বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2022

(Under CBCS Pattern)

Semester - VI

Subject : STATISTICS

Paper : DSE 4-T

Full Marks : 40

Time : 2 Hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

[OPERATIONS RESEARCH]

A. Answer any ***two*** questions : 10×2=20

1. (a) Describe EOQ model with shortage.

   (b) Find the optimum order quantity for a product, the price break of which are as follows :

Quantity	Unit cost
$0 \le q_1 \le 800$	Rs. 1.00
$800 \le q_2$	Rs. 0.98

The yearly demand for the product is 1600 units, cost of placing an order is Rs. 5 and the cost of storage is 10 percent per year.

2. (a) Use graphical method to solve the LPP

Maximize $Z = 3x_1 + 2x_2$

Subject to
$$\begin{aligned} 5x_1 + x_2 &\geq 10 \\ x_1 + x_2 &\geq 6 \\ x_1 + 4x_2 &\geq 12 \\ x_{1,} \quad x_2 &\geq 0 \end{aligned}$$

(b) Mathematically formulate an assignment problem. Hence, solve the following assignment problem using Hungarian Method.

A company has 5 jobs to be done on five machines. Any job can be done on any machine. The cost of doing the jobs on different machines are given below. Assign the jobs for different machines so as to minimize the total cost. 4+6

Jobs	**Machines**				
	A	**B**	**C**	**D**	**E**
1	13	8	16	18	19
2	9	15	24	9	12
3	12	9	4	4	4
4	6	12	10	8	13
5	15	17	18	12	20

3. (a) Solve the following transportation problem using Vogel's approximation method

		Warehouse						
Factory		**A**	**B**	**C**	**D**	**E**	**F**	**Availability**
	1	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
	Requirement	4	4	6	2	4	2	

(b) Using dominance, solve the pay-off matrix given by

Player B

$$\textbf{Player A} \begin{bmatrix} 2 & -2 & 4 & 1 \\ 6 & 1 & 12 & 3 \\ -3 & 2 & 0 & 6 \\ 2 & -3 & 7 & 7 \end{bmatrix}$$

5+5

4. (a) Using dual simplex method solve

Minimize $Z = 2x_1 + 2x_2 + 4x_3$

Subject to
$$\begin{aligned} 2x_1 + 3x_2 + 5x_3 &\geq 2 \\ 3x_1 + x_2 + 7x_3 &\leq 3 \\ x_1 + 4x_2 + 6x_3 &\leq 5 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

(b) A company has to supply an item 1000 times per month at a uniform rate and each time a production run is started it costs Rs. 200. Cost of storing is Rs. 20 per item per month. The number of items to be produced per run has to be ascertained. Determine the total set up cost and average inventory cost if the run size is 500, 600, 700 and 800. Find the optimal production run size using the EOQ formulae.

6+4

B. Solve any *four* questions : 5×4=20

5. Solve using Charne's big M method the following LPP :

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

Subject to
$$\begin{aligned} x_1 + 2x_2 + 3x_3 &= 15 \\ 2x_1 + x_2 + 5x_3 &= 20 \\ x_1 + 2x_2 + x_3 + x_4 &= 10 \\ x_1, x_2, x_3, x_4 &\geq 0 \end{aligned}$$

6. Find the minimum transportation cost using MODI Method :

Destination

		D_1	D_2	D_3	D_4	Supply
	F_1	19	30	50	10	7
Source	F_2	70	30	40	60	9
	F_3	40	8	70	20	18
	Demand	5	8	7	14	

7. A salesman has to visit five cities A, B, C, D and E. The distance (in hundred miles) between the five cities is as follows :

From \	A	B	C	D	E
A	–	7	6	8	4
B	7	–	8	5	6
C	6	8	–	9	7
D	8	5	9	–	8
E	4	6	7	8	–

If the salesman starts from city A and has to come back to his starting point, which route should be selected so that the total distance travelled is minimum ?

8. Prove that the necessary and sufficient condition for the mixed strategies p*, q* to be the optimal strategy of a game problem for each player respective is $E(p, q^*) \le E(P^*, q^*) = v \le E(p^*, q)$, v being the value of the game.

9. Explain the EOQ model with two-price break.

Hence solve the following problem.

Order quantity	**Unit price**
$0 \le q_1 \le 500$	10.00
$500 \le q_2 \le 750$	9.25
$750 \le q_3$	8.75

The monthly demand for the product is 200 units, cost storage is 2 per cent of the unit cost and the cost of ordering is Rs. 350.

10. Write the general formulation of LPP and matrix form of LPP. Hence solve theLPP graphically

Maximize $Z = x_1 + x_2$

Subject to the constraints

$$\begin{aligned} x_1 + x_2 &\leq 1 \\ -3x_1 + x_2 &\geq 3 \\ x_1, x_2 &\geq 0 \end{aligned}$$