NAME:- Muhammad USMAN Khan

ID NO:- 15038

Semester:- BS (SE) 4th Section:- A.

Q) There are total of 5 machines and five employements are to be relegated and the related cost network is as per the following. Located the best possible task

Solution:-

		Machines				
J O B S		A	B	C	D	E
	1	6	12	3	11	15
	2	4	2	7	1	10
	3	8	11	10	7	11
	4	16	19	122	23	21
	5	9	5	7	6	10

Balanced assignment problem

Hungerian method

Phase I:- Row and column reduction

Step 0:- subtract the minimum value of each row from the enteries of that column

Phase (2) optimation of the problem

a) Row scaning

b) Column scaning

Row min

		Machines					
		A	B	C	D	E	
J	1	6	12	3	11	15	3
O	2	4	2	7	1	10	1
B	3	8	11	10	7	11	7
S	4	16	19	122	23	21	16
	5	9	5	7	6	10	5

		Machines				
		A	B	C	D	E
J	1	3	9	0	8	12
O	2	3	1	6	0	9
B	3	1	4	3	0	4
S	4	0	3	106	7	5
	5	4	0	2	1	5
		0	0	0	0	4

Columns minimum:

		Machines					
		A	B	C	D	E	
J	1	3	9	$\boxed{0}$	8	8	→ Row scanning
O	2	3	1	6	$\boxed{0}$	5	
B	3	1	4	3	0	$\boxed{0}$	→ column scanning
S	4	$\boxed{0}$	3	106	7	1	
	5	4	$\boxed{0}$	2	1	1	

Page no.

	Machines					
	A	B	C	D	E	
1	6	12	$\boxed{3}$	11	15	
2	4	2	7	$\boxed{1}$	10	
3	8	11	10	7	$\boxed{11}$	
4	$\boxed{16}$	19	22	23	21	
5	9	$\boxed{5}$	7	6	10	

JOBS

Job	Machines	Times
1	C	3
2	D	1
3	E	11
4	A	16
5	B	5

Total hours:- 36

Solution is optimal and Job machine operator.

Q2) minimize $= 2x_1 + 3x_2$

subj $= (1/2)x_1 + (1/4)x_2 \leq 4$

$x_1 + 3x_2 \geq 20$

$x_1 + x_2 = 10$

$x_1, x_2 \geq 0.$

Solution:- $(1/2)x_1 + 1/4 x_2 + s_1 = 4.$

$x_1 + 3x_2 - s_2 + a_1 = 20$

$x_1 + x_2 + a_2 = 10$

$z = -2x_1 - 3x_2$

$z = -2x_1 - 3x_2 - mA_1 - mA_2$

$z + 2x_1 + 3x_2 + mA_1 + mA_2 = 0$

$2x_1 + 3x_2 + mA_1 + mA_2 + z = 0$

	x_1	x_2	s_1	s_2	a_1	a_2	z	
$\to R_1$	1/2	1/4	1	0	0	0	0	4
$\to R_2$	1	3	0	-1	1	0	0	20
$\to R_3$	1	1	0	0	0	1	0	10
$\to R_4$	2	3	0	0	m	m	1	0

$R_4 + (-mR_3)$

2	3	0	0	m	m	1	0
-m	-m	0	0	0	-m	0	-10m
2-m	3-m	0	0	m	0	1	-10m

x_1	x_2	s_1	s_2	a_1	a_2	z	
$\frac{1}{2}$	$\frac{1}{4}$	1	0	0	0	0	4
1	3	0	-1	1	0	0	20
1	1	0	0	0	1	0	10
2 - m	3-m	0	0	m	0	1	-10m

$R_4 + (-mR_2)$

$$\begin{array}{cccccccc} 2-m & 3-m & 0 & 0 & m & 0 & 1 & -10m \\ -m & -3m & 0 & m & -m & 0 & 0 & -20m \\ \hline 2-2m & 3-4m & 0 & m & 0 & 0 & 1 & -30m \end{array}$$

x_1	x_2	s_1	s_2	a_1	a_2	z	
$\frac{1}{2}$	$\frac{1}{4}$	1	0	0	0	0	4 = 16
1	$\boxed{3}$	0	-1	1	0	0	20
1	1	0	0	0	1	0	10
2-2m	3-4m	0	m	0	0	1	-30m

× 4 to R_1

x_1	x_2	s_1	s_2	a_1	a_2	z	
2	1	4	0	0	0	0	16
1	3	0	-1	1	0	0	20
1	1	0	0	0	1	0	10
2-2m	3-4m	0	m	0	0	1	-30m

$\times \frac{1}{3}$ to R_2

x_1	x_2	s_1	s_2	a_1	a_2	z	
2	1	4	0	0	0	0	16
$\frac{1}{3}$	1	0	$-\frac{1}{3}$	$\frac{1}{3}$	0	0	$\frac{20}{3}$
1	1	0	0	0	1	0	10
2-2m	3-4m	0	m	0	0	1	-30m

$R_1 + (-1 R_2)$

2	1	4	0	0	0	0		16
$-\frac{1}{3}$	-1	0	$\frac{1}{3}$	$-\frac{1}{3}$	0	0		$-\frac{20}{3}$
$\frac{5}{3}$	0	4	$\frac{1}{3}$	$-\frac{1}{3}$	0	0		$\frac{28}{3}$

x_1	x_2	s_1	s_2	a_1	a_2	z	
$\frac{5}{3}$	0	4	$\frac{1}{3}$	$-\frac{1}{3}$	0	0	$\frac{28}{3}$
$\frac{1}{3}$	1	0	$-\frac{1}{3}$	$\frac{1}{3}$	0	0	$\frac{20}{3}$
1	1	0	0	0	1	0	10
2-2m	3-4m	0	m	0	0	1	-30m

$R_3 + (-1\, R_2)$

1	1	0	0	0	1	0	10
$-1/3$	-1	0	$1/3$	$-1/3$	0	0	$-20/3$
$2/3$	0	0	$1/3$	$-1/3$	1	0	$10/3$

x_1	x_2	s_1	s_2	a_1	a_2	z	
$5/3$	0	4	$1/3$	$-1/3$	0	0	$28/3$
$1/3$	1	0	$-1/3$	$1/3$	0	0	$20/3$
$2/3$	0	0	$1/3$	$-1/3$	1	0	$10/3$
$2-2m$	$3-4m$	0	m	0	0	1	$-30m$

$R_4 + (-(3-4m\, R_2))$

$2-2m$	$3-4m$	0	m	0	0	1	$-30m$
$-1+4m$	$-3+4m$	0	$1-4m$	$-1+4m$	0	0	$-10+80m$
$1+2m$	0	0	$1-3m$	$1+4m$	0	1	$-10+50m$

	x_1	x_2	s_1	s_2	a_1	a_2	z	
x_2	$5/3$	0	4	$1/3$	$-1/3$	0	0	$28/3$
s_1	$1/3$	1	0	$-1/3$	$1/3$	0	0	$20/3$
a_2	$2/3$	0	0	$1/3$	$-1/3$	1	0	$10/3$
z	$1+2m$	0	0	$1-3m$	$1+4m$	0	1	$-10+50m$

$x_2 = \boxed{28/3}$

$s_1 = \boxed{20/3}$ $\qquad z = \boxed{-10+50m}$

$a_2 = \boxed{10/3}$

Solution.

Q3. Use Vogel's Method to obtain the initial feasible solution of :-

	Destination				
Origin	1	2	3	4	Supply
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Demand	60	40	30	110	240

240 \ 240

Demand = Supply

(Balanced transportation problem)

	A	B	C	D	supply				
	[10] 20 ×	[40] 22	× 17	[80] 4	~~120~~ ~~80~~ 0	13	13	-	-
	[10] 24	× 37	[30] 9	[30] 7	~~70~~ ~~40~~ ~~10~~	2	2	2	17
	[50] 32	× 37	20 ×	15 ×	~~50~~ 0	5	5	5	17
Demand	~~60~~ ~~50~~ 0	~~40~~ 0	~~30~~ 0	~~110~~ ~~30~~ 0					
	4	15	8	3					
	4	-	8	3					
	8	-	11	8					
	8	-	-	8					

Total cost =

$= 40(22) + 80(4) + 10(24) + 30(9) + 30(7) + 50(32)$

$= 880 + 320 + 240 + 270 + 210 + 1600$

Ans = $\boxed{3520}$ =)