

Here are detailed notes for **Module 2** of your HSMC-501 course covering **Critical Path Method (CPM)** and **Programme Evaluation Review Technique (PERT)**:

2.1 CPM and PERT

Meaning:

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Critical Path Method (CPM):

- A project management technique used to plan, schedule, and control activities in a project.
- Focuses on determining the longest path (critical path) in the network diagram to identify activities that directly affect project completion time.

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Programme Evaluation Review Technique (PERT):

- A statistical tool used for project management that analyzes and represents the tasks involved in completing a project.
 - Suitable for projects where activity durations are uncertain, using probabilistic time estimates.
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Features:

1.

CPM:

- Based on deterministic time estimates.
- Focuses on time-cost trade-offs.
- Primarily used for repetitive projects (e.g., construction).
- Identifies the critical path for time optimization.

2.

PERT:

- Based on probabilistic time estimates (optimistic, pessimistic, and most likely times).
- Handles uncertainty and complexity.
- Best suited for R&D projects.

Differences between CPM and PERT:

| Aspect | CPM | PERT |
|----------------|--------------------------------------|-----------------------------------|
| Time Estimates | Deterministic (fixed) | Probabilistic (variable) |
| Focus | Time-cost optimization | Time estimation under uncertainty |
| Application | Construction, manufacturing projects | Research, development projects |

| | | |
|---------------|-------------------------------|---|
| Nature | Activity-oriented | Event-oriented |
| Critical Path | Critical path is well-defined | Critical path may vary with probabilities |

Applications:

- CPM:
 - Used in construction, production scheduling, and plant maintenance.
 - PERT:
 - Ideal for research projects, software development, and new product launches.
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2.2 Terms Used in Network Diagram

1. **Event (Node):** A point that marks the start or end of an activity.
2. **Activity:** A task or set of tasks that consume time and resources.
3. **Dummy Activity:** A representation of dependency without time or resource consumption.
4. **Critical Path:** The longest path through the network with zero float.
5. **Float (Slack):** The amount of time an activity can be delayed without affecting the project timeline.
6. **Earliest Start Time (EST):** The earliest time an activity can begin.
7. **Latest Finish Time (LFT):** The latest time an activity must be completed.

Network Diagram for a Real-Life Project

Example Project: **Building a House**

Activities:

1. Design approval
2. Site preparation
3. Foundation laying
4. Wall construction
5. Roofing
6. Plumbing
7. Electrical wiring
8. Interior finishing
9. Painting
10. Final inspection

Network Diagram:

Start --> (1) Design Approval --> (2) Site Prep --> (3) Foundation --> (4) Wall Construction --> (5) Roofing
--> (6) Plumbing & (7) Electrical --> (8) Interior --> (9) Painting --> (10) Final Inspection --> End

Computation of LPO and EPO:

- 1.

Earliest Possible Occurrence (EPO):

- Calculated by moving forward in the network.
- Add the duration of preceding activities to the starting time.

2.

Latest Possible Occurrence (LPO):

- Calculated by moving backward in the network.
- Subtract the duration of succeeding activities from the ending time.

Determination of Critical Path:

- Add activity durations along all possible paths.
- Identify the path with the longest duration as the **critical path**.

Floats:

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Types of Floats:

1. **Total Float (TF):** The total time an activity can be delayed without affecting the project.
2. **Free Float (FF):** The time an activity can be delayed without delaying the next activity.
3. **Independent Float (IF):** The time an activity can be delayed without affecting the earliest start of succeeding activities.

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Formulae:

- $TF = LFT - EST - \text{Duration}$
- $FF = \text{EST of Next Activity} - EST - \text{Duration}$

Crashing of Network:

- **Definition:** Shortening the project duration by allocating extra resources to critical activities.
- **Steps:**
 1. Identify critical activities.
 2. Calculate the cost of crashing per unit time.
 3. Select activities with the least crashing cost.

Updating the Network:

- **Definition:** Revising the network to reflect changes in the project.

- **Applications:**

- Accommodating delays.
 - Reallocating resources.
 - Managing changes in project scope.
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