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SARDAR PATEL UNIVERSITY

M.Sc. (Semester - III) Examination (MC)

Thursday April 19, 2018

Time: 02:00 p.m. to 05:00 p.m.

Subject: Mathematics

Course No. PS03EMTH13 (Operations Research)

Total Marks: 70

- Note: (1) All the questions are to be answered in the answer book only.
 (2) Figures to the right indicate marks of the respective question.

Q-1 Choose the most appropriate answer from the options given. (08)

- _____ method cannot be used to solve an LPP with more than 4 decision variables.
 (a) Graphical (b) Big M (c) Simplex (d) Two-phase
- All the constraints of an LPP when expressed in the standard form are of _____ type.
 (a) \leq (b) \geq (c) \neq (d) $=$
- In graphical method, the feasible region is always _____.
 (a) a triangle (b) open (c) convex (d) an empty set
- A basic feasible solution is called _____ if all the basic variables are non-zero.
 (a) non-basic (b) infeasible (c) non-degenerate (d) degenerate
- An assignment problem can be solved by _____ method.
 (a) Simplex (b) Hungarian (c) Big M (d) Graphical
- In a transportation problem if the supply exceeds the demand, then _____.
 (a) dummy source is added (c) a demand is reduced
 (b) a source is reduced (d) dummy destination is added
- In an assignment problem the number of tasks _____ number of men.
 (a) $<$ (b) $>$ (c) $=$ (d) none of these
- If one of the constraints is non-linear, then the problem is _____.
 (a) LPP (b) NLPP (c) Partial LPP (d) Partial NLPP

Q-2 Attempt *Any Seven* of the following: (14)

- What is the use of a slack variable in LPP?
- What is meant by an initial basic feasible solution?
- Express the following LPP in the standard form:
 Maximize $z = 3x_1 - 5x_2$ subject to $x_1 + 2x_2 \leq 3$, $2x_1 + x_2 \leq 4$, and $x_1, x_2 \geq 0$.
- In an LPP, show that the set of feasible solutions is a convex set.
- In an LPP how an equality constraint is dealt with?
- What are the constraints in an assignment problem?
- Explain the term "dummy source" in a transportation problem.
- What is the use of uv -method?
- In an NLPP how Lagrangian is defined?

Q-3 (a) State and prove the fundamental theorem of linear programming. (06)

- A farmer has a supply of chemical fertilizer of Type-I which contains 10% Nitrogen, and 6% of Phosphoric acid and Type-II fertilizer which contains 5% Nitrogen and 10% Phosphoric acid. After testing the soil conditions of a field it is found that at least 14 kg of Nitrogen and 14 kg of Phosphoric acid is required for a good crop. The fertilizer of Type-I costs ₹ 2/kg and that of Type-II costs ₹ 3/kg. Using graphical method, determine how many kilograms of each fertilizer should be used such that the cost is minimum? (06)

(P.T.O.)

OR

- (b) Solve the following LPP by the simplex method: (06)

$$\text{Max } z = 4x_1 + 10x_2$$

subject to $2x_1 + x_2 \leq 50$, $2x_1 + 3x_2 \leq 90$, $2x_1 + 5x_2 \leq 100$, and $x_1, x_2 \geq 0$.

- Q-4 (a) Describe the Two-phase method for solving an LPP. (06)

- (b) Solve the following LPP by Big
- M
- method: (06)

$$\text{Max } z = 6x_1 + 4x_2$$

subject to $2x_1 + 3x_2 \leq 30$, $3x_1 + 2x_2 \leq 24$, $x_1 + x_2 \geq 3$, and $x_1, x_2 \geq 0$.

OR

- (b) Obtain the dual of the following problem: (06)

$$\text{Max } z = 5x_1 + 6x_2$$

subject to $x_1 + 2x_2 = 5$, $-x_1 + 5x_2 \geq 3$, $4x_1 + 7x_2 \leq 9$, and x_1 unrestricted, $x_2 \geq 0$.

- Q-5 (a) State various methods to obtain initial basic feasible solution to a transportation problem and describe any one of them. (06)

- (b) Obtain the initial basic feasible solution of the following transportation problem by Northwest-corner method. (06)

	D	E	F	G	Availability
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement	200	225	275	250	

OR

- (b) Solve the following assignment problem by Hungarian method. (06)

Men	Jobs			
	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

- Q-6 (a) Obtain the bordered Hessian matrix for the objective function (06)

$z = 2x_1 + 3x_2 - (x_1^2 + x_2^2 + x_3^2)$, the constraints are $x_1 + x_2 \leq 1$, $2x_1 + 3x_2 \leq 6$ and $x_1, x_2 \geq 0$.

- (b) What is meant by bordered Hessian matrix? Explain its use. (06)

OR

- (b) Obtain the conditions for
- $\text{Max } z = x_1^2 + 3x_2^2 + 5x_3^3$
- subject to (06)

$x_1 + 2x_2 + 3x_3 = 2$, $x_1 + 2x_2 + x_3 = 5$, and $x_1, x_2, x_3 \geq 0$.

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