

NETWORK ANALYSIS

1. Small project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers.
- (a) Draw the project network and identify all the paths through it.
 - (b) Find the expected duration and variance for each activity. What is expected project length ?
 - (c) Calculate the variance and standard deviation of project length. What is the probability that the project will be completed :
 - i) At least 3 weeks earlier than expected ? .
 - ii) No more than 3 weeks later than expected ?
 - (d) If the project due date is 18 weeks, what is the probability of not meeting the due date ?
 - (e) What due date has about 90% chance of being met ?
 - (f) Find the event or node variances in the network.
 - (g) What is the probability to complete event 5 by 11 weeks?

Activity	Least time (weeks) (t_o)	Most likely time (weeks) (t_m)	Great time (weeks) (t_p)
1—2	1	1	7
1—3	1	4	7
1—4	2	2	8
2—5	1	1	1
3—5	2	5	14
4—6	2	5	8
5—6	3	6	15

2. The monthly maintenance work in a machine shop consists of 10 steps A to J. The inter-relationship between them are identified by event numbers :

Steps	Event Numbers	Duration (Days)
A	1-2	3
B	2-3	5
C	2-4	8
D	3-5	4
E	3-6	2
F	4-6	9
G	4-7	3
H	5-8	12
I	6-8	10
J	7-8	6

- (a) Draw a Network.
- (b) Compute early and late start and finish time for each activity.
- (c) How much slack does Activity (3-5), Activity (4-6) and Activity (7-8) have ?
- (d) Identify the critical path and critical activities.
- (e) If Activity (2-3) takes 8 days instead of 5 days what will be the project completion time ?

3. XYZ Ltd. Planning a project to introduce a new product, as listed the following activities :

Activity	Preceding activity	Expected time (week)
A	--	6
B	--	3
C	A	5
D	A	4
E	A	3
F	C	3
G	D	5
H	B, D, E	5
I	H	2
J	I, G, F	3

- (a) Draw the critical path network for the project and determine the critical path and its duration.
(b) If the start of activity B is delayed by 3 weeks. Activity E by 2 weeks and activity G by 2 weeks, how is the total time for the project affected ?
(c) Assume that time given in the above table are the expected times of the activities, the durations of which are normally distributed with the following standard deviation.

Activity	A	B	C	D	E	F	G	H	I	J
Standard deviation	1	0.5	1	1	0.5	0.5	1	1	0.5	1

Ignoring the delay referred to in (b) and the possible effect of uncertainty in non-critical activities, determine a 95% confidence interval for the expected time on the critical path.

- (d) The costs of the project are estimated to be ` 10,00,000. If it is completed within 24 weeks the expected returns should be about ` 10,00,000 but if the deadline of 24 weeks is not met, the product will fail to penetrate the market a net revenue of only ` 200,000 is expected. Determine the expected profit on this subject. For simplicity, you should ignore the delays referred to in (b) and the possible effect of uncertainty in non-critical activities.

4. A project consists of 7 activities. The time for performance of each of the activities is a random variable with the respective probability distribution as given below:

Activity	Immediate predecessor	Time (in days) and its probability				
A	-	3	4	5		
		0.20	0.60	0.20		
B	-	4	5	6	7	8
		0.10	0.30	0.30	0.20	0.10
C	A	1	3	5		
		0.15	0.75	0.10		
D	B, C	4	5			
		0.80	0.20			
E	D	3	4	5	6	
		0.10	0.30	0.30	0.30	
F	D	5	7			
		0.20	0.80			
G	E, F	2	3			
		0.50	0.50			

- Draw the network diagram and identify the critical path using the expected activity times.
- Simulate the project using random numbers to determine the activity times. Find the critical path and the project duration (two times)

	A	B	C	D	E	F	G
Run-1	97	95	12	11	90	49	57
Run-2	80	67	14	99	16	89	96

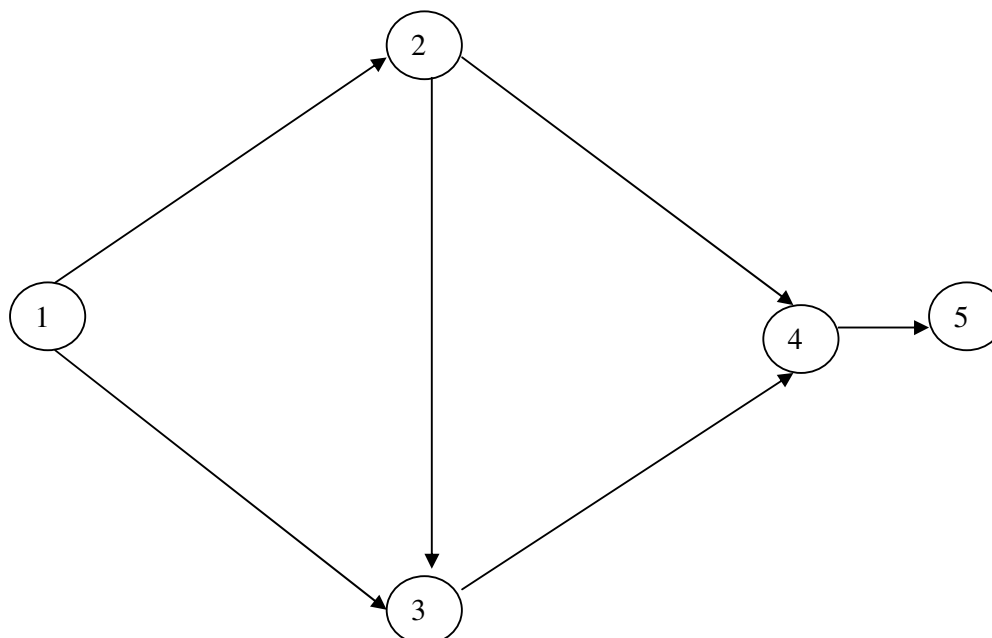
5. The time and cost estimates and precedence relationship of the different activities constituting a project are given below

Job	Preceded By	Normal		Crash	
		Time days (days)	Cost	Time days (days)	Cost
A	--	7	500	5	900
B	A	4	400	2	600
C	A	5	500	5	500
D	A	6	800	4	1,000
E	B,C	7	700	4	1,000
F	C,D	5	800	2	1,400
G	E,F	6	800	4	1,600

Note . The indirect cost per day of project is ` 700.

- Draw a project network diagram and find the critical path.
- Find out the normal duration and the minimum duration?
- Determine optimum versus cost-schedule.

6. The normal time, crash time and crashing cost per day are given for the following network:



Activity	Normal time (days)	Crash time (days)	Crashing cost (` / days)
1-2	18	14	40
1-3	23	22	20
2-3	8	5	60
2-4	10	6	40
3-4	3	2	80
4-5	8	6	50

- (i) Crash the project duration in steps and arrive at the minimum duration. What will be the critical path and the cost of crashing?
- (ii) If there is an indirect cost of ` 70 per day, what will be the optimal project duration and the cost of crashing?