Model Question Paper

Fourth Semester M.Sc Degree Examination (CSS)

ST4E08 : STATISTICAL COMPUTING - 3

Time: 3 hours Total Weights: 30

(Answer any three questions. Each question carries weightage 10.)

1. Derive a sequential inspection plan for accepting lots following normal distribution with S.D. 4 given that lot is acceptable when average of the lot is large and that an acceptable grade is given as 20 units and tolerance grade as 18 units with producer's risk = .05 = consumer's risk. Draw its O.C. curve and ASN curve.

2. Specification limits for a measurement of a product in a process are 1.650 ± 0.0010 cm. The mean and range of subgroups of size 4 are given below:

   (a) Set up $\bar{X}$-chart and R-chart with first 20 observations.

   (b) Is the process under control for the next 7 periods?

   (c) Find the expected proportion defectives in a process controlled by these charts.

   (d) What is the probability that the $\bar{X}$-chart catches shift in the mean level to 1.6503 when R-chart shows control?

Values recorded are for $U = \dfrac{X - 1.65}{0.0001}$

Subgroup		*Mean*	*Range*	*Subgroup*		*Mean*	*Range*
1	...	1.5	7	15	...	-0.5	12
2	...	3.8	8	16	...	-0.6	8
3	...	4.5	9	17	...	2.3	8
4	...	1.6	4	18	...	2.0	8
5	...	0.0	8	19	...	3.5	6
6	...	1.3	16	20	...	4.0	9
7	...	0.0	4	21	...	6.8	12
8	...	0.2	2	22	...	0.5	1
9	...	0.8	1	23	...	2.5	6
10	...	2.5	5	24	...	-1.5	3
11	...	0.3	1	25	...	-4.5	8
12	...	1.0	3	26	...	-0.5	10
13	...	2.8	7	27	...	1.5	3
14	...	-1.8	7				

3. Let Q=A $x_1^{\alpha} x_2^{\beta} x_3^{\gamma}$ be a production function, where Q denotes production, x_1 denotes capital input, x_2 denotes labour input, x_3 denotes other factors of production. A data on 10 observations gave the following:-

Industry serial number	*Production* Q	*Capital input*(x_1) ('0000 *Rs.*)	*Labour input*(x_2)	*Other factors*(x_3)
1	24720	69392	304	500
2	9600	4806	4716	100
3	16720	34569	498	150
4	8020	2086	6009	75
5	32460	11897	1201	240
6	50440	22208	172	750
7	12070	5789	7372	50
8	252720	90975	340	1000
9	123500	87325	175	955
10	185700	75382	473	875

Fit the production function. Is there any evidence that $\alpha + \beta = 1$?

4. The following data relates to the national income (y) and investments(x) for a period of 10 years:-

y	80.4	86.4	91.6	94.4	98.1	99.5	100.5	102.6	105.0	110.5
x	4.7	6.3	3.6	4.5	7.8	9.9	12.1	13.1	13.7	15.7

Fit the model $y = a + bx + u$ to the data and test for the presence of autocorrelated errors.

5. (a) Four gasoline dealers A, B, C and D require 50, 40, 60 and 40 KL of gasoline respectively. It is possible to supply these from locations 1, 2 and 3 which have 80, 100 and 50 KL respectively. The cost in Rs. for shipping every KL is shown in the table below:

		A	B	C	D
Location	1	7	6	6	6
	2	5	7	6	7
	3	8	5	8	6

Determine the most economical supply pattern.

(b) Solve the quadratic programming problem:

$$\begin{aligned} \text{Maximize} \quad & 3x_1 + 6x_2 - 4x_1x_2 - 3x_1^2 - 2x_2^2 \\ \text{Subject to} \quad & 3x_1 + 2x_2 \leq 4 \\ & x_1 + x_2 \leq 1 \\ & x_1, x_2 \geq 0. \end{aligned}$$

6. (a) An electro-mechanicall equipment has a puchase price of Rs.7,000. Its running costs per year and resale values are given below:

Year	:	1	2	3	4	5	6	7	8
Running costs (Rs.)	:	2000	2100	2300	2600	3000	3500	4100	4600
Resale values (Rs.)	:	4000	3000	2200	1600	1400	700	700	700

At which year is the replacement due ?

(b) Seven jobs are to be processed through two machines A and B. Processing times (in hours) are given below:

Jobs	:	1	2	3	4	5	6	7
Machine A	:	10	9	7	15	18	20	14
Machine B	:	12	8	7	12	10	6	13

Determine the optimum sequence for the jobs and also total elapsed time.