
Software Project Management

Objectives

- To understand the need, scope and purpose of project planning.
- To describe the project planning process.
- To develop a project plan.
- To perform project scheduling using techniques such as Gantt chart, PERT chart and critical path method.
- To understand the need for tracking a project schedule.
- To explain project staffing and project monitoring.
- To develop the risk management plan.

Why SPM??

- Concerned with activities involved in ensuring that software is delivered on time and on schedule and in accordance with the requirements of the organization developing the software.
- Project management is needed because software development is always subject to budget and schedule constraints that are set by the organization developing the software.

Topics covered

- Project planning
- Project scheduling

Project planning

- Before starting a software project, it is essential to determine the task to be performed and properly manage allocation of tasks among individuals involved in software development.

Objectives of project planning

- ❖ It defines the roles and responsibilities of the project management team members.
- ❖ It ensures that the project management team works according to the objectives.
- ❖ It checks the feasibility of the user requirements.
- ❖ It determines project constraints.

Principles of project planning

- Clear project planning
- Risk analysis
- Tracking of project plan
- Meet quality standards
- Description of flexibility

Project Scheduling

- Scheduling is an important project planning activity.

Steps :

- ❖ Identify all the tasks needed to complete the project
- ❖ Break down large tasks into small activities.
- ❖ Determine the dependency among different activities.
- ❖ Allocates resources to activities.
- ❖ Plan the starting and ending dates for different activities.
- ❖ Determine the **critical path**.

Work Breakdown Structure (WBS)

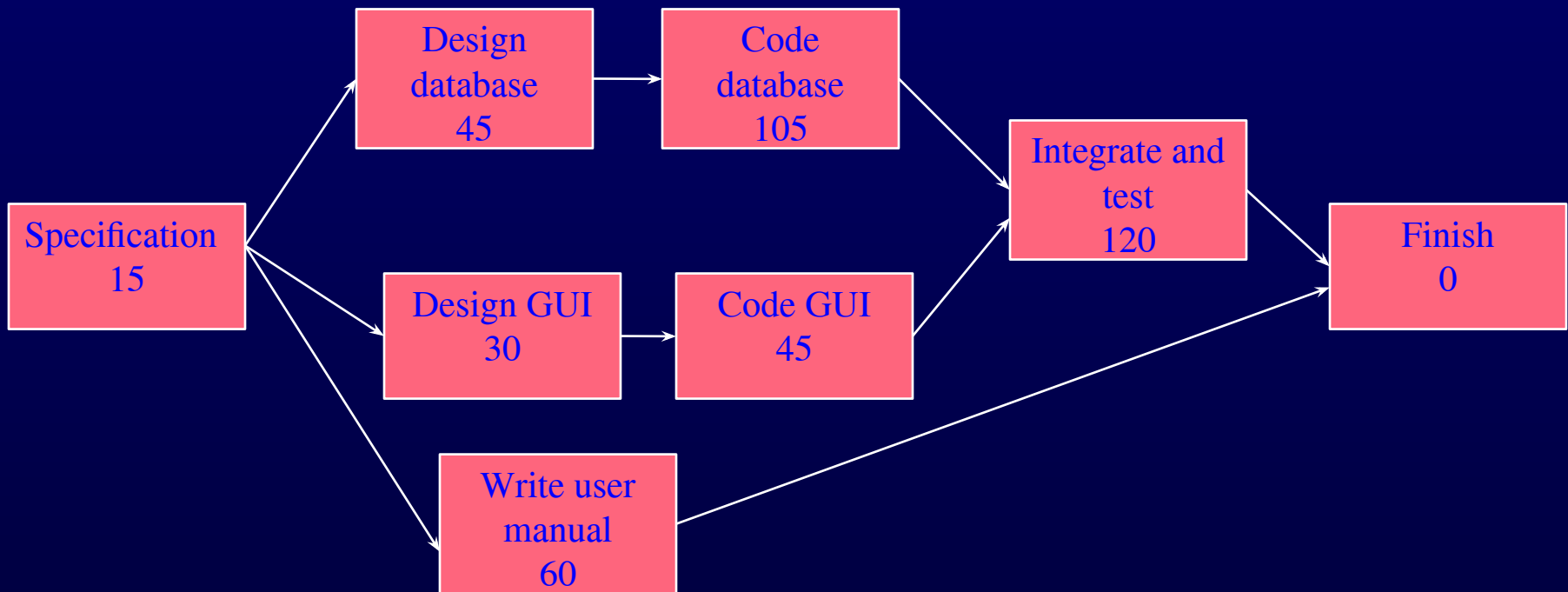
- It is used to decomposed a given task into small activities.

Activity Networks

- WBS representation of a project is transformed into an activity network by representing activities identified in WBS along with their inter-dependencies.
- An activity network shows the different activities making up a project, their estimated durations and inter-dependencies.

Activity Networks

- Each activity is represented by a rectangular node and the duration of the activity is shown along with the task.



Critical Path Method (CPM)

- Project parameters:
 - ▢ MT(minimum time) to complete the project
= maximum of all paths from start to finish
 - ▢ ES(earliest start) time of a task = maximum of all paths from start to this task
 - ▢ LS(latest start) time = MT- maximum of all paths from this task to finish

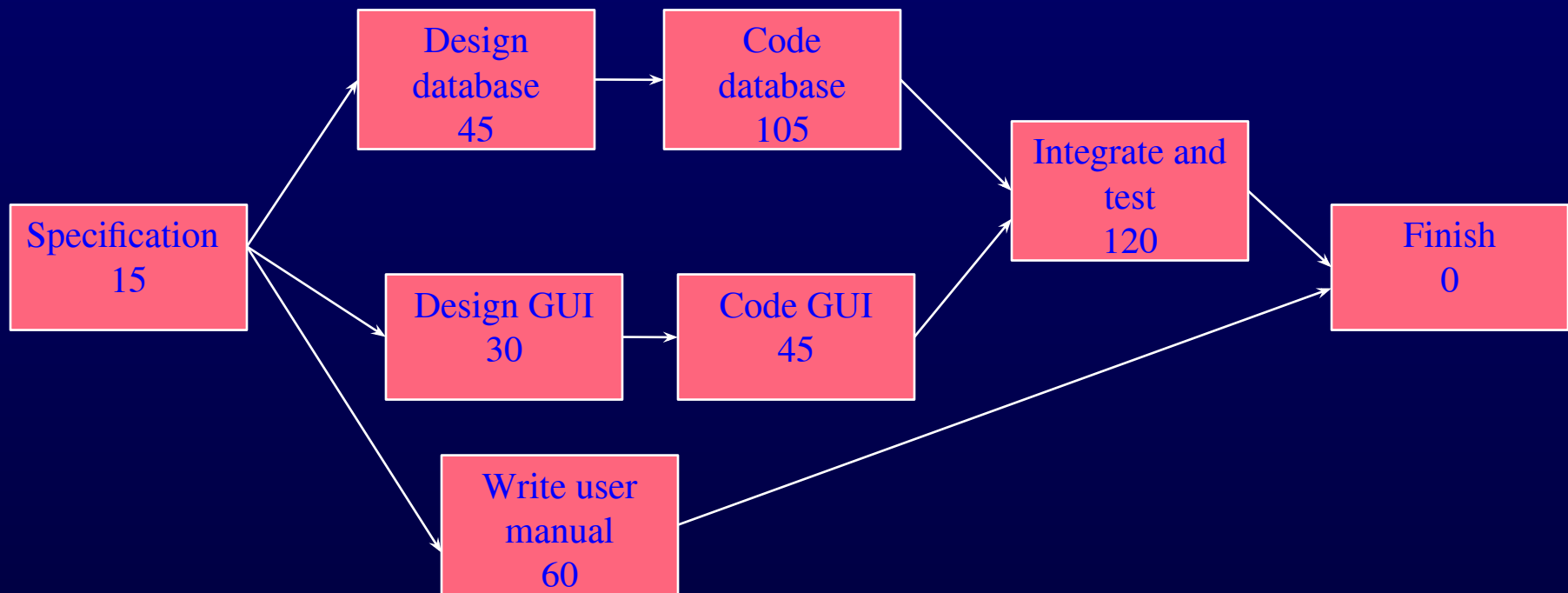
Critical Path Method (CPM)

- Project parameters:
 - ▢ $EF(\text{earliest finish}) \text{ time of a task} = ES \text{ time} + \text{duration of the task}$
 - ▢ $LF(\text{latest finish}) \text{ time of a task} = LS \text{ time} + \text{duration of the task}$
 - ▢ $ST(\text{slack time}) = LS - ES \text{ (or } LF - EF \text{)}.$

Slack time is the total time that a task may be delayed without affecting the end time of the project.

Critical Path Method (CPM)

Compute the project parameters for the following activity network.



Task	MT	ES	LS	EF	LF	ST
Specification						
Design database						
Design GUI						
Code database						
Code GUI						
Integrate and test						
Write user manual						

Critical Path Method (CPM)

Task	MT	ES	LS	EF	LF	ST
Specification	285	0	0	15	15	0
Design database		15	15	60	60	0
Design GUI		15	90	45	120	75
Code database		60	60	165	165	0
Code GUI		45	120	90	165	75
Integrate and test		165	165	285	285	0
Write user manual		15	225	75	285	210

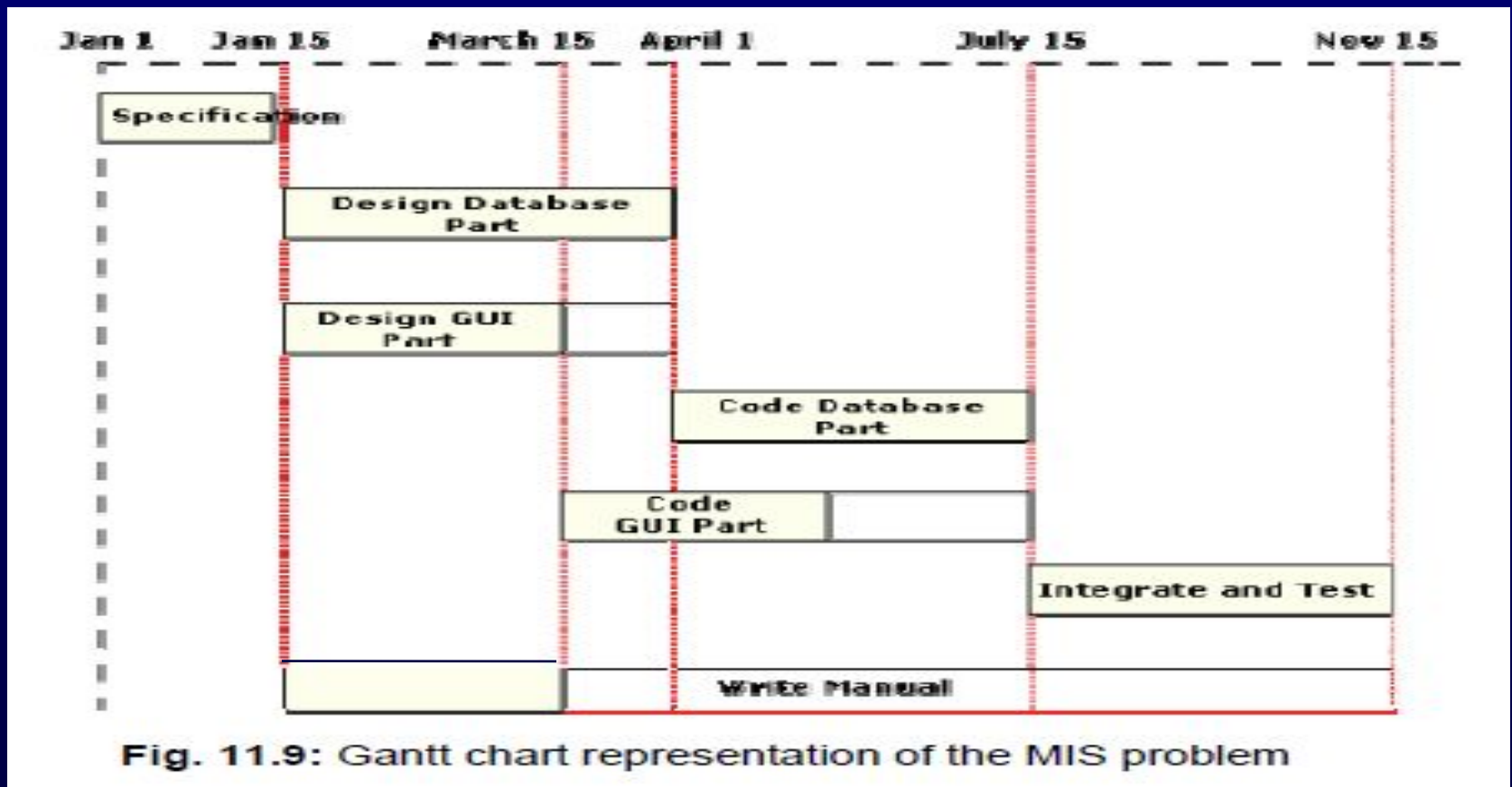
Gantt Chart

- Gantt charts are mainly used to allocate resources to activities include staff, hardware and software.
- Gantt chart is a special type of bar chart where each bar represents an activity.
- The bars are drawn along a time line.
- The length of each bar is proportional to the duration of time planned for the corresponding activity.

Gantt Chart

- Each bar consists of a shaded part and a white part. The shaded part shows the length of the estimated time and white part shows the slack time.

Gantt Chart



Notation	Activity	Duration (months)
T1	Requirement specification	1
T2	Design Database part	2
T3	Design Interface part	2
T4	Code database part	5
T5	Code interface part	3
T6	Code control processing part	2
T7	Integrate and test	6
T8	Write user manual	3

The following precedence relation holds among the different tasks:

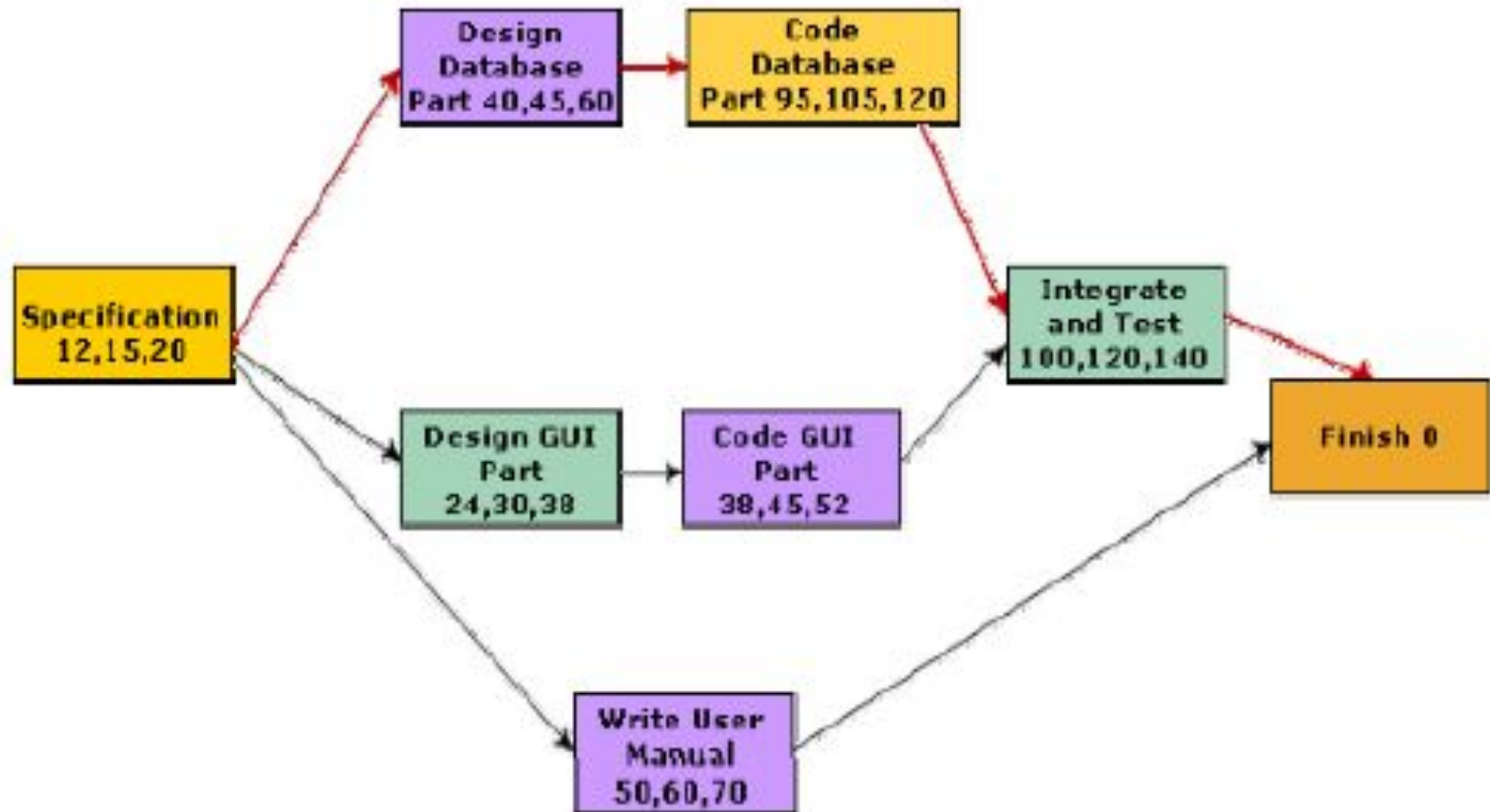
$$T1 < \{T2, T3\} < \{T4, T5, T6\} < T7$$

Draw the **Activity network** and **Gantt Chart**. Also find the **Critical path**.

PERT Chart

- Project Evaluation and Review Technique chart.
- It consists of a network of boxes and arrows.
- Boxes represents the tasks with the variations in the project estimation.
pessimistic, **nominal** and **optimistic** estimation.
- There may be more than one critical path, depending on the permutations of the estimates for each task.

PERT Chart



Project Monitoring

- Project manager has to monitor the project continuously to ensure that it is progressing as per plan.
- **Milestones** are designated.
- The tasks along a critical path are called **critical task**.
- If necessary, a manager may switch resources from a non-critical task to a critical task.

Project Staffing

- The number of team members required in a project depends on the type of project and the effort and cost required for it.
- Project staffing is the process of searching, evaluating and establishing a working relationship among the members of a project.
- It is important to assign different roles and responsibilities to different individuals according to their skill, abilities and experience.

Project Staffing

- Factors for staffing:
 - ▢ Application domain experience
 - ▢ Platform experience
 - ▢ Programming language experience
 - ▢ Educational qualification
 - ▢ Communication ability
 - ▢ Team spirit

Project Staffing

- Principles of project staffing:
 - ❖ The task should be assigned to staff members according to their skills and abilities.
 - ❖ Every staff member should be assigned a designation.
 - ❖ Every staff member should be constrained to follow the guidelines and standards of the organization.

Effort vs. Time

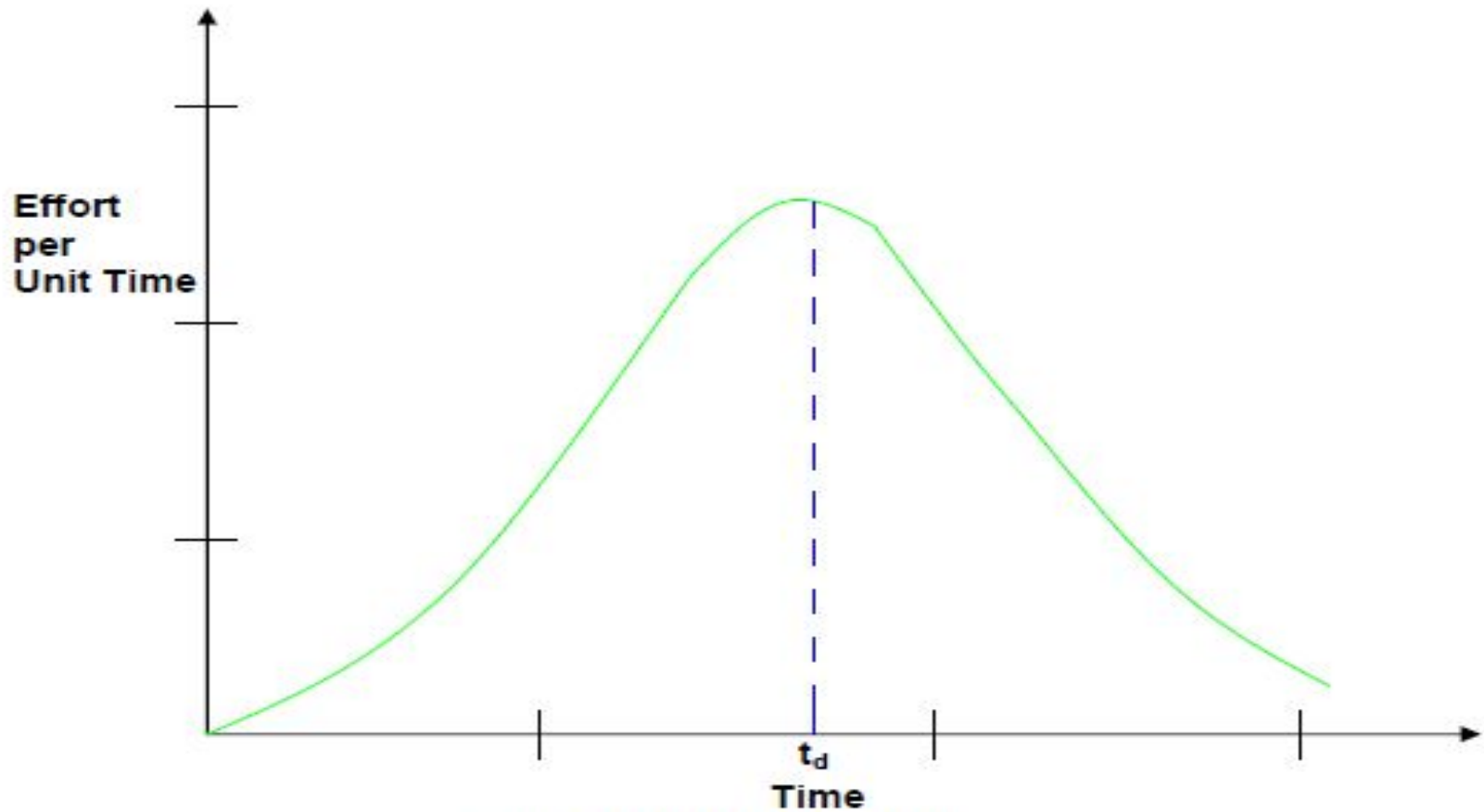


Fig. 11.6: Rayleigh curve

Putnam's Work

- By analyzing a large number of projects, Putnam derived the following expression:

$$L = P (E)^{1/3} (t_d)^{4/3}$$

Where, L is the project size in KLOC

P is software quality parameter

E= total effort in person-months

t_d = the project duration in months

Putnam's Work

- The effort can be calculated by the following equation:

$$E = L^3 / (P^3 t_d^4)$$

Effect of schedule change on Cost

From Putnam's proposed expression

$$E = (L^3/P^3) * 1/t_d^4$$