Salahaddin University-Erbil
College of Administration and Economics
Department: Statistics and Information
2nd Examination

Subject: **Experimental Design**
Date: 12-4-2022
Stage: four
Time: **90** minutes

Q1// A) Create the **design** for: (10 Marks)

1- GLS with 4 replications.

1. CRD (2 × 3 × 2) with 2 replications.

B) Create the **Linear** Model for: (10 Marks)

1. RCBD (9 × 3 × 5) r=6.
2. CRD (9 × 4) with 5 replications.

Q2// from the following data Factorial (RCBD) **test** if there are any deferent or not? *a*=5% (40 Marks)

	b_1		b_2		b_3	
	a_1	a_2	a_1	a_2	a_1	a_2
r1	**4**	**3**	**9**	**8**	**1**	**2**
r2	**5**	**2**	**10**	**9**	**3**	**4**

Q3// from Q2 find LSD_a (least significant deference) (40 Marks)

$\mathbf{F_{(0.05;5,1)}}$= 230.1619, $\mathbf{F_{(0.05;1,5)}}$= 6.6079, $\mathbf{F_{(0.01;1,5)}}$= 16.2582, $\mathbf{F_{(0.05;2,5)}}$= 5.7861, $\mathbf{t_{(0.025;5)}}$=2.571, $\mathbf{t_{(0.05;5)}}$=2.015

Good Luck

Dr. Omiad Saber Abdullah Shwany

Salahaddin University-Erbil
College of Administration and Economics
Department: Statistics and Information
2nd Examination

Subject: **Experimental Design**
Date: 12-4-2022
Stage: four
Time: **90** minutes

Q1// A) Create the **design** for: (10 Marks)

2- GLS with 4 replications.

1. CRD (2 × 3 × 2) with 2 replications.

B) Create the **Linear** Model for: (10 Marks)

2. RCBD (9 × 3 × 5) r=6.
2. CRD (9 × 4) with 5 replications.

Q2// from the following data Factorial (RCBD) **test** if there are any deferent or not? *a*=5% (40 Marks)

	b_1		b_2		b_3	
	a_1	a_2	a_1	a_2	a_1	a_2
r1	**4**	**3**	**9**	**8**	**1**	**2**
r2	**5**	**2**	**10**	**9**	**3**	**4**

Q3// from Q2 find LSD_a (least significant deference) (40 Marks)

$\mathbf{F_{(0.05;5,1)}}$= 230.1619, $\mathbf{F_{(0.05;1,5)}}$= 6.6079, $\mathbf{F_{(0.01;1,5)}}$= 16.2582, $\mathbf{F_{(0.05;2,5)}}$= 5.7861, $\mathbf{t_{(0.025;5)}}$=2.571, $\mathbf{t_{(0.05;5)}}$=2.015

Good Luck

Dr. Omiad Saber Abdullah Shwany

Salahaddin University-Erbil
College of Administration and Economics
Department: Statistics and Information
Final Exam: 1st Trial 2021 – 2022

Subject: Experimental Design
Date: 21-5-2022 Saturday
Stage: four
Time: 3 Hours

Q1// from the following data test if there are any deferent or not? if the experimental unit are homogeneous? With five stapes, alpha=0.05: (20 Marks)

Temperature	Replications	Pressure b_1=200	b_2=215	b_3=230	Sum A_i
a_1=150	r_1	90.4	90.7	90.2	542.5
	r_2	90.2	90.6	90.4	
a_2=160	r_1	90.1	90.5	89.9	541.5
	r_2	90.3	90.6	90.1	
a_3=170	r_1	90.5	90.8	90.4	543.4
	r_2	90.7	90.9	90.1	
Sum B_j		542.2	544.1	541.1	1627.4

if :

$F_{(0.05;3;6)} = 4.7571$
$F_{(0.05;6;3)} = 8.9407$
$F_{(0.05;2,9)} = 4.2565$
$F_{(0.05;4,9)} = 3.6331$

Solution//

Let Temperature = Factor A then (a1= 150, a2=160, a3=170)
Let Pressure= Factor B then (b1= 200, b2=215, b3=230), alpha=5%

(1) H_{0A}: $\mu_1 = \mu_2 = \mu_3$
H_{0B}: $\mu_1 = \mu_2 = \mu_3$
H_{0AB}: $\mu_{11} = \mu_{12} = \cdots = \mu_{33}$

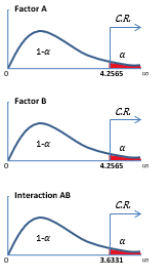
(2) H_{1A}: *at least two means are not equal*
H_{1B}: *at least two means are not equal*
H_{1AB} *at least two means are not equal*

(3) alpha=0.05

d.f.2=d.f.Error=ab(r-1)=3*3*(2-1)=9

$d.f._{1A}$=a-1=3-1=2
$d.f._{1B}$=a-1=3-1=2
$d.f._{1AB}$=(a-1)(b-1)=(3-1)(3-1)=2*2=4

$F_{A(0.05,2,9)}$= 4.2565
$F_{B(0.05,2,9)}$= 4.2565
$F_{AB(0.05,4,9)}$= 3.6331



(4)

Y...= 1627.4

$$C.F. = \frac{(Y...)^2}{abr} = \frac{(1627.4)^2}{3(3)(2)} = 147135.04$$

$$SST = \sum_{i=1}^{3}\sum_{j=1}^{3}\sum_{k=1}^{2}(Y_{ijk}^2) - C.F. = (90.4^2 + 90.2^2 + \ldots + 90.1^2) - 147135.04$$
=147136.34-147135.04=1.298

$$SSA = \frac{\sum_{i=1}^{3} Y_{i..}^2}{br} - C.F. = \frac{542.5^2+541.5^2+543.4^2}{3(2)} - 147135.04$$
=147135.34-147135.04=0.301

$$SSB = \frac{\sum_{j=1}^{3} Y_{.j.}^2}{ar} - C.F. = \frac{542.2^2+544.1^2+541.1^2}{3(2)} - 147135.04$$
=147135.81-147135.04= 0.786

$$SSAB = \frac{\sum_{i=1}^{3}\sum_{j=1}^{3} Y_{ij.}^2}{r} - C.F. - SSA - SSB$$
$$= \frac{180.6^2+180.4^2+\cdots+180.5^2}{2} - 147135.04 - 0.301 - 0.786 =$$
= 147135.81 - 147135.04
= 0.069

$$SSE_{rror} = SST - SSA - SSB - SSAB$$
= 1.289-0.301-0.768-0.069= 0.160

S.O.V.	d.f.	S.S.	MS	$F_{Cal.}$	$F_{tab.}$
Factor A	2	0.301	0.151	*8.466	4.256
Factor B	2	0.768	0.384	*21.6	4.256
Interaction AB	4	0.069	0.017	0.97	3.633
Error	9	0.16	0.018		
Total	17	1.298			

(5) We reject H_{0A} and H_{0B} only.

Q2// A) From the ANOVA table below (LSD Latin Square Design) find the relative efficiency of RE (LSD: $RCBD_{(Row\ \&\ Columns)}$ and RE (LSD: CRD): (10 Marks)

S.O.V.	d.f.	SS	MS
Row	4	5.6	
Column	4	63.2	
treatments	4	46.3	
Error	12	3.54	

$$R.E._{(LD:RCBD_{Row})} = \frac{MS_{Col.} + (r-1)MS_E}{rMS_E} \times 100$$

$$R.E._{(LD:CRD)} = \frac{MS_{Row} + MS_{Col.} + (r-1)MS_E}{(r+1)MS_E} \times 100$$

1) 1151.186% (RE for LSD better than RCBD $_{Row.}$)
2) 174.9153% (RE for LSD better than RCBD $_{Col.}$)
3) 1038.418% (RE for LSD better than CRD)

Q2// B) Use LSDα with five stapeses, for the following information at alpha=0.05: (10 Marks)

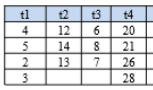
t1	t2	t3	t4	t5
4	12	6	20	2
5	14	8	21	3
2	13	7	26	
3			28	

S.O.V.	SS	df	MS	Fcal.	Ftab.	
treatments	1079.5	4	269.875	54.721	3.35669	$t_{(0.025;11)}$=2.201
Error	54.25	11	4.932			
Total	1133.75	15				

Solution: Let Alpha=0.05

(1) H_0: $\mu_1 = \mu_2$, $\mu_1 = \mu_3, \dots, \mu_4 = \mu_5$

(2) H_1: $\mu_1 \neq \mu_2$, $\mu_1 \neq \mu_3, \dots, \mu_4 \neq \mu_5$



(3) $\alpha = 0.05 \rightarrow \frac{\alpha}{2} = 0.025$

$d.f.Error = 11\ then:$

$t_{(\frac{\alpha}{2},d.f.Error)} = t_{(0.025;11)} = 2.201$

$$LSD_{\alpha\,(\mu_1=\mu_2\ ,\mu_1=\mu_3,\dots,\mu_2=\mu_4,\dots,\mu_3=\mu_4)} = t_{(\frac{\alpha}{2},d.f.Error)} \times \sqrt{MSE(\tfrac{1}{r_1}+\tfrac{1}{r_2})} = t_{(0.025;11)} \times \sqrt{MSE(\tfrac{1}{4}+\tfrac{1}{3})}$$

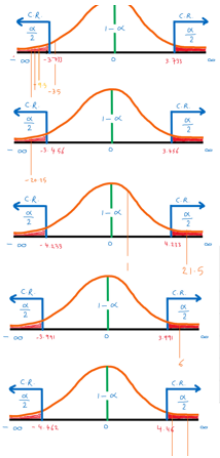
$$= t_{(0.025;11)} \times \sqrt{MSE\left(\tfrac{1}{4}+\tfrac{1}{3}\right)} = 2.201 \times \sqrt{4.932\left(\tfrac{1}{4}+\tfrac{1}{3}\right)} = 3.733$$

$$LSD_{\alpha\,(\mu_1=\mu_4)} = t_{(0.025;11)} \times \sqrt{MSE\left(\tfrac{1}{4}+\tfrac{1}{4}\right)} = 2.201 \times \sqrt{4.932\left(\tfrac{1}{4}+\tfrac{1}{4}\right)} = 3.456$$

$$LSD_{\alpha\,(\mu_1=\mu_5,\mu_4=\mu_5)} = t_{(0.025;11)} \times \sqrt{MSE\left(\tfrac{1}{4}+\tfrac{1}{2}\right)} = 2.201 \times \sqrt{4.932\left(\tfrac{1}{4}+\tfrac{1}{2}\right)} = 4.233$$

$$LSD_{\alpha\,(\mu_2=\mu_3)} = t_{(0.025;11)} \times \sqrt{MSE\left(\tfrac{1}{3}+\tfrac{1}{3}\right)} = 2.201 \times \sqrt{4.932\left(\tfrac{1}{3}+\tfrac{1}{3}\right)} = 3.991$$

$$LSD_{\alpha\,(\mu_2=\mu_5,\mu_3=\mu_5)} = t_{(0.025;11)} \times \sqrt{MSE\left(\tfrac{1}{3}+\tfrac{1}{2}\right)} = 2.201 \times \sqrt{4.932\left(\tfrac{1}{3}+\tfrac{1}{2}\right)} = 4.462$$



r=		Mean1	Mean2	Mean3	Mean4	Mean5
		3.5	13	7	23.75	2.5
4	Mean1	3.5		-9.5 *	-3.5 *#	-20.25 *#	1 *^5
3	Mean2	13			6 *	-10.75 *^	10.5 *^
3	Mean3	7				-16.75 *^	4.5 *^
4	Mean4	23.75					21.25 *#
2	Mean5	2.5					

(5) *we not reject* H_0: $\mu_1 = \mu_3$, $\mu_1 = \mu_5$ only.

Salahaddin University-Erbil
College of Administration and Economics
Department: Statistics and Information
Final Exam: 1st Trial 2020 – 2021

Subject: Experimental Design
Date: 26-5-2021 Wednesday
Stage: four
Time: 2 Hours

Q1//

A) Create the **design** for: (15 Marks)

3- CRD with four replications and four treatments.
4- CRD (S=4, t=3, r=2).
5- RCBD with four Blocks and four treatments after that if we have messing data in $Y_{32.}$
6- GLS (Graeco Latin Square Design) with six replications.
7- Factorial CRD (2×3×2) with two replications.

B) Create the **Linear** Model for: (10 Marks)

3. RCBD (t=4, r=5)
4. Sampling CRD if (t=5, r=4, s=6).
5. LSD (Latin Square Design) if r=8.
6. GLS (Graeco Latin Square Design) with seven replications.
7. Factorial CRD (8×5×4) with ten replications.

Q2// A) from the following data (Latin Square Design) test if there are any deferent or not? If alpha=0.05: (15 Marks)

Row	Column 1	Column 2	Column 3	Column 4	Rows Total
1	1 (A)	2 (C)	4 (B)	2 (D)	9
2	2 (C)	2 (A)	1 (D)	6 (B)	11
3	5 (B)	1 (D)	0 (A)	2 (C)	8
4	1 (D)	9 (B)	2 (C)	1 (A)	13
Columns Total	9	14	7	11	41

B) From (Q2// A) above find LSD_a (Least Significant Difference) with 5 stapes. (10 Marks)

Q3// From the ANOVA table below (LSD Latin Square Design) find the relative efficiency of RE (LSD: $RCBD_{(Row\ \&\ Columns)}$ and RE (LSD: CRD): (10 Marks)

S.O.V.	d.f.	SS	MS
Row	4	1.34	
Column	4	2.83	
treatments	4	3.44	
Error	12	0.12	

if $F_{(0.05;3;6)}$= 4.7571, $F_{(0.05;6;3)}$=8.9407, $F_{(0.01;3;6)}$= 9.7795, $F_{(0.01;6;3)}$= 27.9107, $t_{(0.025,6)}$= 2.496,

$$R.E._{(LD:RCBD_{Row})} = \frac{MS_{Col.} + (r-1)MS_E}{rMS_E} \times 100 \qquad R.E._{(LD:CRD)} = \frac{MS_{Row} + MS_{Col.} + (r-1)MS_E}{(r+1)MS_E} \times 100$$

Good Luck

Dr. Omiad Saber Abdullah Shwany

Salahaddin University-Erbil
College of Administration and Economics
Department: Statistics and Information
Final Exam: 2nd Trial 2020 – 2021

Subject: Experimental Design
Date: - 6 - 2021
Stage: four
Time: 2 Hours

Q1//

A) Create the **design** for: (15 Marks)

8- CRD (S=6, t=3, r=2).
9- Factorial CRD (2×2×2) with two replications.
10- CRD with three replications and three treatments.
11- GLS (Graeco Latin Square Design) with four replications.
12- RCBD with three Blocks and four treatments after that if we have messing data in $Y_{42.}$

B) Create the **Linear** Model for: (10 Marks)

8. GLS (Graeco Latin Square Design) with 10 replications.
9. Factorial CRD (5×6×7) with ten replications.
10. LSD (Latin Square Design) if r=7.
11. Sampling CRD if (t=6, r=4, s=8).
12. RCBD (t=6, r=4)

Q2// A) from the following data (CRD) test if there are any deferent or not? If alpha=0.05: (15 Marks)

Replicate	Treatment			
	t1	t2	t3	t4
1	2	1.7	2	2.1
2	2.2	1.9	2.4	2.2
3	1.8	1.5	2.7	2.2
4	2.3		2.5	1.9
5	1.7		2.4	

B) From (Q2// A) above find LSD_a (Least Significant Difference) with 5 stapeses. (10 Marks)

Q3// From the ANOVA table below (LSD Latin Square Design) find the relative efficiency of RE (LSD: RCBD (Row & Columns) and RE (LSD: CRD): (10 Marks)

S.O.V.	d.f.	SS	MS
Row	4	0.05	
Column	4	0.72	
treatments	4	2.65	
Error	12	0.12	

if $F_{(0.025;3;13)}$= 4.3472, $F_{(0.05;3;13)}$=3.4105, $F_{(0.01;3;13)}$= 5.7394, $F_{(0.05;13;3)}$= 26.9831, $t_{(0.025,13)}$= 2.16,

$$R.E._{(LD:CRD)} = \frac{MS_{Row} + MS_{Col.} + (r-1)MS_E}{(r+1)MS_E} \times 100 \qquad R.E._{(LD:RCBD_{Row})} = \frac{MS_{Col.} + (r-1)MS_E}{rMS_E} \times 100$$

Good Luck

Dr. Omiad Saber Abdullah Shwany

Salahaddin University-Erbil
College of Administration and Economics
Department: Statistics and Information
Final Exam: 1st Trial 2020 – 2021

Subject: Experimental Design
Date: 26-5-2021 Wednesday
Stage: four
Time: 2 Hours

Q1//

A) Create the **design** for: (15 Marks)

13- CRD with four replications and four treatments.
14- CRD (S=4, t=3, r=2).
15- RCBD with four Blocks and four treatments after that if we have messing data in $Y_{32.}$
16- GLS (Graeco Latin Square Design) with six replications.
17- Factorial CRD (2×3×2) with two replications.

B) Create the **Linear** Model for: (10 Marks)

13. RCBD (t=4, r=5)
14. Sampling CRD if (t=5, r=4, s=6).
15. LSD (Latin Square Design) if r=8.
16. GLS (Graeco Latin Square Design) with seven replications.
17. Factorial CRD (8×5×4) with ten replications.

Q2// A) from the following data (Latin Square Design) test if there are any deferent or not? If alpha=0.05: (15 Marks)

Row	Column 1	Column 2	Column 3	Column 4	Rows Total
1	1 (A)	2 (C)	4 (B)	2 (D)	9
2	2 (C)	2 (A)	1 (D)	6 (B)	11
3	5 (B)	1 (D)	0 (A)	2 (C)	8
4	1 (D)	9 (B)	2 (C)	1 (A)	13
Columns Total	9	14	7	11	41

B) From (Q2// A) above find LSD_a (Least Significant Difference) with 5 stapes. (10 Marks)

Q3// From the ANOVA table below (LSD Latin Square Design) find the relative efficiency of RE (LSD: $RCBD_{(Row\ \&\ Columns)}$ and RE (LSD: CRD): (10 Marks)

S.O.V.	d.f.	SS	MS
Row	4	1.34	
Column	4	2.83	
treatments	4	3.44	
Error	12	0.12	

if $F_{(0.05;3;6)}$= 4.7571, $F_{(0.05;6;3)}$=8.9407, $F_{(0.01;3;6)}$= 9.7795, $F_{(0.01;6;3)}$= 27.9107, $t_{(0.025,6)}$= 2.496,

$$R.E._{(LD:RCBD_{Row})} = \frac{MS_{Col.} + (r-1)MS_E}{rMS_E} \times 100 \qquad R.E._{(LD:CRD)} = \frac{MS_{Row} + MS_{Col.} + (r-1)MS_E}{(r+1)MS_E} \times 100$$

Good Luck

Dr. Omiad Saber Abdullah Shwany

Experimental Design and Analysis
Time: 90 minutes

Date: 8-5-2014 Thursday

2nd Examination

University of Salahadden-Erbil
Collage of Adm. and Economics
Statistics Department 4th Stage

Q1// Create the design (انشاء تصميم) and find the Linear Model for: (40 Degrees)

1- (4×2) CRD with 3 replications.

2- (3×3) RCBD with 2 Blocks.

3- 2^3 confounding 2blocks and 3repleaction.

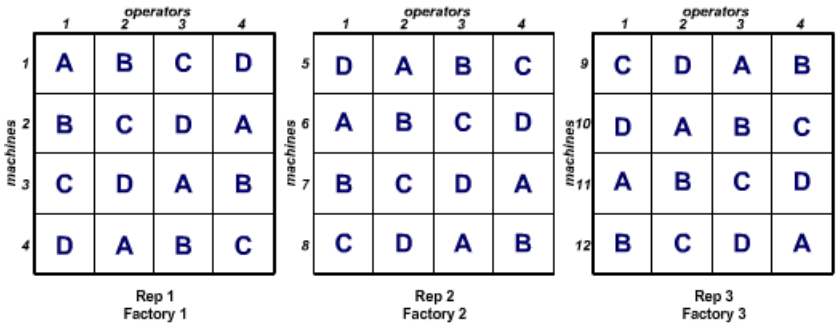
4- RCBD (4×3) r=3 if Factor A is Whole Plots and Factor B (Sub-plot).

Q2// Define these designs (ما نوع التصميم المستخدم) and find the linear model: (20 Degrees)

(A)

	c1		c2		c3		c4	
r1	b1	a4	b1	a2	b3	a3	b2	a1
	b3		b2		b2		b3	
	b2		b3		b1		b1	
r2	b3	a3	b2	a1	b3	a2	b3	a4
	b2		b3		b1		b1	
	b1		b1		b2		b2	
r3	b3	a1	b2	a3	b1	a4	b3	a2
	b2		b1		b2		b2	
	b1		b3		b3		b1	
r4	b2	a2	b1	a4	b1	a1	b2	a3
	b1		b3		b3		b1	
	b3		b2		b2		b3	

(B)



Q3// Test the hypotheses with LSD if possible for: (40 Degrees)

Row	Column 1	Column 2	Column 3	Column 4	Row $(\sum R)$
1	1.640 (B)	1.210 (D)	1.425 (C)	1.345 (A)	5.620
2	1.475 (C)	1.185 (A)	1.400 (D)	1.290 (B)	5.350
3	1.670 (A)	0.710 (C)	1.665 (B)	1.180 (D)	5.225
4	1.565 (D)	1.290 (B)	1.655 (A)	0.660 (C)	5.170
Column total $(\sum C)$	6.350	4.395	6.145	4.475	21.365

If $\Longrightarrow$ $F_{(0.05;3;3)}$= 9.2766, $F_{(0.025;3;6)}$= 15.439, $t_{(0.05;\,6)}$= 2.4469; $t_{(0.025;\,6)}$= 2.9687; $F_{(0.05;3;6)}$= 4.7571

Treatment	Total
A	5.855
B	5.885
C	4.270
D	5.355

Experimental Design and Analysis
Time: 90 minutes

3rd Examination

Date: 18-5-2014 Sunday

University of Salahadden-Erbil
Collage of Adm. and Economics
Statistics Department 4th Stage

Q1// Create the design (انشاء تصميم) and find the Linear Model for: (50 Degrees)

1- 2^3 confounding 2 blocks and 2 replications.
2- GLS with 4 treatments.
3- (2×4) RCBD with 3 Blocks.
4- RCBD (4×3) r=4 if Factor A is Whole Plots and Factor B (Sub-plot).
5- (2×5) CRD with 3 replications.

Q2// The yield (نتيجه) of a chemical process is being studied. The two most important variables are thought to be the pressure and the temperature. Three levels of each factor are selected, and a factorial experiment with two replicates is performed. The yield data follow; Test the hypotheses with LSD if possible: (50 Degrees)

Temperature	*Replications*	*Pressure*			
		200	*215*	*230*	*Sum Rows*
150	r_1	90.4	90.7	90.2	542.5
	r_2	90.2	90.6	90.4	
160	r_1	90.1	90.5	89.9	541.5
	r_2	90.3	90.6	90.1	
170	r_1	90.5	90.8	90.4	543.4
	r_2	90.7	90.9	90.1	
Sum Columns		542.2	544.1	541.1	1627.4

If $\Longrightarrow$ $F_{(0.01;2;2)}= 99$, $F_{(0.025;2;9)}= 5.7147$, $F_{(0.05;2;9)}= 4.2565$, $t_{(0.025;\ 9)}= 2.685$; $t_{(0.05;\ 9)}= 2.262$

Experimental Design and Analysis
Time: 90 minutes
Date: 8-12-2016 Thursday

1st Examination

University of Salahadden-Erbil
Collage of Administration and Economics
Statistics Department 4th Stage

Q1// create the design and find the Linear Model for (دیزاین و مۆدێڵ بدۆزەوە): (30 Degrees)

1- CRD with four replications and five treatments if t_3 is missing.
2- RCBD with three Blocks and four treatments.

Q2// from the following information (CRD design) do the Duncan multiple range test with five stapes if MSE=6.23 and alpha=5%: (40 Degrees)

Treatments	t_1	t_2	t_3	t_4	t_5
Mean Value	6.4	8.7	9.1	16.3	14
r	4	6	8	7	5

Q3// find ANOVA with 5 stapes: (30 Degrees)

Blocks	Treatment			
	t_1	t_2	t_3	t_4
1	9	11	4	7
2	8	13	6	10
3	9	8	7	5

if : $F_{(0.01;6,3)}$= 27.9107, $F_{(0.01;3,6)}$= 9.7795, $F_{(0.05;3,6)}$= 4.7571, $F_{(0.05;6,3)}$= 8.9406

Dr. Omiad Saber Abdullah & M. Karzan Faezy Hamad

if:

Critical values q'(p, df; 0.05) for Duncan's multiple range tests

$d.f._{Error}$	2	3	4	5	6	7	8	9
5	3.635	3.749	3.796	3.814	3.814	3.814	3.814	3.814
:	:	:	:	:	:	:	:	:
25	2.913	3.059	3.154	3.221	3.271	3.310	3.341	3.366
29	2.892	3.039	3.135	3.202	3.253	3.293	3.326	3.352
30	2.888	3.035	3.131	3.199	3.250	3.290	3.322	3.349

Experimental Design and Analysis
Time: 90 minutes
Date: 6-2-2019 Thursday

1st Examination

University of Salahadden-Erbil
Collage of Administration and Economics
Statistics Department 4th Stage

Q1// create the design and find the Linear Model for: (30 Degrees)

1- CRD with three replications and five treatments.
2- CRD with two replications and four treatments and 5 samples.

Q2// from the following information (CRD design) do the Duncan multiple range test with five stapeses if MSE=8.23 and alpha=5%: (35 Degrees)

Treatments	t_1	t_2	t_3	t_4	t_5
Mean Value	4.31	8.7	19.1	16.3	14
r	4	6	8	7	5

Q3// find ANOVA with 5 stapes if alpha 2.5%: (35 Degrees)

replications	Treatment			
	t_1	t_2	t_3	t_4
1	9	11	4	7
2	8	13	6	10
3	9	8	7	5
4	10	15	8	8

if: $F_{(0.05;3,12)} = 3.4903$, $F_{(0.05;12,3)} = 8.7446$, $F_{(0.025;3,12)} = 4.4742$, $F_{(0.025;12,3)} = 14.3366$

Dr. Omiad Saber Abdullah

6-2-2019 Lecturer

if:

Critical values q'(p, df; 0.05) for Duncan's multiple range tests

$d.f._{Error}$	2	3	4	5	6	7	8	9
5	3.635	3.749	3.796	3.814	3.814	3.814	3.814	3.814
:	:	:	:	:	:	:	:	:
25	2.913	3.059	3.154	3.221	3.271	3.310	3.341	3.366
29	2.892	3.039	3.135	3.202	3.253	3.293	3.326	3.352
30	2.888	3.035	3.131	3.199	3.250	3.290	3.322	3.349

Experimental Design and Analysis | *University of Salahadden-Erbil*
Time: 90 minutes | *Collage of Adm. and Economics*
Date: 6-5-2021 Thursday | *2nd Examination* | *Statistics Department 4th Stage*

Q1// Create the design and find the Linear Model for: (50 Degrees)

1- (2×3×2) CRD with 3 replications.
2- LSD (Latin Square Design) with 5 treatments.
3- GLS (Graeco-Latin Square Design) with 4 treatments.
4- (4×3) CRD with 2 replications.
5- RCBD (4 treatments, 2 Blocks)

Q2// Test the hypotheses of this design (Factorial CRD): (50 Degrees)

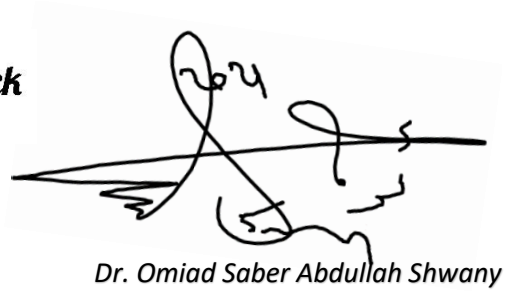
Temperature	Replications	Pressure		
		b_1	b_2	b_3
a_1	r_1	4	7	2
	r_2	2	6	4
a_2	r_1	1	5	-1
	r_2	3	6	1
a_3	r_1	5	8	4
	r_2	7	9	1

If :

$F_{(0.01,2,9)}=8.0215$, $F_{(0.01,9,2)}=99.3881$, $F_{(0.01,4,9)}=6.4221$, $F_{(0.01,9,4)}=14.6591$

$F_{(0.05,2,9)}=4.2565$, $F_{(0.05,9,2)}=19.3848$, $F_{(0.05,4,9)}=3.6331$, $F_{(0.05,9,4)}=5.9988$

good luck



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