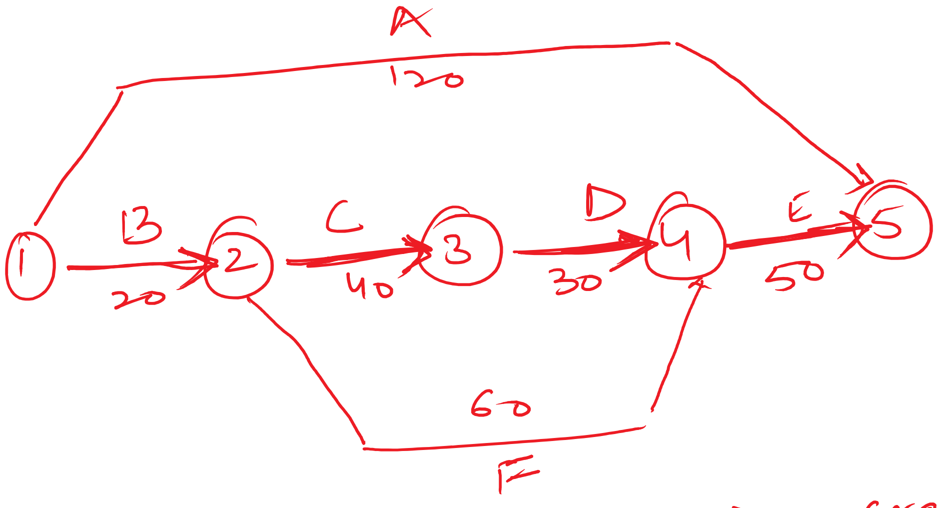


ND - Normal duration, CD - crash duration
NC - Normal cost, CC - crash cost

Activity	ND	CD	NC	CC	Slope crash cost
A	120	100	12000	14000	$ 100
B	20	15	1800	2800	$ 200
C	40	30	16000	22000	$ 600
D	30	20	1400	2000	$ 60 ✗
E	50	40	3600	4800	$ 120 ✓
F	60	45	13500	18000	$ 300

To Determine Crash cost slope:

for Activity A

$$S_A = \frac{CC - NC}{ND - CD}$$

→ slope for activity A

Activity A crash cost slope

Activity A Crash cost 1800/-

$$S_A = \frac{14000 - 12000}{120 - 100} = \frac{\cancel{2000}}{\cancel{20}}$$

$$\boxed{S_A = 100 \text{ INR} \mid \$/\text{day}}$$

Activity B

$$\frac{2800 - 1800}{20 - 15} = \frac{\cancel{1000}}{\cancel{5}} \quad \$200 / \text{day}$$

Activity C

$$S_C = \frac{22000 - 16000}{40 - 30} = \frac{6000}{10} = \$600/\text{day}$$

Activity D

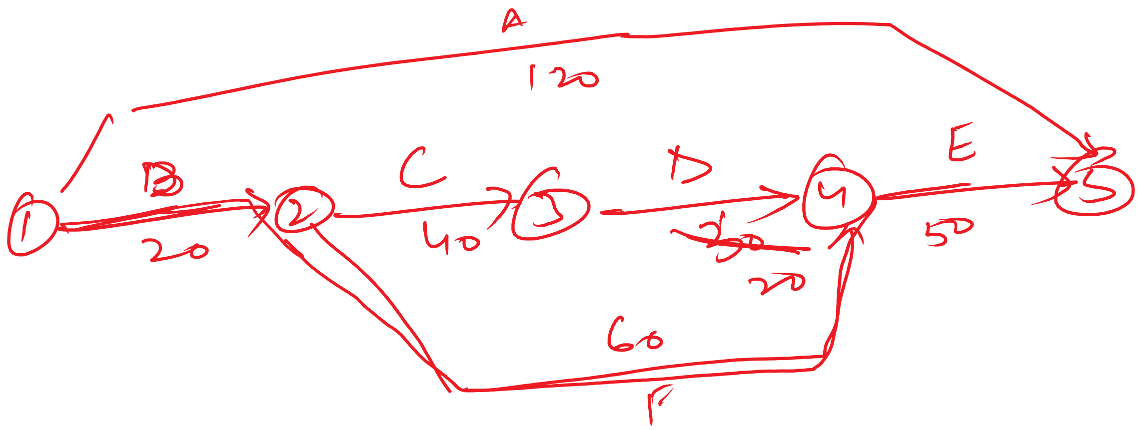
$$S_D = \frac{2000 - 1400}{30 - 20} = \$60/\text{day}$$

Activity E

$$S_E = \frac{4800 - 3600}{50 - 40} = \frac{1200}{10} = \$120/\text{day}$$

Activity F

$$S_F = \frac{18000 - 13500}{60 - 45} = \frac{\overset{3}{\cancel{4500}}}{\cancel{15}} = \$300/\text{day}$$



B - C - D - E = Normal duration

20 + 40 + 30 + 50 = 140 days.

Normal cost of project:

$48300

overall duration will become 130 days

B - C - D - E = 130 days

B - F - E = 130 days.

~~Total~~ project cost at 130 days

is Normal cost of the product + cost of crashing the activity D by 10 days

= $48300 + 60 × 10

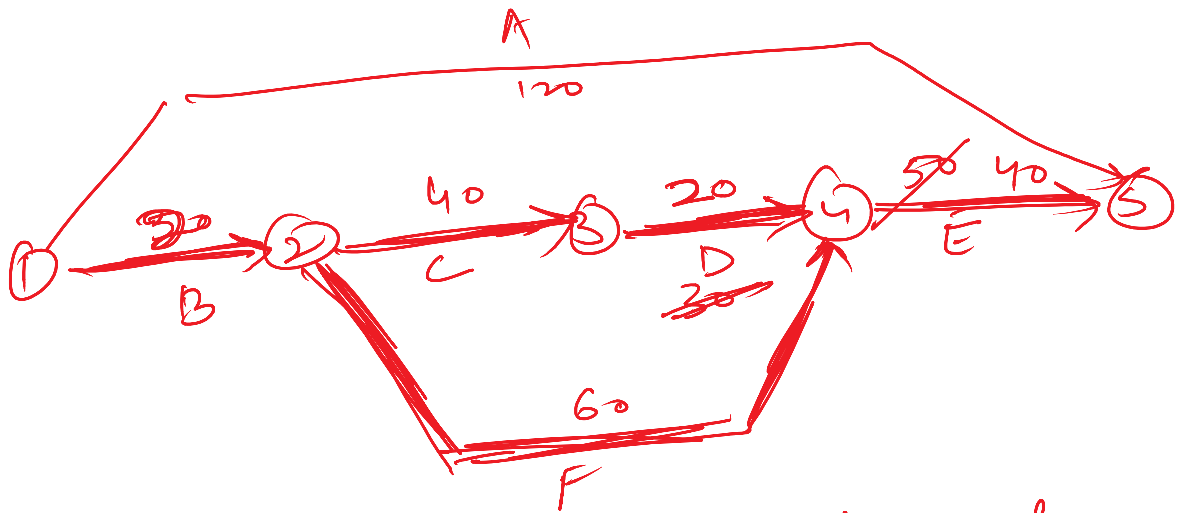
= 48300 + $600

TC = $48900

Next Activity that would be crashed is Activity E

it has least slope crash cost of $120/day

Activity E crashed by 10 days



Crashing for Activity E by 10 days will cost additional $120/day.

$120 \times 10 = \$1200$

Total duration = 120 days

Total project cost =

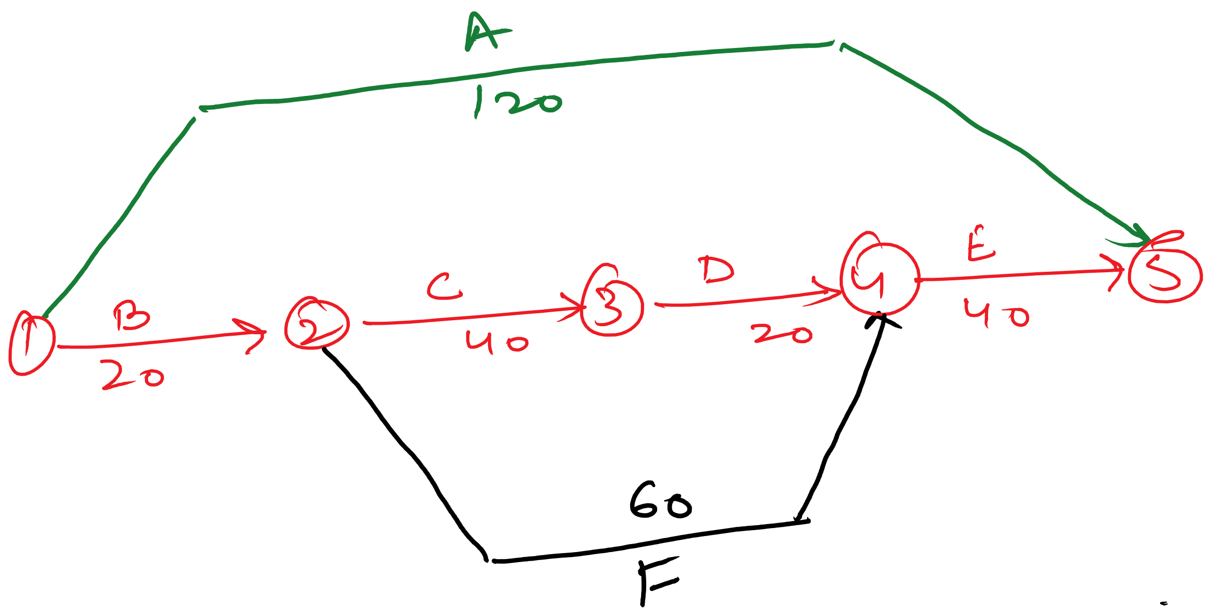
$50,100

= $48900 + $1200

= $50100

3 critical paths those having

120 days to complete project.



Activity (A) is paired with each of the other activities to determine which has least slope crash cost for those activities which have remaining days to be crashed.

Activity A (\$100) + Activity B (\$200)

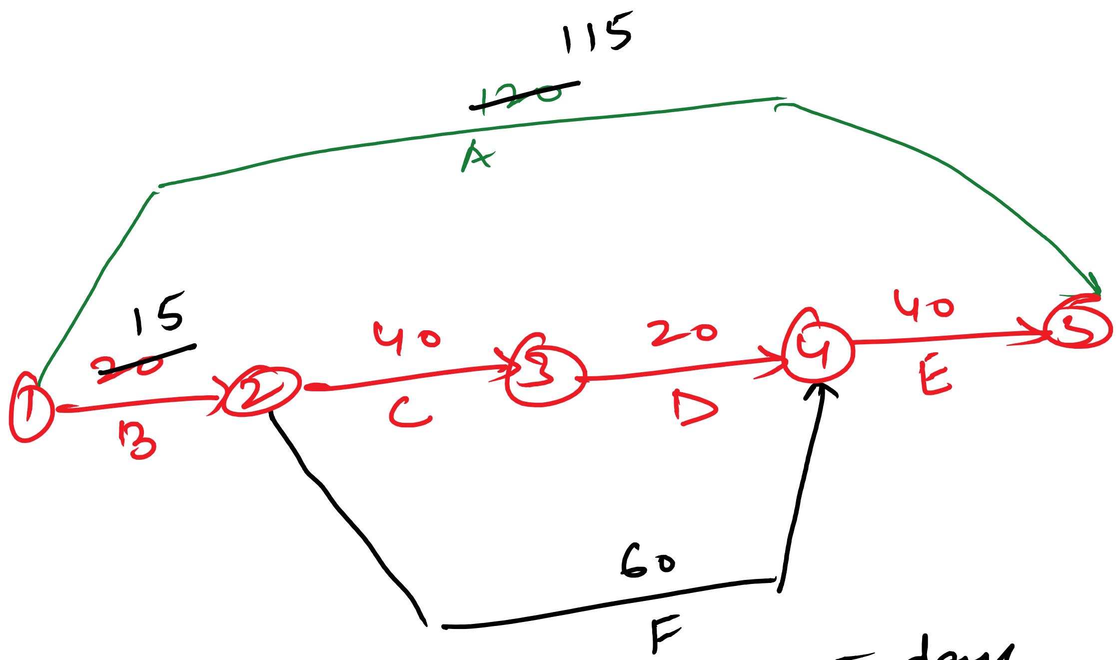
Activity A (\$100) + Activity C (600) + Activity F (\$300)

least crash cost slope

A (\$100) + B (\$200) = \$300/day

A (\$100) + C (\$600) + F (\$300)

= \$1000



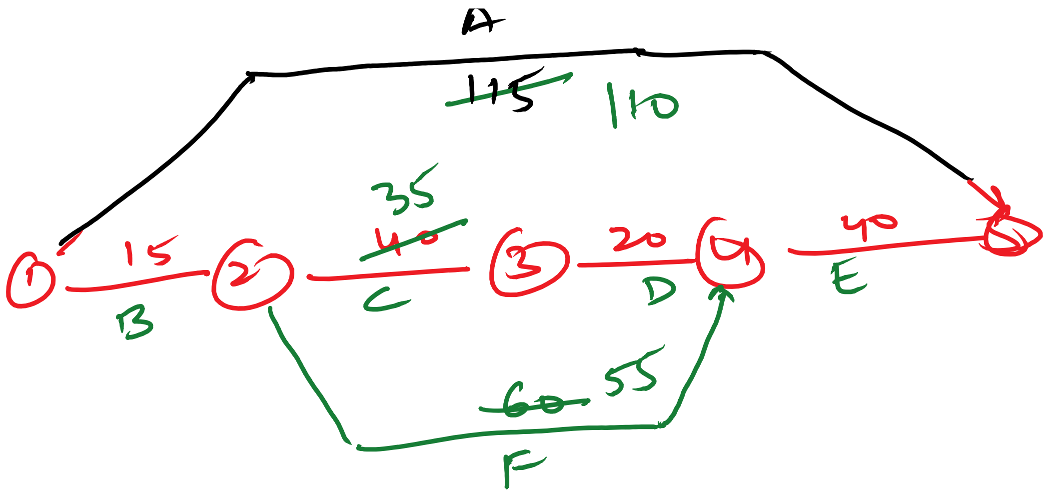
Reducing the project duration 5 days

5 × 300 = $1500 crashing cost &
the total cost will be: 50100 + 1500
= $51600

Activities crashed here & can't be crashed anymore.

Total project duration is 110 days

A – C – F



5 days for crashing — ~~110~~

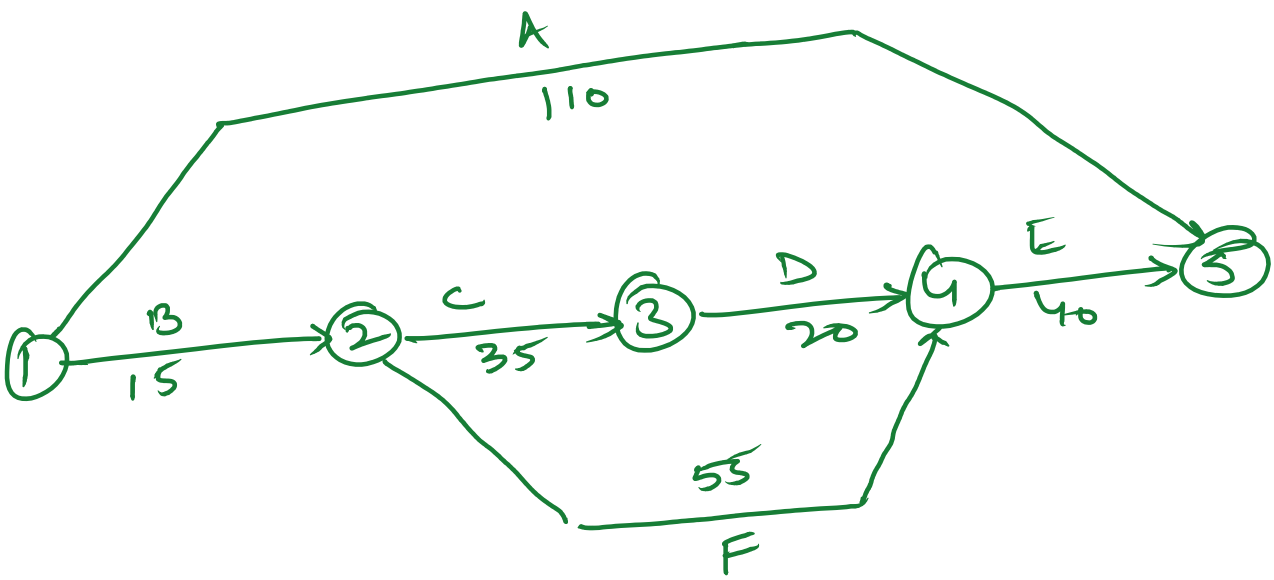
A + C + F

$100 + $600 + $300 = $1000

5 day × $1000 = $5000

Total project duration will be = 110 day

Total project cost = 51600 + 5000 = $56600



A — 110 day

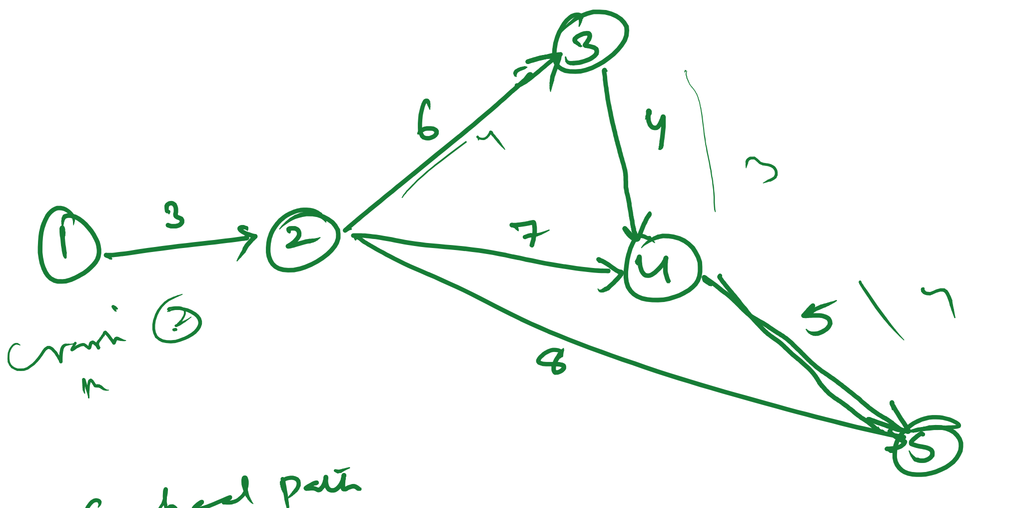
B – C – D – E = 110 days

B – F – E = 110 days

Exercise 2

Construct a network diagram
Calculate project cost ?
Indirect cost = Rs 100/day

Activity	Normal		Crash	
	ND	NC	CD	CC
1-2	3	300	2	400
2-3	6	480	4	520
2-4	7	2100	5	2500
2-5	8	400	6	600
3-4	4	320	3	360
4-5	5	500	4	520



Critical path
1-2-3-4-5 = 18 days.
3 + 6 + 4 + 5 = 18 days (ND)
2 + 4 + 3 + 4 = 13 day (Crash Duration)
Normal Cost = 300 + 480 + 2100 + 400 + 320 + 500

$= 4100$

Crash cost $= 400 + 500 + 2500 + 600 + 360 + 520$
$= 4900$

Crash cost slope

Activity 1-2

$$= \frac{400-300}{3-2} = \frac{100}{1} = 100/\text{day}$$

Activity 2-3

$$\frac{520-480}{6-4} = \frac{40}{2} = 20/\text{day}$$

Activity 2-4

$$\frac{2500-2100}{7-5} = \frac{400}{2} = 200/\text{day}$$

Activity 2-5

$$\frac{600-400}{8-6} = \frac{200}{2} = 100/\text{day}$$

Activity 3-4

$$\frac{360-320}{4-3} = 40/\text{day.}$$

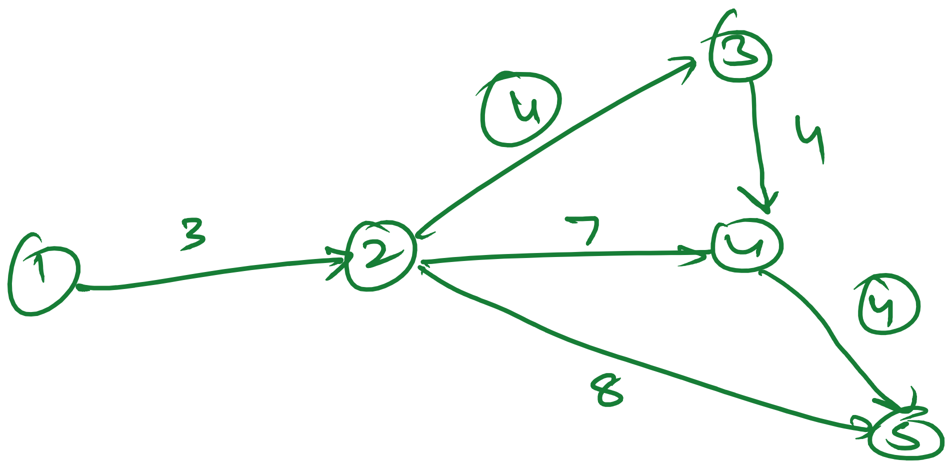
Activity 4-5

Activity 4-5

$$\frac{520 - 500}{5 - 4} = 20/\text{day}.$$

Activity 2-3 & 4-5 have the least crash cost slope.

We will crashed these 2 activities first.



from this network.

after crashing, activity 2-3 is cut by 2 days & activity 4-5 is cut by 1 day

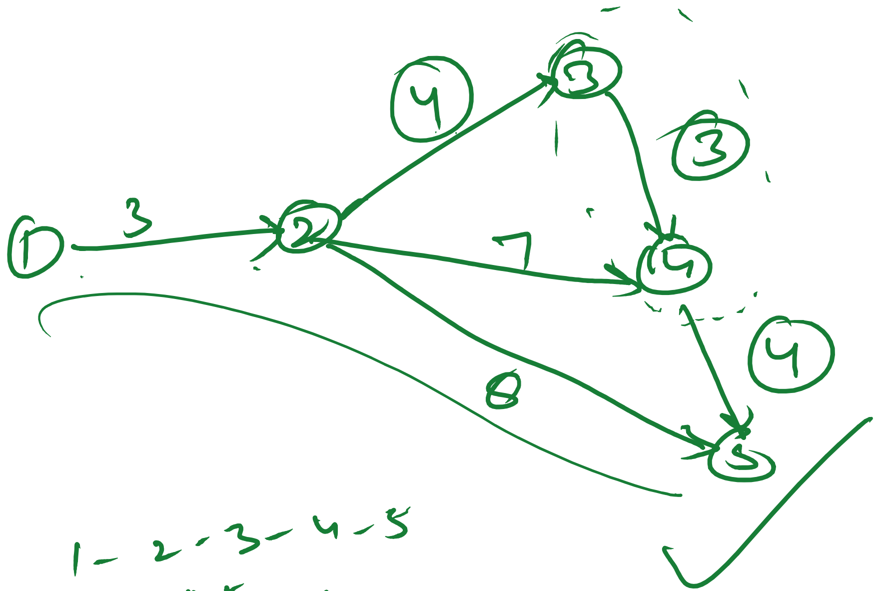
the critical path = 1-2-3-4-5

the new project duration is

= 3+4+4+4

= 15 days

II nd stage. Activity 3-4



1-2-3-4-5
14 days.

1-2-4-5 = 14 day

There is no other activity on both the critical path which has cost slope less than indirect cost (100/-)

optimum network -
& hence 14 days is the optimum project duration to complete the

project :

Total Indirect cost for 14 day = 14×100
= 1400/-

Total project cost {optimum duration or path)

1-2, 2-3, 3-4, 4-5, 2-4, 2-5

1-2, 2-3, 2-4, 2-5, 3-4, 4-5

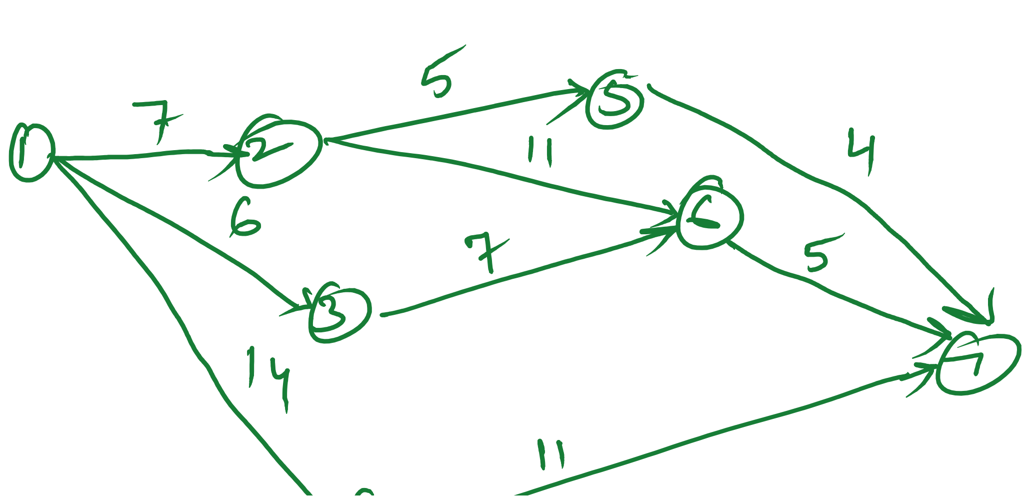
300 + 520 + 2100 + 400 + 360 + 520

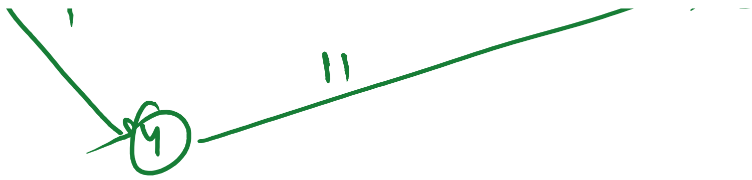
= 4200 + 1400 = 5600/-

Normal duration = 18 day
TC = 4100 + 18×100 = 5900/-

Exercise 3

$$\text{Exp time} = \frac{t_0 + 4 \times t_m + t_p}{6}$$





1 − 4 − 7 = 25 day

Project duration = 25 day.

Exercise 4

Activity	t_o	t_p	t_m	t_e	σ^2
1-2	3	15	6	7	4
1-3	2	14	5	6	4
✓ 1-4	6	30	12	14	16
2-5	2	8	5	5	1
2-6	5	17	11	11	4
3-6	3	15	6	7	4
✓ 4-7	3	27	9	11	16
5-7	1	7	4	4	1
6-7	2	8	5	5	1

$$t_e = \frac{t_o + t_p + 4 \times t_m}{6} =$$

$$\sigma^2 = \left\{\frac{t_p - t_o}{6}\right\}^2$$

$$\sigma^2 = \left\{\frac{t_p - t_o}{6}\right\}$$

1 - 4 - 7 = 25 day

t_e = 25 day

we need to find the prob of project completed in 27 day?

$$\sigma = \sqrt{\sigma^2}$$

Sum of variances of critical path

1 - 4 - 7 = 16 + 16 = 32

$$\sigma = \sqrt{32}$$

$$\sigma = 5.65$$

path time

$$Z = \frac{x - \mu}{\sigma}$$

$$Z = \frac{27 - 25}{5.65}$$

$$= 0.35$$

from the Z table also we can get the value

63.68%

.6368

63.689