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T.Y. B.Sc. (Semester – III) Examination, 2009
MATHEMATICS (Paper – VII) (MT-337)
A) Operations Research – I
B) Graph Theory
C) Computational Mathematics – I
D) Combinatorics
(2004 Pattern)

Time : 2 Hours Max. Marks : 40

***Note** : 1) Candidates are advised to see the relevant question paper and solve the same.*
*2) **Use** of logarithmic tables and calculators is **allowed**.*
*3) **All** questions are **compulsory**.*
*4) Graph paper will be **supplied** on demand.*
*5) Figures to the **right** indicate **full** marks.*

A) Operations Research – I

1. Attempt the following : **10**

i) Define a standard form of LPP.

ii) What is the difference between slack and surplus variables.

iii) When do we use artificial variable in simplex method ?

iv) What is an unbalanced transportation problem ?

v) What is the condition that the transportation problem has an alternate optimum solution ?

vi) What is an assignment problem ?

vii) Write two applications of duality in LPP.

viii) True/False. Every transportation problem is an assignment problem.

ix) Find a feasible region of the following LPP.

Maximize $Z = x_1 + 2x_2$
Subject to,
$x_1 = 2, x_2 = 3$

x) What do you mean by degeneracy in a transportation problem ?

P.T.O.

2. Attempt **any two** of the following : **10**

i) Wild West produces two types of cowboy hats. Type 1 hat requires twice as much labour time as does each of type 2. If all produced hats are of type 2 only, the company can produce a total of 400 hats a day. The market daily limits are 150 and 200 hats for type 1 and 2 respectively. The profit per type 1 hat is Rs. 8 and that of type 2 hat is Rs. 5. Formulate the problem as a linear programming so as to maximize the profit.

ii) Solve the following linear programming problem by simplex method.

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to,

$x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0$

iii) Determine all the basic solutions to the following system of linear equation.

$x_1 + 2x_2 + x_3 = 4$

$2x_1 + x_2 + 5x_3 = 5$

3. Attempt **any two** of the following : **10**

i) Solve the following assignment problem.

		Operator				
		I	**II**	**III**	**IV**	**V**
	A	10	5	13	15	16
Machines	**B**	3	9	18	3	6
	C	10	7	2	2	2
	D	5	11	9	7	12
	E	7	9	10	4	12

ii) Find the initial basic feasible solution by VAM.

	1	**2**	**3**	**4**	**Supply**
1	3	4	6	3	30
2	3	5	7	10	50
3	2	6	5	7	70
Demand	22	44	41	43	

iii) Find optimal solution of the following transportation problem.

		Destination				
		D_1	D_2	D_3	D_4	**Supply**
Origin	O_1	1	2	1	4	30
	O_2	3	3	2	1	50
	O_3	4	2	5	9	20
	Demand	20	40	30	10	

4. Attempt **any one** of the following : **10**

i) Use Big-M method to solve the following linear programming problem.

Maximize $Z = -2x_1 - x_2$

Subject to,

$3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 4$

$x_1 \geq 0, x_2 \geq 0.$

ii) A company has three plants and four warehouses. The supply and demand in units and corresponding transportation cost are given with a solution.

Plants	Warehouses				Supply
	I	II	III	IV	
A	5	10	4 (10)	5	10
B	6 (20)	8	7	2 (5)	25
C	4 (5)	2 (10)	5 (5)	7	20
Demand	25	10	15	5	55

Answer the following questions giving reason.

a) Is this solution feasible ?

b) Is this solution degenerate ?

c) In this solution optimal ?

d) Does this problem have more than one optimal solution ? If so find an alternate solution.

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