PROJECT MANAGEMENT

Project Management with PERT/CPM Part - II

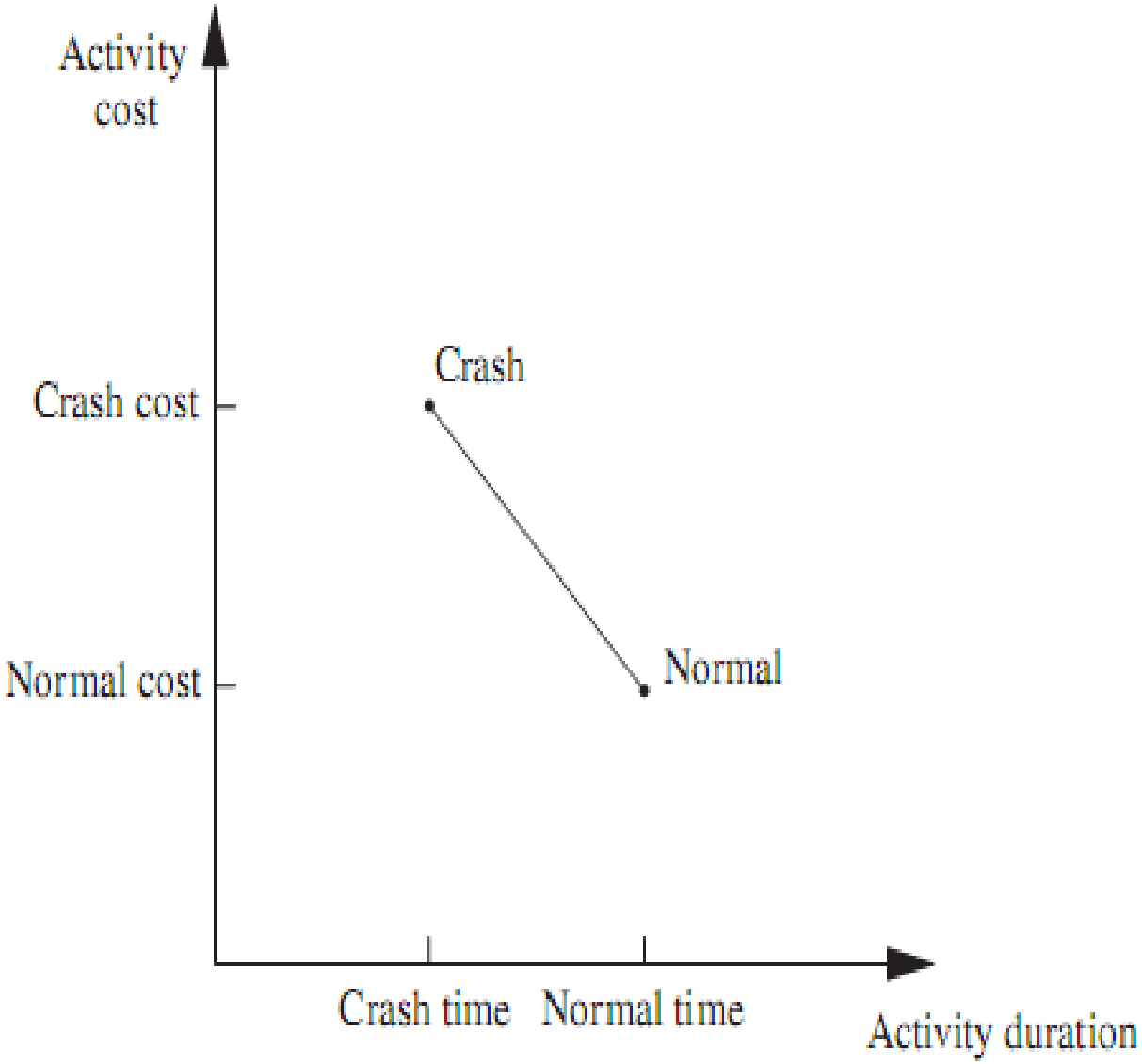
Answered questions.

1. How can the project be displayed graphically to better visualization?
2. What is the total time required to complete the project if no delays occur?
3. When do the individual activities need to start and finish (at the latest) to meet this project completion time?
4. When can the individual activities start and finish (at the earliest) if no delays occur?
5. Which are the critical bottleneck activities where any delays must be avoided to prevent delaying project completion?
6. For the other activities, how much delay can be tolerated without delaying project completion?
7. Given the uncertainties in accurately estimating activity durations, what is the probability of completing the project by the deadline?

Unanswered questions.

8. If extra money is spent to expedite the project, what is the least expensive way of attempting to meet the target completion time (40 weeks)?

CONSIDERING TIME-COST TRADE-OFFS



The normal point on the time-cost graph for an activity shows the time (duration) and cost of the activity when it is performed in the normal way. The crash point shows the time and cost when the activity is fully crashed, i.e., it is fully expedited with no cost spared to reduce its duration as much as possible.

Which Activities Should Be Crashed?

Activity	Time		Cost		Maximum Reduction in Time	Crash Cost per Week Saved
	Normal	Crash	Normal	Crash		
A	2 weeks	1 week	$180,000	$ 280,000	1 week	$100,000
B	4 weeks	2 weeks	$320,000	$ 420,000	2 weeks	$ 50,000
C	10 weeks	7 weeks	$620,000	$ 860,000	3 weeks	$ 80,000
D	6 weeks	4 weeks	$260,000	$ 340,000	2 weeks	$ 40,000
E	4 weeks	3 weeks	$410,000	$ 570,000	1 week	$160,000
F	5 weeks	3 weeks	$180,000	$ 260,000	2 weeks	$ 40,000
G	7 weeks	4 weeks	$900,000	$1,020,000	3 weeks	$ 40,000
H	9 weeks	6 weeks	$200,000	$ 380,000	3 weeks	$ 60,000
I	7 weeks	5 weeks	$210,000	$ 270,000	2 weeks	$ 30,000
J	8 weeks	6 weeks	$430,000	$ 490,000	2 weeks	$ 30,000
K	4 weeks	3 weeks	$160,000	$ 200,000	1 week	$ 40,000
L	5 weeks	3 weeks	$250,000	$ 350,000	2 weeks	$ 50,000
M	2 weeks	1 week	$100,000	$ 200,000	1 week	$100,000
N	6 weeks	3 weeks	$330,000	$ 510,000	3 weeks	$ 60,000

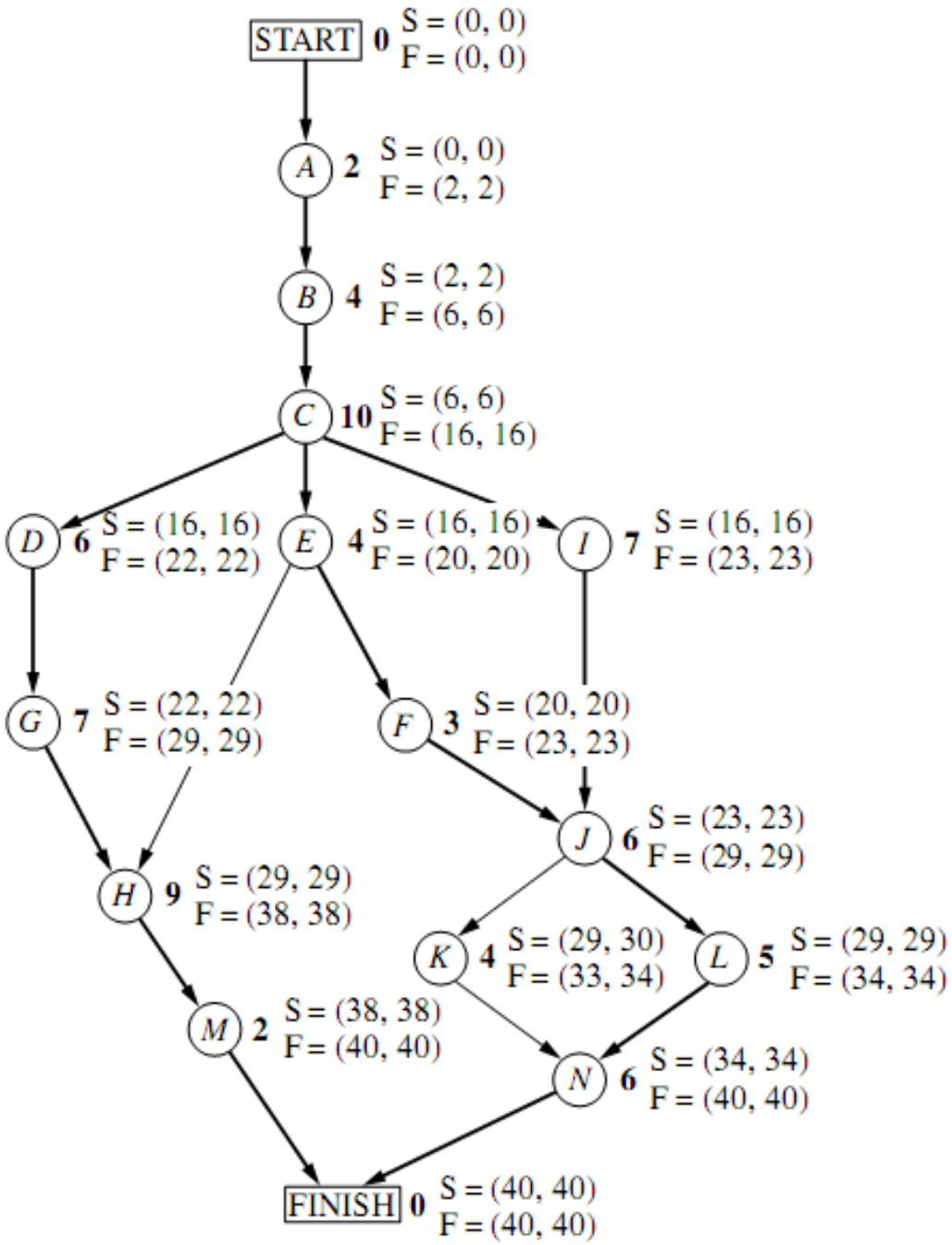
Time-cost trade-off data for the activities of Reliable's project

The final table for performing marginal cost analysis on Reliable's project

Activity to Crash	Crash Cost	Length of Path					
		ABCDGHM	*ABCEHM*	*ABCEFJKN*	*ABCEFJLN*	*ABCIJKN*	*ABCIJLN*
		40	31	43	44	41	42
J	$30,000	40	31	42	43	40	41
J	$30,000	40	31	41	42	39	40
F	$40,000	40	31	40	41	39	40
F	$40,000	40	31	39	40	39	40

The initial table for starting marginal cost analysis of Reliable's project

Activity to Crash	Crash Cost	Length of Path					
		ABCDGHM	*ABCEHM*	*ABCEFJKN*	*ABCEFJLN*	*ABCIJKN*	*ABCIJLN*
		40	31	43	44	41	42



The project network if activities J and F are fully crashed (with all other activities normal) for Reliable's project. The darker arrows show the various critical paths through the project network.

	A	B	C	D	E	F	G	H	I	J	K
1	Reliable Construction Co. Project Scheduling Problem with Time-Cost Trade-offs										
2											
3							Maximum	Crash Cost			
4			Time		Cost		Time	per Week	Start	Time	Finish
5		Activity	Normal	Crash	Normal	Crash	Reduction	saved	Time	Reduction	Time
6		A	2	1	$180000	$280000	1	$100000	0	0	2
7		B	4	2	$320000	$420000	2	$50000	2	0	6
8		C	10	7	$620000	$860000	3	$80000	6	0	16
9		D	6	4	$260000	$340000	2	$40000	16	0	22
10		E	4	3	$410000	$570000	1	$160000	16	0	20
11		F	5	3	$180000	$260000	2	$40000	20	2	23
12		G	7	4	$900000	$1020000	3	$40000	22	0	29
13		H	9	6	$200000	$380000	3	$60000	29	0	38
14		I	7	5	$210000	$270000	2	$30000	16	0	23
15		J	8	6	$430000	$490000	2	$30000	23	2	29
16		K	4	3	$160000	$200000	1	$40000	30	0	34
17		L	5	3	$250000	$350000	2	$50000	29	0	34
18		M	2	1	$100000	$200000	1	$100000	38	0	40
19		N	6	3	$330000	$510000	3	$60000	34	0	40
20											
21									Finish Time =	40	
22									Total Cost =	$4,690,000	

	G	H	K
6	=C6-D6	=(F6-E6)/G6	=I6+C6-J6
7	=C7-D7	=(F7-E7)/G7	=I7+C7-J7
8	=C8-D8	=(F8-E8)/G8	=I8+C8-J8
9	=C9-D9	=(F9-E9)/G9	=I9+C9-J9
10	=C10-D10	=(F10-E10)/G10	=I10+C10-J10
11	=C11-D11	=(F11-E11)/G11	=I11+C11-J11
12	=C12-D12	=(F12-E12)/G12	=I12+C12-J12
13	=C13-D13	=(F13-E13)/G13	=I13+C13-J13
14	=C14-D14	=(F14-E14)/G14	=I14+C14-J14
15	=C15-D15	=(F15-E15)/G15	=I15+C15-J15
16	=C16-D16	=(F16-E16)/G16	=I16+C16-J16
17	=C17-D17	=(F17-E17)/G17	=I17+C17-J17
18	=C18-D18	=(F18-E18)/G18	=I18+C18-J18
19	=C19-D19	=(F19-E19)/G19	=I19+C19-J19

	J
22	=SUM(E6:E19)+SUMPRODUCT(H6:H19,J6:J19)

The spreadsheet displays the application of the CPM method of time-cost trade-offs to Reliable's project, where columns I and J show the optimal solution.