S.Y.B.Sc.(Computer Science) Sem-IV

USCSMT-242: Operations Research

Time: 2 Hours] **[Max marks: 35**

Instructions for candidates:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Non-programmable, single-memory scientific calculator is allowed.

Q.1) Attempt any five questions of the following [5x2=10]

a) Write the standard form of the following Linear Programming Problem:

Minimize $Z = 2x_1 + 4x_2 + x_3$

Subject to $x_1 + 2x_2 - x_3 \leq 5$

$2x_1 - x_2 + 2x_3 = 2$

$-x_1 + 2x_2 + 2x_3 \geq 1$

$x_1, x_2, x_3 \geq 0$

b) Use north-west corner rule to obtain Initial Basic Feasible solution of the following transportation problem:

Origin\Destination	D_1	D_2	D_3	Supply
O_1	13	15	16	17
O_2	7	11	2	12
O_3	19	20	9	16
Demand	14	8	23	45

c) Define Slack Variable and Surplus Variable.

d) Write dual form of the following Linear Programming Problem:

Maximize: $Z = 3x_1 + x_2 + x_3$

Subject to: $x_1 - 2x_2 + x_3 \leq 11$

$-4x_1 + x_2 + 2x_3 \geq 3$

$2x_1 - x_3 = -1,$

$x_1, x_2, x_3 \geq 0$

e) Draw a feasible region for the following constraints.

$x_1 + 2x_2 \leq 20$

$x_1 + x_2 \leq 12$

$x_1 \geq 0, x_2 \geq 0$

f) Find an Initial Basic Feasible solution to the following Transportation Problem

Origin\Destination	D_1	D_2	D_3	Supply
O_1	5	1	8	12
O_2	2	4	0	14
O_3	3	6	7	4
Demand	9	10	11	30

g) Solve the following Assignment Problem.

Person\Task	P	Q	R
A	120	100	80
B	80	90	110
C	110	140	120

Q.2) Attempt any three questions of the following. [3x5=15]

a) Solve the following linear programming problem by Simplex Method.

Maximum $Z = 40x_1 + 35x_2$

Subject to $2x_1 + 3x_2 \leq 60$

$4x_1 + 3x_2 \leq 96$

$x_1, x_2 \geq 0$

b) Find an Initial Basic Feasible solution to the following Transportation Problem using Vogel's Approximation method.

Factory\Warehouse	W_1	W_2	W_3	W_4	Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Requirement	5	8	7	14	34

c) Solve the following assignment problem.

Person\Job	I	II	III	IV	V
A	8	4	2	6	1
B	0	9	5	5	4
C	3	8	9	2	6
D	4	3	1	0	3
E	9	5	8	9	5

d) Solve the following Degeneracy example of LLP by simplex method.

Maximize $Z = 30x + 20y$

Subject to $6x + 8y \leq 480$

$3x + 3y \leq 240$
$x \geq 0, y \geq 0$

e) Solve the following Assignment Problem.

Machines / Operators	I	II	III	IV
A	5	5	-	2
B	7	4	2	3
C	9	3	5	-
D	7	2	6	7

Q.3) Attempt any one question of the following [1x10=10]

1) a) Obtain optimal solution of following Transportation Problem by modified distribution method.

Warehouse / Factory	W_1	W_2	W_3	W_4
F_1	19 (5)	30	50	10 (2)
F_2	70	30	40 (7)	60 (2)
F_3	40	8 (8)	70	20 (10)

b) Solve the assignment problem for maximum cost.

Zone / Salesmen	Z1	Z2	Z3	Z4
S1	4	5	6	7
S2	5	5	7	7
S3	7	6	7	9
S4	8	9	10	10

2) Solve the following linear programming problem by Big-M Method.

Maximize $Z = 4x_1 + x_2$
Subject to $3x_1 + x_2 = 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 4$
$x_1, x_2 \geq 0$

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