

MA 60209 Design of Experiments
Assignment No. 2

1. A university computer service conducted an experiment in which one-coin operated computer terminal was placed at each four different locations on the campus last semester during the midterm week and again during the final week of classes. The data that follow show the number of hours each terminal was not in use during the week at four locations (factor A) and for two different weeks (factor B).

Factor A (location)	Factor B (week)	
	j=1 Midterm	j=2 Final
i=1	16.5	21.4
i=2	11.8	17.3
i=3	12.3	16.9
i=4	16.6	21.0

Carry out the Two-way ANOVA and test for the significance for effects of both factors A and B at level of significance $\alpha = 0.05$. State the conclusions clearly.

2. The staff of the service center for electronic equipment includes three technicians who specialize in repairing three widely used makes of the disk drives for desktop computers. It was desired to study the effect of technician (Factor A) and make of the disk drive (Factor B) on the service time. The data show the number of minutes required to complete the repair job in a study where each technician was randomly assigned to five jobs on each make of the disk drive. (data given in the Table 1 below).
 - (a) Obtain the ANOVA table for Two-way model with interaction.
 - (b) Test for the significance of interaction effects and differences in main factors of both the factors at 1% level of significance.
3. A stimulus -response experiment involving three treatments was laid out in a randomized block design using four subjects. The response was the length of time to reaction measured in seconds. The data (treatment identification numbers are underlined) is given in Table 2. Test if the data present sufficient evidence to indicate a difference in the mean response for both the factors – Stimuli (treatments) and Subjects at 5% level of significance?

Table 1

Factor A (Technician)	Factor B (make of drive)		
	j=1 Make 1	j=2 Make 2	j=3 Make 3
i=1 Technician 1	62	57	59
	48	45	53
	63	39	67
	57	54	66
	69	44	47
i=2 Technician 2	51	61	55
	57	58	58
	45	70	50
	50	66	69
	39	51	49
i=3 Technician 3	59	58	47
	65	63	56
	55	70	51
	52	53	44
	70	60	50

Table 2
Subjects

1	2	3	4
$\frac{1}{1.7}$	$\frac{3}{2.1}$	$\frac{1}{0.1}$	$\frac{2}{2.2}$
$\frac{3}{2.3}$	$\frac{1}{1.5}$	$\frac{2}{2.3}$	$\frac{1}{0.6}$
$\frac{2}{3.4}$	$\frac{2}{2.6}$	$\frac{3}{0.8}$	$\frac{3}{1.6}$

4. The following table gives the yield (quintals per plot) of three varieties of rice, obtained with four different kinds of fertilizers. Carry out the Two Way Analysis of Variance assuming no interaction effect. At 5% level of significance, test the hypotheses of equality in the average yields of the three varieties of rice, and the homogeneity of effects of four types of fertilizers.

Fertilizer	Variety of Rice		
	A	B	C
α	8	3	7
β	10	4	8
γ	6	5	6
Δ	8	4	7

5. The following data represents the units of production per day turned out by four different brands of machines used by four machinists:

Machine	Machinist			
	1	2	3	4
B_1	15	14	19	18
B_2	17	12	20	16
B_3	16	18	16	17
B_4	16	16	15	15

Test whether the differences in the performances of the machinists are significant.
Test whether the differences in the performances of the four brands of machines are significant.

6. An experiment is conducted to determine the differences in average mileage using four different brands of cars of similar level. Two cars of each brand are randomly selected in each of four different metro cities. Each car was then driven on 5 liters of fuel of the same brand. The following table gives the number of km travelled.

Cities	Car Brand							
	A		B		C		D	
Chennai	92.3	104.1	90.4	103.8	110.2	115.0	120.0	125.4
Delhi	96.2	98.6	91.8	100.4	112.3	111.7	124.1	121.1
Kolkata	90.8	96.2	90.3	89.1	107.2	103.8	118.4	115.6
Mumbai	98.5	97.3	96.8	98.8	115.2	110.2	126.2	120.4

Prepare ANOVA table and test hypotheses of homogeneity of car brand effects, city effects and no interaction effects at 10% level of significance.