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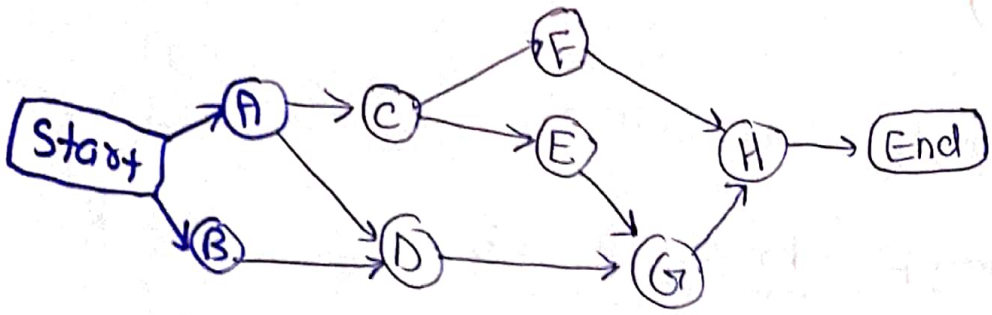
20K-1044

ASSIGNMENT #2

OPERATION RESEARCH

SE-4A

Q.2(A)



Precedence:

A → C → F → H

A → C → E → G → H

A → D → G → H

B → D → G → H

Q.2(b)

a) Expected time $= \frac{a+4m+b}{6}$

For Activity F $= \frac{1+4(2)+9}{6} = 3$

Variance $= \left(\frac{b-a}{6}\right)^2$

For Activity F $= \left(\frac{9-1}{6}\right)^2 = 1.77$

b)

Activity	Expected time	Variance
A	2	0.11
B	3	0.11
C	2	0.11
D	4	0.44
E	4	1
F	3	1.77
G	5	1.77
H	2	0.11

(c)

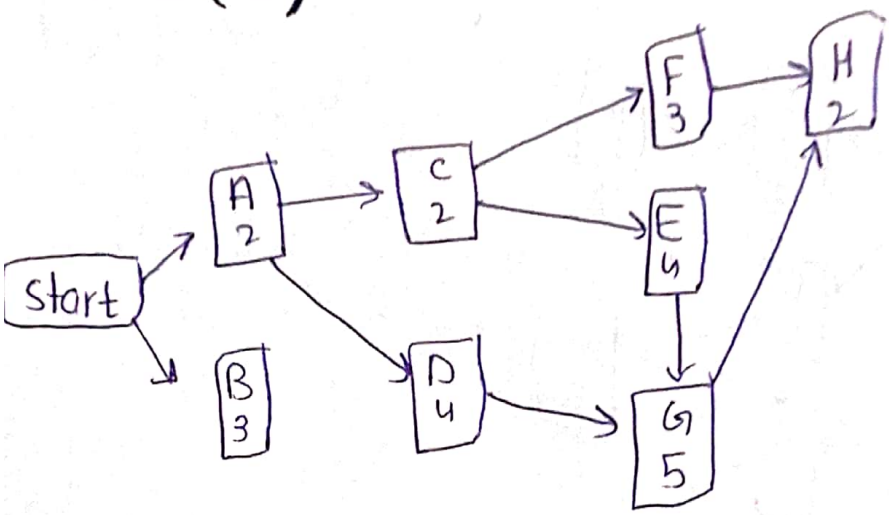
$P(x \leq 16) = 0.5 + P(x > 16)$

$= 1 - P$

$= 1 - 0.715$

$P = 0.284$

Q.2(c)



A → D → G → H

2 + 4 + 5 + 2 = 13

B → D → G → H

3 + 4 + 5 + 2 = 14

A → C → F → H

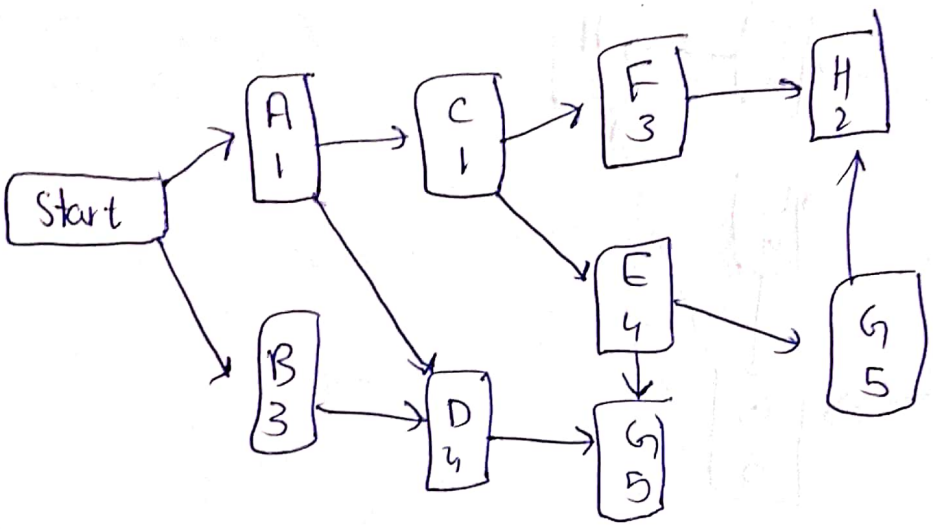
2 + 2 + 3 + 2 = 9

A → C → E → G → H

2 + 2 + 4 + 5 + 12 = 15

Time: 14 weeks

Direct Cost: 308 750



13 weeks:

Q-2)

(i)

	Job 1	Job 2	Job 3	Job 4
1	$1	$4	$6	$3
2	$9	$7	$10	$9
3	$4	$5	$11	$7
4	$8	$7	$8	$5

$P_1 = 1$

$P_2 = 7$

$P_3 = 4$

$P_4 = 5$

0	3	5	2
2	0	3	2
0	1	7	3
3	2	3	0

$q_1 = 0$ $q_2 = 0$ $q_3 = 3$ $q_4 = 0$

0	3	2	2
2	0	0	2
0	1	4	3
3	2	0	0

0	2	1	1
2	0	0	2
0	0	3	2
4	2	0	0

$1+10+5+5=21$

$P_1+P_2+P_3+q_1+q_2+q_3+1$

$=1+7+4+5+0+0+3+0+1=21$

Q.2

(ii)

Job 1	Job 2	Job 3	Job 4
5	13	12	15
15	18	20	6
24	19	20	16
24	8	6	8

$P_1 = 5$

$P_2 = 6$

$P_3 = 16$

$P_4 = 6$

0	8	7	10
9	12	14	0
8	3	4	0
18	2	0	2

$q_1 = 0$ $q_2 = 2$ $q_3 = 0$ $q_4 = 0$

0	6	7	10
9	10	14	0
8	1	4	0
18	0	0	2

$8 + 6 + 16 + 6 = 36$

$P_1 + P_2 + P_3 + P_4 + q_1 + q_2 + q_3 + q_4 + 1$

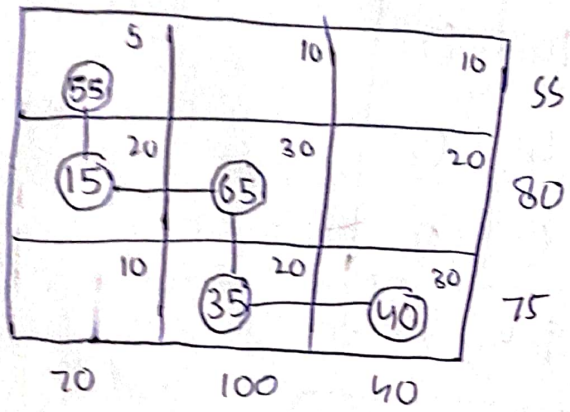
$5 + 6 + 16 + 6 + 0 + 2 + 0 + 0 + 1 = 36$

Q.3

(i)

North-West Method

	1	2	3	Supply
1	5	10	10	55
2	20	30	20	80
3	10	20	30	75
Demand:	70	100	40	



$X_{11} = 55,\ X_{21} = 15,\ X_{22} = 65,\ X_{32} = 35,\ X_{33} = 40$

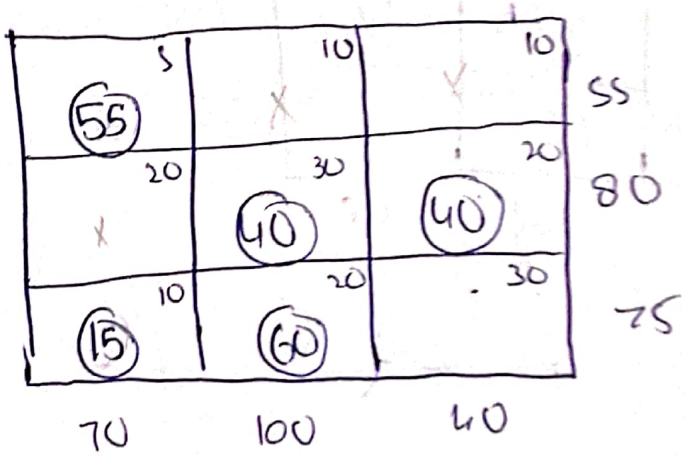
$Z = 55 \times 5 + 15 \times 20 + 65 \times 30 + 35 \times 20 + 40 \times 30$

$= \$4425$

Q.3

Least Cost Method

	1	2	3	
1	5	10	10	55
2	20	30	20	80
3	10	20	30	75
	70	100	40	



$X_{11} = 55,\ X_{31} = 15,\ X_{32} = 60,\ X_{23} = 40,\ X_{22} = 40$

$Z = 55 \times 5 + 15 \times 10 + 60 \times 20 + 40 \times 20 + 40 \times 30$

$= \$3625$

Q.3

Vogel's Approximation

5	10	10
20	30	20
10	20	30

X (5)	(55) (10)	X (10)	55
X (20)	(40) (30)	(40) (20)	80
(70) (10)	(5) (20)	X (30)	75
70	100	40	

Row Penalty

10 - 5 = 5
20 - 20 = 0
20 - 10 = 10

Row Penalty

10 - 10 = 0
30 - 20 = 10
30 - 20 = 10

$X_{31} = 70, X_{12} = 55, X_{22} = 40, X_{32} = 5, X_{23} = 40$

$Z = 70 \times 10 + 55 \times 10 + 40 \times 30 + 5 \times 20 + 40 \times 20$

$Z = \$ 3350$

North-west Method is more reliable as it's gives maximum Profit.

Q.3(ii)

North-West :

			Dummy	Supply
2: (40)	1: (15)	2	0	55
9	4: (5)	10: (20)	0	80
1	2	10	0	75
40	20	20	130	

$Z = 40\times2 + 15\times1 + 5\times4 + 20\times10 + 55\times0 + 75\times0$

$Z = 315$

Least Cost :

			Dummy	
2: X	1: X	2: X	0: (55)	55
9: X	4: X	10: (5)	0: (75)	80
1: (40)	2: (20)	10: (15)	0: X	75
40	20	20	130	

$Z = 40\times1 + 20\times2 + 5\times10 + 15\times10 + 55\times0 + 75\times0$

$Z = \$280$

Vogel's Approximation

			Dummy	
(15) 2	(20) 1	(20) 2	0	55
9	4	10	(60) 0	30
(25) 1	2	10	(50) 0	75
40	20	70	130	

Row-Penalty:

1-0 = 1

4-0 = 4

1-0 = 1

Row Penalty

2-1 = 1

9-4 = 5

2-1 = 1

Row Penalty

2-2 = 0

10-9 = 1

10-1 = 9

$Z = 15 \times 2 + 20 \times 1 + 20 \times 2 + 25 \times 1 + 30 \times 0 + 50 \times 0$

$Z = \$115$