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22MAU516

PSG COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025

(Fifth Semester)

Branch – **MATHEMATICS**

OPERATIONS RESEARCH - I

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 In the primal problem has n constraints and m variable then the number of variables in the dual problem is _____.

(i) m (ii) n

(iii) $m+n$ (iv) $m-n$

2 _____ method is to determine whether the current basic feasible solution of the transportation problem is optimal or not.

(i) Northwest corner (ii) Least cost

(iii) Vogel's approximation (iv) Modi

3 In a _____ integer model, the solution values of the decision variables are 0 or 1.

(i) Pure (ii) 0-1

(iii)Mixed (iv) Pure and Mixed

4 If $t_p = 14,\ t_0 = 2$, then the variance is _____:

(i) 4 (ii) 1

(iii) 2 (iv) 3

5 When a positive quantity K is divided into 5 parts, the maximum value of their product is _____.

(i) 5K (ii) $(K/5)^5$

(iii) $(5K)^5$ (iv) $(K/5)^2$

SECTION - B (15 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a Write the algorithm to solve a LPP in two – phase simplex method.

OR

b Write the dual of the following LPP:

$Maximize\ Z = x_1 - x_2 + 3x_3$ Subject to the constraints:

$x_1 + x_2 + x_3 \leq 10\ ;\ 2x_1 - x_3 \leq 2;\ 2x_1 - 2x_2 + 3x_3 \leq 6,\quad x_1, x_2, x_3 \geq 0.$

7 a Obtain an Initial basic feasible solution for the following TP by Least Cost method.

	A	B	C	D	Capacity
X	1	2	3	4	6
Y	4	3	2	0	8
Z	0	2	2	1	10
Demand	4	6	8	6	

OR

b Explain the Mathematical formulation of the assignment problem.

8 a Consider the following production data:

Product	Profit per unit (Rs.)	Direct labour requirement (hours)
1	6	12
2	8	11
3	5	14

Cont...

Fixed cost (Rs.)	Direct labour requirement
8,000	Up to 10,000 hours
16,000	10,000 to 20,000 hours
22,000	20,000 to 30,000 hours

Formulate an integer programming problem to determine the production schedule so as to maximize the total net profit.

OR

b Write an algorithm to solve Branch and bound method.

9 a Define i) Optimistic time ii) Pessimistic time iii) Most likely time

OR

b Construct a network diagram for the following data:

Activity	A	B	C	D	E	F	G	H	I	J
Preceding activities	-	A	A	B	A	B,E	C	D,F	G	H,I

10 a Explain the steps for solving Dynamic Programming Problem.

OR

b Use Dynamic programming to solve the following problem:

Minimize $Z = y_1^2 + y_2^2 + y_3^2$ Subject to the constraints:

$y_1 + y_2 + y_3 \geq 15$; $y_1, y_2, y_3 \geq 0$.

SECTION - C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a Use two – phase simplex method to solve the following LPP

Maximize $Z = 5x_1 - 4x_2 + 3x_3$ Subject to the constraints:

$2x_1 + x_2 - 6x_3 = 20$; $6x_1 + 5x_2 + 10x_3 \leq 76$; $8x_1 - 3x_2 + 6x_3 \leq 50$, $x_1, x_2, x_3 \geq 0$.

OR

b Write the dual of the following LPP:

Maximize $Z = 3x_1 - 2x_2 + 4x_3$ Subject to the constraints:

$3x_1 + 5x_2 + 4x_3 \geq 7$; $6x_1 + x_2 + 3x_3 \geq 4$; $7x_1 - 2x_2 - x_3 \leq 10$,

$x_1 - 2x_2 + 5x_3 \geq 3$; $4x_1 + 7x_2 - 2x_3 \geq 2$; $x_1, x_2, x_3 \geq 0$.

12 a Obtain an Optimum basic feasible solution for the following TP:

	D	E	F	G	Supply
A	42	48	38	37	160
B	40	49	52	51	150
C	39	38	40	43	190
Demand	80	90	110	160	

OR

b Find an Optimum assignment and the maximum sales for the following assignment problem:

	A	B	C	D
P	140	112	98	154
Q	90	72	63	99
R	110	88	77	121
S	80	64	56	88

13 a Use Branch and bound method to solve the following IPP:

Maximize $Z = 2x_1 + 2x_2$ Subject to the constraints:

$5x_1 + 3x_2 \leq 8$; $x_1 + 2x_2 \leq 4$; $x_1, x_2 \geq 0$ and are integers.

OR

b Use Branch and bound method to solve the following IPP:

Minimize $Z = 4x_1 + 3x_2$ Subject to the constraints:

$5x_1 + 3x_2 \geq 30$; $x_1 \leq 4$; $x_2 \leq 6$ $x_1, x_2 \geq 0$ and are integers.

14 a For the data given below:

Activity	1 - 2	1 – 3	2 - 3	2 - 4	3 - 4	4 - 5
Duration	20	25	10	12	6	10

Draw the network and calculate the length and variance of the critical path.

OR

b Three time estimates of all activities of a project are given below:

Activity	1 - 2	1 – 3	1 - 4	2 - 5	3 - 5	4 - 6	5 – 6
t_0	1	1	2	1	2	2	3
t_m	1	4	2	1	5	5	6
t_p	7	7	8	1	14	8	15

Draw the network and calculate the length and variance of the critical path.

15 a Use Dynamic Programming to show that $Z = p_1 log p_1 + p_2 log p_2 + \cdots + p_n log p_n$ Subject to the constraints: $p_1 + p_2 + \cdots + p_n = 1$ and $p_j \geq 0$ is maximum, when $p_1 = p_2 = \cdots = p_n = 1/n$.

OR

b Use Dynamic Programming to solve the following problem

Minimize $Z = = y_1^2 + y_2^2 + \cdots y_n^2$ Subject to the constraints:

$y_1 . y_2 . y_3 \ldots = c$; $y_j \geq 0$, $i = 1,2,3 \ldots . n$.

Z-Z-Z

END