Boğaziçi University
Department of Industrial Engineering
IE 441 Planning for Engineers

Assignment 3: Project Management

Consider the following project information.

Activity Name	Predecessors	Normal Duration (days)	Crashed Duration (days)	Normal Cost (Thousand TL)	Crashed Cost (Thousand TL)
T1		3	2	220	320
T2	T1	4	2	300	600
T3	T1	2	2	250	250
T4	T2	5	3	420	880
T5	T3	1	1	300	300
T6	T3,T9	2	2	400	400
T7	T4,T5	4	4	650	650
T8	T6,T7	3	3	900	900
T9	T1	5	5	420	420
T10	T9	3	3	280	280
T11	T10	6	4	330	600
T12	T2	8	8	720	720
T13	T3,T4	9	6	300	720
T14	T13	2	1	200	400
T15	T11,T14	8	6	660	1000
T16	T8,T15	0	0	0	0

1. Using the Normal Durations,
    a. Calculate the ES, EF, LF, LS times for each activity
    b. Find the critical path and the project completion time, T1
    c. Calculate Total Slack, Free Slack, Safety Slack, Independent Float for each activity

2. Using the Crashed Durations,
    a. Calculate the ES, EF, LF, LS times for all activities
    b. Find the critical path and the project completion time, T2
    c. Calculate Total Slack, Free Slack, Safety Slack, Independent Float for each activity

3. Using the Crashed Durations and your answer to part (2) find all paths and their criticality level. Are there significant sub-critical paths?

4. Using the Time-Cost Trade-off LP model generate the entire Time-Cost profile for project completion times between T1 and T2.

5. Find the optimal project cost and completion time assuming a promised due date of 50 days. There is a fixed overhead cost of 100,000 TL per day during the project and a penalty cost of 450,000 TL per day the project is late.

6. Now consider that the (normal) durations of the project are only **most likely** durations and actually the durations are random variables with the following information (you can ignore crash durations and all costs from now on):

Activity Name	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16
Min Duration (a)	1	2	1	2	1	2	2	2	2	2	3	6	5	1	6	0
Most Likely Duration (m)	3	4	2	5	1	2	4	3	5	3	6	8	9	2	8	0
Max Duration (b)	5	7	4	7	2	3	5	4	6	7	9	12	11	4	9	0

7. Using the PERT approach, find the expected project completion time and its standard deviation.

8. What is the probability that the project completion time is less than 25 days?

9. Find sub-critical paths (with respect to mean durations) and their criticality level.

10. Does your answer to part (8) change in view of your answer to part (9)? Explain.