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3 (Sem–5/CBCS) STA HE 1

2022

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 ***any seven*** from 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)

Contd.

(b) A constraint in an LPP is expressed as

(i) an equation with = sign

(ii) inequality with $\geq$ sign

(iii) inequality with $\leq$ sign

(iv) Any of the above

(Choose the correct option)

(c) A necessary and sufficient condition for a basic feasible solution to a maximization LPP to be an optimum is that (for all j)

(i) $z_j - c_j \geq 0$

(ii) $z_j - c_j \leq 0$

(iii) $z_j - c_j = 0$

(iv) $z_j - c_j > 0$ *or* $z_j - c_j < 0$

(Choose the correct option)

(d) A balanced transportation problem always has a feasible solution.

(State True ***or*** *False)*

(e) The allocated cells in the transportation table will be called ___ and empty cells will be called _____.

(Fill in the blanks)

(f) When maximum and minimum values of the game are same, then

(i) there is a saddle point

(ii) solution does not exist

(iii) strategies are mixed

(iv) None of the above

(Choose the correct option)

(g) The initial solution of transportation problem obtained by Vogel's approximation method would invariably be very near to optimum solution.

(State True ***or*** *False)*

(h) If the value of game is zero, then the game is called

(i) fair game

(ii) unfair game

(iii) rectangular game

(iv) None of the above

(Choose the correct option)

(i) Inventories in general are build up to

(i) satisfy demand during period of replenishment

(ii) carry reserve stocks to avoid shortages

(iii) keep pace with changing market conditions

(iv) All of the above

(Choose the correct option)

(j) Which of the following is not an assumption underlying the fundamental problem of EOQ ?

(i) Demand is known and uniform

(ii) Lead time is not zero

(iii) Holding cost per unit per time period is constant

(iv) Shortage are not allowed

(Choose the correct option)

(k) Which of the following statements is wrong ?

(i) Slack variables are used to convert the inequalities of the type '$\leq$' into equations

(ii) Surplus variables are used to convert the equalities of the type '$\geq$' into equations

(iii) A LPP with all its constraints are of the type '$\geq$' is said to be in standard form

(iv) An LPP with all its constraints are of the type '$\leq$' is said to be in canonical form

(Choose the correct option)

(l) Linear programming problem involving two decision variables can easily be solved by graphical method.

*(State True **or** False)*

2. Answer ***any four*** from the following questions : 2×4=8

(a) State the different types of models in operations research.

(b) Distinguish between deterministic and stochastic model in inventory control.

(c) Show that transportation problem can be considered as a linear programming problem.

(d) Define pay-off matrix in context with game theory.

(e) Write the role of pivotal element in simplex method.

(f) Explain the terms :

(i) Pure strategy

(ii) Optimum strategy

(g) Define the terms in context with LPP

(i) Basic variable

(ii) Degenerate basic feasible solution

(h) Explain the concept of economic order quantity.

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

(a) A manufacturer of a line of patent medicines is preparing a production plan on medicines *A* and *B*. There are sufficient ingredients available to make 20,000 bottles of *A* and 40,000 bottles of *B* but there are 45,000 bottles into which either of the medicines can be put. Further more it takes 3 hours to prepare enough material to fill 1000 bottles *A*, it takes one hour to prepare enough material to fill 1000 bottles of *B* and there are 66 hours available for this operation. The profit is Rs. 8.00 per bottle of *A* and Rs.7.00 per bottle of *B*.

Formulate this problem as linear programming problems.

(b) Find all the basic solutions of the following problem :

$$x_1 + 2x_2 + x_4 = 4$$
$$2x_1 + x_2 + 5x_3 = 5$$

(c) Explain basic assumption of linear programming problem.

(d) Neon lights in an industrial pack are replaced at the rate of 100 units per day. The physical plant orders the neon lights periodically. It costs Rs.100 to initiate a purchase order. A neon light kept in storage is estimated to cost about Rs.0.02 per day. The lead time between placing and receiving an order is 12 days. Determine the optimum inventory policy for ordering the neon lights.

(e) Explain the procedure of ABC analysis in context with inventory control.

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

(g) Explain competitive games with characteristics.

(h) Explain the different steps of Big-M method for solving a given linear programming problem.

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

(a) If an LPP has a feasible solution then prove that it also has basic feasible solution.

(b) (i) Explain the characteristics of LPP. 4

(ii) Discuss the major steps in the solution of a linear programming problem by graphical method. 6

(c) Solve the linear programming problem by simplex method.

$$Max\ Z = 7x_1 + 5x_2$$

subject to
$$x_1 + 2x_2 \le 6$$
$$4x_1 + 3x_2 \le 12$$
$$x_1 x_2 \ge 0$$

(d) (i) Explain North-West corner rule for finding an initial basic feasible solution for a transportation problem. 4

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

Origin O \ Destination D	D_1	D_2	D_3	Supply
O_1	(2)	(7)	(4)	5
O_2	(3)	(3)	(1)	8
O_3	(5)	(4)	(7)	7
O_4	(1)	(6)	(2)	14
Demand	7	9	18	34

(e) (i) Explain the maximin and minimax strategies used in game theory. 5

(ii) What is saddle point ? Explain the method for detecting a saddle point. 5

(f) Derive economic order quantity model for an inventory problem when shortages of cost are not allowed. Also discuss the characteristic of this model. 7+3=10

(g) (i) Explain various costs associated with inventory control. 8

(ii) Mention the different types of inventory. 2

(h) (i) Explain the theory of dominance in the solution of rectangular game. 4

(ii) In a game of matching coins with two players suppose *A* wins one unit of value when their are two heads, wins nothing when there are two tails and loses ½ unit of value when there are one head and one tail. Determine the pay-off matrix, the best strategies, for each player and the value of the game to *A*. 6

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