

Project Time Management

PERT and CPM Key terms

Word/phrase	Meaning
backward pass	The process to determine the late start or late finish times for activities in the critical path method
critical path method (CPM)	A mathematical modelling technique used to schedule a set of tasks. The model allows the longest path (the critical path) to be determined which gives the minimum time required for project completion
earliest finish time (EF)	The earliest start time for the activity plus the time required to complete the activity (the earliest an activity can be completed)
earliest start time (ES)	The earliest time an activity can start once the previous dependent activities are completed
expected time, T_E	Calculated using O, M and P, the expected time is: $T_E=O+4M+P/6$
forward pass	The process to determine the early start or early finish times for activities in the critical path method
GANTT chart	A diagram that shows each task in a project as a block of calendar time. Each block is labelled with the task description and the amount of time the block represents.
latest finish time (LF)	The latest time an activity can be completed without delaying the entire project.
latest start time (LS)	The latest finish time minus the time required to complete the activity
most likely time (M)	The project manager should have a high degree of certainty that a task will be completed within this time
optimistic time (O)	The shortest time that an activity is likely to take – there will be a small probability (less than 5%) of this happening
pessimistic time (P)	The project manager should be almost certain (e.g. 99%) that the task will be completed within this time
Program Evaluation Review Technique (PERT) chart	An implementation of the Critical Path Method where the time for each task is estimated by using a weighted average based on a probabilistic estimation of the optimal, most likely and a pessimistic time to complete the task
slack	The number of spare / float weeks Float = LS-ES or float = LF - LS

Exercises

1. Your company has decided to purchase a new inventory control system. The main tasks and durations have been identified as follows:

Activity	Preceding Activity	Duration in days		
		Optimistic Estimate O	Most Likely Estimate M	Pessimistic Estimate P
A	-	2	3	10
B	-	3	6	9
C	-	1	2	9
D	A	4	6	14
E	B	2	3	4
F	C	5	7	9
G	E, F	2	3	16
H	C	2	3	10
I	D, G, H	2	3	4

- i.) Calculate the expected time for each activity.
- a. Hint: The time expected is calculated as $TE = (O+4M+P)/6$
- ii.) Draw a network diagram for the project (A-O-N diagram – use British standard BS 4335 notation).

Earliest Start	Duration	Earliest Finish
Activity Label, Activity Description		
Latest Start	Float	Latest Finish

British standard BS 4335

- iii.) On the diagram, compute Early Start (ES), Early Finish (EF), Late Start (LS) and Late Finish (LF) time estimates and total float for each activity.
- iv.) Find the critical path and project duration.

- v.) While the project is going on, the client requested some changes and the request was approved. Duration of the activity E was increased by two more days to meet new changes. How would this affect the project duration and the critical path?
- vi.) Write one (01) advantage and one (01) disadvantage of using a Gantt chart for a project plan in comparison to using an activity-on-arrow diagram.

2.

The probable times (in days) for a number of tasks in a software development project have been estimated. Calculate the weighted expected time.

Task	Description	Optimistic O	Most Likely M	Pessimistic P
A	Produce software specification	4	7	10
B	Write test plans	7	23	27
C	Software design	11	14	17
D	Software code	10	22	28
E	Developer test	7	23	27
F	Software test	22	29	30

The task dependencies are shown below.

Task A to be completed first

Task B - Start when A is complete

Task C - Start when A is complete

Task D - start when B is complete

Task E - Start when C is complete

Task F - Start when D and E are complete

- i.) Construct a PERT chart for the project (Use A-O-A Diagram).
- ii.) Find the critical path and project duration.
- iii.) Construct a GANTT chart for the software development project. Assume that the first task starts on 1st July 2019.

3. Consider the following table.

Activity	Duration (Weeks)
A	3
B	10
C	8
D	11
E	1
F	2
G	2
H	1

- Tasks B, C and D can all run simultaneously but are all dependent on task A.
 - Task E is dependent on tasks B and C
 - Task F is dependent only on task C
 - Task G is dependent on tasks E and F.
 - Task H cannot start until tasks D and G are completed.
- (i) Draw Activity-on-Node diagram for this project, showing clearly the earliest and latest start and end dates and the float, for each node. Highlight and name the critical path, together with the minimum duration for the project.
 - (ii) Task D takes two weeks longer than planned to be delivered and installed. Identify and explain briefly the resultant changes to the AoN diagram and critical path.
 - (iii) Draw a Gantt chart for the revised project