= 1, CR ratio= 4

Table A.232: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0528	0.0490
0	0	0.5	0	0	0.5662	0.2958
0	0	0.5	0.5	0	0.5718	0.3018
0	0.5	0.5	0	0	0.5786	0.3040
0.2	0.4	1	0.8	0.5	0.7918	0.4410

*SB ratio= 1, CR ratio= 4

Table A.233: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0494	0.0520
0	0	0.5	0	0	0.7944	0.7042
0	0	0.5	0.5	0	0.7980	0.7036
0	0.5	0.5	0	0	0.8026	0.7172
0.2	0.5	1	0.8	0.4	0.9698	0.9264

*SB ratio= 2, CR ratio= 4

Table A.234: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0446
0	0	0.5	0	0	0.4202	0.2382
0	0	0.5	0.5	0	0.4110	0.2338
0	0.5	0.5	0	0	0.4136	0.2364
0.2	0.4	1	0.8	0.5	0.5796	0.3270

*SB ratio= 2, CR ratio= 4

Table A.235: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0552	0.0530
0	0	0.5	0	0	0.8596	0.5584
0	0	0.5	0.5	0	0.8524	0.5470
0	0.5	0.5	0	0	0.8424	0.5368
0.2	0.4	1	0.8	0.5	0.9674	0.7514

*SB ratio= 2, CR ratio= 4

Table A.236: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0512	0.0522
0	0	0.5	0	0	0.7494	0.7024
0	0	0.5	0.5	0	0.7586	0.7092
0	0.5	0.5	0	0	0.7500	0.7060
0.2	0.5	1	0.8	0.4	0.9480	0.9266

*SB ratio= 3, CR ratio= 4

Table A.237: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0538	0.0514
0	0	0.5	0	0	0.3526	0.2320
0	0	0.5	0.5	0	0.3560	0.2324
0	0.5	0.5	0	0	0.3518	0.2250
0.2	0.4	1	0.8	0.5	0.4954	0.3090

*SB ratio= 3, CR ratio= 4

Table A.238: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0558
0	0	0.5	0	0	0.7776	0.5418
0	0	0.5	0.5	0	0.7688	0.5432
0	0.5	0.5	0	0	0.7760	0.5386
0.2	0.4	1	0.8	0.5	0.9408	0.7500

*SB ratio= 3, CR ratio= 4

Table A.239: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0460	0.0466
0	0	0.5	0	0	0.8180	0.8142
0	0	0.5	0.5	0	0.8194	0.8066
0	0.5	0.5	0	0	0.8192	0.8000
0.2	0.5	1	0.8	0.4	0.9744	0.9692

*SB ratio= 4, CR ratio= 4

Table A.240: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0538	0.0470
0	0	0.5	0	0	0.3226	0.2578
0	0	0.5	0.5	0	0.3216	0.2634
0	0.5	0.5	0	0	0.3204	0.2526
0.2	0.4	1	0.8	0.5	0.4408	0.3662

*SB ratio= 4, CR ratio= 4

Table A.241: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0530	0.0496
0	0	0.5	0	0	0.7360	0.6466
0	0	0.5	0.5	0	0.7174	0.6354
0	0.5	0.5	0	0	0.7168	0.6364
0.2	0.4	1	0.8	0.5	0.9110	0.8390

*SB ratio= 4, CR ratio= 4

Table A.242: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0498
0	0	0.5	0	0	0.8148	0.7736
0	0	0.5	0.5	0	0.8130	0.7490
0	0.5	0.5	0	0	0.8140	0.7500
0.2	0.5	1	0.8	0.4	0.9594	0.9430

*SB ratio= 8, CR ratio= 4

Table A.243: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0478
0	0	0.5	0	0	0.3856	0.2732
0	0	0.5	0.5	0	0.3818	0.2644
0	0.5	0.5	0	0	0.3986	0.2776
0.2	0.4	1	0.8	0.5	0.5478	0.3866

*SB ratio= 8, CR ratio= 4

Table A.244: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0512	0.0490
0	0	0.5	0	0	0.8378	0.6616
0	0	0.5	0.5	0	0.8256	0.6542
0	0.5	0.5	0	0	0.8202	0.6324
0.2	0.4	1	0.8	0.5	0.9630	0.8432

*SB ratio= 8, CR ratio= 4

Table A.245: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0530	0.0494
0	0	0.5	0	0	0.7012	0.5918
0	0	0.5	0.5	0	0.7054	0.6038
0	0.5	0.5	0	0	0.7082	0.5984
0.2	0.5	1	0.8	0.4	0.9252	0.8490

*SB ratio= 1/8, CR ratio= 9

Table A.246: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0496
0	0	0.5	0	0	0.4248	0.3114
0	0	0.5	0.5	0	0.4196	0.3076
0	0.5	0.5	0	0	0.4278	0.3096
0.2	0.4	1	0.8	0.5	0.5878	0.4302

*SB ratio= 1/8, CR ratio= 9

Table A.247: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=5 Blk =40 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0518	0.0522
0	0	0.5	0	0	0.8468	0.6860
0	0	0.5	0.5	0	0.8454	0.6718
0	0.5	0.5	0	0	0.8390	0.6670
0.2	0.4	1	0.8	0.5	0.9628	0.8574

*SB ratio= 1/8, CR ratio= 9

Table A.248: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0510	0.048
0	0	0.5	0	0	0.7900	0.5018
0	0	0.5	0.5	0	0.7958	0.5144
0	0.5	0.5	0	0	0.7978	0.5150
0.2	0.5	1	0.8	0.4	0.9636	0.7662

*SB ratio= 1/4, CR ratio= 9

Table A.249: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0466	0.0490
0	0	0.5	0	0	0.4520	0.1804
0	0	0.5	0.5	0	0.4540	0.1774
0	0.5	0.5	0	0	0.4406	0.1778
0.2	0.4	1	0.8	0.5	0.6220	0.2422

*SB ratio= 1/4, CR ratio= 9

Table A.250: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =40 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0474
0	0	0.5	0	0	0.8838	0.3710
0	0	0.5	0.5	0	0.8702	0.3814
0	0.5	0.5	0	0	0.8682	0.3736
0.2	0.4	1	0.8	0.5	0.9812	0.5376

*SB ratio= 1/4, CR ratio= 9

Table A.251: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0516	0.0502
0	0	0.5	0	0	0.7336	0.4742
0	0	0.5	0.5	0	0.7286	0.4820
0	0.5	0.5	0	0	0.7154	0.4606
0.2	0.5	1	0.8	0.4	0.9356	0.7162

*SB ratio= 1/3, CR ratio= 9

Table A.252: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under T(3)*(3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0454	0.0464
0	0	0.5	0	0	0.3872	0.1628
0	0	0.5	0.5	0	0.3856	0.1482
0	0.5	0.5	0	0	0.3896	0.1646
0.2	0.4	1	0.8	0.5	0.5418	0.2040

*SB ratio= 1/3, CR ratio= 9

Table A.253: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =30 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0490	0.0506
0	0	0.5	0	0	0.8050	0.3142
0	0	0.5	0.5	0	0.7932	0.3096
0	0.5	0.5	0	0	0.7970	0.3252
0.2	0.4	1	0.8	0.5	0.9424	0.4474

*SB ratio= 1/3, CR ratio= 9

Table A.254: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0474	0.0492
0	0	0.5	0	0	0.7840	0.5164
0	0	0.5	0.5	0	0.7882	0.5276
0	0.5	0.5	0	0	0.7908	0.5250
0.2	0.5	1	0.8	0.4	0.9650	0.7640

*SB ratio= 1/2, CR ratio=9

Table A.255: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0480	0.0522
0	0	0.5	0	0	0.4078	0.1442
0	0	0.5	0.5	0	0.4040	0.1510
0	0.5	0.5	0	0	0.4066	0.1472
0.2	0.4	1	0.8	0.5	0.5566	0.1872

*SB ratio= 1/2, CR ratio=9

Table A.256: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=15 Blk =30 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0498
0	0	0.5	0	0	0.8384	0.2846
0	0	0.5	0.5	0	0.8362	0.2958
0	0.5	0.5	0	0	0.8250	0.2802
0.2	0.4	1	0.8	0.5	0.9624	0.4084

*SB ratio= 1/2, CR ratio=9

Table A.257: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0506	0.0500
0	0	0.5	0	0	0.4920	0.3892
0	0	0.5	0.5	0	0.5054	0.3842
0	0.5	0.5	0	0	0.5014	0.3812
0.2	0.5	1	0.8	0.4	0.7536	0.5940

*SB ratio= 1, CR ratio= 9

Table A.258: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0520
0	0	0.5	0	0	0.2200	0.1180
0	0	0.5	0.5	0	0.2188	0.1112
0	0.5	0.5	0	0	0.2202	0.1158
0.2	0.4	1	0.8	0.5	0.2986	0.1464

*SB ratio= 1, CR ratio= 9

Table A.259: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=10 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0452	0.0504
0	0	0.5	0	0	0.4872	0.2020
0	0	0.5	0.5	0	0.4850	0.1986
0	0.5	0.5	0	0	0.4956	0.2064
0.2	0.4	1	0.8	0.5	0.6708	0.2798

*SB ratio= 1, CR ratio= 9

Table A.260: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0528	0.0496
0	0	0.5	0	0	0.7952	0.7014
0	0	0.5	0.5	0	0.7978	0.7066
0	0.5	0.5	0	0	0.8006	0.7128
0.2	0.5	1	0.8	0.4	0.9700	0.9222

*SB ratio= 2, CR ratio= 9

Table A.261: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0528	0.0546
0	0	0.5	0	0	0.3236	0.1504
0	0	0.5	0.5	0	0.3186	0.1538
0	0.5	0.5	0	0	0.3338	0.1490
0.2	0.4	1	0.8	0.5	0.4698	0.2120

*SB ratio= 2, CR ratio= 9

Table A.262: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =15 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0482	0.0506
0	0	0.5	0	0	0.7442	0.3280
0	0	0.5	0.5	0	0.7262	0.3354
0	0.5	0.5	0	0	0.7354	0.3390
0.2	0.4	1	0.8	0.5	0.9110	0.4826

*SB ratio= 2, CR ratio= 9

Table A.263: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0564	0.0490
0	0	0.5	0	0	0.7462	0.7136
0	0	0.5	0.5	0	0.7376	0.7020
0	0.5	0.5	0	0	0.7606	0.7046
0.2	0.5	1	0.8	0.4	0.9470	0.9202

*SB ratio= 3, CR ratio= 9

Table A.264: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0464	0.0524
0	0	0.5	0	0	0.2746	0.1488
0	0	0.5	0.5	0	0.2732	0.1496
0	0.5	0.5	0	0	0.2802	0.1560
0.2	0.4	1	0.8	0.5	0.3830	0.1942

*SB ratio= 3, CR ratio= 9

Table A.265: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=30 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0502	0.0534
0	0	0.5	0	0	0.6336	0.3130
0	0	0.5	0.5	0	0.6398	0.3414
0	0.5	0.5	0	0	0.6260	0.3212
0.2	0.4	1	0.8	0.5	0.8318	0.4716

*SB ratio= 3, CR ratio= 9

Table A.266: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0530	0.0514
0	0	0.5	0	0	0.8168	0.8068
0	0	0.5	0.5	0	0.8120	0.8018
0	0.5	0.5	0	0	0.8106	0.8032
0.2	0.5	1	0.8	0.4	0.9728	0.9670

*SB ratio= 4, CR ratio= 9

Table A.267: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0532	0.0458
0	0	0.5	0	0	0.2894	0.1652
0	0	0.5	0.5	0	0.3004	0.1624
0	0.5	0.5	0	0	0.3100	0.1660
0.2	0.4	1	0.8	0.5	0.4242	0.2268

*SB ratio= 4, CR ratio= 9

Table A.268: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0526	0.0540
0	0	0.5	0	0	0.5656	0.3952
0	0	0.5	0.5	0	0.5616	0.4082
0	0.5	0.5	0	0	0.5556	0.3934
0.2	0.4	1	0.8	0.5	0.7502	0.5470

*SB ratio= 4, CR ratio= 9

Table A.269: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0440	0.0412
0	0	0.5	0	0	0.8092	0.7554
0	0	0.5	0.5	0	0.8072	0.7548
0	0.5	0.5	0	0	0.7980	0.7518
0.2	0.5	1	0.8	0.4	0.9708	0.9454

*SB ratio= 8, CR ratio= 9

Table A.270: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0518	0.0492
0	0	0.5	0	0	0.2400	0.1630
0	0	0.5	0.5	0	0.2442	0.1712
0	0.5	0.5	0	0	0.2332	0.1672
0.2	0.4	1	0.8	0.5	0.3424	0.2308

*SB ratio= 8, CR ratio= 9

Table A.271: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0584	0.0552
0	0	0.5	0	0	0.6978	0.3938
0	0	0.5	0.5	0	0.6768	0.3918
0	0.5	0.5	0	0	0.6906	0.3978
0.2	0.4	1	0.8	0.5	0.8802	0.5708

*SB ratio= 8, CR ratio= 9

Table A.272: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0454	0.0468
0	0	0	0.5	0	0.5048	0.4310
0	0	0	0.5	0.5	0.3164	0.2738
0	0	0.5	0.5	0	0.8160	0.7136
0.2	0.5	0.8	1	0.4	0.9478	0.8846

*SB ratio= 1/8, CR ratio= 4

Table A.273: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0414	0.0420
0	0	0	0.5	0	0.2932	0.2342
0	0	0	0.5	0.5	0.1802	0.1552
0	0	0.5	0.5	0	0.5502	0.4166
0.2	0.5	0.8	1	0.4	0.7214	0.5684

*SB ratio= 1/8, CR ratio= 4

Table A.274: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0450	0.0500
0	0	0	0.5	0	0.6502	0.5142
0	0	0	0.5	0.5	0.3852	0.3102
0	0	0.5	0.5	0	0.9458	0.8446
0.2	0.5	0.8	1	0.4	0.9906	0.9542

*SB ratio= 1/8, CR ratio= 4

Table A.275: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0524	0.0490
0	0	0	0.5	0	0.6030	0.4286
0	0	0	0.5	0.5	0.3798	0.2794
0	0	0.5	0.5	0	0.8932	0.6216
0.2	0.5	0.8	1	0.4	0.9752	0.8148

*SB ratio= 1/4, CR ratio= 4

Table A.276: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0502	0.0506
0	0	0	0.5	0	0.3236	0.1730
0	0	0	0.5	0.5	0.2022	0.1208
0	0	0.5	0.5	0	0.6016	0.2704
0.2	0.5	0.8	1	0.4	0.7788	0.3702

*SB ratio= 1/4, CR ratio= 4

Table A.278: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0458	0.0512
0	0	0	0.5	0	0.7368	0.3806
0	0	0	0.5	0.5	0.4460	0.2332
0	0	0.5	0.5	0	0.9710	0.5944
0.2	0.5	0.8	1	0.4	0.9972	0.7998

*SB ratio= 1/4, CR ratio= 4

Table A.279: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0486	0.0502
0	0	0	0.5	0	0.5428	0.3956
0	0	0	0.5	0.5	0.3348	0.2484
0	0	0.5	0.5	0	0.8274	0.5726
0.2	0.5	0.8	1	0.4	0.9560	0.7746

*SB ratio= 1/3, CR ratio= 4

Table A.280: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0482
0	0	0	0.5	0	0.2964	0.1626
0	0	0	0.5	0.5	0.1750	0.1176
0	0	0.5	0.5	0	0.5112	0.2310
0.2	0.5	0.8	1	0.4	0.6992	0.3208

*SB ratio= 1/3, CR ratio= 4

Table A.281: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0512
0	0	0	0.5	0	0.6456	0.3444
0	0	0	0.5	0.5	0.3810	0.2086
0	0	0.5	0.5	0	0.9376	0.5306
0.2	0.5	0.8	1	0.4	0.9916	0.7288

*SB ratio= 1/3, CR ratio= 4

Table A.282: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0482	0.0486
0	0	0	0.5	0	0.6060	0.4482
0	0	0	0.5	0.5	0.3914	0.3032
0	0	0.5	0.5	0	0.8896	0.6296
0.2	0.5	0.8	1	0.4	0.9816	0.8346

*SB ratio= 1/2, CR ratio= 4

Table A.283: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0468	0.0532
0	0	0	0.5	0	0.3180	0.1726
0	0	0	0.5	0.5	0.1898	0.1232
0	0	0.5	0.5	0	0.5576	0.2328
0.2	0.5	0.8	1	0.4	0.7382	0.3200

*SB ratio= 1/2, CR ratio= 4

Table A.284: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0478	0.0532
0	0	0	0.5	0	0.6992	0.3472
0	0	0	0.5	0.5	0.4304	0.2326
0	0	0.5	0.5	0	0.9564	0.5324
0.2	0.5	0.8	1	0.4	0.9938	0.7246

*SB ratio= 1/2, CR ratio= 4

Table A.285: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0464	0.0494
0	0	0	0.5	0	0.3826	0.3452
0	0	0	0.5	0.5	0.2458	0.2378
0	0	0.5	0.5	0	0.6268	0.4920
0.2	0.5	0.8	1	0.4	0.7920	0.6638

*SB ratio= 1, CR ratio= 4

Table A.286: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0422	0.0436
0	0	0	0.5	0	0.1816	0.1288
0	0	0	0.5	0.5	0.1264	0.1040
0	0	0.5	0.5	0	0.3072	0.1766
0.2	0.5	0.8	1	0.4	0.4174	0.2226

*SB ratio= 1, CR ratio= 4

Table A.287: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0488
0	0	0	0.5	0	0.3950	0.2528
0	0	0	0.5	0.5	0.2282	0.1642
0	0	0.5	0.5	0	0.6856	0.3632
0.2	0.5	0.8	1	0.4	0.8582	0.5388

*SB ratio= 1, CR ratio= 4

Table A.288: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0476	0.0530
0	0	0	0.5	0	0.6696	0.6414
0	0	0	0.5	0.5	0.4308	0.4342
0	0	0.5	0.5	0	0.9008	0.8150
0.2	0.5	0.8	1	0.4	0.9822	0.9560

*SB ratio= 2, CR ratio= 4

Table A.289: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0416	0.0456
0	0	0	0.5	0	0.2946	0.2032
0	0	0	0.5	0.5	0.1838	0.1488
0	0	0.5	0.5	0	0.4836	0.2680
0.2	0.5	0.8	1	0.4	0.5926	0.4014

*SB ratio= 2, CR ratio= 4

Table A.290: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0536
0	0	0	0.5	0	0.6800	0.4918
0	0	0	0.5	0.5	0.4256	0.3124
0	0	0.5	0.5	0	0.9282	0.6620
0.2	0.5	0.8	1	0.4	0.9872	0.8518

*SB ratio= 2, CR ratio= 4

Table A.291: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0528
0	0	0	0.5	0	0.6180	0.6448
0	0	0	0.5	0.5	0.4130	0.4422
0	0	0.5	0.5	0	0.8528	0.8100
0.2	0.5	0.8	1	0.4	0.9696	0.9528

*SB ratio= 3, CR ratio= 4

Table A.292: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0446	0.0486
0	0	0	0.5	0	0.2634	0.2152
0	0	0	0.5	0.5	0.1790	0.1590
0	0	0.5	0.5	0	0.4336	0.2696
0.2	0.5	0.8	1	0.4	0.6038	0.4018

*SB ratio= 3, CR ratio= 4

Table A.293: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0508	0.0530
0	0	0	0.5	0	0.6120	0.4856
0	0	0	0.5	0.5	0.3814	0.3120
0	0	0.5	0.5	0	0.8692	0.6450
0.2	0.5	0.8	1	0.4	0.9718	0.8478

*SB ratio= 3, CR ratio= 4

Table A.294: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0434	0.0522
0	0	0	0.5	0	0.7102	0.7546
0	0	0	0.5	0.5	0.4702	0.5356
0	0	0.5	0.5	0	0.9102	0.9002
0.2	0.5	0.8	1	0.4	0.9896	0.9874

*SB ratio= 4, CR ratio= 4

Table A.295: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0498	0.0500
0	0	0	0.5	0	0.2384	0.2332
0	0	0	0.5	0.5	0.1760	0.1798
0	0	0.5	0.5	0	0.3938	0.3280
0.2	0.5	0.8	1	0.4	0.5434	0.4626

*SB ratio= 4, CR ratio= 4

Table A.296: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0514	0.0508
0	0	0	0.5	0	0.5864	0.5820
0	0	0	0.5	0.5	0.3604	0.3862
0	0	0.5	0.5	0	0.8244	0.7556
0.2	0.5	0.8	1	0.4	0.9542	0.9200

*SB ratio= 4, CR ratio= 4

Table A.297: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under N (0.1) * (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0458
0	0	0	0.5	0	0.6416	0.7520
0	0	0	0.5	0.5	0.4166	0.5294
0	0	0.5	0.5	0	0.8590	0.8952
0.2	0.5	0.8	1	0.4	0.9704	0.9844

*SB ratio= 8, CR ratio= 4

Table A.298: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under T(3)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0480	0.0486
0	0	0	0.5	0	0.2978	0.2464
0	0	0	0.5	0.5	0.1926	0.1788
0	0	0.5	0.5	0	0.4764	0.3228
0.2	0.5	0.8	1	0.4	0.6498	0.4840

*SB ratio= 8, CR ratio= 4

Table A.299: Estimated rejection percentages for the two proposed tests for trt=5 p=3 n=40 Blk =5 under exp (1)* (2) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0526	0.0522
0	0	0	0.5	0	0.6772	0.5836
0	0	0	0.5	0.5	0.4310	0.3900
0	0	0.5	0.5	0	0.9118	0.7570
0.2	0.5	0.8	1	0.4	0.9888	0.9196

*SB ratio= 8, CR ratio= 4

Table A.300: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0458	0.0460
0	0	0	0.5	0	0.5020	0.4310
0	0	0	0.5	0.5	0.3028	0.2748
0	0	0.5	0.5	0	0.8250	0.7138
0.2	0.5	0.8	1	0.4	0.9456	0.8816

*SB ratio= 1/8, CR ratio= 9

Table A.301: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0476	0.0468
0	0	0	0.5	0	0.2752	0.2144
0	0	0	0.5	0.5	0.1700	0.1446
0	0	0.5	0.5	0	0.5218	0.3790
0.2	0.5	0.8	1	0.4	0.6744	0.5180

*SB ratio= 1/8, CR ratio= 9

Table A.302: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=5 Blk =40 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0492	0.0478
0	0	0	0.5	0	0.5936	0.4492
0	0	0	0.5	0.5	0.3332	0.2528
0	0	0.5	0.5	0	0.9168	0.7766
0.2	0.5	0.8	1	0.4	0.9854	0.9182

*SB ratio= 1/8, CR ratio= 9

Table A.303: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0502	0.0486
0	0	0	0.5	0	0.6002	0.4092
0	0	0	0.5	0.5	0.3744	0.2702
0	0	0.5	0.5	0	0.8872	0.6218
0.2	0.5	0.8	1	0.4	0.9772	0.8148

*SB ratio= 1/4, CR ratio= 9

Table A.304: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0494	0.0480
0	0	0	0.5	0	0.2866	0.1448
0	0	0	0.5	0.5	0.1744	0.1084
0	0	0.5	0.5	0	0.5372	0.2024
0.2	0.5	0.8	1	0.4	0.7150	0.2744

*SB ratio= 1/4, CR ratio= 9

Table A.305: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =40 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0434	0.0452
0	0	0	0.5	0	0.6444	0.2764
0	0	0	0.5	0.5	0.3734	0.1818
0	0	0.5	0.5	0	0.9506	0.4782
0.2	0.5	0.8	1	0.4	0.9932	0.6386

*SB ratio= 1/4, CR ratio= 9

Table A.306: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0500
0	0	0	0.5	0	0.5498	0.3960
0	0	0	0.5	0.5	0.3398	0.2502
0	0	0.5	0.5	0	0.8320	0.5600
0.2	0.5	0.8	1	0.4	0.9522	0.7702

*SB ratio= 1/3, CR ratio= 9

Table A.307: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0438	0.0454
0	0	0	0.5	0	0.2536	0.1266
0	0	0	0.5	0.5	0.1686	0.1078
0	0	0.5	0.5	0	0.4588	0.1768
0.2	0.5	0.8	1	0.4	0.6194	0.2526

*SB ratio= 1/3, CR ratio= 9

Table A.308: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =30 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0454	0.0498
0	0	0	0.5	0	0.5652	0.2322
0	0	0	0.5	0.5	0.3206	0.1670
0	0	0.5	0.5	0	0.8942	0.3942
0.2	0.5	0.8	1	0.4	0.9776	0.5528

*SB ratio= 1/3, CR ratio= 9

Table A.309: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0470	0.0526
0	0	0	0.5	0	0.6100	0.4488
0	0	0	0.5	0.5	0.3988	0.3090
0	0	0.5	0.5	0	0.8830	0.6270
0.2	0.5	0.8	1	0.4	0.9786	0.8290

*SB ratio= 1/2, CR ratio= 9

Table A.310: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0494
0	0	0	0.5	0	0.2666	0.1214
0	0	0	0.5	0.5	0.1722	0.1006
0	0	0.5	0.5	0	0.4836	0.1656
0.2	0.5	0.8	1	0.4	0.6562	0.2206

*SB ratio= 1/2, CR ratio= 9

Table A.311: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=15 Blk =30 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0510	0.0550
0	0	0	0.5	0	0.5998	0.2358
0	0	0	0.5	0.5	0.3552	0.1586
0	0	0.5	0.5	0	0.9150	0.3558
0.2	0.5	0.8	1	0.4	0.9812	0.5112

*SB ratio= 1/2, CR ratio= 9

Table A.312: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0480	0.0504
0	0	0	0.5	0	0.3768	0.3352
0	0	0	0.5	0.5	0.2378	0.2270
0	0	0.5	0.5	0	0.6210	0.4794
0.2	0.5	0.8	1	0.4	0.7878	0.6642

*SB ratio= 1, CR ratio= 9

Table A.313: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0504	0.0508
0	0	0	0.5	0	0.1532	0.1102
0	0	0	0.5	0.5	0.1090	0.0874
0	0	0.5	0.5	0	0.2602	0.1278
0.2	0.5	0.8	1	0.4	0.3478	0.1612

*SB ratio= 1, CR ratio= 9

Table A.314: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=10 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0454	0.0480
0	0	0	0.5	0	0.3252	0.1770
0	0	0	0.5	0.5	0.1904	0.1222
0	0	0.5	0.5	0	0.5966	0.2566
0.2	0.5	0.8	1	0.4	0.7694	0.3492

*SB ratio= 1, CR ratio= 9

Table A.315: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0528	0.0496
0	0	0.5	0	0	0.7952	0.7014
0	0	0.5	0.5	0	0.7978	0.7066
0	0.5	0.5	0	0	0.8006	0.7128
0.2	0.5	1	0.8	0.4	0.9700	0.9222

*SB ratio= 2, CR ratio= 9

Table A.316: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0470	0.0478
0	0	0	0.5	0	0.2246	0.1404
0	0	0	0.5	0.5	0.1636	0.1092
0	0	0.5	0.5	0	0.3988	0.1810
0.2	0.5	0.8	1	0.4	0.5516	0.2320

*SB ratio= 2, CR ratio= 9

Table A.317: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =15 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0452	0.0490
0	0	0	0.5	0	0.5344	0.2944
0	0	0	0.5	0.5	0.3254	0.1984
0	0	0.5	0.5	0	0.8362	0.4112
0.2	0.5	0.8	1	0.4	0.9574	0.6006

*SB ratio= 2, CR ratio= 9

Table A.318: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0484	0.0468
0	0	0	0.5	0	0.6238	0.6506
0	0	0	0.5	0.5	0.4030	0.4342
0	0	0.5	0.5	0	0.8566	0.8096
0.2	0.5	0.8	1	0.4	0.9658	0.9558

*SB ratio= 3, CR ratio= 9

Table A.319: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0524	0.0526
0	0	0	0.5	0	0.1960	0.1288
0	0	0	0.5	0.5	0.1398	0.1116
0	0	0.5	0.5	0	0.3370	0.1744
0.2	0.5	0.8	1	0.4	0.4680	0.2302

*SB ratio= 3, CR ratio= 9

Table A.320: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=30 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0496	0.0552
0	0	0	0.5	0	0.4680	0.2938
0	0	0	0.5	0.5	0.2728	0.1952
0	0	0.5	0.5	0	0.7500	0.4020
0.2	0.5	0.8	1	0.4	0.9028	0.5830

*SB ratio= 3, CR ratio= 9

Table A.321: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0442	0.0462
0	0	0	0.5	0	0.7166	0.7556
0	0	0	0.5	0.5	0.4820	0.5380
0	0	0.5	0.5	0	0.9044	0.8936
0.2	0.5	0.8	1	0.4	0.9878	0.9882

*SB ratio= 4, CR ratio= 9

Table A.322: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0488	0.0466
0	0	0	0.5	0	0.2194	0.1590
0	0	0	0.5	0.5	0.1442	0.1180
0	0	0.5	0.5	0	0.3666	0.1934
0.2	0.5	0.8	1	0.4	0.4972	0.2748

*SB ratio= 4, CR ratio= 9

Table A.323: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =10 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0414	0.0476
0	0	0	0.5	0	0.4150	0.3428
0	0	0	0.5	0.5	0.2628	0.2372
0	0	0.5	0.5	0	0.6558	0.4866
0.2	0.5	0.8	1	0.4	0.8548	0.6896

*SB ratio= 4, CR ratio= 9

Table A.324: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =5 under N (0.1) * (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0502	0.0502
0	0	0	0.5	0	0.6296	0.7442
0	0	0	0.5	0.5	0.4314	0.5298
0	0	0.5	0.5	0	0.8590	0.8924
0.2	0.5	0.8	1	0.4	0.9696	0.9870

*SB ratio= 8, CR ratio= 9

Table A.325: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =5 under T(3)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0496	0.0500
0	0	0	0.5	0	0.1726	0.1512
0	0	0	0.5	0.5	0.1302	0.1188
0	0	0.5	0.5	0	0.2804	0.1938
0.2	0.5	0.8	1	0.4	0.4048	0.2808

*SB ratio= 8, CR ratio= 9

Table A.326: Estimated rejection percentages for the two proposed tests for trt=5 p=4 n=40 Blk =5 under exp (1)* (3) for Both Mixed design*.

MU1	MU2	MU 3	MU 4	MU 5	A**	A***
0	0	0	0	0	0.0506	0.0576
0	0	0	0.5	0	0.4962	0.3440
0	0	0	0.5	0.5	0.3066	0.2322
0	0	0.5	0.5	0	0.8008	0.5062
0.2	0.5	0.8	1	0.4	0.9340	0.6704

*SB ratio= 8, CR ratio= 9

APPENDIX B. SCENARIO TWO

Table B.1: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0.0446	0.0462	0.0452
0	1	1.5	1	0	1	0	1	0.8882	0.9974	0.9772
0	1	1.5	1	1.5	1	0	1	0.8898	0.9952	0.9792
1.5	1	1.5	1	0	1	0	1	0.5750	0.8548	0.7442
0.3	1	1.8	1	0.8	1	0.5	1	0.8534	0.9886	0.9606

Table B.2: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0454	0.0428	0.0442
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7386	0.9514	0.8902
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.7372	0.9496	0.8886
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.4366	0.6890	0.5812
0.5	1 σ^2	0.8	1 σ^2	1.8	1 σ^2	0.3	1 σ^2	0.6868	0.9306	0.8552

Table B.3: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
1	1	1	1	1	1	1	1	0.0474	0.0496	0.0468
1	1	1.5	1	1	1	1	1	0.6280	0.8988	0.8072
1	1	1.5	1	1.5	1	1	1	0.6192	0.8814	0.7886
1.5	1	1.5	1	1	1	1	1	0.3560	0.5766	0.4766
1.6	1	2	1	1.5	1	1.3	1	0.5664	0.8420	0.7358

Table B.4: Percentage of Rejection for k= 4 Populations p=2; Normal Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0.0514	0.0510	0.0500
0	1	0	9	0	1	0	1	0.6734	0.2096	0.4624
0	1	0	9	0	9	0	1	0.6938	0.1722	0.4396
0	9	0	9	0	1	0	1	0.3950	0.1418	0.2778
0	4	0	9	0	8	0	5	0.3298	0.1098	0.2276

Table B.5: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0436	0.0438	0.0442
0	$1\ \sigma^2$	0	$9\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.6986	0.1294	0.4240
0	$1\ \sigma^2$	0	$9\ \sigma^2$	0	$9\ \sigma^2$	0	$1\ \sigma^2$	0.6890	0.1288	0.4260
0	$9\ \sigma^2$	0	$9\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.3734	0.1032	0.2368
0	$3\ \sigma^2$	0	$9\ \sigma^2$	0	$8\ \sigma^2$	0	$5\ \sigma^2$	0.3098	0.0910	0.2040

Table B.6: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0532	0.0518	0.0560
1	1^2	1	9^2	1	1^2	1	1^2	0.6668	0.1290	0.4042
1	1^2	1	9^2	1	9^2	1	1^2	0.6698	0.1384	0.4106
1	9^2	1	9^2	1	1^2	1	1^2	0.3544	0.0982	0.2250
1	4^2	1	9^2	1	5^2	1	3^2	0.4056	0.1046	0.2588

Table B.7: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0.0502	0.0496	0.0522
0	1	1.5	9	0	1	0	1	0.8200	0.3780	0.6410
0	1	1.5	9	1.5	9	0	1	0.8588	0.3650	0.6674
1.5	9	1.5	9	0	1	0	1	0.5322	0.2504	0.4116
0.3	4	1.8	9	0.8	8	0.5	5	0.5076	0.2328	0.4044

Table B.8: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0526	0.0492	0.0504
0	$1\ \sigma^2$	0.5	$5\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.9036	0.5228	0.7848
0	$1\ \sigma^2$	0.5	$9\ \sigma^2$	0.5	$9\ \sigma^2$	0	$1\ \sigma^2$	0.9110	0.5218	0.7984
0.5	$9\ \sigma^2$	0.5	$9\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.5954	0.2958	0.4866
0.3	$3\ \sigma^2$	1.8	$9\ \sigma^2$	0.8	$8\ \sigma^2$	0.5	$5\ \sigma^2$	0.9658	0.9626	0.9744

Table B.9: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0484	0.0488	0.0480
1	1^2	2	2^2	1	1^2	1	1^2	0.7424	0.6534	0.7460
1	1^2	2	2^2	2	2^2	1	1^2	0.7364	0.6460	0.7396
2	2^2	2	2^2	1	1^2	1	1^2	0.4512	0.3872	0.4508
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	0.5216	0.4448	0.5194

Table B.10: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0.0570	0.0560	0.0560
0	1	0	1	1.5	1	0	1	0.8862	0.9976	0.9786
0	1	0	1	1.5	1	1.5	1	0.5632	0.8444	0.7360
0	1	1.5	1	1.5	1	0	1	0.8804	0.9958	0.9742
0.5	1	0.8	1	1.8	1	0.3	1	0.8540	0.9900	0.9658

Table B.11: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0484	0.0452	0.0484
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7410	0.9524	0.8890
0	1 σ^2	0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.4326	0.6852	0.5812
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.7350	0.9504	0.8830
0.5	1 σ^2	0.8	1 σ^2	1.8	1 σ^2	0.3	1 σ^2	0.6888	0.9262	0.8516

Table B.12: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
1	1	1	1	1	1	1	1	0.0480	0.0456	0.0462
1	1	1	1	1.5	1	1	1	0.8528	0.9370	0.9200
1	1	1	1	1.5	1	1.5	1	0.5218	0.6164	0.5986
1	1	1.5	1	1.5	1	1	1	0.8346	0.9140	0.9006
1.3	1	1.5	1	2	1	1.6	1	0.5612	0.8468	0.7470

Table B.13: Percentage of Rejection for k= 4 Populations p=3; Normal Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0.0518	0.0472	0.0468
0	1	0	1	0	9	0	1	0.6608	0.2024	0.4426
0	1	0	1	0	9	0	9	0.4054	0.1488	0.2880
0	1	0	9	0	9	0	1	0.6864	0.1692	0.4424
0	5	0	8	0	9	0	4	0.3460	0.1024	0.2332

Table B.14: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0512	0.0492	0.0522
0	1 σ^2	0	1 σ^2	0	9 σ^2	0	1 σ^2	0.7052	0.1336	0.4244
0	1 σ^2	0	1 σ^2	0	9 σ^2	0	9 σ^2	0.3662	0.1022	0.2352
0	1 σ^2	0	9 σ^2	0	9 σ^2	0	1 σ^2	0.6902	0.1276	0.4154
0	5 σ^2	0	8 σ^2	0	9 σ^2	0	3 σ^2	0.3078	0.0874	0.1994

Table B.15: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0540	0.0534	0.0522
1	1^2	1	1^2	1	9^2	1	1^2	0.6724	0.1332	0.4050
1	1^2	1	1^2	1	9^2	1	9^2	0.3578	0.0952	0.2298
1	1^2	1	9^2	1	9^2	1	1^2	0.6820	0.1336	0.4034
1	3^2	1	5^2	1	9^2	1	4^2	0.4050	0.1038	0.2608

Table B.16: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0.0526	0.0494	0.0514
0	1	0	1	1.5	9	0	1	0.8160	0.3814	0.6412
0	1	0	1	1.5	9	1.5	9	0.5260	0.2414	0.4036
0	1	1.5	9	1.5	9	0	1	0.8562	0.3622	0.6794
0.5	5	0.8	8	1.8	9	0.3	3	0.5460	0.2624	0.4328

Table B.17: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0512	0.0500	0.0536
0	$1\ \sigma^2$	0	$1\ \sigma^2$	1.5	$9\ \sigma^2$	0	$1\ \sigma^2$	0.9996	0.9882	0.9988
0	$1\ \sigma^2$	0	$1\ \sigma^2$	1.5	$9\ \sigma^2$	1.5	$9\ \sigma^2$	0.9380	0.8116	0.9134
0	$1\ \sigma^2$	1.5	$9\ \sigma^2$	1.5	$9\ \sigma^2$	0	$1\ \sigma^2$	0.9998	0.9890	0.9992
0.5	$5\ \sigma^2$	0.8	$8\ \sigma^2$	1.8	$9\ \sigma^2$	0.3	$3\ \sigma^2$	0.9996	0.9744	0.9972

Table B.18: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	0.0466	0.0458	0.0462
1	1^2	1	1^2	2	2^2	1	1^2	0.7368	0.6402	0.7320
1	1^2	1	1^2	2	2^2	2	2^2	0.4506	0.3864	0.4478
1	1^2	2	2^2	2	2^2	1	1^2	0.7540	0.6574	0.7482
2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.5152	0.4266	0.5030

Table B.19: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0508	0.0530	0.0500
0	1	1.5	1	0	1	0	1	0	1	0.8348	0.9886	0.9510
0	1	1.5	1	1.5	1	0	1	0	1	0.9608	0.9998	0.9974
1.5	1	1.5	1	0	1	0	1	0	1	0.6080	0.8850	0.7860
0.4	1	1.8	1	0.8	1	0.5	1	0.3	1	0.8704	0.9912	0.9692

Table B.20: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.0468	0.0532	0.0490
0	$1\ \sigma^2$	1.5	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.6744	0.9232	0.8412
0	$1\ \sigma^2$	1.5	$1\ \sigma^2$	1.5	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.8570	0.9862	0.9582
1.5	$1\ \sigma^2$	1.5	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0	$1\ \sigma^2$	0.4714	0.7262	0.6234
0.4	$1\ \sigma^2$	1.8	$1\ \sigma^2$	0.8	$1\ \sigma^2$	0.5	$1\ \sigma^2$	0.3	$1\ \sigma^2$	0.7590	0.9568	0.9008

Table B.21: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1	1	1	1	1	1	1	1	1	0.0500	0.0480	0.0466
1	1	1.5	1	1	1	1	1	1	1	0.5814	0.8624	0.7478
1	1	1.5	1	1.5	1	1	1	1	1	0.7546	0.9646	0.9016
1.5	1	1.5	1	1	1	1	1	1	1	0.3892	0.6300	0.5218
1.6	1	2	1	1.8	1	1.5	1	1.2	1	0.7510	0.9554	0.8950

Table B.22: Percentage of Rejection for k= 5 Populations p=2; Normal Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0560	0.0524	0.0538
0	1	0	9	0	1	0	1	0	1	0.6136	0.2028	0.4146
0	1	0	9	0	9	0	1	0	1	0.8134	0.2074	0.5502
0	9	0	9	0	1	0	1	0	1	0.4378	0.1528	0.2966
0	3	0	9	0	8	0	5	0	4	0.5256	0.1450	0.3428

Table B.23: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0480	0.0488	0.0472
0	1 σ^2	0	9 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.6224	0.1260	0.3726
0	1 σ^2	0	9 σ^2	0	9 σ^2	0	1 σ^2	0	1 σ^2	0.8328	0.1558	0.5242
0	9 σ^2	0	9 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.4036	0.1042	0.2532
0	4 σ^2	0	9 σ^2	0	8 σ^2	0	5 σ^2	0	3 σ^2	0.4986	0.1100	0.3102

Table B.24: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with same means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0476	0.0482	0.0474
1	1^2	1	9^2	1	1^2	1	1^2	1	1^2	0.6234	0.1240	0.3808
1	1^2	1	9^2	1	9^2	1	1^2	1	1^2	0.8170	0.1546	0.5204
1	9^2	1	9^2	1	1^2	1	1^2	1	1^2	0.3894	0.1050	0.2452
1	4^2	1	9^2	1	8^2	1	5^2	1	3^2	0.4512	0.1134	0.2834

Table B.25: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0542	0.0474	0.0508
0	1	1.5	9	0	1	0	1	0	1	0.7792	0.3676	0.6136
0	1	1.5	9	1.5	9	0	1	0	1	0.9370	0.4534	0.7756
1.5	9	1.5	9	0	1	0	1	0	1	0.5694	0.2632	0.4424
0.4	4	1.8	9	0.8	8	0.5	5	0.3	3	0.7716	0.3132	0.6012

Table B.26: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0466	0.0450	0.0476
0	1 σ^2	0.5	9 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.9032	0.4958	0.7810
0	1 σ^2	0.5	9 σ^2	0.5	9 σ^2	0	1 σ^2	0	1 σ^2	0.9882	0.6554	0.9304
0.5	9 σ^2	0.5	9 σ^2	0	1 σ^2	0	1 σ^2	0	1 σ^2	0.6888	0.3454	0.5638
0.4	4 σ^2	1.8	9 σ^2	0.8	8 σ^2	0.5	5 σ^2	0.3	3 σ^2	0.9818	0.9440	0.9786

Table B.27: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0510	0.0538	0.0504
1	1^2	2	2^2	1	1^2	1	1^2	1	1^2	0.6900	0.5994	0.6852
1	1^2	2	2^2	2	2^2	1	1^2	1	1^2	0.8550	0.7676	0.8496
2	2^2	2	2^2	1	1^2	1	1^2	1	1^2	0.4902	0.4166	0.4858
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	1.8	1.8^2	0.6094	0.5332	0.6082

Table B.28: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0520	0.0510	0.0486
0	1	0	1	1.5	1	0	1	0	1	0.8900	0.9966	0.9826
0	1	0	1	1.5	1	1.5	1	0	1	0.8830	0.9966	0.9780
0	1	1.5	1	1.5	1	0	1	0	1	0.8960	0.9964	0.9790
0.3	1	0.5	1	1.8	1	0.8	1	0.4	1	0.8930	0.9962	0.9774

Table B.29: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0520	0.0524	0.0528
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7470	0.9540	0.8966
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.7480	0.9616	0.9010
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7520	0.9540	0.8936
0.3	$1\sigma^2$	0.5	$1\sigma^2$	1.8	$1\sigma^2$	0.6	$1\sigma^2$	0.4	$1\sigma^2$	0.7510	0.9594	0.8962

Table B.30: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1	1	1	1	1	1	1	1	1	0.0468	0.0518	0.0480
1	1	1	1	1.5	1	1	1	1	1	0.6424	0.9184	0.8252
1	1	1	1	1.5	1	1.5	1	1	1	0.6394	0.9080	0.8164
1	1	1.5	1	1.5	1	1	1	1	1	0.6366	0.9054	0.8136
1.2	1	1.4	1	2	1	1.8	1	1.5	1	0.6602	0.9126	0.8228

Table B.31: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with equal means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0430	0.0480	0.0446
0	1	0	1	0	9	0	1	0	1	0.6880	0.2232	0.4672
0	1	0	1	0	9	0	9	0	1	0.7080	0.1966	0.4618
0	1	0	9	0	9	0	1	0	1	0.6990	0.1888	0.4542
0	3	0	5	0	9	0	8	0	4	0.5330	0.1384	0.3450

Table B.32: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with equal means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0500	0.0492	0.0472
0	$1\sigma^2$	0	$1\sigma^2$	0	$9\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7060	0.1328	0.4312
0	$1\sigma^2$	0	$1\sigma^2$	0	$9\sigma^2$	0	$9\sigma^2$	0	$1\sigma^2$	0.7080	0.1376	0.4402
0	$1\sigma^2$	0	$9\sigma^2$	0	$9\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7030	0.1332	0.4278
0	$3\sigma^2$	0	$5\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$4\sigma^2$	0.7200	0.1380	0.4456

Table B.33: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with equal means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0536	0.0504	0.0516
1	1^2	1	1^2	1	9^2	1	1^2	1	1^2	0.6920	0.1392	0.4222
1	1^2	1	1^2	1	9^2	1	9^2	1	1^2	0.6946	0.1374	0.4156
1	1^2	1	9^2	1	9^2	1	1^2	1	1^2	0.7012	0.1436	0.4332
1	3^2	1	4^2	1	9^2	1	8^2	1	5^2	0.3288	0.0938	0.2156

Table B.34: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0490	0.0508	0.0488
0	1	0	1	1.5	9	0	1	0	1	0.7420	0.1420	0.4484
0	1	0	1	1.5	9	1.5	9	0	1	0.7300	0.1418	0.4374
0	1	1.5	9	1.5	9	0	1	0	1	0.7280	0.1460	0.4400
0.3	3	0.5	5	1.8	9	0.8	8	0.4	4	0.7180	0.3178	0.5696

Table B.35: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and different when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0504	0.0480	0.0516
0	$1\sigma^2$	0	$1\sigma^2$	0.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9166	0.5436	0.8084
0	$1\sigma^2$	0	$1\sigma^2$	0.5	$5\sigma^2$	0.5	$5\sigma^2$	0	$1\sigma^2$	0.9214	0.5400	0.8174
0	$1\sigma^2$	0.5	$5\sigma^2$	0.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9150	0.5300	0.7998
0.3	$1\sigma^2$	0.5	$3\sigma^2$	1.2	$5\sigma^2$	0.6	$4\sigma^2$	0.2	$2\sigma^2$	0.9772	0.8702	0.9604

Table B.36: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and different when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0474	0.0484	0.0494
1	1^2	1	1^2	2	2^2	1	1^2	1	1^2	0.7488	0.6644	0.7446
1	1^2	1	1^2	2	2^2	2	2^2	1	1^2	0.7528	0.6810	0.7574
1	1^2	2	2^2	2	2^2	1	1^2	1	1^2	0.7690	0.6706	0.7596
1.5	1.5^2	1.8	1.8^2	3	3^2	2.5	2.5^2	2	2^2	0.6046	0.5274	0.6010

Table B.37: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0520	0.0524	0.0512
0	1	0	1	0	1	1.5	1	0	1	0.8340	0.9888	0.9600
0	1	0	1	0	1	1.5	1	1.5	1	0.6060	0.8914	0.7822
0	1	0	1	1.5	1	1.5	1	0	1	0.9570	0.9990	0.9950
0.3	1	0.5	1	0.8	1	1.8	1	0.4	1	0.8960	0.9944	0.9774

Table B.38: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0530	0.0506	0.0508
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.6840	0.9252	0.8472
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0.4740	0.7458	0.6312
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.8630	0.9880	0.9590
0.3	$1\sigma^2$	0.5	$1\sigma^2$	0.8	$1\sigma^2$	1.8	$1\sigma^2$	0.4	$1\sigma^2$	0.7350	0.9472	0.8874

Table B.39: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and equal variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1	1	1	1	1	1	1	1	1	0.0512	0.0520	0.0508
1	1	1	1	1	1	1.5	1	1	1	0.5808	0.8662	0.7552
1	1	1	1	1	1	1.5	1	1.5	1	0.4044	0.6314	0.5278
1	1	1	1	1.5	1	1.5	1	1	1	0.7594	0.9700	0.9092
1.2	1	1.5	1	1.8	1	2	1	1.6	1	0.7452	0.9590	0.8920

Table B.40: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with equal means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0560	0.0546	0.0566
0	1	0	1	0	1	0	9	0	1	0.6250	0.2032	0.4288
0	1	0	1	0	1	0	9	0	9	0.4390	0.1600	0.3074
0	1	0	1	0	9	0	9	0	1	0.8240	0.2124	0.5476
0	4	0	5	0	8	0	9	0	3	0.5320	0.1298	0.3428

Table B.41: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with equal means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0450	0.0482	0.0486
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$9\sigma^2$	0	$1\sigma^2$	0.6340	0.1280	0.3932
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$9\sigma^2$	0	$9\sigma^2$	0.3910	0.0968	0.2426
0	$1\sigma^2$	0	$1\sigma^2$	0	$9\sigma^2$	0	$9\sigma^2$	0	$1\sigma^2$	0.8430	0.1542	0.5302
0	$3\sigma^2$	0	$5\sigma^2$	0	$8\sigma^2$	0	$9\sigma^2$	0	$4\sigma^2$	0.5020	0.1136	0.3088

Table B.42: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with equal means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0488	0.0498	0.0500
1	1^2	1	1^2	1	1^2	1	9^2	1	1^2	0.6170	0.1238	0.3710
1	1^2	1	1^2	1	1^2	1	9^2	1	9^2	0.4136	0.1108	0.2650
1	1^2	1	1^2	1	9^2	1	9^2	1	1^2	0.8138	0.1530	0.5190
1	3^2	1	5^2	1	8^2	1	9^2	1	4^2	0.4426	0.1074	0.2772

Table B.43: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and different variance when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	1	0	1	0	1	0	1	0	1	0.0490	0.0472	0.0474
0	1	0	1	0	1	1.5	9	0	1	0.7830	0.3714	0.6164
0	1	0	1	0	1	1.5	9	1.5	9	0.5830	0.2802	0.4538
0	1	0	1	1.5	9	1.5	9	0	1	0.9380	0.4548	0.7818
0.3	3	0.5	5	0.8	8	1.8	9	0.4	4	0.7790	0.3200	0.6210

Table B.44: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and different when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0510	0.0510	0.0504
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.5	$5\sigma^2$	0	$1\sigma^2$	0.8578	0.4910	0.7412
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.5	$5\sigma^2$	0.5	$5\sigma^2$	0.6368	0.3312	0.5198
0	$1\sigma^2$	0	$1\sigma^2$	0.5	$5\sigma^2$	0.5	$5\sigma^2$	0	$1\sigma^2$	0.9708	0.6376	0.9020
0.3	$1\sigma^2$	0.5	$3\sigma^2$	0.8	$4\sigma^2$	1.8	$5\sigma^2$	0.4	$2\sigma^2$	0.9988	0.9888	0.9984

Table B.45: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and different when the sample size n=5 under CRD.

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	T_1	T_2	TW_2
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0482	0.0484	0.0472
1	1^2	1	1^2	1	1^2	2	2^2	1	1^2	0.7066	0.6116	0.6948
1	1^2	1	1^2	1	1^2	2	2^2	2	2^2	0.4914	0.4294	0.4908
1	1^2	1	1^2	2	2^2	2	2^2	1	1^2	0.8560	0.7746	0.8516
1.8	1.8	2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.6162	0.5392	0.6090

APPENDIX C. SCENARIO THREE

Table C.1: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1	0	1	0	1	0.0476	0.0452	0.0464
0	1	1.5	1	0	1	0.9704	0.9958	0.9718
0	1	1.5	1	1.5	1	0.4818	0.5812	0.4698
1.5	1	1.5	1	0	1	0.5112	0.5982	0.4906
1.5	1	2	1	1.8	1	0.2248	0.2518	0.2182

Table C.2: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1 σ^2	0	1 σ^2	0	1 σ^2	0.0482	0.0512	0.0530
0	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.8764	0.9456	0.8736
0	1 σ^2	1.5	1 σ^2	1.5	1 σ^2	0.3854	0.4574	0.3784
1.5	1 σ^2	1.5	1 σ^2	0	1 σ^2	0.6690	0.9266	0.8360
1.5	1 σ^2	2	1 σ^2	1.8	1 σ^2	0.1900	0.2042	0.1850

Table C.3: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
1	1	1	1	1	1	0.0512	0.0500	0.0506
1	1	1.5	1	1	1	0.9504	0.9782	0.9386
1	1	1.5	1	1.5	1	0.4534	0.5092	0.4222
1.5	1	1.5	1	1	1	0.4710	0.5114	0.4254
1.5	1	2	1	1.8	1	0.7464	0.8240	0.7110

Table C.4: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1	0	1	0	1	0.0486	0.0546	0.0552
0	1	0	5	0	1	0.7914	0.2152	0.4980
0	1	0	5	0	5	0.3058	0.1056	0.1948
0	5	0	5	0	1	0.3140	0.1116	0.2062
0	5	0	9	0	8	0.2140	0.0868	0.1474

Table C.5: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0476	0.0476	0.0480
0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.7852	0.1414	0.1904
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0.2792	0.0790	0.0952
0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.2852	0.0834	0.1050
0	$5\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0.3066	0.0924	0.1110

Table C.6: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	0.0486	0.0432	0.0444
1	1^2	1	5^2	1	1^2	0.9966	0.2052	0.7248
1	1^2	1	5^2	1	5^2	0.6078	0.1054	0.2788
1	5^2	1	5^2	1	1^2	0.6178	0.1098	0.2856
1	5^2	1	9^2	1	8^2	0.2820	0.0718	0.1444

Table C.7: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1	0	1	0	1	0.0480	0.0494	0.0502
0	1	1.5	5	0	1	0.9690	0.5606	0.8080
0	1	1.5	5	1.5	5	0.5338	0.2482	0.3726
1.5	5	1.5	5	0	1	0.5360	0.2510	0.3806
1.5	5	2	9	1.8	8	0.2394	0.1078	0.1694

Table C.8: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0504	0.0528	0.0496
0	$1\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	1.0000	0.9902	0.9988
0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0.8486	0.5640	0.6780
1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0.8414	0.5784	0.6842
1.5	$5\sigma^2$	2	$9\sigma^2$	1.8	$8\sigma^2$	0.4080	0.2424	0.2974

Table C.9: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	0.0486	0.0518	0.0534
1	1^2	2	2^2	1	1^2	0.9992	0.9568	0.9816
1	1^2	2	2^2	2	2^2	0.7722	0.5200	0.5950
2	2^2	2	2^2	1	1^2	0.7866	0.5232	0.6072
2	2^2	4	4^2	3	3^2	0.9662	0.7736	0.8556

Table C.10: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1	0	1	0	1	0.0524	0.0512	0.0498
0	1	1.5	1	0	1	0.9966	0.9976	0.9874
0	1	1.5	1	1.5	1	0.6168	0.6438	0.5184
1.5	1	1.5	1	0	1	0.6228	0.6532	0.5248
1.5	1	2	1	1.8	1	0.2782	0.2876	0.2384

Table C.11: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0534	0.0510	0.0500
0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.9532	0.9688	0.9038
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0.4752	0.4948	0.3932
1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.4956	0.5086	0.4094
1.5	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	0.2124	0.2202	0.1852

Table C.12: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
1	1	1	1	1	1	0.0498	0.0458	0.0478
1	1	1.5	1	1	1	0.9992	0.9998	0.9966
1	1	1.5	1	1.5	1	0.7012	0.7474	0.6038
1.5	1	1.5	1	1	1	0.7056	0.7586	0.6000
1.5	1	2	1	1.8	1	0.4744	0.4878	0.3984

Table C.13: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1	0	1	0	1	0.0526	0.0502	0.0536
0	1	0	5	0	1	0.9012	0.2370	0.5658
0	1	0	5	0	5	0.3982	0.1232	0.2378
0	5	0	5	0	1	0.4036	0.1168	0.2394
0	5	0	9	0	8	0.2634	0.0878	0.1676

Table C.14: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0516	0.0494	0.0528
0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.9036	0.1590	0.2630
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0.3750	0.0938	0.1318
0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.3680	0.0972	0.1280
0	$5\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0.1970	0.0756	0.0912

Table C.15: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	0.0562	0.0542	0.0516
1	1^2	1	5^2	1	1^2	1.0000	0.2326	0.7928
1	1^2	1	5^2	1	5^2	0.7582	0.1126	0.3082
1	5^2	1	5^2	1	1^2	0.7614	0.1144	0.3106
1	5^2	1	9^2	1	8^2	0.3680	0.0776	0.1664

Table C.16: Percentage of Rejection for k=3 Populations p=2; Normal Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	1	0	1	0	1	0.0486	0.0478	0.0496
0	1	1.5	5	0	1	0.9960	0.6264	0.8836
0	1	1.5	5	1.5	5	0.6844	0.2804	0.4458
1.5	5	1.5	5	0	1	0.6910	0.2824	0.4436
1.5	5	2	9	1.8	8	0.3124	0.1222	0.2038

Table C.17: Percentage of Rejection for k=3 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0550	0.0536	0.0584
0	$1\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	1.0000	0.9962	0.9998
0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0.9468	0.6494	0.8234
1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0.9492	0.6496	0.8170
1.5	$5\sigma^2$	2	$9\sigma^2$	1.8	$8\sigma^2$	0.5254	0.2884	0.3918

Table C.18: Percentage of Rejection for k=3 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	0.0452	0.0478	0.0484
1	1^2	2	2^2	1	1^2	1.0000	0.9576	0.9868
1	1^2	2	2^2	2	2^2	0.8870	0.5314	0.6186
2	2^2	2	2^2	1	1^2	0.8858	0.5362	0.6342
2	2^2	4	4^2	3	3^2	0.9926	0.7914	0.8814

Table C.19: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0548	0.0518	0.0542
0	1	1.5	1	0	1	0	1	0.9630	0.9934	0.9680
0	1	1.5	1	1.5	1	0	1	0.9592	0.9934	0.9672
1.5	1	1.5	1	0	1	0	1	0.7080	0.8234	0.6998
1.2	1	2	1	1.8	1	1.5	1	0.4296	0.5102	0.4170

Table C.20: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0482	0.0456	0.0492
0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8612	0.9308	0.8548
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.8610	0.9370	0.8600
1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.5506	0.6526	0.5294
1.2	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	1.5	$1\sigma^2$	0.3284	0.3752	0.3090

Table C.21: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	0.0478	0.0458	0.0470
1	1	1.5	1	1	1	1	1	0.5560	0.6690	0.5496
1	1	1.5	1	1.5	1	1	1	0.5470	0.6456	0.5470
1.5	1	1.5	1	1	1	1	1	0.3004	0.3496	0.2890
1.2	1	2	1	1.8	1	1.5	1	0.6736	0.7908	0.6674

Table C.22: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0540	0.0484	0.0522
0	1	0	5	0	1	0	1	0.7604	0.1994	0.2526
0	1	0	5	0	5	0	1	0.7930	0.1800	0.2328
0	5	0	5	0	1	0	1	0.4690	0.1418	0.1708
0	2	0	9	0	8	0	5	0.5232	0.1270	0.1612

Table C.23: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0454	0.0468	0.0458
0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7636	0.1370	0.1836
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.7640	0.1366	0.1906
0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.4328	0.1018	0.1266
0	$2\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$5\sigma^2$	0.4350	0.0984	0.1220

Table C.24: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0500	0.0492	0.0490
1	1^2	1	5^2	1	1^2	1	1^2	0.9934	0.2072	0.2396
1	1^2	1	5^2	1	5^2	1	1^2	0.9960	0.1996	0.2356
1	5^2	1	5^2	1	1^2	1	1^2	0.8310	0.1376	0.1592
1	2^2	1	9^2	1	8^2	1	5^2	0.8094	0.1280	0.1456

Table C.25: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0514	0.0476	0.0464
0	1	1.5	5	0	1	0	1	0.9604	0.5364	0.6362
0	1	1.5	5	1.5	5	0	1	0.9840	0.5644	0.6790
1.5	5	1.5	5	0	1	0	1	0.7520	0.3514	0.4182
1.2	2	2	9	1.8	8	1.5	5	0.7616	0.2242	0.3068

Table C.26: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0486	0.0522	0.0506
0	$1\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9450	0.7270	0.7694
0	$1\sigma^2$	0.5	$1.5\sigma^2$	0.5	1.5	0	$1\sigma^2$	0.9458	0.7234	0.7694
0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.6750	0.4282	0.4654
0.3	$1.2\sigma^2$	0.9	$1.8\sigma^2$	0.8	$1.5\sigma^2$	0.5	$1.3\sigma^2$	0.8964	0.6444	0.6908

Table C.27: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0436	0.0500	0.0504
1	1^2	1.5	1.5^2	1	1^2	1	1^2	0.8822	0.6200	0.6662
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8898	0.6292	0.6736
1.5	1^2	1.5	1.5^2	1	1^2	1	1^2	0.5902	0.3614	0.3948
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	0.9674	0.7816	0.8246

Table C.28: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0470	0.0418	0.0450
0	1	1.5	1	0	1	0	1	0.9930	0.9974	0.9766
0	1	1.5	1	1.5	1	0	1	0.9938	0.9970	0.9774
1.5	1	1.5	1	0	1	0	1	0.8446	0.8754	0.7516
1.2	1	2	1	1.8	1	1.5	1	0.5434	0.5420	0.4452

Table C.29: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0504	0.0538	0.0530
0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9556	0.9602	0.8940
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.6982	0.6990	0.5886
1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9518	0.9584	0.8918
1.2	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	1.5	$1\sigma^2$	0.4146	0.4298	0.3450

Table C.30: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	0.0508	0.0484	0.0478
1	1	1.5	1	1	1	1	1	0.9482	0.9550	0.8822
1	1	1.5	1	1.5	1	1	1	0.9494	0.9590	0.8950
1.5	1	1.5	1	1	1	1	1	0.6956	0.7018	0.5934
1.2	1	2	1	1.8	1	1.5	1	0.4238	0.4236	0.3400

Table C.31: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0504	0.0532	0.0528
0	1	0	5	0	1	0	1	0.8928	0.2284	0.3254
0	1	0	5	0	5	0	1	0.9184	0.1896	0.2992
0	5	0	5	0	1	0	1	0.6056	0.1572	0.2160
0	2	0	9	0	8	0	5	0.6748	0.1498	0.2076

Table C.32: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0526	0.0470	0.0504
0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8942	0.1614	0.2658
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.8940	0.1580	0.2606
0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.5704	0.1148	0.1666
0	$2\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$5\sigma^2$	0.5702	0.1150	0.1684

Table C.33: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0488	0.0488	0.0486
1	1^2	1	5^2	1	1^2	1	1^2	0.9996	0.2216	0.3020
1	1^2	1	5^2	1	5^2	1	1^2	0.9988	0.2112	0.2874
1	5^2	1	5^2	1	1^2	1	1^2	0.9368	0.1516	0.1866
1	2^2	1	9^2	1	8^2	1	5^2	0.9150	0.1476	0.1874

Table C.34: Percentage of Rejection for k=4 Populations p=2; Normal Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0486	0.0450	0.0432
0	1	1.5	5	0	1	0	1	0.9934	0.6190	0.7884
0	1	1.5	5	1.5	5	0	1	0.9990	0.6078	0.8076
1.5	5	1.5	5	0	1	0	1	0.8742	0.3876	0.5352
1.2	2	2	9	1.8	8	1.5	5	0.7616	0.2242	0.3068

Table C.35: Percentage of Rejection for k=4 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0478	0.0540	0.0544
0	$1\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9858	0.7288	0.8160
0	$1\sigma^2$	0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0.9860	0.7458	0.8220
0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8164	0.4396	0.5138
0.3	$1.2\sigma^2$	0.9	$1.8\sigma^2$	0.8	$1.5\sigma^2$	0.5	$1.3\sigma^2$	0.9674	0.6836	0.7612

Table C.36: Percentage of Rejection for k=4 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0554	0.0534	0.0518
1	1^2	1.5	1.5^2	1	1^2	1	1^2	0.9518	0.6518	0.7260
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9608	0.6592	0.7422
1.5	1^2	1.5	1.5^2	1	1^2	1	1^2	0.7310	0.3836	0.4438
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	0.9946	0.7986	0.8704

Table C.37: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0504	0.0492	0.0518
0	1	0	1	1.5	1	0	1	0.9662	0.9920	0.9674
0	1	0	1	1.5	1	1.5	1	0.7090	0.8206	0.7028
0	1	1.5	1	1.5	1	0	1	0.9672	0.9914	0.9678
1.5	1	1.8	1	2	1	1.2	1	0.4432	0.5278	0.4368

Table C.38: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0488	0.0554	0.0532
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.8554	0.9366	0.8532
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0.5526	0.6524	0.5466
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.8582	0.9372	0.8498
1.5	$1\sigma^2$	1.8	$1\sigma^2$	2	$1\sigma^2$	1.2	$1\sigma^2$	0.3258	0.3846	0.3182

Table C.39: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	0.0548	0.0504	0.0504
1	1	1	1	1.5	1	1	1	0.5442	0.6682	0.5468
1	1	1	1	1.5	1	1.5	1	0.3128	0.3586	0.2988
1	1	1.5	1	1.5	1	1	1	0.5476	0.6446	0.5378
1.5	1	1.8	1	1	1	1.2	1	0.6708	0.789	0.6696

Table C.40: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0474	0.0520	0.0534
0	1	0	1	0	5	0	1	0.7710	0.2010	0.2526
0	1	0	1	0	5	0	5	0.4776	0.1452	0.1716
0	1	0	5	0	5	0	1	0.7980	0.1754	0.2274
0	5	0	8	0	9	0	2	0.5314	0.1318	0.1604

Table C.41: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0504	0.0554	0.0540
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.7668	0.1270	0.1756
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0.4324	0.1010	0.1284
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.7670	0.1342	0.1856
0	$5\sigma^2$	0	$8\sigma^2$	0	$9\sigma^2$	0	$2\sigma^2$	0.4368	0.1122	0.1342

Table C.42: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0516	0.0514	0.0518
1	1^2	1	1^2	1	5^2	1	1^2	0.9930	0.2154	0.2532
1	1^2	1	1^2	1	5^2	1	5^2	0.8342	0.1442	0.1600
1	1^2	1	5^2	1	5^2	1	1^2	0.9946	0.2056	0.2378
1	5^2	1	8^2	1	9^2	1	2^2	0.8050	0.1374	0.1558

Table C.43: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0530	0.0562	0.0536
0	1	0	1	1.5	5	0	1	0.9644	0.5424	0.6450
0	1	0	1	1.5	5	1.5	5	0.7498	0.3300	0.4058
0	1	1.5	5	1.5	5	0	1	0.9822	0.5494	0.6716
1.5	5	1.8	8	2	9	1.2	2	0.6226	0.1874	0.2312

Table C.44: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0482	0.0454	0.0462
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0.9998	0.9842	0.9970
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0.9764	0.7896	0.8842
0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0.9998	0.9854	0.9974
1.5	$5\sigma^2$	1.8	$8\sigma^2$	2	$9\sigma^2$	1.2	$2\sigma^2$	0.8822	0.5404	0.6474

Table C.45: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0462	0.0492	0.0498
1	1^2	1	1^2	1.5	1.5^2	1	1^2	0.8820	0.6256	0.6686
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	0.6050	0.3952	0.4246
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8912	0.6296	0.6748
2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.9642	0.7712	0.8110

Table C.46: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0532	0.0584	0.0566
0	1	0	1	1.5	1	0	1	0.9944	0.9954	0.9812
0	1	0	1	1.5	1	1.5	1	0.8336	0.8578	0.7326
0	1	1.5	1	1.5	1	0	1	0.9924	0.9978	0.9780
1.5	1	1.8	1	2	1	1.5	1	0.5602	0.5572	0.4606

Table C.47: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0504	0.0538	0.0530
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.9556	0.9602	0.8940
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0.6982	0.6990	0.5886
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.9518	0.9584	0.8918
1.5	$1\sigma^2$	1.8	$1\sigma^2$	2	$1\sigma^2$	1.2	$1\sigma^2$	0.4146	0.4298	0.3450

Table C.48: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	0.0496	0.0480	0.0460
1	1	1	1	1.5	1	1	1	0.7018	0.7238	0.5948
1	1	1	1	1.5	1	1.5	1	0.4052	0.3960	0.3172
1	1	1.5	1	1.5	1	1	1	0.6888	0.6988	0.5858
1.5	1	1.8	1	1	1	1.2	1	0.8182	0.8318	0.7198

Table C.49: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0518	0.0482	0.0518
0	1	0	1	0	5	0	1	0.8880	0.2398	0.3406
0	1	0	1	0	5	0	5	0.6054	0.1496	0.2122
0	1	0	5	0	5	0	1	0.9182	0.1950	0.3070
0	5	0	8	0	9	0	2	0.6538	0.1424	0.2066

Table C.50: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0524	0.0482	0.0508
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.8982	0.1562	0.2656
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0.5682	0.1120	0.1600
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.9100	0.1532	0.2634
0	$5\sigma^2$	0	$8\sigma^2$	0	$9\sigma^2$	0	$2\sigma^2$	0.5646	0.1134	0.1700

Table C.51: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0524	0.0578	0.0578
1	1^2	1	1^2	1	5^2	1	1^2	0.9996	0.2256	0.3040
1	1^2	1	1^2	1	5^2	1	5^2	0.9334	0.1422	0.1802
1	1^2	1	5^2	1	5^2	1	1^2	0.9998	0.2256	0.3090
1	5^2	1	8^2	1	9^2	1	2^2	0.9130	0.1426	0.1808

Table C.52: Percentage of Rejection for k=4 Populations p=3; Normal Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0.0484	0.0488	0.0502
0	1	0	1	1.5	5	0	1	0.9928	0.5960	0.7734
0	1	0	1	1.5	5	1.5	5	0.8750	0.3842	0.5224
0	1	1.5	5	1.5	5	0	1	0.9986	0.6248	0.8218
1.5	5	1.8	8	2	9	1.2	2	0.7614	0.2002	0.3036

Table C.53: Percentage of Rejection for k=4 Populations p=3; T (3)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0476	0.0490	0.0488
0	$1\sigma^2$	0	$1\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0.9852	0.7400	0.8230
0	$1\sigma^2$	0	$1\sigma^2$	0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0.8200	0.4562	0.5258
0	$1\sigma^2$	0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0.9888	0.7424	0.8218
1.5	$5\sigma^2$	1.8	$8\sigma^2$	2	$9\sigma^2$	1.2	$2\sigma^2$	0.9598	0.5936	0.7702

Table C.54: Percentage of Rejection for k=4 Populations p=3; Exponential (1)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	0.0526	0.0496	0.0522
1	1^2	1	1^2	1.5	1.5^2	1	1^2	0.9624	0.6456	0.7292
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	0.7412	0.3934	0.4532
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9638	0.6546	0.7374
2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.9934	0.7924	0.8648

Table C.55: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0500	0.0492	0.0494
0	1	1.5	1	0	1	0	1	0	1	0.9382	0.9828	0.9410
0	1	1.5	1	1.5	1	0	1	0	1	0.9944	0.9990	0.9940
1.5	1	1.5	1	0	1	0	1	0	1	0.7536	0.8554	0.7484
1.4	1	2	1	1.8	1	1.5	1	1.2	1	0.6080	0.7132	0.5868

Table C.56: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0500	0.0452	0.0484
0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8236	0.9086	0.8162
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9466	0.9848	0.9412
1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.6074	0.7016	0.5852
1.4	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	1.5	$1\sigma^2$	1.2	$1\sigma^2$	0.4630	0.5542	0.4520

Table C.57: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	1	1	0.0470	0.0488	0.0496
1	1	1.5	1	1	1	1	1	1	1	0.5092	0.6094	0.4886
1	1	1.5	1	1.5	1	1	1	1	1	0.6840	0.7826	0.6660
1.5	1	1.5	1	1	1	1	1	1	1	0.3384	0.3856	0.3088
1.4	1	2	1	1.8	1	1.5	1	1.2	1	0.8656	0.9370	0.8550

Table C.58: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0470	0.0486	0.0494
0	1	0	5	0	1	0	1	0	1	0.7404	0.1956	0.2374
0	1	0	5	0	5	0	1	0	1	0.9026	0.2062	0.2626
0	5	0	5	0	1	0	1	0	1	0.5218	0.1466	0.1774
0	4	0	9	0	8	0	5	0	2	0.8608	0.1670	0.2240

Table C.59: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0560	0.0486	0.0520
0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7008	0.1304	0.1688
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8958	0.1608	0.2220
0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.4832	0.0974	0.1272
0	$4\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$5\sigma^2$	0	$2\sigma^2$	0.7744	0.1438	0.1886

Table C.60 Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0482	0.0504	0.0504
1	1^2	1	5^2	1	1^2	1	1^2	1	1^2	0.9864	0.1972	0.2284
1	1^2	1	5^2	1	5^2	1	1^2	1	1^2	0.9998	0.2458	0.2932
1	5^2	1	5^2	1	1^2	1	1^2	1	1^2	0.8792	0.1406	0.1596
1	4^2	1	9^2	1	8^2	1	5^2	1	2^2	0.9918	0.1928	0.2290

Table C.61: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0462	0.0514	0.0514
0	1	1.5	5	0	1	0	1	0	1	0.9460	0.5120	0.6046
0	1	1.5	5	1.5	5	0	1	0	1	0.9970	0.6606	0.7656
1.5	5	1.5	5	0	1	0	1	0	1	0.7918	0.3632	0.4422
1.4	4	2	9	1.8	8	1.5	5	1.2	2	0.9206	0.2702	0.3508

Table C.62: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0504	0.0516	0.0514
0	$1\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9998	0.9704	0.9918
0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9998	0.9980	0.9994
1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9860	0.8360	0.9198
1.4	$4\sigma^2$	2	$9\sigma^2$	1.8	$8\sigma^2$	1.5	$5\sigma^2$	1.2	$2\sigma^2$	0.9946	0.7618	0.8634

Table C.63: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0472	0.0490	0.0500
1	1^2	1.5	1.5^2	1	1^2	1	1^2	1	1^2	0.8480	0.5804	0.6180
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	1	1^2	0.9578	0.7410	0.7856
1.5	1.5^2	1.5	1.5^2	1	1^2	1	1^2	1	1^2	0.6590	0.4068	0.4432
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	1.8	1.8^2	0.9930	0.8744	0.9058

Table C.64: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0552	0.0490	0.0500
0	1	1.5	1	0	1	0	1	0	1	0.9868	0.9900	0.9572
0	1	1.5	1	1.5	1	0	1	0	1	0.9996	1.0000	0.9970
1.5	1	1.5	1	0	1	0	1	0	1	0.8840	0.9054	0.7978
1.4	1	2	1	1.8	1	1.5	1	1.2	1	0.7554	0.7520	0.6436

Table C.65: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0486	0.0522	0.0532
0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9298	0.9366	0.859
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9902	0.9906	0.9626
1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7488	0.7626	0.6392
1.4	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	1.5	$1\sigma^2$	1.2	$1\sigma^2$	0.5928	0.6006	0.4898

Table C.66: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	1	1	0.0504	0.0478	0.0468
1	1	1.5	1	1	1	1	1	1	1	0.6556	0.6766	0.5438
1	1	1.5	1	1.5	1	1	1	1	1	0.8168	0.8386	0.7186
1.5	1	1.5	1	1	1	1	1	1	1	0.4404	0.4416	0.3534
1.4	1	2	1	1.8	1	1.5	1	1.2	1	0.9608	0.9602	0.8946

Table C.67: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0496	0.0482	0.0462
0	1	0	5	0	1	0	1	0	1	0.8498	0.2238	0.3218
0	1	0	5	0	5	0	1	0	1	0.9738	0.2546	0.3890
0	5	0	5	0	1	0	1	0	1	0.6452	0.1688	0.2250
0	4	0	9	0	8	0	5	0	2	0.9476	0.2102	0.3344

Table C.68: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0472	0.0482	0.0414
0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8604	0.1614	0.2562
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9664	0.2000	0.3374
0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.6282	0.1154	0.1716
0	$4\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$5\sigma^2$	0	$2\sigma^2$	0.8978	0.1756	0.2830

Table C.69: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0542	0.0504	0.0498
1	1^2	1	5^2	1	1^2	1	1^2	1	1^2	0.9992	0.2070	0.2802
1	1^2	1	5^2	1	5^2	1	1^2	1	1^2	1.0000	0.2798	0.3808
1	5^2	1	5^2	1	1^2	1	1^2	1	1^2	0.9590	0.1492	0.1900
1	4^2	1	9^2	1	8^2	1	5^2	1	2^2	0.9996	0.2148	0.2924

Table C.70: Percentage of Rejection for k=5 Populations p=2; Normal Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0470	0.0528	0.0528
0	1	1.5	5	0	1	0	1	0	1	0.9552	0.5150	0.6070
0	1	1.5	5	1.5	5	0	1	0	1	0.9998	0.7390	0.8966
1.5	5	1.5	5	0	1	0	1	0	1	0.9004	0.4092	0.5554
1.4	4	2	9	1.8	8	1.5	5	1.2	2	0.9806	0.3276	0.5074

Table C.71: Percentage of Rejection for k=5 Populations p=2; T (3)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	1	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0472	0.0470	0.0468
0	$1\sigma^2$	0.5	$2\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9990	0.7574	0.8436
0	$1\sigma^2$	0.5	$2\sigma^2$	0.5	$2\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9994	0.9010	0.9570
0.5	$2\sigma^2$	0.5	$2\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9746	0.5284	0.6232
0.2	$1.2\sigma^2$	0.9	$2\sigma^2$	0.8	$1.8\sigma^2$	0.6	$1.5\sigma^2$	0.3	$1.3\sigma^2$	0.9992	0.8916	0.9410

Table C.72: Percentage of Rejection for k=5 Populations p=2; Exponential (1)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0462	0.0466	0.0490
1	1^2	1.5	1.5^2	1	1^2	1	1^2	1	1^2	1.0000	0.9990	1.0000
1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	1	1^2	1.0000	1.0000	1.0000
1.5	1.5^2	1.5	1.5^2	1	1^2	1	1^2	1	1^2	1.0000	0.9754	0.9916
1.5	1.5^2	3	3^2	2.5	2.5^2	2	2^2	1.8	1.8^2	0.9996	0.8896	0.9390

Table C.73: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0518	0.0508	0.0498
0	1	0	1	1.5	1	1.5	1	0	1	0.8674	0.9872	0.9500
0	1	0	1	1.5	1	1.5	1	0	1	0.8668	0.9858	0.9476
0	1	1.5	1	1.5	1	0	1	0	1	0.8630	0.9866	0.9470
1.2	1	1.5	1	2	1	1.8	1	1.4	1	0.4206	0.6086	0.5086

Table C.74: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0488	0.0506	0.0500
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8686	0.9386	0.8648
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.8782	0.9464	0.8692
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8760	0.9430	0.8686
1.2	$1\sigma^2$	1.5	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	1.4	$1\sigma^2$	0.4184	0.4776	0.4076

Table C.75: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	1	1	0.0488	0.0478	0.0496
1	1	1	1	1.5	1	1	1	1	1	0.5764	0.6832	0.5628
1	1	1	1	1.5	1	1.5	1	1	1	0.5770	0.6640	0.5518
1	1	1.5	1	1.5	1	1	1	1	1	0.5814	0.6744	0.5618
1.2	1	1.5	1	2	1	1.8	1	1.4	1	0.8266	0.9062	0.8128

Table C.76: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0510	0.0502	0.0498
0	1	0	1	0	5	0	1	0	1	0.7888	0.2132	0.2642
0	1	0	1	0	5	0	5	0	1	0.7948	0.1886	0.2320
0	1	0	5	0	5	0	1	0	1	0.8032	0.1966	0.2446
0	2	0	5	0	9	0	8	0	4	0.7736	0.1644	0.2144

Table C.77: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0454	0.0436	0.0454
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7946	0.1380	0.1840
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.7888	0.1402	0.1932
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.7934	0.1394	0.1896
0	$2\sigma^2$	0	$5\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$4\sigma^2$	0.6774	0.1236	0.1648

Table C.78: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0508	0.0504	0.0510
1	1^2	1	1^2	1	5^2	1	1^2	1	1^2	0.9440	0.1932	0.2040
1	1^2	1	1^2	1	5^2	1	5^2	1	1^2	0.9372	0.2046	0.2174
1	1^2	1	5^2	1	5^2	1	1^2	1	1^2	0.9378	0.1950	0.2100
1	2^2	1	4^2	1	9^2	1	8^2	1	5^2	0.8464	0.1392	0.1502

Table C.79: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0540	0.0540	0.0520
0	1	0	1	1.5	5	0	1	0	1	0.9700	0.5572	0.6582
0	1	0	1	1.5	5	1.5	5	0	1	0.9734	0.5532	0.6612
0	1	1.5	5	1.5	5	0	1	0	1	0.9788	0.5590	0.6648
1.2	2	1.5	5	2	9	1.8	8	1.4	4	0.8492	0.2492	0.3198

Table C.80: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0522	0.0520	0.0520
0	$1\sigma^2$	0	$1\sigma^2$	0.5	1.5	0	$1\sigma^2$	0	$1\sigma^2$	0.9416	0.7154	0.7600
0	$1\sigma^2$	0	$1\sigma^2$	0.5	1.5	0.5	1.5	0	$1\sigma^2$	0.9558	0.7346	0.7768
0	$1\sigma^2$	0.5	1.5	0.5	1.5	0	$1\sigma^2$	0	$1\sigma^2$	0.9534	0.7256	0.7720
0.2	1.2	0.5	1.5	0.8	$1.8\sigma^2$	0.6	$1.2\sigma^2$	0.3	$1.3\sigma^2$	0.9520	0.7846	0.8216

Table C.81: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0510	0.0476	0.0464
1	1^2	1	1^2	1.5	1.5^2	1	1^2	1	1^2	0.8010	0.6172	0.6406
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8068	0.6172	0.6412
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.8112	0.6270	0.6512
1.2	1.2^2	1.5	1.5^2	3	3^2	2	2^2	1.8	1.8^2	0.9972	0.9594	0.9660

Table C.82: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0498	0.0506	0.0494
0	1	0	1	1.5	1	0	1	0	1	0.9946	0.9980	0.9812
0	1	0	1	1.5	1	1.5	1	0	1	0.9950	0.9978	0.9816
0	1	1.5	1	1.5	1	0	1	0	1	0.9944	0.9966	0.9814
1.2	1	1.5	1	2	1	1.8	1	1.4	1	0.6898	0.6876	0.5752

Table C.83: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0484	0.0484	0.0506
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9558	0.9614	0.8972
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.9584	0.9612	0.8946
0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.9584	0.9652	0.9038
1.2	$1\sigma^2$	1.5	$1\sigma^2$	2	$1\sigma^2$	1.8	$1\sigma^2$	1.4	$1\sigma^2$	0.5196	0.5408	0.4316

Table C.84: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	1	1	0.0436	0.0502	0.0474
1	1	1	1	1.5	1	1	1	1	1	0.7222	0.7416	0.6010
1	1	1	1	1.5	1	1.5	1	1	1	0.7154	0.7322	0.6064
1	1	1.5	1	1.5	1	1	1	1	1	0.7098	0.7342	0.5988
1.2	1	1.5	1	2	1	1.8	1	1.4	1	0.9256	0.9404	0.8530

Table C.85: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0478	0.0474	0.0518
0	1	0	1	0	5	0	1	0	1	0.8964	0.2504	0.3518
0	1	0	1	0	5	0	5	0	1	0.9152	0.2168	0.3274
0	1	0	5	0	5	0	1	0	1	0.9134	0.2208	0.3266
0	2	0	5	0	9	0	8	0	4	0.9002	0.1960	0.3000

Table C.86: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0472	0.0482	0.0414
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.8604	0.1614	0.2562
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.9664	0.2000	0.3374
0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.6282	0.1154	0.1716
0	$2\sigma^2$	0	$5\sigma^2$	0	$9\sigma^2$	0	$8\sigma^2$	0	$4\sigma^2$	0.8978	0.1756	0.2830

Table C.87: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0546	0.0496	0.0508
1	1^2	1	1^2	1	5^2	1	1^2	1	1^2	0.9998	0.2330	0.3132
1	1^2	1	1^2	1	5^2	1	5^2	1	1^2	0.9998	0.2392	0.3172
1	1^2	1	5^2	1	5^2	1	1^2	1	1^2	0.9996	0.2108	0.2912
1	2^2	1	4^2	1	9^2	1	8^2	1	5^2	0.9840	0.1664	0.2186

Table C.88: Percentage of Rejection for k=5 Populations p=3; Normal Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0482	0.0542	0.0520
0	1	0	1	1.5	5	0	1	0	1	0.9928	0.6074	0.7744
0	1	0	1	1.5	5	1.5	5	0	1	0.9962	0.6206	0.7946
0	1	1.5	5	1.5	5	0	1	0	1	0.998	0.6376	0.8148
1.2	2	1.5	5	2	9	1.8	8	1.4	4	0.9432	0.2982	0.4416

Table C.89: Percentage of Rejection for k=5 Populations p=3; T (3)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0522	0.0498	0.0494
0	$1\sigma^2$	0	$1\sigma^2$	0.5	1.5	0	$1\sigma^2$	0	$1\sigma^2$	0.9876	0.7516	0.8316
0	$1\sigma^2$	0	$1\sigma^2$	0.5	1.5	0.5	1.5	0	$1\sigma^2$	0.9910	0.7462	0.8324
0	$1\sigma^2$	0.5	1.5	0.5	1.5	0	$1\sigma^2$	0	$1\sigma^2$	0.9878	0.7514	0.8354
0.2	1.2	0.5	1.5	0.8	1.8	0.6	1.2	0.3	1.3	0.9912	0.8096	0.8796

Table C.90: Percentage of Rejection for k=5 Populations p=3; Exponential (1)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0456	0.0438	0.0436
1	1^2	1	1^2	1.5	1.5^2	1	1^2	1	1^2	0.9664	0.6608	0.7508
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9678	0.6608	0.7514
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9688	0.6686	0.7492
1.2	1.2^2	1.5	1.5^2	3	3^2	2	2^2	1.8	1.8^2	1.0000	0.9688	0.9856

Table C.91: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0430	0.0440	0.0438
0	1	0	1	0	1	1.5	1	0	1	0.8622	0.9784	0.9218
0	1	0	1	0	1	1.5	1	1.5	1	0.6186	0.8396	0.7196
0	1	0	1	1.5	1	1.5	1	0	1	0.9954	0.9998	0.9930
1.2	1	1.5	1	1.8	1	2	1	1.4	1	0.5802	0.6884	0.5726

Table C.92: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0498	0.0446	0.0478
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.7262	0.8902	0.7888
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0.4844	0.6784	0.5670
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.9530	0.9846	0.9474
1.2	$1\sigma^2$	1.5	$1\sigma^2$	1.8	$1\sigma^2$	2	$1\sigma^2$	1.4	$1\sigma^2$	0.4554	0.5386	0.4430

Table C.93: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and equal variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	1	1	0.0454	0.0516	0.0494
1	1	1	1	1	1	1.5	1	1	1	0.4324	0.5944	0.4854
1	1	1	1	1	1	1.5	1	1.5	1	0.2616	0.3842	0.3052
1	1	1	1	1.5	1	1.5	1	1	1	0.6974	0.7834	0.6714
1.2	1	1.5	1	1.8	1	2	1	1.4	1	0.8718	0.9394	0.8620

Table C.94: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0472	0.0482	0.0490
0	1	0	1	0	1	0	5	0	1	0.6312	0.1882	0.2160
0	1	0	1	0	1	0	5	0	5	0.4116	0.1478	0.1668
0	1	0	1	0	5	0	5	0	1	0.9074	0.2114	0.2752
0	2	0	5	0	8	0	9	0	4	0.8648	0.1786	0.2402

Table C.95: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0472	0.0510	0.0558
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.6114	0.1262	0.1594
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0.3778	0.1036	0.1234
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.8978	0.1622	0.2306
0	$2\sigma^2$	0	$5\sigma^2$	0	$8\sigma^2$	0	$9\sigma^2$	0	$4\sigma^2$	0.7756	0.1392	0.1848

Table C.96: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with equal means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0476	0.0552	0.0552
1	1^2	1	1^2	1	1^2	1	5^2	1	1^2	0.9724	0.1892	0.2252
1	1^2	1	1^2	1	1^2	1	5^2	1	5^2	0.8074	0.1372	0.1568
1	1^2	1	1^2	1	5^2	1	5^2	1	1^2	1.0000	0.2492	0.3230
1	2^2	1	5^2	1	8^2	1	9^2	1	4^2	0.9976	0.2184	0.2716

Table C.97: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n=12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0486	0.0490	0.0476
0	1	0	1	0	1	1.5	5	0	1	0.8776	0.4870	0.5578
0	1	0	1	0	1	1.5	5	1.5	5	0.6624	0.3586	0.4058
0	1	0	1	1.5	5	1.5	5	0	1	0.9958	0.6616	0.7726
1.2	2	1.5	5	1.8	8	2	9	1.4	4	0.9182	0.2672	0.3504

Table C.98: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0524	0.0494	0.0494
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0.9990	0.9660	0.9862
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0.9304	0.8120	0.8678
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$5\sigma^2$	1.5	$5\sigma^2$	0	$1\sigma^2$	0.9998	0.9980	0.9996
1.5	$2\sigma^2$	1.5	$5\sigma^2$	1.8	$8\sigma^2$	2	$9\sigma^2$	1.4	$4\sigma^2$	0.9762	0.5838	0.7040

Table C.99: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and different variance when number of blocks equal the sample size under mixed design. (n= 12, Blk=12).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0464	0.0508	0.0516
1	1^2	1	1^2	1	1^2	1.5	1.5^2	1	1^2	0.7906	0.5880	0.6254
1	1^2	1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	0.5404	0.3930	0.4186
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9734	0.7606	0.8088
1.8	1.8^2	2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.9948	0.8756	0.9088

Table C.100: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0424	0.0476	0.0484
0	1	0	1	0	1	1.5	1	0	1	0.9420	0.9872	0.9458
0	1	0	1	0	1	1.5	1	1.5	1	0.7314	0.8770	0.7572
0	1	0	1	1.5	1	1.5	1	0	1	0.9996	1.0000	0.9968
1.2	1	1.5	1	1.8	1	2	1	1.4	1	0.7362	0.7578	0.6494

Table C.101: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0476	0.0504	0.0508
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.8412	0.9128	0.8272
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0.5802	0.7164	0.5928
0	$1\sigma^2$	0	$1\sigma^2$	1.5	$1\sigma^2$	1.5	$1\sigma^2$	0	$1\sigma^2$	0.9886	0.9888	0.9614
1.2	$1\sigma^2$	1.5	$1\sigma^2$	1.8	$1\sigma^2$	2	$1\sigma^2$	1.4	$1\sigma^2$	0.5840	0.6070	0.4930

Table C.102: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and equal variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1	1	1	1	1	1	1	1	1	0.0456	0.0490	0.0486
1	1	1	1	1	1	1.5	1	1	1	0.5300	0.6312	0.5078
1	1	1	1	1	1	1.5	1	1.5	1	0.3348	0.4118	0.3324
1	1	1	1	1.5	1	1.5	1	1	1	0.8232	0.8282	0.7082
1.2	1	1.5	1	1.8	1	2	1	1.4	1	0.9464	0.9616	0.8924

Table C.103: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0438	0.0464	0.0454
0	1	0	1	0	1	0	5	0	1	0.7440	0.2132	0.2720
0	1	0	1	0	1	0	5	0	5	0.5090	0.1640	0.1994
0	1	0	1	0	5	0	5	0	1	0.9720	0.2350	0.3662
0	2	0	5	0	8	0	9	0	4	0.9526	0.2102	0.3362

Table C.104: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0508	0.0502	0.0492
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.7376	0.1402	0.2076
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0.4536	0.1076	0.1394
0	$1\sigma^2$	0	$1\sigma^2$	0	$5\sigma^2$	0	$5\sigma^2$	0	$1\sigma^2$	0.9738	0.1950	0.3298
0	$2\sigma^2$	0	$5\sigma^2$	0	$8\sigma^2$	0	$9\sigma^2$	0	$4\sigma^2$	0.8882	0.1650	0.2702

Table C.105: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with equal means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0490	0.0498	0.0510
1	1^2	1	1^2	1	1^2	1	5^2	1	1^2	0.9896	0.2004	0.2524
1	1^2	1	1^2	1	1^2	1	5^2	1	5^2	0.8522	0.1408	0.1678
1	1^2	1	1^2	1	5^2	1	5^2	1	1^2	1.0000	0.2650	0.3654
1	2^2	1	5^2	1	8^2	1	9^2	1	4^2	0.9996	0.2218	0.3000

Table C.106: Percentage of Rejection for k=5 Populations p=4; Normal Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n=12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	1	0	1	0	1	0	1	0	1	0.0532	0.0560	0.0518
0	1	0	1	0	1	1.5	5	0	1	0.9522	0.5428	0.6710
0	1	0	1	0	1	1.5	5	1.5	5	0.7778	0.3868	0.4820
0	1	0	1	1.5	5	1.5	5	0	1	0.9998	0.7138	0.8934
1.2	2	1.5	5	1.8	8	2	9	1.4	4	0.9840	0.3416	0.5164

Table C.107: Percentage of Rejection for k=5 Populations p=4; T (3)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.0436	0.0488	0.0502
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0.9328	0.6726	0.7374
0	$1\sigma^2$	0	$1\sigma^2$	0	$1\sigma^2$	0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0.7140	0.4722	0.5186
0	$1\sigma^2$	0	$1\sigma^2$	0.5	$1.5\sigma^2$	0.5	$1.5\sigma^2$	0	$1\sigma^2$	0.9986	0.8484	0.9100
0.4	$1.4\sigma^2$	0.6	$1.6\sigma^2$	0.8	$1.8\sigma^2$	1.2	$2\sigma^2$	0.5	$1.5\sigma^2$	0.9994	0.9524	0.9770

Table C.108: Percentage of Rejection for k=5 Populations p=4; Exponential (1)-Distribution with different means and different variance when number of blocks twice the sample size under mixed design. (n= 12, Blk=24).

μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4	μ_5	σ_5	L_3	L_4	LW_4
1	1^2	1	1^2	1	1^2	1	1^2	1	1^2	0.0480	0.0454	0.0452
1	1^2	1	1^2	1	1^2	1.5	1.5^2	1	1^2	0.8676	0.5942	0.6572
1	1^2	1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	0.6386	0.4080	0.4552
1	1^2	1	1^2	1.5	1.5^2	1.5	1.5^2	1	1^2	0.9938	0.7754	0.8492
1.8	1.8^2	2	2^2	2.5	2.5^2	3	3^2	1.5	1.5^2	0.9992	0.8876	0.9342