

### III Semester M.Sc. (Statistics) Practical Examination

#### Paper 3.5 – Practical II

Time : 3 hrs.

Max. Marks: 40

Answer any three questions without omitting any part.

#### Part A (Operations Research)

1. a) A truck owner finds from his passed records that the cost per year of running a truck and resale value whose purchase price is RS 6000/- are as given below. At what stage the replacement must be made.

Year	1	2	3	4	5	6	7	8
Running cost	1000	1200	1400	1800	2300	2800	3400	4000
Resale value	3000	1500	750	375	200	200	200	200

- b) Use simplex method to solve the LPP

$$\text{maximize } Z=3X_1+2X_2+5X_3$$

$$\text{Subject to } X_1+X_2+X_3\leq 9, 2X_1+3X_2+5X_3\leq 30, X_1, X_2, X_3\geq 0.$$

2. a) Use two phase simplex method to solve the LPP,

$$\text{Minimize } Z=-2x_1-x_2$$

$$\text{Subject to } x_1+x_2\geq 2, x_1+x_2\leq 4, x_1, x_2\geq 0$$

- b) Two companies A&B are competing for the same product. Their different strategies are given in the following matrix.

$$\text{Company A} \begin{matrix} & \text{Company B} \\ \begin{pmatrix} 2 & -2 & 3 \\ -3 & 5 & -1 \end{pmatrix} \end{matrix}$$

Use linear programming to determine the best strategies for both the players.

#### Part B (Testing of Hypotheses)

- 3 a) Find UMPU test of size 0.01 for testing  $H_0: \sigma^2=3$  against  $H_1: \sigma^2 \neq 3$  in  $N(0, \sigma^2)$ . Write down your conclusions if the observations are -1.8, 2.9, 4.3, -4.7, -4.1, 4.2, 3.9, 3.2, -2.5, -3.4.
- b) Obtain the SPRT of strength (0.01, 0.02) to test the hypothesis that  $H_0: \theta=2$  against  $H_1: \theta=3$ , where  $\theta$  is the mean of negative exponential distribution. Give the conclusion if the observations are 4.1, 4.2, 5.6, 1.6, 2.3, 3.2, 3.8, 3.0, 1.0, 2.0, 4.1, 8.2.
- c) Using K-S test, examine whether the two samples come from same populations or not  
Sample I : 27, 32, 29, 41, 32, 23, 28, 29, 27, 26, 28, 22, 27, 19, 32, 40, 35  
Sample II: 25, 24, 26, 21, 13, 29, 30, 16, 11, 18, 17, 21
4. a) Find the most powerful test for testing  $H_0: \theta=3$  against  $H_1: \theta=1$ , where  $\theta$  is the parameter of Poisson distribution. Draw your conclusions, if the observations are 18, 21, 19, 15, 23, 16, 22, 16, 24, 17.

- b) Given below are mileages (in 1000 metre) for eight tyre each of two brands A and B
- |         |      |      |      |      |      |      |      |      |
|---------|------|------|------|------|------|------|------|------|
| Brand A | 32.1 | 20.6 | 17.8 | 28.4 | 19.6 | 21.4 | 19.9 | 30.1 |
| Brand B | 19.8 | 27.6 | 30.9 | 27.6 | 34.1 | 18.7 | 16.9 | 17.9 |
- Test the null hypothesis that the two samples come from the same population using the Mann-Whitney test at 10% level of significance.

- c) By SPRT method for a  $N(\theta, 25)$ , test  $H_0: \theta = 135$  against  $H_1: \theta = 136$ , given that the strength of the test is  $(0.01, 0.03)$  for the data drawn sequentially as given below.

138	120	135
136	104	108
155	140	120
151	160	125
144	144	106
121	145	145
137	130	123

Draw your conclusions.

### Part C (Multivariate Analysis)

5. The body dimensions of four different slugs collected from north eastern Libya during February-March, 1993 have been recorded. The information is collected on body length and body weight of 20 slugs of each type. The sample covariance matrices of each slug are given below. Test the homogeneity of covariance matrices at 5% significant level.

$$S_1 = \begin{bmatrix} 52.6500 & 05.8825 \\ 05.8825 & 00.9013 \end{bmatrix} \quad S_2 = \begin{bmatrix} 42.1475 & 09.4325 \\ 09.4325 & 04.3085 \end{bmatrix} \quad S_3 = \begin{bmatrix} 15.0000 & 01.7200 \\ 01.7200 & 00.3014 \end{bmatrix}$$

$$S_4 = \begin{bmatrix} 47.6475 & 05.5950 \\ 05.5950 & 00.8350 \end{bmatrix}$$

6. Consider 3 populations consisting of Brahmin caste, Artisan caste and Korwa caste. Measurements of each individual of a caste on stature, sitting height, nasal depth and nasal height were taken. The means of these variables in the three populations are,

Measurement	Brahmin	Artisan	Korwa
Stature ( $x_1$ )	164.51	158.17	160.53
Sitting height ( $x_2$ )	86.43	81.16	81.47
Nasal depth ( $x_3$ )	25.49	21.44	23.84
Nasal height ( $x_4$ )	51.24	46.72	48.62

The matrix of correlations for all the population is,

1.0000	0.5849	0.1774	0.1974
0.5849	1.0000	0.2094	0.2170
0.1774	0.2094	1.0000	0.2910
0.1974	0.2170	0.2910	1.0000

The standard deviations are  $\sigma_1 = 5.74$ ,  $\sigma_2 = 2.30$ ,  $\sigma_3 = 1.74$  and  $\sigma_4 = 3.5$ . To which population would you classify the individual with the measurements [ 162 84 24 49] ?