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SARDAR PATEL UNIVERSITY

M.Sc. (Semester-III) Examination
October – 2016
Friday, 28 October 2016
Time: 02:00 PM to 5:00 PM
Subject: Mathematics
Course No.PS03EMTH13 (Operations Research)

Note: (1) All questions (including multiple choice questions) are to be answered in the answer book only.
(2) Numbers to the right indicate full marks of the respective question.

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

(1) An LPP must have
(a) an objective function (b) constraints
(c) decision variables (d) all of these

(2) The set of all feasible solutions to an LPP is
(a) finite (b) convex (c) rectangular (d) polygonal

(3) In the graphical method, optimal solution lies _____ the feasible region
(a) inside (b) on the edges of (c) on the vertices of (d) anywhere outside

(4) A basic solution to the system is called _____ if all basic variables are non-negative.
(a) non-degenerate (b) feasible
(c) degenerate (d) non-feasible

(5) In simplex method for a maximization problem optimal solution is reached if all
(a) $z_j - c_j \geq 0$ (b) $z_j - c_j > 0$ (c) $z_j - c_j < 0$ (d) $z_j - c_j \leq 0$

(6) Which of the following method is not suitable for solving in an assignment problem?
(a) Hungarian (b) complete evaluation (c) VAM (d) all of these

(7) If the demand is less than the availability in a TP then_____
(a) a dummy demand point zero cost is added.
(b) a dummy demand point with negative cost is added.
(c) a dummy source with zero cost is added.
(d) a dummy source with negative cost is added.

(8) An optimization problem is called an NLPP if
(a) the objective function is non-linear
(b) all constraints are linear
(c) all constraints are of '=' type
(d) none of the above

Q-2 Answer any **Seven.** (14)

(1) What are limitations of graphical method for solving an LPP?
(2) What is meant by canonical form of an LPP?
(3) What is use of an artificial variable?
(4) Define a convex set.
(5) What is meant by an initial basic feasible solution?
(6) Explain the term "dummy destination" in context of a transportation problem.
(7) Explain how an assignment problem can be regarded as a transportation problem.
(8) Describe the complete enumeration method for solving an assignment problem.
(9) What is bordered Hessian matrix?

Q-3

(a) State and prove Fundamental Theorem of Linear Programming. (06)

(b) A company produces pen drives and memory cards at two different factories. (06)
Daily production capacity at Factory A is 16 boxes of pen drives and 20 boxes of memory cards and at Factory B it is 12 boxes of pen drives and 20 boxes of memory cards. Daily running cost of Factory A and Factory B is Rs. 1000 and Rs. 800 respectively. Using graphical method find the number of days should each factory be operated so that 96 boxes of pen drives and 140 boxes of memory cards manufactured at a minimum cost.

OR

(b) Using simplex method solve the system: $x_1 + x_2 = 1, 2x_1 + x_2 = 3$.

Q-4

(a) Describe the steps in simplex method of solving an LPP. (06)

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

$\text{Max } Z = x_1 - 3x_2 - 2x_3$
subject to $3x_1 - x_2 + 2x_3 \leq 7,\ 2x_1 - 4x_2 \geq 12,\ -4x_1 + 3x_2 + 8x_3 = 10$
$x_1, x_2 \geq 0$ and x_3 unrestricted in sign.

OR

(b) Using two-phase method show that the following LPP has no feasible solution:
Max. $Z = 5x_1 + 3x_2$ subject to $2x_1 + x_2 \leq 0, x_1 + 4x_2 \geq 6$ and $x_1, x_2, x_3 \geq 0$.

Q-5

(a) State various methods to obtain initial basic feasible solution to a transportation problem. Describe any one. (06)

(b) Express the following transportation problem as a linear programming problem (06)

	D1	D2	D3	D4	Availability
O1	11	13	17	14	250
O2	16	18	14	10	300
O3	21	24	13	10	400
Demand	200	225	275	250	

OR

(b) Solve the following TP using an appropriate method

	D1	D2	D3	D4	D5	Availability
Mumbai	20	18	18	21	19	100
Delhi	21	22	23	20	24	125
Kolkata	18	19	21	18	19	175
Requirement	60	80	85	105	70	

Q-6

(a) Using Hungarian method solve the following assignment problem. (06)

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

(b) Discuss graphical representation of the following NLPP (06)
Max. $f(x_1, x_2) = x_1^2 + x_2^2$ s. t. $x_2^2 - x_1 \leq 1,\ x_1 + x_2 \leq 2;\ x_1, x_2 \geq 0$

OR

(b) Obtain bordered Hessian matrix for the following NLPP:
Optimize $z = 4x_1 + 9x_2 - x_1^2 - x_2^2$ subject to the constraints
$4x_1 + 3x_2 = 15,\ 3x_1 + 5x_2 = 14$ and $x_1, x_2 \geq 0$.

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