

Sri SivaSubramaniya Nadar College of Engineering

Department of Mathematics

Subject: UMA 1478 Probability & Statistics

(Common to IV semester CSE & IT)

OPEN BOOK ASSIGNMENT

UNIT 4: DESIGN OF EXPERIMENTS

UNIT 5: STATISTICAL QUALITY CONTROL

ANSWER ALL THE QUESTIONS:

1. The four samples below have been obtained from normal population with equal variances. Test the hypothesis at 1% level that the population means are equal using one-way analysis of variance.

Sample I : 15 17 14 11
Sample II : 12 10 13 17 14
Sample III: 14 09 07 10 08 07
Sample IV: 10 14 13 15 12

2. Four doctors, each test four treatments for a certain disease and observe the number of days each patient takes to receive. The results are as follows (recovery time in days).

Doctor	Treatment			
	1	2	3	4
A	10	14	19	20
B	11	15	17	21
C	9	12	16	19
D	8	13	17	20

Discuss the difference between (a) doctors and (b) treatments.

3. The following data resulted from an experiment to compare 3 burners B_1, B_2 and B_3 . A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.

	Engine 1	Engine 2	Engine 3
Day 1	$B_1(16)$	$B_2(17)$	$B_3(20)$
Day 2	$B_2(16)$	$B_3(21)$	$B_1(15)$
Day 3	$B_3(15)$	$B_1(12)$	$B_2(13)$

Test the hypothesis that there is no difference between the burners.

4. The following data are obtained from a 2^2 factorial experiment blocked 3 times. Evaluate the sum of squares for all factorial effect by the contrast method. Draw a conclusion at 0.01 level of significance.

Treatment	BLOCKS		
Combination	I	II	III
(1)	12	19	10
K	15	20	16
P	24	16	17
KP	24	17	29

5. The following data gives the average life in hours and range in hours of 12 samples each of 5 lamps. Construct the control charts for \bar{X} and R and comment on the state of control.

\bar{X}	120	127	152	157	160	134	137	123	140	144	120	127
R	30	44	60	34	38	35	45	62	39	50	35	41

6. A machine fills boxes with dry cereal. 15 samples of 4 boxes are drawn randomly. The weights of the sampled boxes are shown as follows. Draw the control charts for the sample mean and sample range and determine whether the process is in a state of control.

Sample No:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Weight of boxes (X):	10.0	10.3	11.5	11.0	11.3	10.7	11.3	12.3	11.0	11.3	12.5	11.9	12.1	11.9	10.6
	10.2	10.9	10.7	11.1	11.6	11.4	11.4	12.1	13.1	12.1	11.9	12.1	11.1	12.1	11.9
	11.3	10.7	11.4	10.7	11.9	10.7	11.1	12.7	13.1	10.7	11.8	11.6	12.1	13.1	11.7
	12.4	11.7	12.4	11.4	12.1	11.0	10.3	10.7	12.4	11.5	11.3	11.4	11.7	12.0	12.1

7. 10 samples each of size 50 were inspected and the number of defectives in the inspection was: 2, 1, 1, 2, 3, 5, 5, 1, 2, 3. Draw the appropriate control chart for defectives.
8. Fifteen samples each of size 50 were inspected and the number of defectives in the inspection were 2, 3, 4, 2, 3, 0, 1, 2, 2, 3, 5, 5, 1, 2, 3. Draw the control chart for the number of defectives and comment on the state of control.
9. A plant produces paper for newsprint and rolls of paper are inspected for defects. The results of inspection of 20 rolls of papers are given below: Draw the c-chart and comment on the state of control.

Roll Number (i)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Number of defects: (c)	19	10	8	12	15	22	7	13	18	13	16	14	8	7	6	4	5	6	8	9

10. The following data resulted from an experiment to compare 3 burners B_1 , B_2 and B_3 . A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.

	Engine 1	Engine 2	Engine 3
Day 1	$B_1(16)$	$B_2(17)$	$B_3(20)$
Day 2	$B_2(16)$	$B_3(21)$	$B_1(15)$
Day 3	$B_3(15)$	$B_1(12)$	$B_2(13)$

Test the hypothesis that there is no difference between the burners
