

National University of Lesotho
Faculty of Agriculture
Department of Soil Science and Resource Conservation
SSR 327: Biometrics II

May 2014

100 Marks

3 Hours

INSTRUCTIONS

Answer ALL questions

Question 1

- a) Indicate the conditions under which a researcher can use each of the following experimental designs **(6 marks)**
- i) Completely Randomized design (CRD)
 - ii) Completely Randomized Block Design (CRBD)
 - iii) Latin Square Design (LS)
- b) Define the following **(6 marks)**
- i) Experimental error
 - ii) Experimental unit
 - iii) Single factor experiments
- c) State the advantage and disadvantage of complete randomized design (CRD) **(2 marks)**
- d) Discuss two commonly used tests to detect mean differences among treatments **(6 marks)**

Question 2 (20 marks)

An experiment was conducted in which three NPK fertilizers were applied to 12 plots of the same size, fertility, slope and climate. Each fertilizer treatment was applied to 4 plots and the dry matter yield per plot was recorded as follows:

Treatments	Plot yield (kg/plot)			
F ₁ (control)	60	64	65	55
F ₂	75	70	66	69
F ₃	74	78	72	68

- a) State the null hypothesis and test if there are no significant differences among the three NPK fertilizers.
- b) Prepare anova table and carry-out mean comparison using LSD at 1%. $F_{\text{tab}} = 8.02$, $t_{(\text{Edf}, 0.01)} = 3.25$

Question 3 (20 marks)

Apple trees given fertilizer treatments were grown in eight districts of Lesotho. Five trees were grown in each district. Each tree was given five different fertilizer treatments. The treatments were applied randomly to the trees in each district in a completely randomized block design. The yield of each tree was expressed in tones as shown.

	Trees							
Treatments	1	2	3	4	5	6	7	8
1	1.29	1.10	1.34	1.39	1.30	1.19	1.33	1.00
2	1.33	1.00	1.31	1.31	1.26	1.24	1.35	1.09
3	1.24	1.05	1.41	1.41	1.35	1.17	1.29	1.19
4	1.28	1.03	1.39	1.39	1.36	1.18	1.38	1.14
5	1.31	1.17	1.28	1.28	1.39	1.14	1.32	1.14

Given that F_{tab} at 5% for blocks = 2.36 and for treatments = 2.71. Prepare the anova table and compare means using Duncan's test

Note: Significant Studentized Ranges for 5% level New Multiple Range Test

Error df	$p = \text{number of means for range being tested}$								
	2	3	4	5	6	7	8	8	9
28	2.90	3.04	3.13	3.20	3.26	3.30	3.33	3.35	3.37

Question 4 (20 marks)

Given the following field trial results' Test the hypothesis that there is no difference among the five treatments, Compare the treatment means with the aid of LSD at 5%. Which fertilizer rate would you recommend and why?

Rows	Column 1	Column 2	Column 3	Column 4	Column 5
1	A 5.7	E 11.9	D 13.4	C 11.0	B 8.3
2	D 11.9	B 8.9	A 7.2	E 13.5	C 13.2
3	B 8.6	A 7.9	C 13.6	D 15.5	E 14.5
4	C 13.8	D 14.4	E 17.6	B 9.8	A 7.9
5	E 15.9	C 15.2	B 8.9	A 9.1	D 18.2

Additional information: At 5% significance level, $F_{\text{tab}} = 3.26$ and $t_{(\text{Edf}, 0.05)} = 2.179$. Treatment A is the control.

Question 5

The following data represent the plot yield in an experiment on the effect of 4 levels of Nitrogen fertilizer and 2 levels of phosphorus fertilizer on maize yield. The experiment is a 4×2 factorial in RCBD. Given that at 5% F_{tab} for nitrogen = 3.34, F_{tab} for block = 3.74, F_{tab} for phosphorus = 4.60 and F_{tab} for $N \times P$ (interaction) = 3.34. Prepare the anova and compare means using LSD at 5% and $t_{(\text{Edf}, 0.05)} = 2.145$. State your conclusions.

Nitrogen (N) Kg/ha	Phosphorus (P) Kg/ha	Replications/Blocks			(NP)Totals	(N) Totals
		I	II	III		
0	0	38.62	40.26	39.23	118.11	
	40	32.75	32.36	37.25	102.36	
20	0	55.07	53.86	47.37	156.30	
	40	48.81	49.62	51.43	149.86	
40	0	40.49	51.94	46.94	139.37	
	40	46.11	52.31	39.30	137.72	
60	0	58.88	50.43	49.93	159.24	
	40	61.55	48.49	46.87	156.91	
	Block Totals	382.28	379.27	358.32	1119.87	