PERT (Project Evaluation and Review Technique)

PERT or the Program Evaluation and Review Technique is a method that analyzes the time required to complete each task and its associated dependencies, and to determine the minimum amount of time required to complete a certain project. The process takes into consideration three different time estimates:

Optimistic Time (To): The minimum amount of time required to complete the project, assuming everything goes better than expected.

Pessimistic Time (Tp): The maximum time required to complete the task, assuming things go wrong.

Most Likely Time (Tm): The most likely amount of time required to complete the tasks, assuming everything goes alright.

PERT Chart vs Gantt Chart

PERT (Program Evaluation and Review Technique) and Gantt charts are both tools used in project management, but they serve different purposes:

PERT Charts:

- Visualize task dependencies and their interrelatedness in a project
- Emphasize the sequence and timing of tasks
- Are helpful in planning and scheduling projects with multiple tasks and dependencies

Gantt Charts:

- Visualize task progress over time
- Emphasize the duration of tasks and their start/end dates
- They are useful for monitoring progress and ensuring tasks are completed on time.

How Do You Make a PERT Chart?

Define the project scope: Determine the objectives and goals of the project, and list all the tasks required to achieve those objectives.

Establish task dependencies: Identify the dependencies between tasks and determine the

order in which tasks must be completed.

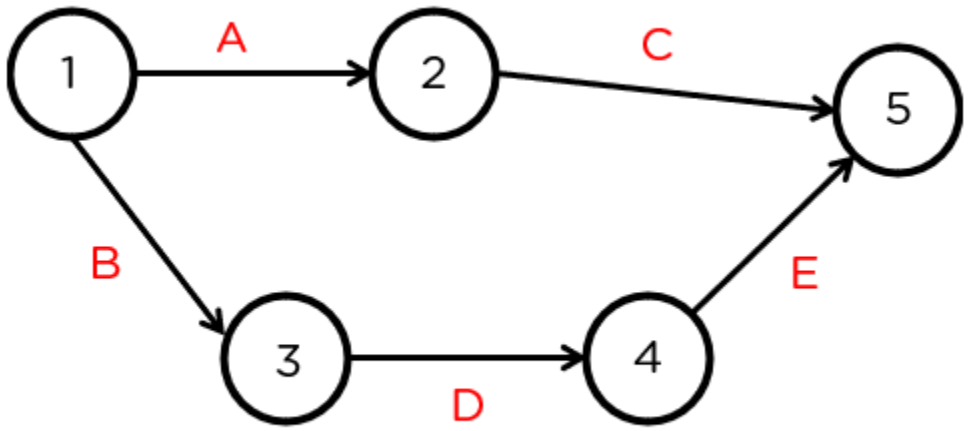
Determine task duration: Estimate the time each task will take to complete.

Create a network diagram: Use arrows to connect the tasks and show their dependencies on each other. Number the tasks and events, and list their estimated duration.

Add critical path information: Determine the critical path and the sequence of tasks that determines the minimum overall project duration.

Update the chart regularly: Revisit the PERT chart regularly to reflect changes in the project, such as changes in task dependencies, duration, or priority.

Present the chart: The final PERT chart should clearly show the relationships between tasks, the critical path, and the estimated duration of each task.



Event

A circle represents events and will occur at the start and end of an activity. Event 1 is the tail event, and Event 2 is the head event. In the case of our example, node 1 will be referred to as the tail event, and 2 will be referred to as the head event.

Activity

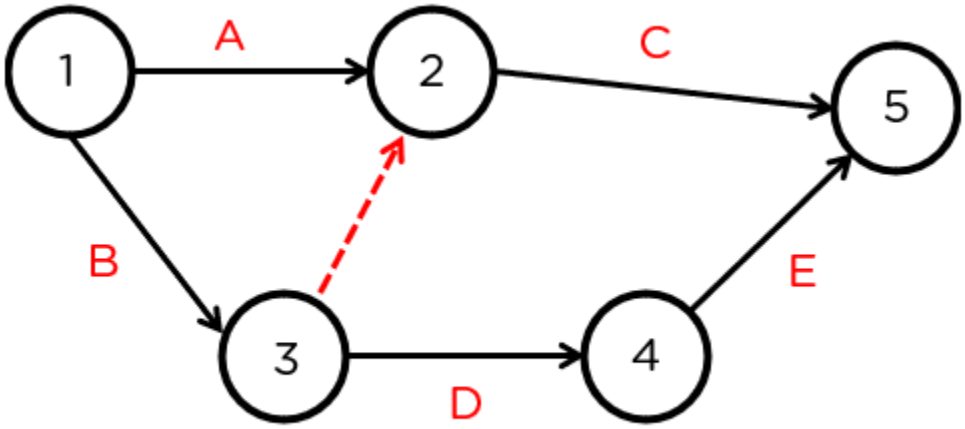
Activities represent action and consumption of resources like time, money, and energy required to complete the project. In the case of our example, A, B, C, D, and E represent

the activities taking place between their respective events.

Dummy Activity

A dummy activity represents a relationship between two events. In the case of the example below this, the dotted line represents a relationship between nodes 3 and 2.

The activity between these nodes will not have any value.



Other rules that need to be considered are:

- The network should have a unique starting and ending node.
- No activity can be represented by more than a single arc (the line with an arrow connecting the events) in the network.
- No two activities can have the same starting and ending node.

The PERT Analysis Method

In the question here, we have three objectives:

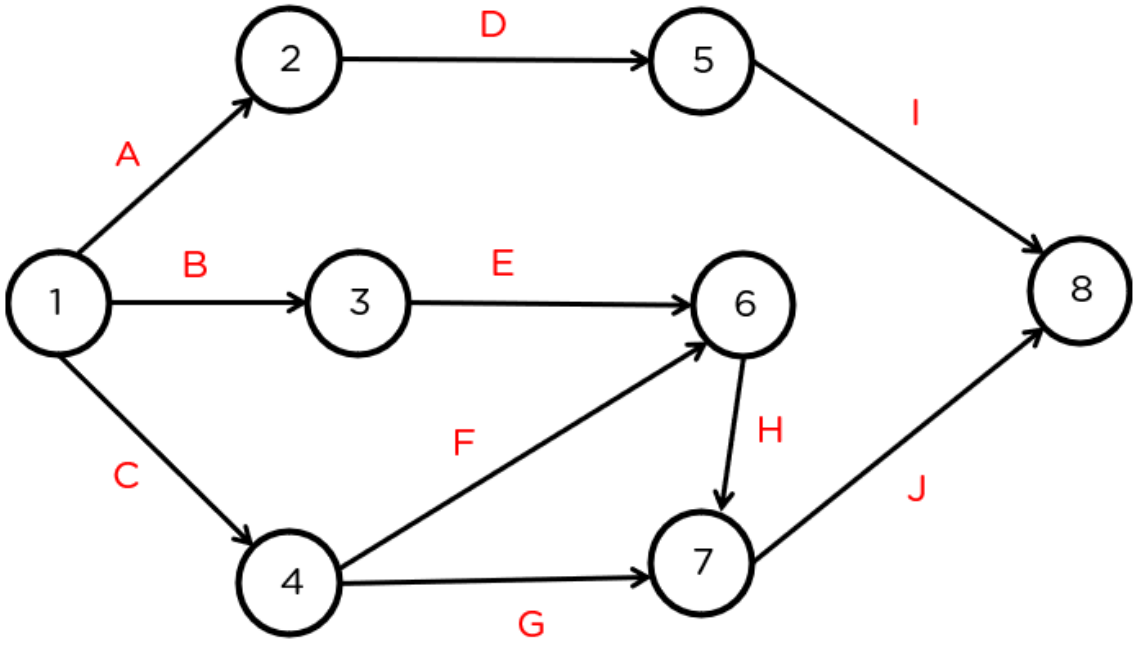
1. Draw the network diagram.

2. Find the mean and variance.

3. Find the critical path and estimated time of completion.

Activities	Immediate Predecessor	Optimistic Time	Most Likely Time	Pessimistic Time
A	-	6	7	8
B	-	3	5	7
C	-	4	7	10
D	A	2	3	4
E	B	3	4	11
F	C	4	8	12
G	C	3	3	9
H	E, F	6	6	12
I	D	5	8	11
J	H, G	3	3	9

Now, let's draw the network diagram.



Now that we've created the network diagram, let's move ahead. Next, as part of the PERT analysis, let's have a look at how to determine the mean and variance.

The mean, which is also the estimated time can be determined using the formula:

$$T_e = \frac{T_0 + 4Tm + Tp}{6}$$

We can calculate the variance using this formula:

$$\sigma^2 = \left(\frac{T_P - T_0}{6}\right)^2$$

Let's apply the formula to each activity.

Activities	Immediate Predecessor	Optimistic Time	Most Likely Time	Pessimistic Time	Mean	Variance
A	-	6	7	8	7	0.11
B	-	3	5	7	5	0.44
C	-	4	7	10	7	1
D	A	2	3	4	3	0.11
E	B	3	4	11	5	1.77
F	C	4	8	12	8	1.77
G	C	3	3	9	4	1
H	E, F	6	6	12	7	1
I	D	5	8	11	7	1
J	H, G	3	3	9	4	1

Now, for the third part of the PERT analysis. We need to find the critical path and the estimated time.

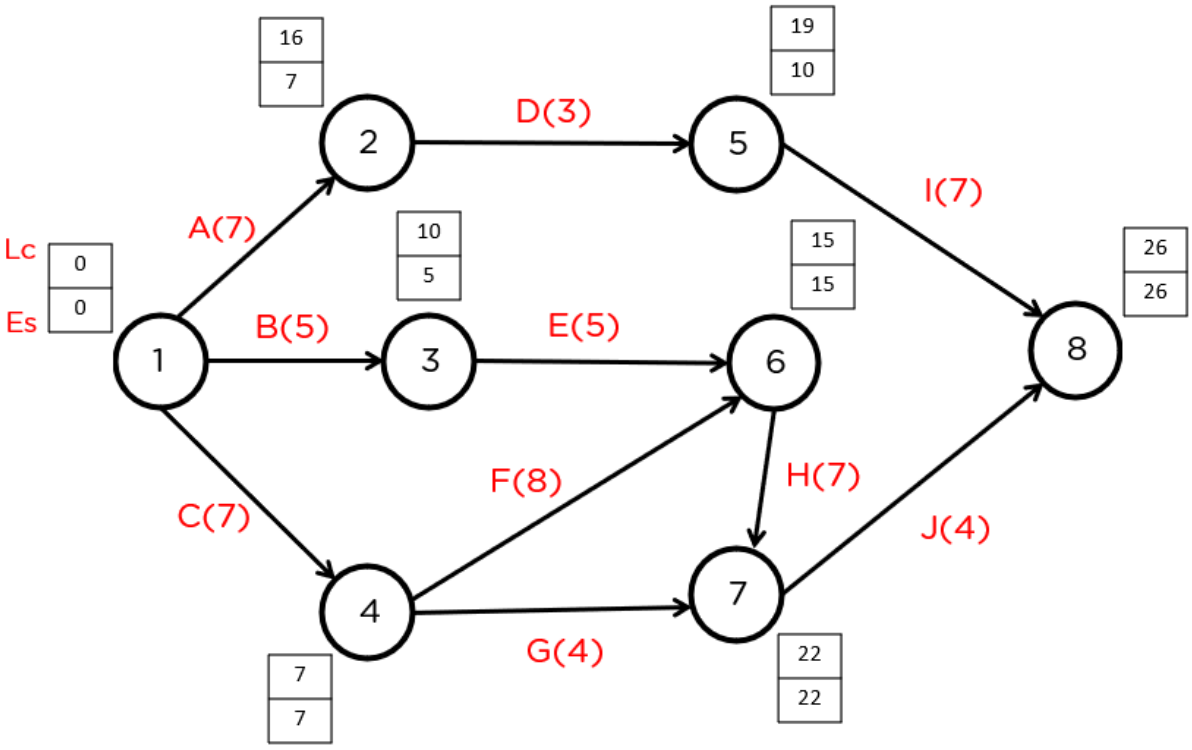
For this, we'll need to find two values, Earliest Start Time (Es) and Latest Completion Time (Lc).

The process of determining the Es for all events is called a forward pass.

The process of determining the Lc for all events is called a backward pass.

Let's get into the forward pass. For this first, we must create boxes at all nodes. We then divide these into two. The lower half of the box represents the earliest start time of the node, while the lower half represents the latest completion time.

Your network diagram should look something like this.



From the diagram, we can see that nodes that satisfy the requirements are:

1 - 4 - 6 - 7 - 8 or C - F - H - J

The estimated time is: 7 + 8 + 7 + 4 = 26 days.

Advantages of Using a PERT Chart

Visualization: PERT charts provide a visual representation of project tasks, allowing for a clear understanding of project timelines, dependencies and critical paths.

Planning and scheduling: PERT charts help project managers to create a detailed project plan, including defining tasks, estimating task durations, and setting deadlines.

Risk Management: PERT charts allow project managers to identify and analyze potential risks, enabling them to develop mitigation strategies.

Resource Allocation: PERT charts help project managers to identify resource requirements and allocate resources effectively, reducing the risk of delays or overloading.

Improved communication: PERT charts can be shared with all stakeholders, helping to ensure clear communication of project plans and progress.

Adaptability: PERT charts can be easily updated to reflect changes in the project, ensuring that project plans remain relevant and accurate.

Disadvantages of Using PERT Chart

Complexity: PERT charts can be challenging for those needing project management experience.

Time-consuming: Creating a PERT chart can be time-consuming and requires significant effort.

Dependent on accurate information: PERT charts rely on precise information about task durations and dependencies, and errors in this information can significantly impact the chart's effectiveness.

Limited scope: PERT charts are limited in their scope and may not be suitable for larger, more complex projects.

Over-reliance: Over-reliance on PERT charts can lead to a lack of flexibility and an inability to respond to changes in the project.

Inflexibility: Once a PERT chart has been created, it can be difficult to make changes to the project plan, limiting the ability to respond to changes in project requirements.

PERT	CPM
PERT is that technique of project management which is used to manage uncertain (i.e., time is not known) activities of any project.	CPM is that technique of project management which is used to manage only certain (i.e., time is known) activities of any project.
It is an event oriented technique which means that the network is constructed on the basis of events.	It is an activity oriented technique which means that the network is constructed on the basis of activities.
It is a probability model.	It is a deterministic model.
It majorly focuses on time as meeting time targets or estimation of percent completion is more important.	It majorly focuses on Time-cost trade off as minimizing cost is more important.
It is appropriate for high precision time estimation.	It is appropriate for reasonable time estimation.
It has Non-repetitive nature.	It has a repetitive nature.
There is no chance of crashing as there is no certainty of time.	There may be crashes because of certain time boundation.
It doesn't use any dummy activities.	It uses dummy activities for representing a sequence of activities.
It is suitable for projects which require research and development.	It is suitable for construction projects.