PD-364-S.E.-CV-19

M.A./M.Sc. MATHEMATICS (3rd Semester)

Examination, Dec.-2020

Paper-V

OPERATON RESEARCH-I

Time : Three Hours] **[Maximum Marks : 80**

Note : Answer from both the Sections as directed. The figures in the right-hand margin indicate marks.

Section-A

1. **Choose the correct Answer:-** 1x10=10

(a) **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

(b) **If dual has unbounded solution, primal has.**

(i) an unbounded solution (ii) an infeasible solution

(iii) a feasible solution (iv) none of the above

(c) **Dual simplex method is applicable to these Lpp's that start with.**

(i) an infeasible solution (ii) an infeasible but optimum solution

(iii) a feasible solution (iv) a feasible and optimum solution

(d) **Given a system of m simultaneous linear equations in n unknown $(m < n)$, the number of basic variable will be.**

(i) m (ii) n (iii) n-m (iv) n+m

(e) **Deviational variables in goal programming problem must satisfy following conditions:**

(i) $d_i^+ + d_i^- = 0$ (ii) $d_i^+ - d_i^- = 0$ (iii) $d_i^+ \times d_i^- = 0$ (iv) $d_i^+ \div d_i^- = 0$

(f) **Karmarkar's algorithm.**

(i) cuts across the interior of the solution space (ii) reduces the number of iterations

(iii) is suitable for extremely large linear programming problems (iv) all of the above

(g) **While solving a transportation problem, the occurrence of degeneracy means that.**

(i) total supply equals total demand (ii) the solution so obtained is not feasible

(iii) the few allocations become negative (iv) none of the above

(h) **The method used for solving an assignment problem is called.**

(i) MODI method (ii) reduced matrix method

(iii) Hundarian method (iv) none of the above

(i) **A minimal spanning tree involves.**

(i) all the nodes with cycles allowed (ii) all the nodes with cycles not allowed

(iii) the shortest path between starting and ending nodes

(iv) a connected network with all directed potential links

(j) **The term commonly used for activity slack time is.**

(i) free float (ii) independent float (iii) total float (iv) all of the above

2. **Answer the following questions:-** 2x5=10

(a) **Define slack and surplus variables in L.P.P.**

(b) **Prove that the dual of the dual of a given primal is again primal.**

(c) **Write a short note on parametric linear programming.**

(d) **Explain North-West corner method to solve transportation problem for an initial solution.**

(e) **Explain the following:**

(i) a tree (ii) a spanning tree

Section-B

12x5=60

Answer all questions.

3. Solve the following L.P.P. by using simplex method.

Maximize $z = 5x_1 + 4x_2$

Subject to the constraints:

$4x_1 + 5x_2 \leq 10$, $3x_1 + 2x_2 \leq 9$, $8x_1 + 3x_2 \leq 12$

$x_1 \geq 0$ *and* $x_2 \geq 0$

OR

Use penalty method to solve the following L.P.P.-

Maximize $z = 2x_1 + 3x_2$

Subject to the constraints:

$x_1 + 2x_2 \leq 4$, $x_1 + x_2 = 9$; $x_1 \geq 0$ *and* $x_2 \geq 0$

4. Write down the dual of the following L.P.P. and solve

Maximize $z = 8x_1 + 4x_2$

Subject to the constraints:

$4x_1 + 2x_2 \leq 30$, $2x_1 + 4x_2 \leq 24$, x_1 *and* $x_2 \geq 0$

OR

Use dual simplex method to solve the L.P.P.

Maximize $z = x_1 + 2x_2 + 3x_3$

Subject to the constraints:

$x_1 - x_2 + x_3 \geq 4$, $x_1 + x_2 + 2x_3 \leq 8$,

$x_2 - x_3 \geq 2$; $x_1, x_2, x_3 \geq 0$

5. Using the bounded variable technique, solve the following L.P.P.

Maximize $z = x_2 + 3x_3$

Subject to the constraints:

$x_1 + x_2 + x_3 \leq 10$, $x_1 - 2x_3 \geq 0$, $2x_2 - x_3 \leq 10$,

$0 \leq x_1 \leq 8$, $0 \leq x_2 \leq 4$, $x_3 \geq 0$

OR

For the following L.P.P.

Maximize $z = (3 - 6\lambda)x_1 + (2 - 2\lambda)x_2 + (5 - 5\lambda)x_3$

Subject to the constraints:

$x_1 + 2x_2 + x_3 \leq 430$, $3x_1 + 2x_3 \leq 460$,

$x_1 + 4x_2 \leq 420$, $x_1, x_2, x_3 \geq 0$

find the range of λ over the solution remains basic and optimal.

6. Consider a transportation problem with m=3 and n=4, where:

$c_{11} = 2$, $c_{12} = 3$, $c_{13} = 11$, $c_{14} = 7$

$c_{21} = 1$, $c_{22} = 0$, $c_{23} = 6$, $c_{24} = 1$

$c_{31} = 5$, $c_{32} = 8$, $c_{33} = 15$, $c_{34} = 9$

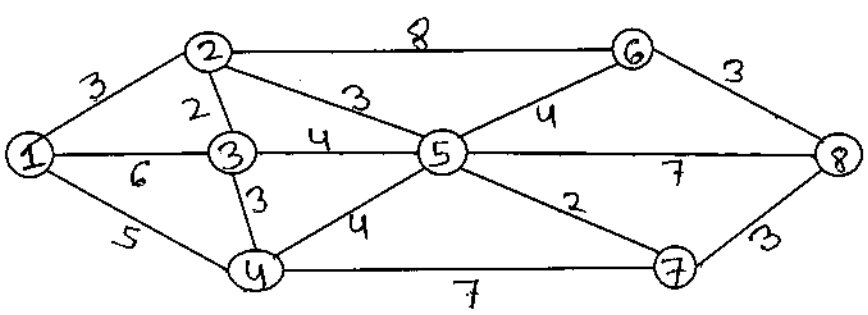
Suppose $s_1 = 6$, $s_2 = 1$ and $s_3 = 10$ where $D_1 = 7$, $D_2 = 5$, $D_3 = 3$, and $D_4 = 2$, Apply the transportation simplex method to find out an optimal solution.

OR

Solve the following assignment problem:

	M_1	M_2	M_3	M_4
J_1	5	8	3	2
J_2	10	7	5	8
J_3	4	10	12	10
J_4	8	6	9	4

7. Consider the following network



The distance (in miles) between different stations is shown on each link, determine the shortest route from station 1 to 8.

OR

A small project consists of seven activities for which relevant data are given below:

Activity	Preceding Activities	Activity Duration (Days)
A	-	4
B	-	7
C	-	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

(i) Draw the network and find the project completion time.
(ii) Calculate total float for each of the activities and highlight the critical path.
(iii) Draw the time scaled diagram.