M.Sc. - II (Mathematics) (New CBCS Pattern) Semester-IV

PSCMTH20A - Operations Research-II

P. Pages : 3 **GUG/S/25/13775**

Time : Three Hours Max. Marks : 100

Notes : 1. Solve all the **five** questions.
2. Each questions carry equal marks.

UNIT – I

1. a) Find the optimum integer solution to the LPP: **10**

Maximize $z = x_1 + 4x_2$

Subject to the constraints:

$$2x_1 + 4x_2 \le 7,$$
$$5x_1 + 3x_2 \le 15,$$
$$x_1, x_2 \ge 0$$

& are integers.

b) Solve the mixed integer programming problem: **10**

Maximize $z = 4x_1 + 6x_2 + 2x_3$

Subject to the constraints:

$$4x_1 - 4x_2 \le 5,$$
$$-x_1 + 6x_2 \le 5,$$
$$-x_1 + x_2 + x_3 \le 5$$
$$x_1, x_2, x_3 \ge 0,$$
$$x_1 \& x_3$$

are integers.

OR

c) Use branch & bound method to solve the linear programming problem. **10**

Maximize $z = 2x_1 + 3x_2$

Subject to the constraints:

$$5x_1 + 7x_2 \le 35,$$
$$4x_1 + 9x_2 \le 36,$$
$$x_1, x_2 \ge 0$$

& are integers.

d) Solve the LPP: **10**

Maximize $z = 11x_1 + 4x_2$

Subject to the constraints:

$$-x_1 + 2x_2 \le 4,$$
$$5x_1 + 2x_2 \le 16,$$
$$2x_1 - x_2 \le 4,$$
$$x_1, x_2$$

are non zero integers.

UNIT – II

2. a) Use revised simplex method to solve the LPP: **10**

Minimize $z = x_1 + x_2$

Subject to the constraints:

$$x_1 + 2x_2 \geq 7,$$
$$4x_1 + x_2 \geq 6,$$
$$x_1, x_2 \geq 0$$

b) Use simplex method to solve the goal programming problem. **10**

Minimize $z = p_1 d_1^- + p_2\left(2d_2^- + d_3^-\right) + p_3 d_1^+$

Subject to constraints:

$$x_1 + x_2 + d_1^- - d_1^+ = 400,$$
$$x_1 + d_2^- = 240, x_2 + d_3^- = 300,$$
$$x_1, x_2, d_1^-,$$
$$d_1^+, d_2^-, d_3^- \geq 0$$

OR

c) Solve the LPP: **10**

Maximize $(5x_1 + 3x_2)(5x_1 + 2x_2 + 1)$

Subject to constraints:

$$3x_1 + 5x_2 \leq 15,$$
$$5x_1 + 2x_2 \leq 10,$$
$$x_1, x_2 \geq 0$$

d) Solve the LPP: **10**

Maximize $z = \dfrac{5x_1 + 2x_2}{x_1 + 8x_2 + 1}$

Subject to constraints:

$$3x_1 + x_2 \geq 1,$$
$$x_1, x_2 \geq 0$$

UNIT – III

3. a) Explain the optimum sequence algorithm for processing n jobs through two machines. **10**

b) In a factory there are 6 jobs to perform, each of which should go through two machines A & B in the order A, B. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time, T. What is the value of T? **10**

Job:	J_1	J_2	J_3	J_4	J_5	J_6
Machine A:	1	3	8	5	6	3
Machine B:	5	6	3	2	2	10

OR

c) Discuss the operating characteristics of a queueing system. **10**

d) In a railway marshaling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate. **10**

i) The mean queue size (line length)

ii) The probability that the queue size exceeds 10.

UNIT – IV

4. a) Explain the general Nonlinear Programming Problem (NLPP). **10**

b) Obtain the set of necessary conditions for the NLPP: **10**

Maximize $z = x_1^2 + 3x_2^2 + 5x_3^2$

Subject to the constraints:

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

OR

c) Use Beale's method to solve the NLPP: **10**

Minimize $z = 6 - 6x_1 + 2x_1^2 - 2x_1x_2 + 2x_2^2$

Subject to the constraints : $x_1 + x_2 \leq 2$ & $x_1, x_2 \geq 0$

d) Use separable convex programming to solve the NLPP: **10**

Maximize $f(x) = 3x_1 + 2x_2$

Subject to the constraints : $g(x) = 4x_1^2 + x_2^2 \leq 16$ & $x_1, x_2 \geq 0$

5. a) Explain the construction of Gomory's constraints. **5**

b) What are the steps of graphical goal attainment method. **5**

c) What are the operating characteristics of a queuing system. **5**

d) Define the saddle point of a pay off matrix & saddle value problem. **5**

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