3 (Sem–5/CBCS) STA HE 1

2024

STATISTICS

(Honours Elective)

Paper : STA–HE–5016

(Operations Research)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions as directed : 1×7=7

   (a) Operations Research achieved recognition as a subject for study in the universities in the year

   (i) 1953

   (ii) 1957

   (iii) 1959

   (iv) 1950

   (Choose the correct option)

(b) All constraints in an LPP as well as its objective function must be linear in nature. *(State 'True' **or** 'False')*

(c) In a LPP with m constraints in n variables, the maximum number of basic solutions are

(i) ${}^{n}C_{m+1}$

(ii) ${}^{n}C_{m}$

(iii) ${}^{n}C_{m-1}$

(iv) None of the above

(Choose the correct option)

(d) A two-person zero-sum game means that

(i) the sum of losses to one player is equal to the sum of gains to other

(ii) the sum of losses to one player is not equal to the sum of gains to other.

(iii) Both (i) and (ii)

(iv) None of the above

(Choose the correct option)

(e) A mixed strategy game can be solved by

(i) algebraic method

(ii) matrix method

(iii) graphical method

(iv) All of the above

(Choose the correct option)

(f) The solution to a transportation problem with m rows (supplies) and n columns (destinations) is feasible if number of positive allocations are

(i) $m+n$

(ii) mn

(iii) $m+n-1$

(iv) $m+n+1$

(Choose the correct option)

(g) In ABC analysis 'A' items requires

(i) no safety stock

(ii) low safety stock

(iii) moderate safety stock

(iv) high safety stock

(Choose the correct option)

2. Answer the following questions : 2×4=8

(a) Express the following LPP in standard form :

Maxinize $Z = 5x_1 + 3x_2 + 2x_3$

subject to

$$3x_1 - 2x_2 + 4x_3 \leq 5$$

$$2x_1 + 5x_2 + 3x_3 \geq 12$$

$x_1, x_2 \geq 0$ and x_3 is unrestricted in sign.

(b) Define inventory. What is the objective of an inventory problem?

(c) State the condition for the existence of feasible solution to an $m \times n$ transportation problem.

(d) Define payoff matrix in context with game theory.

3. Answer ***any three*** from the following questions : 5×3=15

(a) A firm manufactures two types of products A and B and sells them at a profit of Rs. 2 on type A and Rs.3 on type B. Each product is processed on two machines M_1 and M_2 . Type A requires one minute of processing time on M_1 and two minutes on M_2. Type B requires one minute on M_1 and one minute on M_2.The machine M_1 is available for not more than 6 hours 40 minutes while machine M_2 available for 10 hours during working day. Formulate the problem as a linear programming problem.

(b) Explain Vogel's approximation method to solve transportation problem for an initial basic feasible solution.

(c) Define the following : 2+1+1+1=5

(i) Competitive game

(ii) Pure strategy

(iii) Mixed strategy

(iv) *n*-person game

(d) Define saddle point and value of game with examples.

(e) Write a note on ABC analysis.

4. Answer ***any three*** questions from the following : 10×3=30

(a) Define slack and surplus variables. Solve the following LPP by simplex method : 3+7=10

Maximize $Z = 2x_1 + 3x_2$

subject to $x_1 + x_2 \leq 1$

$3x_1 + x_2 \leq 4$

$x_1, x_2 \geq 0$

(b) (i) Explain the principle of dominance in game theory. 5

(ii) A and B play game in which each has three coins Re.1, Rs.2 and Rs.5. Each selects a coin without the knowledge of the other's choice. If the sum of the coin is an odd amount, A wins B's coin and if the sum is even, B wins A's coin. Find the best strategy for each player and the value of the game. 5

(c) (i) What are the characteristics of the standard form of an LPP? 4

(ii) Solve the following LPP graphically : 6

Maximize $Z = 5x_1 + 3x_2$

subject to $3x_1 + 5x_2 \le 15$

$5x_1 + 2x_2 \le 10$

$x_1, x_2 \ge 0$

(d) What is economic order quantity (EOQ)? Obtain the economic order quantity of an inventory problem where lead time is zero, demand is uniform, production is instantaneous and shortages are not alllowed. 1+9=10

(e) (i) Formulate mathematically a transportation problem as a linear programming problem having m origins and n destinations. 4

(ii) Determine an initial basic feasible solution to the following transportation problem using Vogel's method. 6

Origin \ Destination	D_1	D_2	D_3	Supply
O_1	13	15	16	17
O_2	7	11	2	12
O3	19	20	9	16
Demand	14	8	23	

(f) (i) Mention the differeat types of inventory. 2

(ii) Explain various costs associated with inventory control. 8