

III Semester M.Sc (Statistics) Practical Examination January 2014

Paper 3.5 Practical II

Time: Three hrs

Maximum Marks: 40

Answer any three questions without omitting any part

Part I (Operations Research)

1 (a) A manufacturer is offered two machines A and B. Machine A has cost price of \$2500, its running cost is \$400 for each of the first 5 years and increases by \$100 every subsequent year. Machine B, having the same capacity as A, costs \$1250 has running cost of \$600 for 6 years, increasing by \$100 per year thereafter. If the money is worth 10% per year, which machine should be purchased? Scrap values of both machines is negligibly small.

(b) Use two-phase simplex method to solve the following LPP

Maximize $Z = 5x_1 - 4x_2 + 3x_3$,

subject to the constraints

$$2x_1 + x_2 - 6x_3 = 20$$

$$6x_1 + 5x_2 + 10x_3 \leq 76$$

$$8x_1 + 3x_2 - 6x_3 \leq 50$$

and $x_1, x_2, x_3 \geq 0$

(8+5= 13marks)

OR

2(a) The following matrix represented the payoff matrix of player A in a rectangular game between two players A and B. Using dominance reduce the game to 2X4 game and solve the game by graphical method.

| | | | |
|----|---|----|----|
| 19 | 6 | 7 | 5 |
| 7 | 3 | 14 | 6 |
| 12 | 8 | 18 | 4 |
| 8 | 7 | 13 | -1 |

(b) The time estimates (in weeks) for the activities of a PERT network are given below

| Activity | Optimistic time | Most likely time | Pessimistic time |
|----------|-----------------|------------------|------------------|
| 1-2 | 1 | 1 | 7 |
| 1-3 | 1 | 4 | 7 |
| 1-4 | 2 | 2 | 8 |
| 2-5 | 1 | 1 | 1 |
| 3-5 | 2 | 5 | 14 |
| 4-6 | 2 | 5 | 8 |
| 5-6 | 3 | 6 | 15 |

(i) Draw the project network

(ii) Identify the critical path and determine expected project length

(iii) What is the probability that the project will be completed no more than 4 weeks later than expected time

(6+7=13 marks)

Part II (Testing of Statistical Hypothesis)

3. (i). Let X follows $B(10, P)$. Find UMP non-randomized size 0.05 tests for testing $H_0: P < 0.25$ Vs $H_1: P \geq 0.25$. Also find the power of the test for $P=0.3, 0.4, 0.5$ and 0.6 .

(ii). Using K-S test, examine whether the following observations are drawn from $U(0,1)$

0.277, 0.435, 0.130, 0.143, 0.853, 0.294, 0.697, 0.940, 0.648, 0.324

(iii). Construct SPRT of strength (0.05, 0.05) for testing the hypothesis $H_0: \sigma=1$ Vs $H_1: \sigma=2$.

Draw your conclusions based on the following observations

20, 16, 18, 21, 19, 16, 21, 23, 18

(14 marks)

OR

4. (i). When the first proof of a book of 1200 pages were read, the distribution of printing mistakes were found as follows

| | | | | | | | |
|------------------|-------|----|----|---|---|---|---|
| No. of mistakes: | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| No. of pages | : 275 | 72 | 30 | 7 | 5 | 2 | 1 |

Fit a Poisson distribution for the data and test the goodness of fit

(ii). The following data represent the lifetime in hours of batteries for two different brands

| | | | | | | |
|-----------|-----|-----|-----|-----|-----|----|
| Brand A : | 40, | 30, | 40, | 45, | 55, | 30 |
| Brand B : | 50, | 50, | 45, | 55, | 60, | 40 |

Using K-S test, examine whether the two brands differ with respect to their average life length.

(iii). Construct SPRT of strength (0.01, 0.03) for testing the hypothesis $H_0: P=0.4$ Vs $H_1: P=0.5$, where P is the probability of success in a Bernoulli trial. Draw your conclusions based on the following.

Also draw OC and ASN curves

(14 marks)

Part III (Multivariate Analysis)

5. A census provided tract information on 5 socioeconomic variables for Madison, Wisconsin, area. The covariance matrix for data from 14 tracts is given. Can the sample variation be summarized by one or two principal components?

$$\begin{pmatrix} 4.308 & 1.683 & 1.803 & 2.155 & -0.253 \\ 1.683 & 1.768 & 0.588 & 0.177 & 0.176 \\ 1.803 & 0.588 & 0.801 & 1.065 & -0.158 \\ 2.155 & 0.177 & 1.065 & 1.970 & -0.357 \\ -0.253 & 0.176 & -0.158 & -0.357 & 0.504 \end{pmatrix}$$

(13 marks)

OR

6. Data (in cm's) relating to four measurements on two species of Iris (in centimeters), namely *Iris versicolour* and *Iris setosa*, from samples of sizes 50 each are summarized below. The measurements are X_1 = sepal length, X_2 = sepal width X_3 = petal length and X_4 = petal width.

$$\bar{X}_1 = \begin{pmatrix} 5.936 \\ 2.770 \\ 4.260 \\ 1.326 \end{pmatrix}, \quad \bar{X}_2 = \begin{pmatrix} 5.006 \\ 3.428 \\ 1.462 \\ 0.246 \end{pmatrix}, \quad S = \begin{pmatrix} 19.1434 & 9.0356 & 9.7634 & 3.2394 \\ 9.0356 & 11.8658 & 4.6232 & 2.4746 \\ 9.7634 & 4.6232 & 12.2978 & 3.8794 \\ 3.2394 & 2.4746 & 3.8794 & 2.4604 \end{pmatrix}$$

Examine whether the means of the two populations are significantly different using the Hotelling's T^2 statistic.

(13 marks)