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Programme: MSc. (Statistics)

Part-1

Semester-2

Practical based on Designs of Experiments
CRD, RBD, LSD, BIBD

- 1) Three fertilizers treatment A, B and C each applied to seven plots of strawberry plants, resulted in the following weights of crop (lb/plot)

A: 24, 18, 18, 29, 22, 17, 15

B: 46, 39, 37, 50, 44, 45, 30

C: 32, 30, 26, 41, 36, 28, 27

Perform the analysis to test the hypothesis of no difference in the treatment effects at 0.01 level of significance.

- 2) An experiment was conducted in Rabi season on a variety of tomato during 2010-11 with 5 treatments of integrated nutrient management viz Trt1~farmers practice (2.5 tonnes farmyard manure/ha), Trt2~ recommended dose of fertilizers (NPK 120:75:100), Trt3~50% recommended dose of fertilizers +vermin-compost 5 tonnes/ha, Trt4 ~50% recommended dose of fertilizers + vermin-compost 5 tonnes/ha and Trt5~50% recommended dose of fertilizers + vermi-compost 10 tonnes/ha + farmyard manures 5 tonnes/ha. The objective of the experiment was to find out the most appropriate integrated nutrient management system for tomato. The experiment was conducted using a completely randomized design and the dry matter accumulation (gm/plant) was recorded after the experiment was over.

Tr1	Tr2	Tr3	Tr4	Tr5
108.2	225.2	176.5	201.3	214.3
112.7	226.4	195.2	183.6	226.2
116.8	135.2	188.4	197.5	215.0
106.8	227.5	190.3	186.1	230.6
117.9	218.2	210.3	188.6	212.6
	229.1	195.1	210.4	260.4
				227.6
				228.3

- 3) A fast food franchise is a test marketing 3 new menu items. To find out if they have the same popularity, 18 franchisee restaurants are randomly chosen for participation in the study. In accordance with the completely randomized designs, 6 of the restaurants are randomly chosen to test market the first new menu item, another 6 for the second menu item, and the remaining 6 for the last menu item. The following table shows represent the sales figures of the new menu items in the 18 restaurants after a week of test marketing. At .05 level of significance, test whether the mean sales volume for the 3 new menu items are all equal.

Item1	Item2	Item3
22	52	16
42	33	24
44	8	19
52	47	18
45	43	34
37	32	39

- 4) The data from an experiment that compared six rates of seeding of rice variety IR8, given in the table below:

Grain Yield of Rice variety IR8 with six different rates of seeding

Treatment Kg seed/ha	Grain Yield, kg/ha			
	R1	R2	R3	R4
25	5113	5398	5307	4678
50	5346	5952	4719	4264
75	5272	5713	5483	4749
100	5164	4831	4986	4410
125	4804	4848	4432	4748
150	5254	4542	4919	4098

Analyze the design.

- 5) Suppose that an experimenter is studying the effects of five different formulations of a rocket propellant used in aircrew escape systems on the observed burning rate. Each formulation is mixed from a batch of raw material that is only large enough for five formulations to be tested. Furthermore, the formulations are prepared by several operators, and there may be substantial differences in the skills and experience of the operators.

Batches of Raw Material	Operators				
	1	2	3	4	5
1	A = 24	B = 20	C = 19	D = 24	E = 24
2	B = 17	C = 24	D = 30	E = 27	A = 36
3	C = 18	D = 38	E = 26	A = 27	B = 21
4	D = 26	E = 31	A = 26	B = 23	C = 22
5	E = 22	A = 30	B = 20	C = 29	D = 31

- 6) Armitage quotes a paper which reported an experiment that had been designed as a Latin square. The skins of rabbits' backs were inoculated with a diffusing factor in six separate sites. Six rabbits were therefore used and the order in which the sites were inoculated was done six different ways. The outcome measured was the area of the blister (cm²). The overall objective was to see whether or not the order of administration affected this outcome. The experimental design and data are represented in the Latin square below.

		<u>Rabbit</u>					
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
a		iii	v	iv	i	vi	ii
		7.9	8.7	7.4	7.4	7.1	8.2
b		iv	ii	vi	v	iii	i
		6.1	8.2	7.7	7.1	8.1	5.9
c		i	iii	v	vi	ii	iv
		7.5	8.1	6	6.4	6.2	7.5
d		vi	i	iii	ii	iv	v
		6.9	8.5	6.8	7.7	8.5	8.5
e		ii	iv	i	iii	v	vi
		6.7	9.9	7.3	6.4	6.4	7.3
f		v	vi	ii	iv	i	iii
		7.3	8.3	7.3	5.8	6.4	7.7

- 7) Use the data set “taste” from package “daewr” as an example. Twelve different panelists rated four different recipes. Analyze the BIBD.
- 8) Below is the data for the metal hardness data. Each coupon is subjected to each of the 4 tips. Suppose that a coupon is only large enough that 3 tips can be used. Then the blocks would be ‘incomplete’. One way to run the experiment is to randomly assign 3 tips to each block, perhaps requiring that each tip appears 3 times in total.

	Coupon			
Tip	1	2	3	4
1	9.3	9.4	-	10
2	-	9.3	9.8	9.9
3	9.2	9.4	9.5	-
4	9.7	-	10	10.2

Analyze the design

- 9) Case Study
