SOLUTION MID 2

Q:1(a)

$$\max: Z = -5x_1 - 25x_2 - 20x_3$$

$$x_1 - x_2 + x_3 \leq -2$$

$$-x_1 + 3x_2 \leq -3$$

$$x_1, x_2, x_3 \geq 0 \qquad \text{(1 mark)}$$

Adding slack variables

$$x_1 - x_2 - x_3 + x_4 = -2$$

$$-x_1 + 3x_2 + x_5 = -3$$

$$x_i \geq 0 \quad i = 1, 2, \ldots, 5$$

Basic	x_1	x_2	x_3	x_4	x_5	Sol
Z	5	25	20	0	0	0
x_4	1	-1	-1	1	0	-2
← x_5	-1	3	0	0	1	-3
Ratio	$\left\lvert\frac{5}{-1}\right\rvert$					

(3 marks)

Z	0	40	20	0	5	-15
← x_4	0	2	-1	1	1	-5
x_1	1	-3	0	0	-1	3
Ratio	-	[illegible]	$\left\lvert\frac{20}{-1}\right\rvert$	-	[illegible]	

(3 marks)

Z	0	80	0	20	25	-115
x_3	0	-2	1	-1	-1	5
x_1	1	-3	0	1	-1	3

Optimal and feasible solution is

$$x_1 = 3, \quad x_2 = 0, \quad x_3 = 5 \qquad \text{(1 mark)}$$

$$Z_{max} = -115$$

b.-

Primal $\min Z = x_1 + x_2$

$+x_1 - x_3 = 6 \rightarrow y_1$

$x_2 - x_4 = 6 \rightarrow y_2$

$-x_1 - x_2 - x_5 = -11 \rightarrow y_3$

$x_i \geq 0.$

Dual

$\max w = 6y_1 + 6y_2 - 11y_3$

$y_1 - y_3 \leq 1$

$y_2 - y_3 \leq 1$

$y_1, y_2, y_3 \geq 0$

Solving dual

Basic	y_1	y_2	y_3	y_4	y_5	Sol.
W	-6	-6	11	0	0	0
y_4	1	0	-1	1	0	1
y_5	0	1	-1	0	1	1

(y_3 is a non basic var whose column containts negative enteries;

$\Rightarrow$ dual is unbouded.

which shows that primal is infeasible.

OR Using simplex method.

Basic	y_1	y_2	y_3	y_4	y_5	Sol.
W	0	-6	5	6	0	6
y_1	1	0	-1	1	0	1
$\leftarrow y_5$	0	1	-1	0	1	1
W	0	0	-1	6	6	12
y_1	1	0	-1	1	0	1
y_2	0	1	-1	0	1	1

Dual is unbounded

$\Rightarrow$ primal is infeasible.

Q2

North West Corner method

	1	2	3	
1	9 (5)	3 (1)	8	12 ~~5~~
2	2	7 (4)	7 (0)	14 ~~4~~
3	3	6	4 (7)	4
	~~9~~	~~6~~ 7	~~4~~ 4	

(2 marks)

Transportation Cost = 45 + 3 + 28 + 28

= $104

Least Cost method

	1	2	3	
1	2 (5)	10 (1)	8	~~12~~ 2
2	3 (2)	~~4~~	11 (0)	~~14~~ ~~5~~
3	4 (3)	~~6~~	~~7~~	~~4~~
	2 ~~6~~ ~~9~~	10	~~4~~	

(2marks)

Transportation Cost = 10 + 10 + 6 + 12 =

$38

VAM

	1	2	3				
1	5	1	8	12	4	4	4
2	3 (2)	~~4~~	11 (0)	~~14~~ ~~5~~	2	2	2
3	4 (3)	~~6~~	~~7~~	~~4~~	3	(3)	–
	2 ~~5~~ ~~9~~	10	11		1	2	

(3marks)

	1	3	(7)
	1	3	–
	(3)	3	

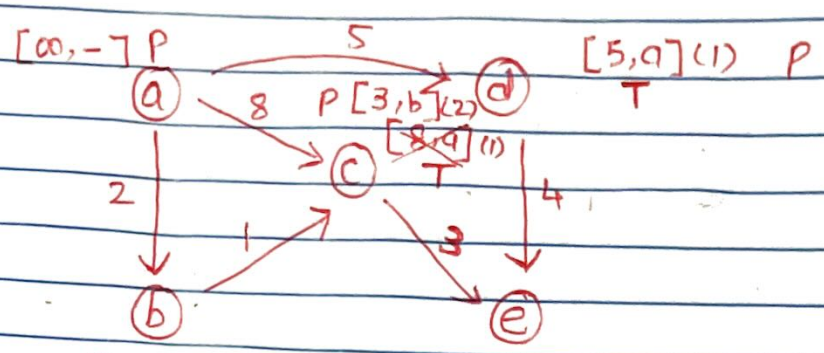
1	5	1	12
	2	10	
	2	10	

Transportation Cost = $38.

NW Corner method gives the worst T.C.

(1 mark)

Q3



P [2,a] (1)

P ~~T~~ [6,c] (3)
~~T~~ [9,d] (4)

Node	Label	status
a	[∞,-]	P
b	[2,a]	T → P
d	[5,a]	T

a	[0, -]	P
b	[2, a]	P
c	[3, b]	T → P
d	[5, a]	T

a	[0, -]	P
b	[2, a]	P
c	[3, b]	P
d	[5, a]	T → P
e	[6, c]	T

a	[0, -]	P
b	[2, a]	P
c	[3, b]	P
d	[5, a]	P
e	[6, c]	P

Route a → b → c → e