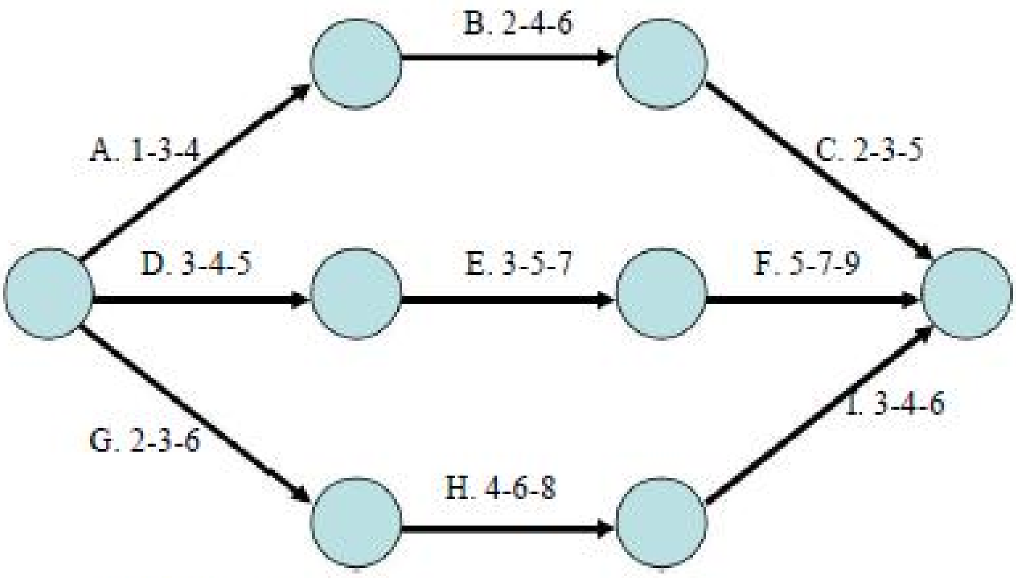
Software Project Management

SE 803, Marks-50, Time- 2Hours

GROUP A [23 Marks]

Q1. The network diagram for a software project is shown below, with three time estimates (optimistic, most likely, and pessimistic) for each activity. Activity times are in weeks.

[3+5+3+4]



Answer the following:

a. Develop the probabilistic project model and compute the Beta distribution expected duration, variance, and standard deviation for each task.

	Beta Distribution Duration		
Task	μ	σ2	σ
A	2.8	0.3	0.5
B	4.0	0.4	0.7
C	3.2	0.3	0.5
D	4.0	0.1	0.3
E	5.0	0.4	0.7
F	7.0	0.4	0.7
G	3.3	0.4	0.7
H	6.0	0.4	0.7
I	4.2	0.3	0.5

b. Identify

- How many paths are in the project?
- The slack, expected duration, variance and standard deviation for each path.
- The critical path.
- The expected project duration.
- Does the critical path have the largest variance? If not, which path has the highest variability?

Software Project Management

SE 803, Marks-50, Time- 2Hours

Path	Time	Crit	Slack	σ2	σ	Tasks	Start	2	3
1	10.0		6.0	0.9	1.0	3	A	B	C
2	16.0	CP	0.0	1.0	1.0	3	D	E	F
3	13.5		2.5	1.1	1.1	3	G	H	I

c. Calculate each path probability for completing the project in 17 weeks. Show your answer to 4 decimal places of accuracy.

Start	2	3	P (< 17)
A	B	C	1.0000
D	E	F	.8413
G	H	I	.9995

d. Identify

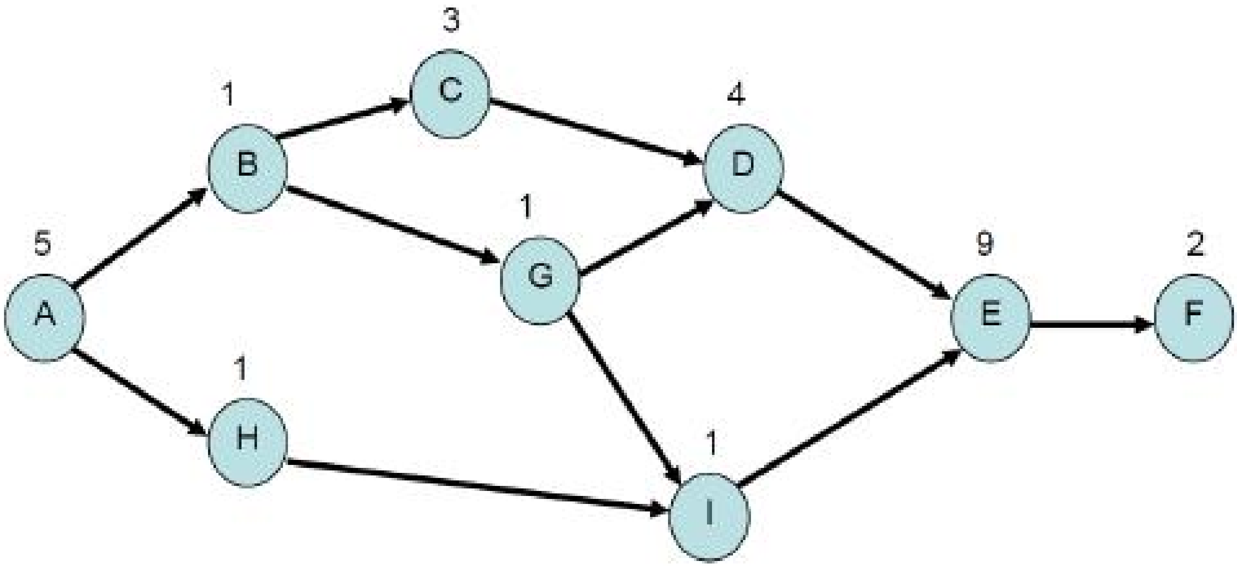
- The early and late start for each task.
- The early and late finish for each task.
- The slack for each task.
- The critical tasks.

	Early		Late		Task	Crit
Task	Start	Finish	Start	Finish	Slack	Task
A	0.0	2.8	6.0	8.8	6.0	
B	2.8	6.8	8.8	12.8	6.0	
C	6.8	10.0	12.8	16.0	6.0	
D	0.0	4.0	0.0	4.0	0.0	CT
E	4.0	9.0	4.0	9.0	0.0	CT
F	9.0	16.0	9.0	16.0	0.0	CT
G	0.0	3.3	2.5	5.8	2.5	
H	3.3	9.3	5.8	11.8	2.5	
I	9.3	13.5	11.8	16.0	2.5	

Q2. The AON diagram is shown for a software project is shown below, with the most likely estimate for each activity. Activity times are in days. [2+4+1+1]

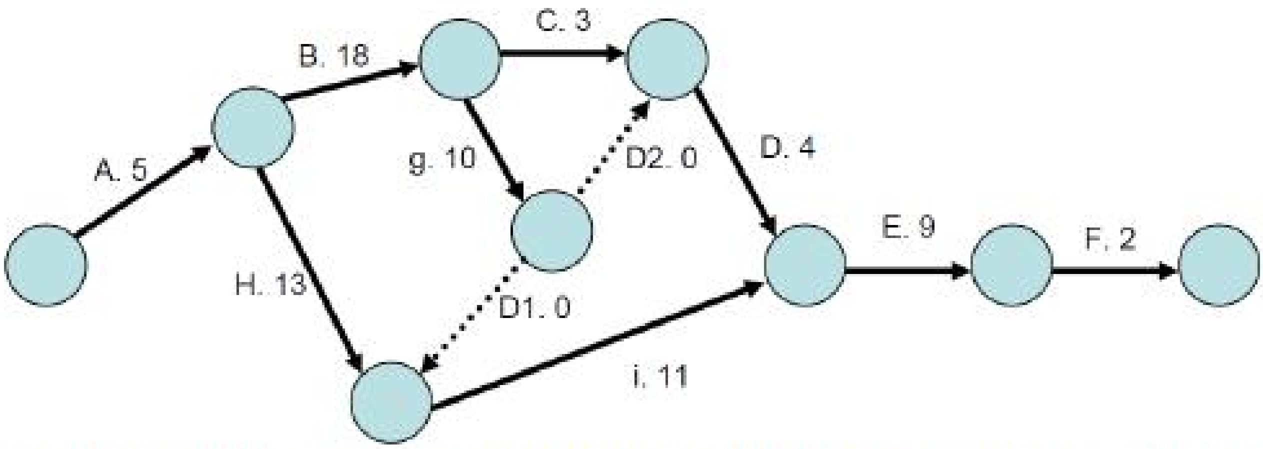
Software Project Management

SE 803, Marks-50, Time- 2Hours



Answer the following:

a. Convert the AON diagram to an AOA diagram. Hint: The AOA diagram will require 2 dummy activities which you should label D1 and D2.



b. Use the AON diagram and identify all paths, the expected length of each path, the critical path, most likely project duration, and slack time for each path.

Path	Time	Crit	Slack	σ2	σ	Tasks	Start	2	3	4	5	6
1	41.0		14.0			6	A	B	C	D	E	F
2	48.0		7.0			6	A	B	G	D	E	F
3	55.0	CP	0.0			6	A	B	G	I	E	F
4	40.0		15.0			5	A	H	I	E	F	

c. Which task has the largest slack time?

H

d. What is the latest start time for task E?

Day 44

	Early		Late	
Task	Start	Finish	Start	Finish
E	44.0	53.0	44.0	53.0

Software Project Management

SE 803, Marks-50, Time- 2Hours

GROUP B [27]

Q3. NTT DATA has four potential projects all with an initial cost of $2,000,000. The capital budget for the year will only allow NTT DATA industries to accept one of the four projects. Given the discount rates and the future cash flows of each project, which project should they accept? What are the IRRs of the four projects for NTT DATA? [5+5]

Cash Flows	*Project M*	*Project N*	*Project O*	*Project P*
Year one	$500,000	$600,000	$1,000,000	$300,000
Year two	$500,000	$600,000	$800,000	$500,000
Year three	$500,000	$600,000	$600,000	$700,000
Year four	$500,000	$600,000	$400,000	$900,000
Year five	$500,000	$600,000	$200,000	$1,100,000
Discount Rate	6%	9%	15%	22%

Solution, find the NPV of each project and compare the NPVs.

Project M's NPV = -\$2,000,000 + \$500,000/1.05 + \$500,000/1.05^2 + \$500,000/1.05^3 + \$500,000/1.05^4 + \$500,000/1.05^5

Project M's NPV = -\$2,000,000 + \$476,190.48 + \$453,514.74 + \$431,918.80 + \$411,351.24 + \$391,763.08

Project M's NPV = $164,738.34

Project N's NPV = -\$2,000,000 + \$600,000/1.09 + \$600,000/1.09^2 + \$600,000/1.09^3 + \$600,000/1.09^4 + \$600,000/1.09^5

Project N's NPV = -\$2,000,000 + \$550,458.72 + \$505,008.00 + \$463,331.09 + \$425,055.13 + \$389,958.83

Project N's NPV = $333,790.77

Project O's NPV = -\$2,000,000 + \$1,000,000/1.15 + \$800,000/1.15^2 + \$600,000/1.15^3 + \$400,000/1.15^4 + \$200,000/1.15^5

Project O's NPV = -\$2,000,000 + \$869,565.22 + \$604,914.93 + \$394,509.74 + \$228,701.30 + \$99,435.34

Project O's NPV = $197,126.53

Software Project Management

SE 803, Marks-50, Time- 2Hours

Project P's NPV = -\$2,000,000 + \$300,000/1.22 + \$500,000/1.22^2 + \$700,000/1.22^3 +

\$900,000/1.22^4 + \$1,100,000/1.22^5

Project P's NPV = -\$2,000,000 + \$245,901.64 + \$335,931.20 + \$385,494.82 + \$406,259.18 +

\$406,999.18

Project P's NPV =-\$219,413.98 (would reject project regardless of budget)

And the ranking order based on NPVs is,

Project N – NPV of \$333,790.77

Project O – NPV of \$197,126.53

Project M – NPV of \$164,738.34

Project P – NPV of -\$219,413.98

NTT DATA should pick Project N.

Solution, this is an iterative process but can be solved quickly on a calculator or spreadsheet.

Enter the keys noted for each project in the CF of a Texas BA II Plus calculator

Cash Flows	*Project M*	*Project N*	*Project O*	*Project P*
CFO	-\$2,000,000	-\$2,000,000	-\$2,000,000	-\$2,000,000
CO1, F1	\$500,000, 1	\$600,000, 1	\$1,000,000, 1	\$300,000, 1
CO2, F2	\$500,000, 1	\$600,000, 1	\$800,000, 1	\$500,000, 1
Year three	\$500,000, 1	\$600,000, 1	\$600,000, 1	\$700,000, 1
Year four	\$500,000, 1	\$600,000, 1	\$400,000, 1	\$900,000, 1
Year five	\$500,000, 1	\$600,000, 1	\$200,000, 1	\$1,100,000, 1
CPT IRR	7.93%	15.24%	20.27%	17.72%

Q4. Tom is the CTO of an international reputed company. His company provides digital innovation, software engineering and management consulting services.
Comparing All Methods that we learned (NPV, Payback Period, Profitability Index) -- Tom is looking at a project with the estimated cash flows as follows:

Initial Investment at start of project: \$3,600,000
Cash Flow at end of Year 1: \$500,000
Cash Flow at end of Years 2 through 6: \$625,000 each year
Cash Flow at end of Year 7 through 9: \$530,000 each year
Cash Flow at end of Year 10: \$385,000

Top management of this company wants to know the Payback Period, NPV, and Profitability Index of this project. The appropriate discount rate for the project is 14%. If the cut-off period is six years for major projects, determine if the project is accepted or rejected under the three different decision models. [3+3+3]

Software Project Management

SE 803, Marks-50, Time- 2Hours

Solution:

Payback Period = -\$3,600,000 + \$500,000 + \$625,000 + \$625,000 + \$625,000 + \$625,000 + \$625,000 = \$ 25,000 and we only need part of year 6 so,

\$600,000 / \$625,000 = **0.96 and Payback Period is 5.96 years and project is accepted.**

$$NPV = -\$3,600,000 + \$500,000 / 1.14 + \$625,000/1.14^2 + \$625,000/1.14^3 + \$625,000/1.14^4 + \$625,000/1.14^5 + \$625,000/1.14^6 + \$530,000/1.14^7 + \$530,000 /1.14^8 + \$530,000/1.14^9 + \$385,000/1.14^{10}$$

NPV = -\$3,600,000 + \$438,596.49 + \$480,917.21 + \$421,857.20 + \$370,050.17 + \$324,605.42 + \$284,741.59 + \$211,807.78 + \$185,796.30 + \$162,979.21 + \$103,851.37 = **-\$614,797.27 and project is rejected using NPV rules.**

$$\text{Present Value of Benefits} = \$500,000 / 1.14 + \$625,000/1.14^2 + \$625,000/1.14^3 + \$625,000/1.14^4 + \$625,000/1.14^5 + \$625,000/1.14^6 + \$530,000/1.14^7 + \$530,000 /1.14^8 + \$530,000/1.14^9 + \$385,000/1.14^{10}$$

Present Value of Benefits = \$438,596.49 + \$480,917.21 + \$421,857.20 + \$370,050.17 + \$324,605.42 + \$284,741.59 + \$211,807.78 + \$185,796.30 + \$162,979.21+ \$103,851.37 = \$2,985,202.73

Present Value of Costs: \$3,600,000

Profitability Index = \$2,985,202.73 / \$3,600,000 = 0.8292 and reject.

Q5. The following table gives data on normal time and cost and crash time & cost for a project

Activity	Normal		Crash	
	Time(weeks)	Cost (Taka)	Time(weeks)	Cost (Taka)
1-2	3	300	2	400

Software Project Management

SE 803, Marks-50, Time- 2Hours

2-3	3	30	3	30
2-4	7	420	5	580
2-5	9	720	7	810
3-5	5	250	4	300
4-5	0	0	0	0
5-6	6	320	4	410
6-7	4	400	3	470
6-8	13	780	10	900
7-8	10	1000	9	1200
Total cost = Taka 4220				

The indirect cost per week is **Taka 50**.

a. Draw the network for the project & Critical path.

b. Find optimum time and optimum cost.

c. Determine minimum total time & corresponding cost.

[2+3+3]

Solution:

a. 1-2-5-6-7-8 = 32 weeks it is critical path (CPM) of the project duration.
b. optimum cost (Taka 5805) and optimum duration (29 weeks)
c. minimum total time (25 weeks) & corresponding cost (Taka 6150)

http://docplayer.net/15560128-B-2-4-6-d-3-4-5-e-3-5-7-f-5-7-9.html

Solution:

Software Project Management
SE 803, Marks-50, Time- 2Hours

Table 2

Activity	Normal		Crash		ΔT	ΔC	Δc/ΔT
	TIME (Weeks) (TN)	Cost (RS.) (CN)	Time(Weeks) (TC)	Cost (Rs.) (CN)			
1-2	3	300	2	400	1	100	100
2-3	3	30	3	30	0	0	0
2-4	7	420	5	580	2	160	80
2-5	9	720	7	810	2	90	45
3-5	5	250	4	300	1	50	50
4-5	0	0	0	0	0	0	0
5-6	6	320	4	410	2	90	45
6-7	4	400	3	470	1	70	70
6-8	13	780	10	900	3	120	40
7-8	10	1000	9	1200	1	200	200

1. Draw the network of the proposed project.

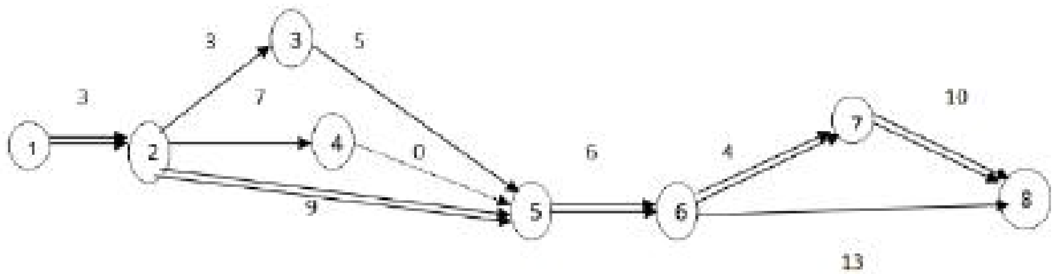


Fig. 4.1

Critical path starting towards end
1-2-3-5-6-7-8 = 31 weeks
1-2-5-6-8 = 30 weeks

1-2-5-6-7-8 = 32 weeks it is critical path (CPM) of the project duration.

Software Project Management
SE 803, Marks-50, Time- 2Hours

2. Optimum time and optimum cost.
Time scale diagram of critical path

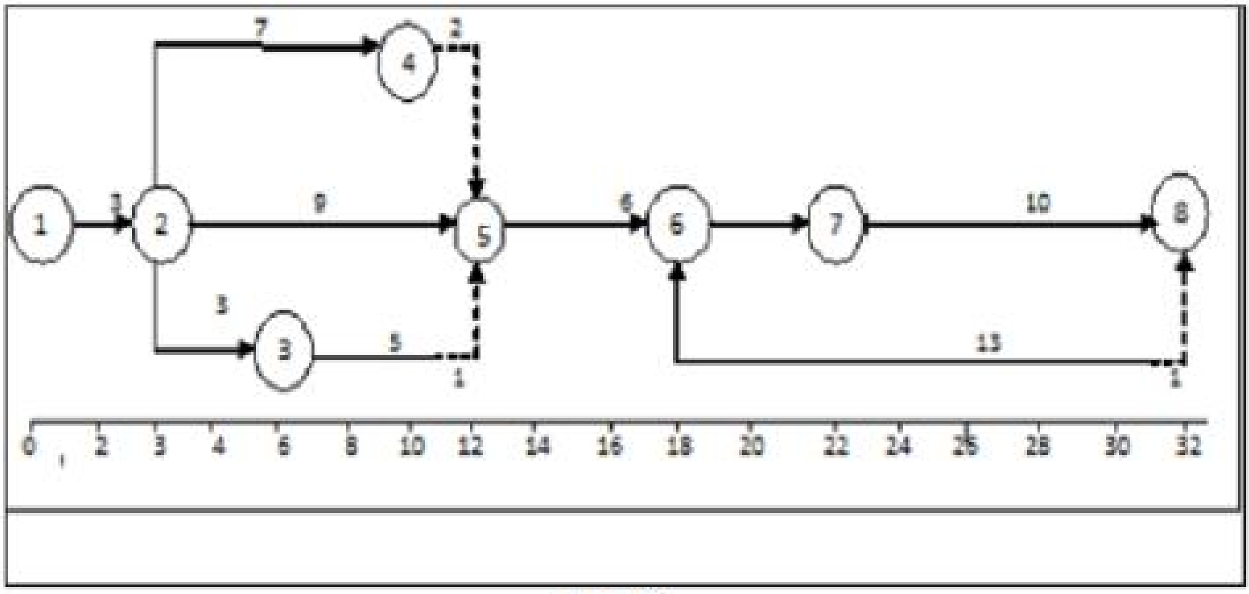


Fig. 4.2

Crashing in activity 2-5 in 1 week.

Now we are identified their activity in critical path which can be crashed with the lowest cost slope that are to be chose as List activity 2-5 $\Delta C/\Delta T = 45$

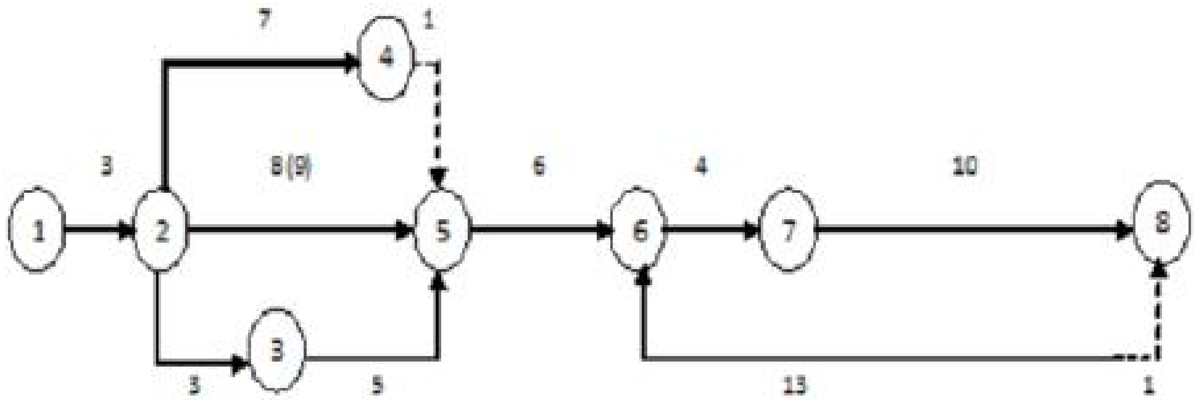


Fig. 4.3

Crashing in activity 5-6 in 2 weeks

Software Project Management

SE 803, Marks-50, Time- 2Hours

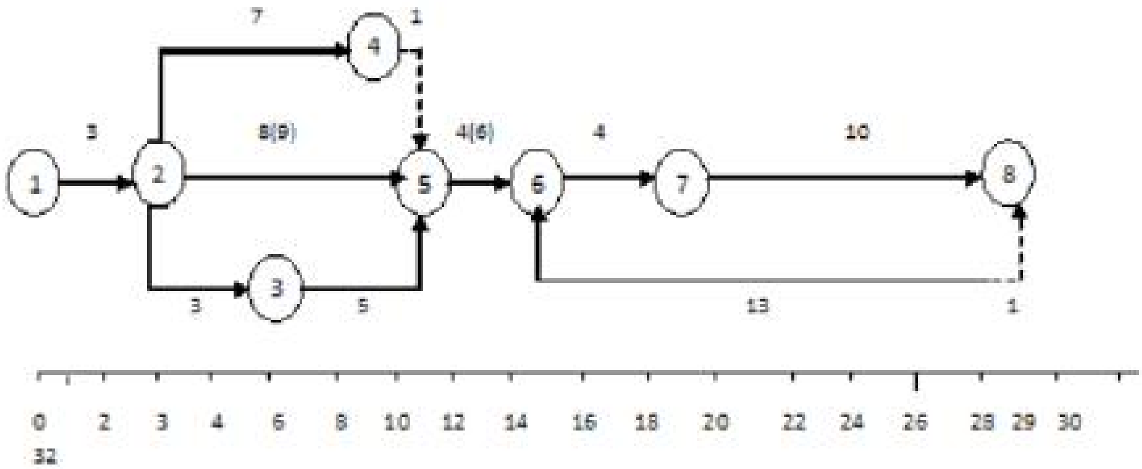


Fig. 4.4

Crashing in activity 6-7 in 1 week.

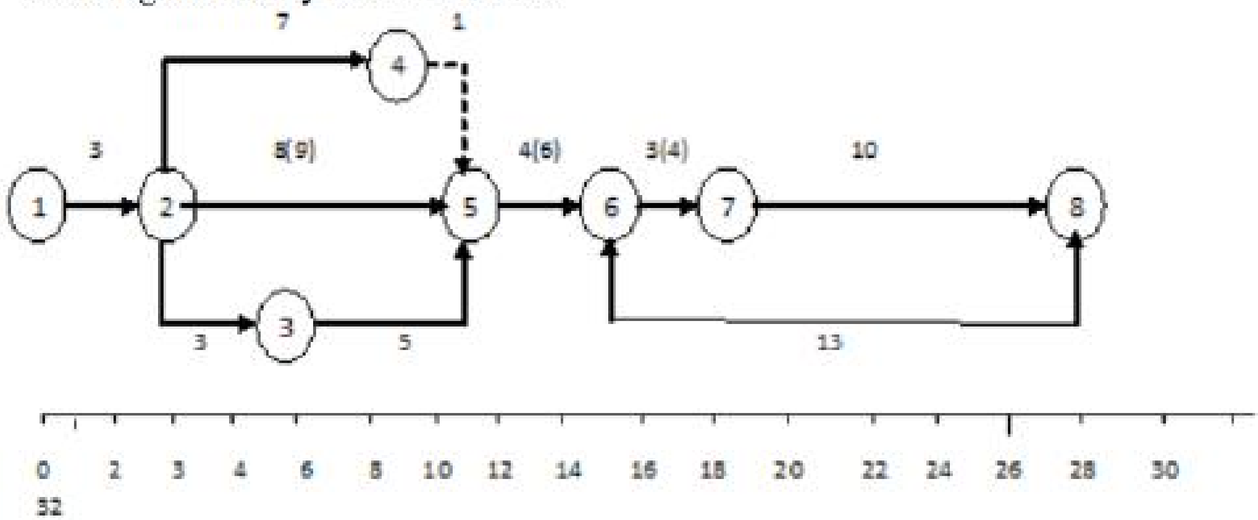


Fig. 4.5

Crashing in activity 1-2 in 1week

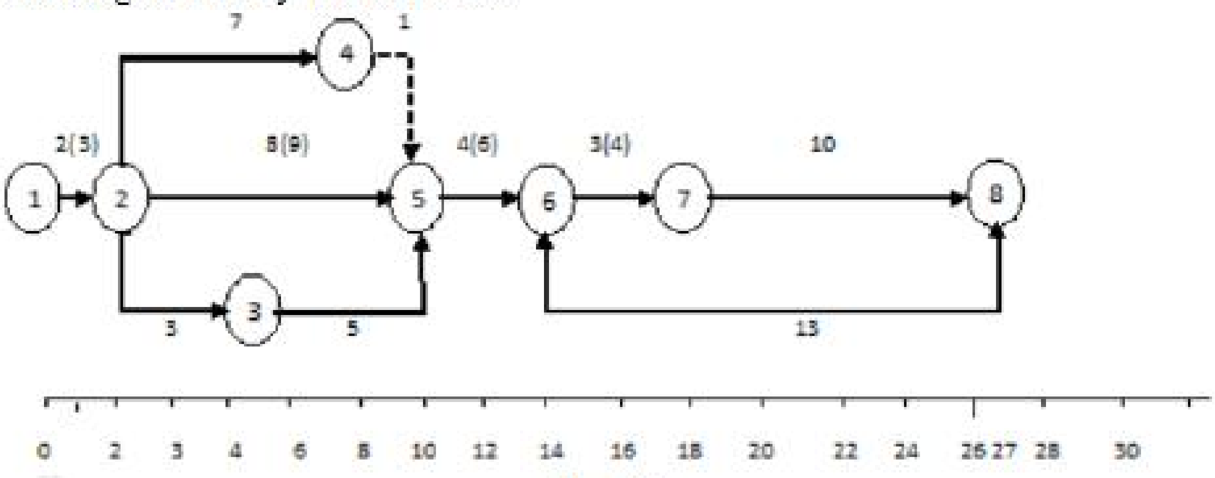


Fig. 4.6

Crashing in activity 6-8 in 2 week

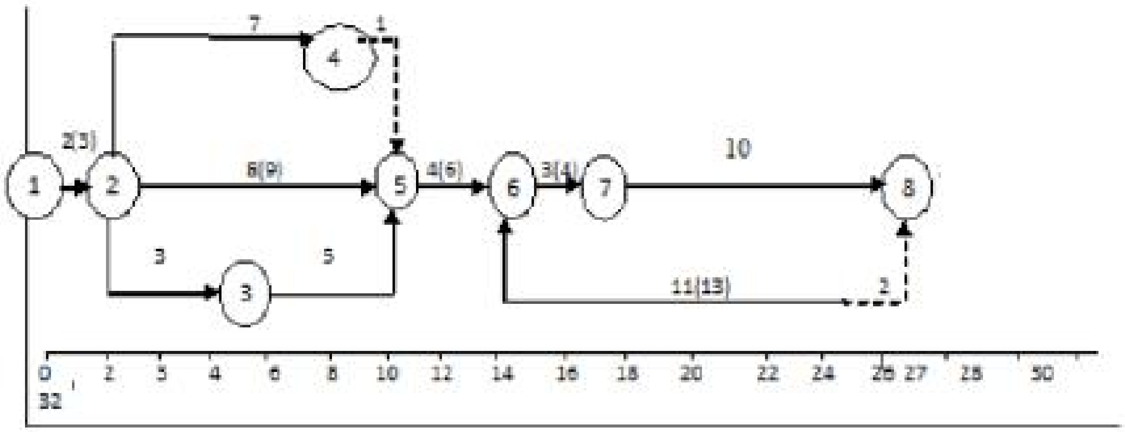


Fig. 4.7

Now Crashing in activity 7-8 in 1 week.

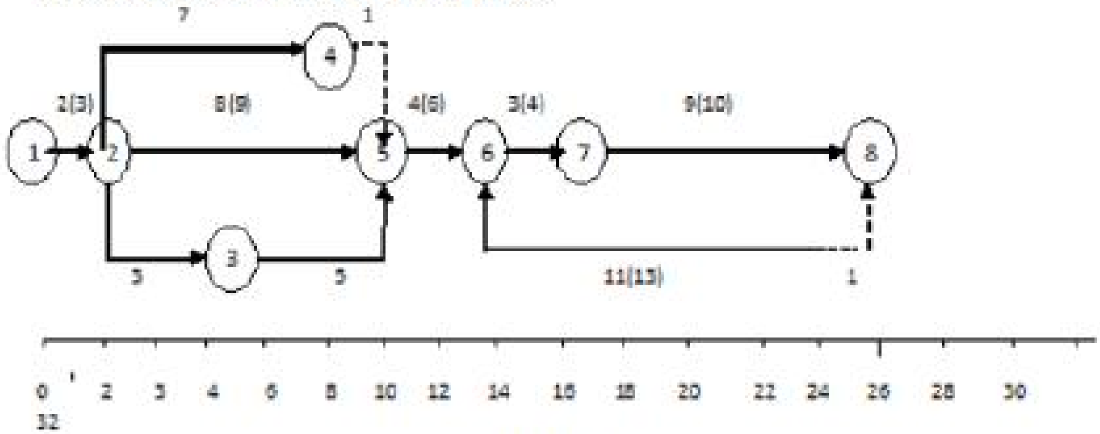


Fig. 4.8

Crashing in activity 3-5 in 1 week.

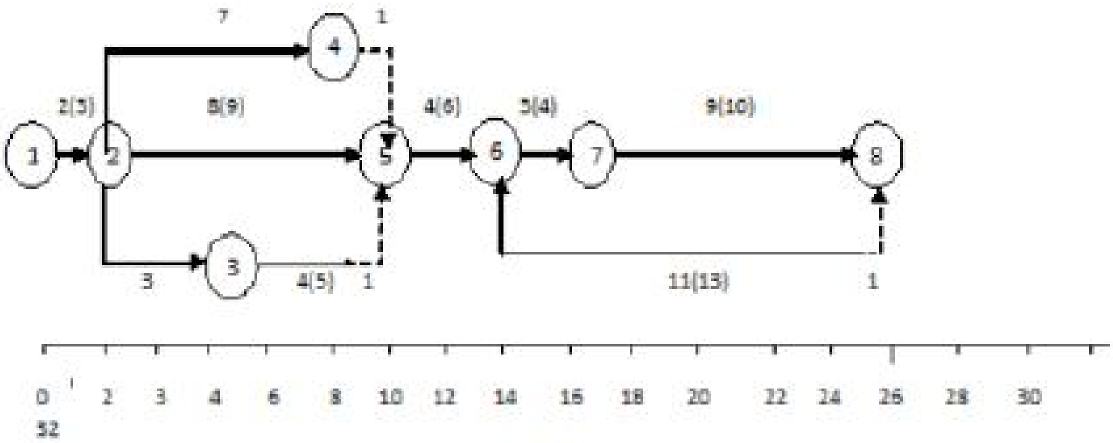


Fig. 4.9

Again crashing in activity 2-5 in remain 1 week.

Software Project Management

SE 803, Marks-50, Time- 2Hours

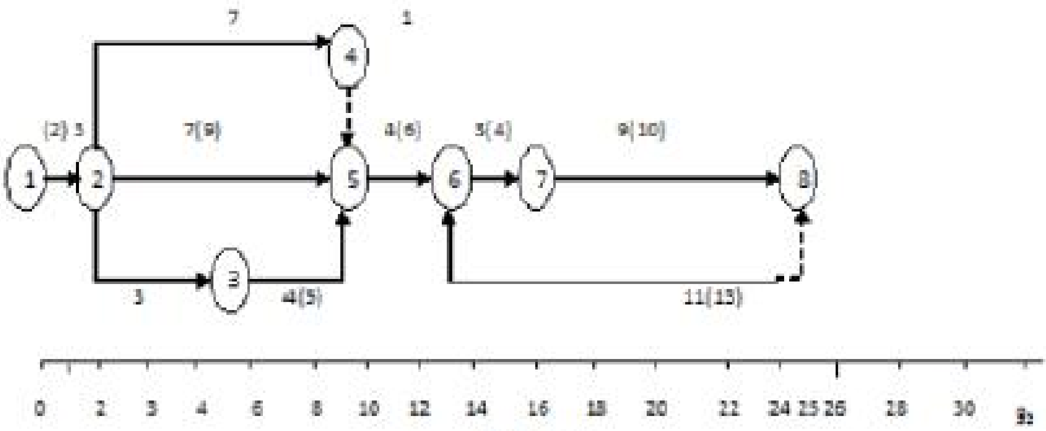


Fig. 4.10

The above results are summarized in the table below.

Activity Crashed	No. Of Week Crash	Represent Fig.	Weeks Saved In Project	Project Duration (Week)	Normal Direct Cost (Dc) Rs.	Indirect Cost (Ic) Rs.	Crash Cost (Cc) Rs.	Total Cost – Dc+Ic+Cc Rs.
CPM	-	fig.4.2	-	32	4220	32 x 50=1600	0	5820
2-5	1	fig.4.3	1	31	4220	31x 50=1550	1x45=45	5815
5-6	2	fig.4.4	2	29	4220	29x 50=1450	45+2x45=135	5805 Least
6-7	1	fig.4.5	1	28	4220	28x 50=1400	135+1x70=205	5825
1-2	1	fig.4.6	1	27	4220	27x 50=1350	205+1x100=305	5875
6-8	2	fig.4.7	-	27	4220	27x 50=1350	305+2x40=385	5955
7-8	1	fig.4.8	1	26	4220	26x 50=1300	385+1x200=585	6105
3-5	1	fig.4.9	-	26	4220	26x 50=1300	585+1x50=635	6155
2-5	1	fig.4.10	1	25	4220	25x 50=1250	635+1x45=680	6150

- The above table indicates the optimum cost (Rs.5805) and optimum duration (29 weeks) and also shows the maximum crashing after the project duration is 25weeks.
- The all project duration is crashing is dependent in critical path (CPM) because the duration is reduce in only crashing in critical path.