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[87/A-24]

SARDAR PATEL UNIVERSITY

Statistics

M.Sc.(QPM) / M.Sc. (Applied Statistics)

SEMESTER I (CBCS) EXAMINATION

Monday, 29th October 2018

OPERATIONS RESEARCH-I **(QP-105 / PS01CAST23)**

Time : 10:00 a.m. to 1:00 p.m. Total Marks: 70

Note: (i) Figures to the right indicate marks.
(ii) Graph paper will be supplied on request.

Q1 (a) Tick the correct answer. [8]

(i) The first step in solving Operations Research problem is
(a) Model building, (b)Obtain alternate solutions,
(c) Obtain basic feasible solutions (d) Formulation of the problem.

(ii) Operations Research is
(a) Independent thinking approach (b) Group thinking approach
(c) Inter-disciplinary team approach (d) None of the above.

(iii) The number at the intersection of key row and key column is known as
(a) Column number (b) Row number,
(c) Key number (d) Cross number.

(iv) Dual of a Duel is
(a) Primal (b) Dual,
(c)Prima dual (d) None of the above.

(v) In graphical solution of solving Linear Programming problem to convert inequalities into equations, we
(a) use slack variables (b) use surplus variables,
(c) use artificial variables (d) simply assume them to be equations.

(vi) Which of the following is not associated with LPP?
(a) Proportionality (b) Uncertainty
(c) Additivity (d) Divisibility

(vii) If all of the decision variables require integer solutions the problem is
(a) a pure integer programming type of problem.
(b) a simplex method type of problem.
(c) a mixed-integer programming type of problem.
(d) a Gorsky type of problem.

(viii) When using a graphical solution procedure, the region bounded by the set of constraints is called the
(a) solution. (b) feasible region.
(c) infeasible region (d) none of the above.

Q2 (a) Answer the following questions (any **SEVEN**). [14]

(i) What are the assumptions of linear programming?

(ii) What are slack variables? When they are useful?

(iii) Explain the primal-dual relationship.

(iv) Define operations research

(v) State the conditions required for applying simplex method to a linear programming problem.

(vi) What is a shadow price?

[P.T.O.]

(vii) How does the simplex algorithm indicate that the problem has no feasible solution?

(viii) What is integer linear programming?

(ix) What are the advantages of the duality?

Q3 (a) State the phases of an operations research study and their importance in solving problems. [6]

(b) Discuss the applications of Linear Programming. [6]

OR

(b) Write the general structure of linear programming problem (LPP). What are the limitations of LP models? [6]

Q4 (a) What steps are required in solving LPPs by graphic method? Discuss in brief. What is a redundant constraint? [6]

(b) A firm is engaged in producing two products, A and B. Each unit of product A requires 2 kg of raw material and 4 labour hours for processing, whereas each unit of product B requires 3 kg of raw material and 3 hours of labour, of the same type. Every week, the firm has an availability of 60 kg of raw material and 96 labour hours. One unit of product A sold yields Rs 40 and one unit of product B sold gives Rs 35 as profit. [6]

Formulate this problem as a linear programming problem to determine as to how many units of each of the products should be produced per week so that the firm can earn the maximum profit.

Assume that there is no marketing constraint so that all that is produced can be sold.

OR

(b) Solve the following LPP by graphical method. [6]

$$Max\ z = 15x_1 + 10x_2$$

Subject to

$$4x_1 + 6x_2 \leq 360$$

$$3x_1 \leq 180$$

$$5x_2 \leq 200$$

$$x_1 \geq 0, x_2 \geq 0$$

Q5 (a) Describe the two-phase method for solving the linear programming problems. [6]

(b) Solve the following LPP by simplex method. [6]

$$Max\ Z = 7x_1 + 14x_2$$

Subject to

$$3x_1 + 2x_2 \leq 36$$

$$x_1 + 4x_2 \leq 10$$

$$x_1 \geq 0, x_2 \geq 0$$

OR

(b) Given below is the simplex tableau for a maximization type of linear programming problem : [6]

Basis	c_j	4 x_1	5 x_2	0 s_1	0 s_2	b_i
x_2	5	1	1	1	0	10
s_2	0	1	0	-1	1	3
	z_j	5	5	5	0	
	$c_j - z_j$	-1	0	-5	0	

Answer the following questions giving reasons in brief :

(i) Is this solution optimal?
(ii) Are there more than one optimal solutions?
(iii) Is this solution degenerate?
(iv) Is this solution feasible?

Q6 (a) Write the procedure for dual simplex method. [6]

(b) Use the penalty (Big-*M*) method to solve the following LPP. [6]

$$Min\ Z = 5x_1 + 3x_2^*$$

Subject to,

$$2x_1 + 4x_2 \leq 12$$

$$2x_1 + 2x_2 = 10$$

$$5x_1 + 2x_2 \geq 10$$

$$x_1, x_2 \geq 0$$

OR

(b) Solve the following LPP using cutting plane (Gomory-cut) algorithm. [6]

$$Max\ z = x_1 + x_2$$

Subject to,

$$3x_1 + 2x_2 \leq 5$$

$$x_2 \leq 2$$

$x_1, x_2 \geq 0$ and integer.