

**Eastern University, Sri Lanka**  
**Final Year First Semester Examination in Agriculture 2013/2014**  
**(September 2015)**

**CS 4102: Design and Analysis of Experiments**

**Answer ALL Questions**

**Time allowed: 02 hours**

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1. A plant scientist performed an experiment to study the effect of four different amino acids ( $A_1$ ,  $A_2$ ,  $A_3$  and  $A_4$ ) on young rice seedlings' growth using Randomized Complete Block Design (RCBD) with five replicates. Shoot dry weight of seedlings (mg) were measured after seven days is given below.

Block	Shoot dry weight (mg)			
	$A_1$	$A_2$	$A_3$	$A_4$
1	4.23	3.85	3.75	3.66
2	4.38	3.78	3.65	3.67
3	4.10	3.91	3.82	3.62
4	3.99	3.94	3.69	3.54
5	4.35	3.86	3.73	3.71

- a. Write the statistical model for the above design.
- b. Perform the Analysis of Variance (ANOVA) for the above experiment.
- c. Interpret the results at 5% significant level.
- d. Calculate the coefficient of variation (CV) for the above experiment.
2. Write the short notes on the following:
- a. Methods used to decide the plot size.
- b. Randomization in Latin Square Design.
- c. Blocking techniques in experimental design.

3. An experiment was conducted using Randomized Complete Block Design (RCBD) with four treatments and five replicates. ANOVA and means of the treatments are given below.

Sources of variation	Df	SS	MS	F
Treatment	03	0.747	0.249	6.38
Block	04	0.241	0.060	
Error	12	0.468	0.039	
Total	19			

Treatments	Mean
T1	1.176
T2	1.640
T3	1.598
T4	1.624

- Compute the relative efficiency of Randomized Complete Block Design compared with Complete Randomized Design.
- Perform the Least Significant Difference (LSD) test for the above data and show what means are significantly different at 5% significant level.
- Write the SAS coding to get the LSD for the above experiment.
- A researcher performed the Analysis of Covariance and obtained the out put as below. (X is a covariate)

Source	df	SS	MS	F value	P>F
Block	3	24.41	8.13	3.67	0.0628
Treatment	3	30.65	10.21	4.61	0.0374
X	1	51.50	51.50	23.22	0.0013
Error	8	17.74	2.21		
Corrected total	15	351.75			

Parameter	Estimate	Standard Error	t Value	Pr >  t
x	-0.348	0.0723	-4.82	0.0013

Interpret the results.

4. A factorial experiment was conducted to study the effect of two varieties ( $V_1$  and  $V_2$ ) and three different fertilizer mixtures ( $F_1$ ,  $F_2$  and  $F_3$ ) on tomato yield using Randomized Complete Block Design (RCBD) with three blocks. Yield recorded from the experiment are given below.

Block	Tomato yield (kg/plot)					
	$V_1F_1$	$V_1F_2$	$V_1F_3$	$V_2F_1$	$V_2F_2$	$V_2F_3$
1	3.56	4.47	4.78	3.54	2.36	3.11
2	2.35	3.01	3.65	3.63	2.53	3.15
3	3.65	3.69	3.85	4.78	3.49	2.95

- Draw the layout for this experiment.
- Perform the ANOVA for the above experiment.
- Interpret the results at 5 % significant level.

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