



# Software Project Management

Durga Prasad Mohapatra

Professor

CSE Deptt.

NIT Rourkela



## **Project scheduling cont...**

# Projects and Activities

- Let us first discuss what do we mean by a project and its activities.
- We will also discuss some assumptions that will be relevant when we start to produce an activity plan.

# Defining Activities

- A project is composed of a number of interrelated activities.
- A project may start when at least one of its activities is ready to start.
- A project will be completed when all of the activities it encompasses have been completed.
- An activity must have a clearly defined start and a clearly defined end-point, normally marked by the production of a tangible deliverable.

# Defining Activities cont ...

- If an activity requires a resource, then that resource requirement must be forecastable and is assumed to be required at a constant level throughout the duration of the activity
- The duration of an activity must be forecastable - assuming normal circumstances, and the reasonable availability of resources.
- Some activities might require that others are completed before they can begin (these are known as precedence requirements).

# Identifying activities

- Essentially there are three approaches to identifying the activities or tasks that make up a project:
  - the activity-based approach,
  - the product-based approach and
  - the hybrid approach

# The activity based approach

- It consists of creating a list of all the activities that the project is thought to involve.
- This might require a brainstorming session involving the whole project team or it might stem from an analysis of similar past projects.
- When listing activities, particularly for a large project, it might be helpful to subdivide the project into the main life cycle stages and consider each of these separately.
- Rather than doing this in an ad hoc manner, with the obvious risks of omitting or double-counting tasks, a much favoured way of generating a task list is to create a Work Breakdown Structure (WBS).

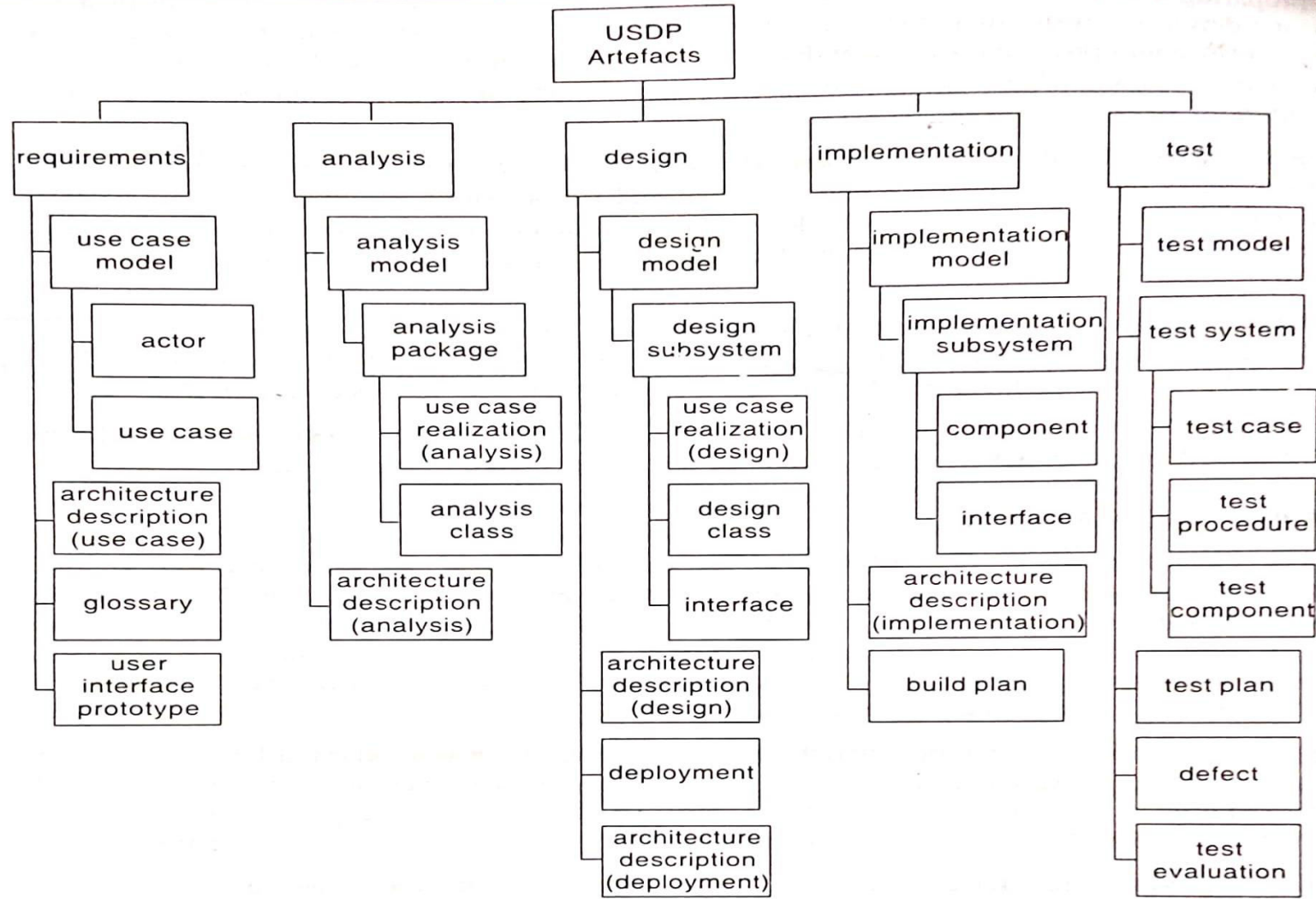
# The product-based approach

- It consists of producing a Product Breakdown Structure (PBS) and a Product Flow Diagram (PFD).
- PFD indicates, for each product, which other products are required as inputs. PFD can be easily transformed into an ordered list of activities by identifying the transformations that turn some products into others.
- Proponents of this approach claim that it is less likely that a product will be left out of a PBS than that an activity might be omitted from an unstructured activity list.
- This approach is suitable when using methodologies such as SSADM or USDP, which clearly specifies, for each step or task, each of the products required and the activities required to produce it.
- For example, the SSADM Reference Manual provides a set of generic PBSs for each stage in SSADM, which can be used as a basis for generating a project specific PBS.

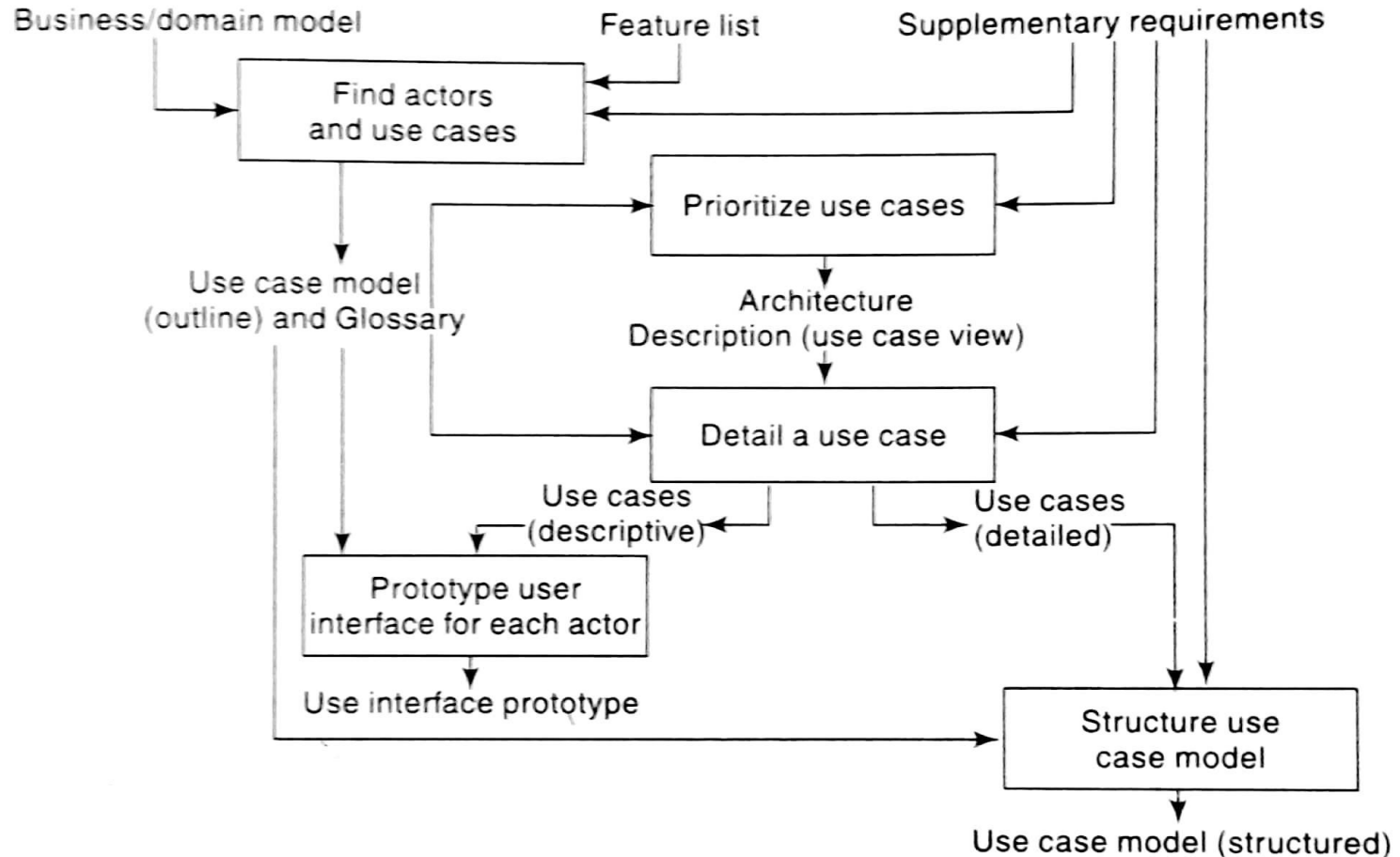


# The product-based approach cont ...

- In the USDP, products are referred to as **artefacts**, and the sequence of activities needed to create them is called a **workflow**.
- USDP emphasizes that processes are iterative. This means that it may not be possible to map a USDP process directly onto a single activity in a network.



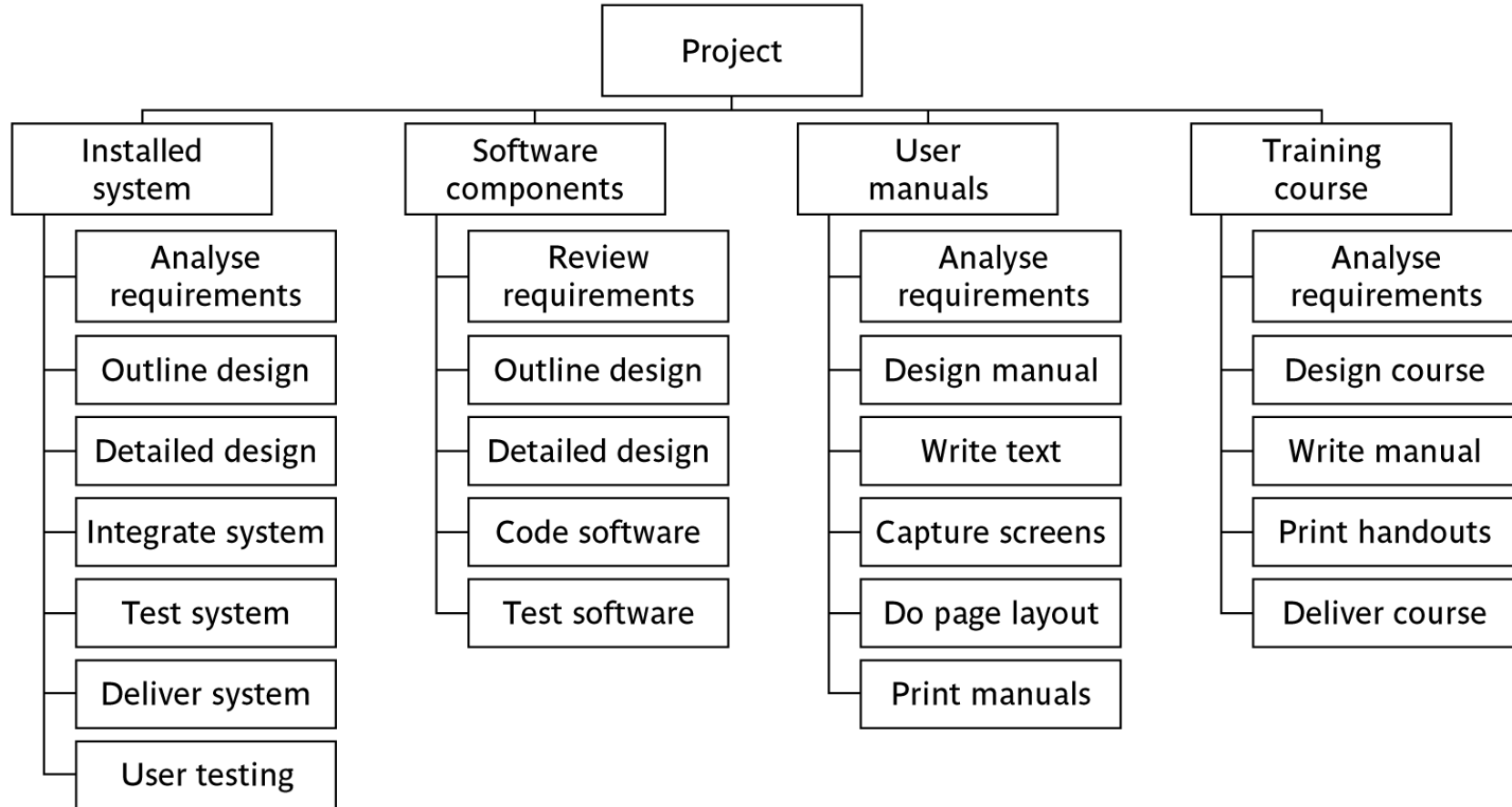
# A structuring of activities for USDP reqmnts capture work flow



# The hybrid approach

- The WBS discussed earlier is based entirely on a structuring of activities.
- Alternatively, and perhaps more commonly, a WBS may be based upon the project's products as shown in next figure, which is in turn based on a simple list of final deliverables and, for each deliverable, a set of activities required to produce that product.
- Next figure illustrates a flat WBS.

# The hybrid approach



# The hybrid approach

- It is likely that, in a project of any size, it would be beneficial to introduce additional levels – structuring both products and activities.
- The degree to which the structuring is product-based or activity-based might be influenced by the nature of the project and the particular development method adopted.
- As with a purely activity-based WBS, having identified the activities, we are then left with the task of sequencing them.
- A framework dictating the number of levels and the nature of each level in the structure may be imposed on a WBS. For example, IBM recommends that the following five levels should be used in a WBS:

# The hybrid approach

- Level 1: **Project**.
- Level 2: **Deliverables** such as software, manuals and training courses.
- Level 3: **Components**, which are the key work items needed to produce deliverables, such as the modules and tests required to produce the system software.
- Level 4: **Work-packages**, which are major work items, or collections of related tasks, required to produce a component.
- Level 5: **Tasks**, which are tasks that will normally be the responsibility of a single person.



# Network Planning Models

- These project scheduling techniques model the project's activities and their relationships as a network.
- In the network, time flows from left to right. These techniques were originally developed in the 1950s – the two best known being CPM (Critical Path Method) and PERT (Program Evaluation Review Technique).
- Both of these techniques used an **activity-on-arrow** approach to visualizing the project as a network where activities are drawn as arrows joining circles, or nodes, which represent the possible start and/or completion of an activity or set of activities.
- More recently a variation on these techniques, called **precedence networks**, has become popular.



# Network Planning Models or Activity Networks

- This method uses **activity-on-node** networks where activities are represented as nodes and the links between nodes represent precedence (or sequencing) requirements.
- This latter approach avoids some of the problems inherent in the activity-on-arrow representation and provides more scope for easily representing certain situations.
- It is this method that is adopted in the majority of computer applications currently available.
- These methods are very similar and it must be admitted that many people use the same name (particularly CPM) indiscriminately to refer to any or all of the methods.

# Activity Networks

- An activity network shows the different activities making up a project, their estimated durations, and their interdependencies.
- Two equivalent representations for activity networks are possible and are in use:
  - Activity on Node (AON)
  - Activity on Edge (AOE) or Activity on Arrow (AOA)

# Activity Networks

- WBS structure can be refined into an activity network representation:
  - Network of boxes and arrows
  - shows different tasks making up a project,
  - represents the ordering among the tasks.
- It is important to realize that developing WBS and activity network
  - requires a thorough understanding of the tasks involved.

# Activity on Node (AON)

- Each activity is represented by a rectangular (some use circular) node and the duration of the activity is shown alongside each task in the node.
- The inter-task dependencies are shown using directional edges.

# Activity on Edge (AOE)

- Tasks are associated with the edges.
- The edges are also annotated with the task duration.
- The nodes in the graph represent project milestones.

# Activity networks

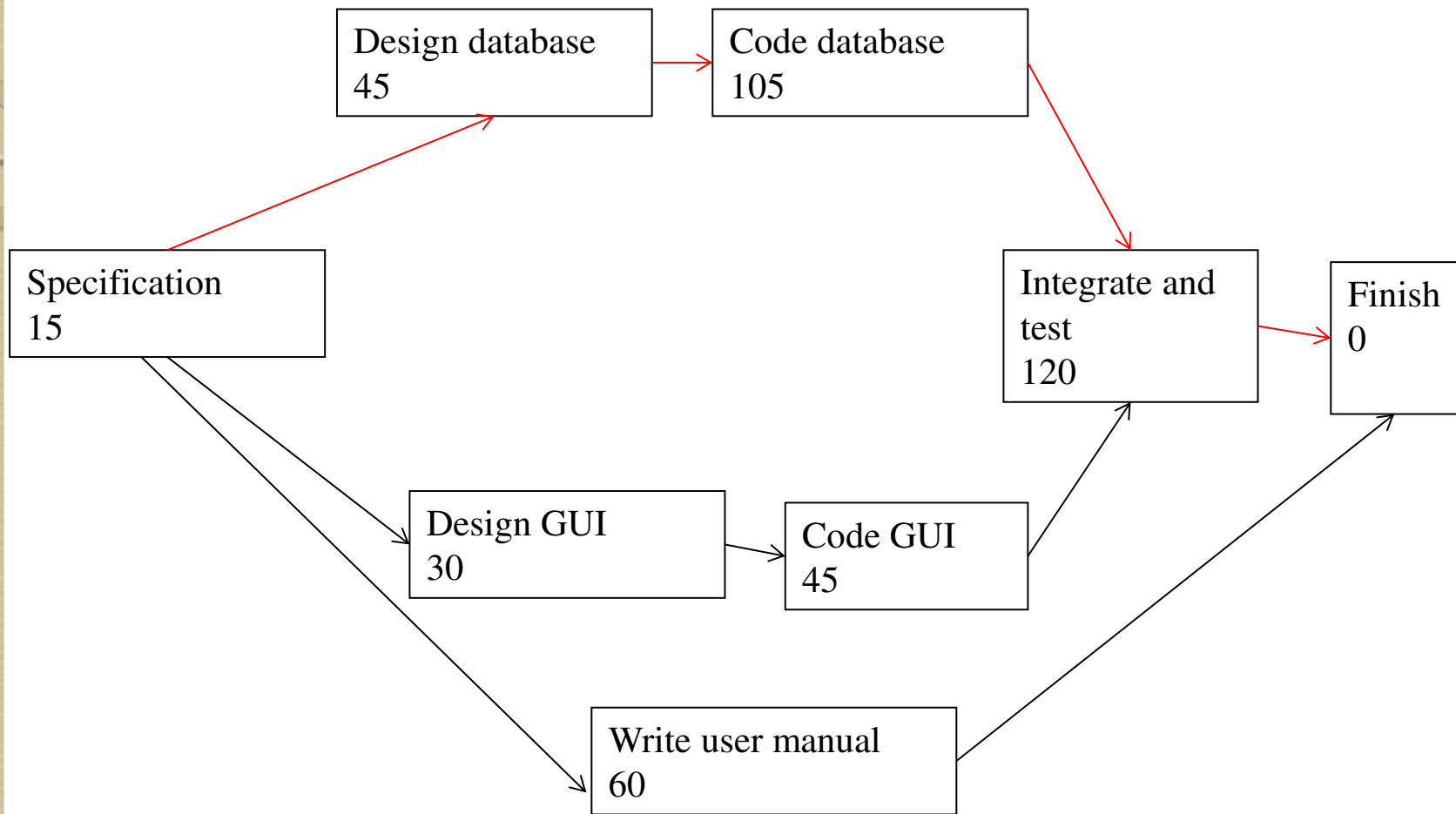
- Activity networks were originally represented using *activity on edge (AOE)* representation.
- However, later *activity on node (AON)* has become popular since this representation is easier to understand and revise.

# Example

- Consider MIS development project.
- Suppose the project manager has determined the durations and dependencies for each task as given in table.

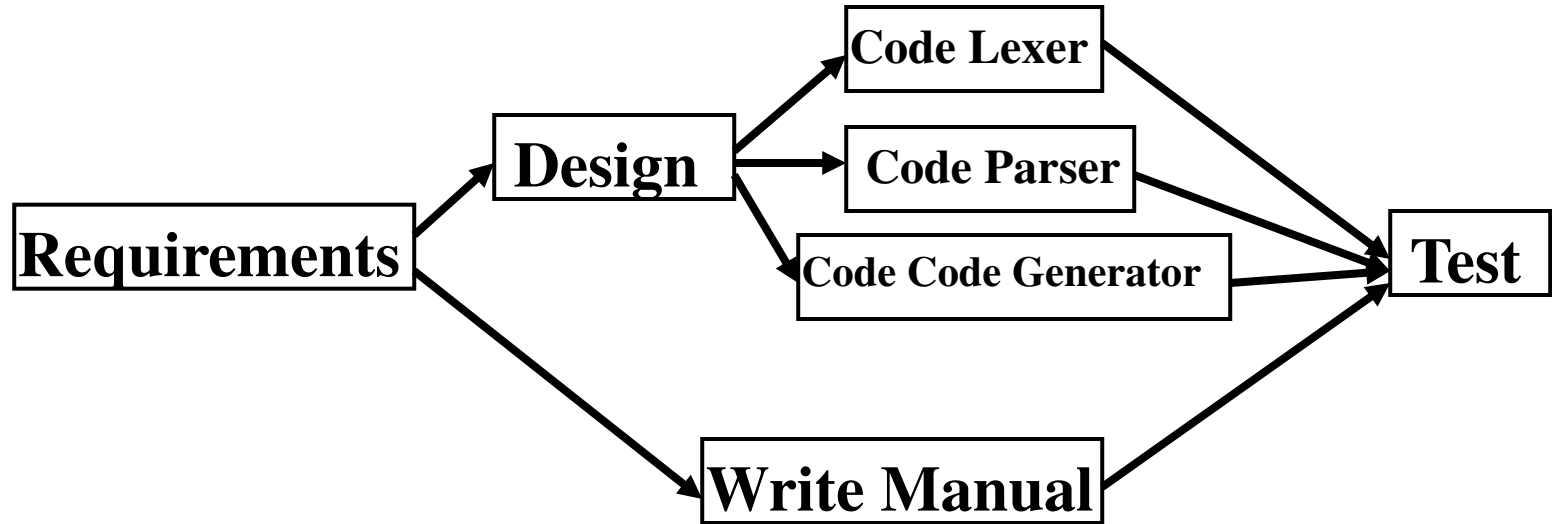
Task number	Task	Duration	Dependent on Tasks
T1	Specification	15	-
T2	Design database	45	T1
T3	Design GUI	30	T1
T4	Code database	105	T2
T5	Code GUI part	45	T3
T6	Integrate and test	120	T4 and T5
T7	Write user manual	60	T1

# Activity Network for MIS Example





# Activity Network for Compiler Project



# Activity Networks cont ...

- Managers can estimate the time durations for the different tasks in several ways.
- One possibility is that they can empirically assign durations to different tasks.
- This however may not be such a good idea, because software developers often resent such unilateral decisions.
- However, some managers prefer to estimate the time for various activities themselves.

## Activity Network cont ...

- They believe that an aggressive schedule would motivate the developers to do a better and faster job.
- On the other hand, careful experiments have shown that unrealistically aggressive schedules not only cause developers to compromise on intangible quality aspects,
  - but also cause greater schedule delays compared to the other approaches.

## Activity Networks cont ...

- A possible alternative is to let each developer himself estimate the time for an activity he would be assigned to.
- This approach can help to accurately estimate the task durations without creating undue schedule pressures.

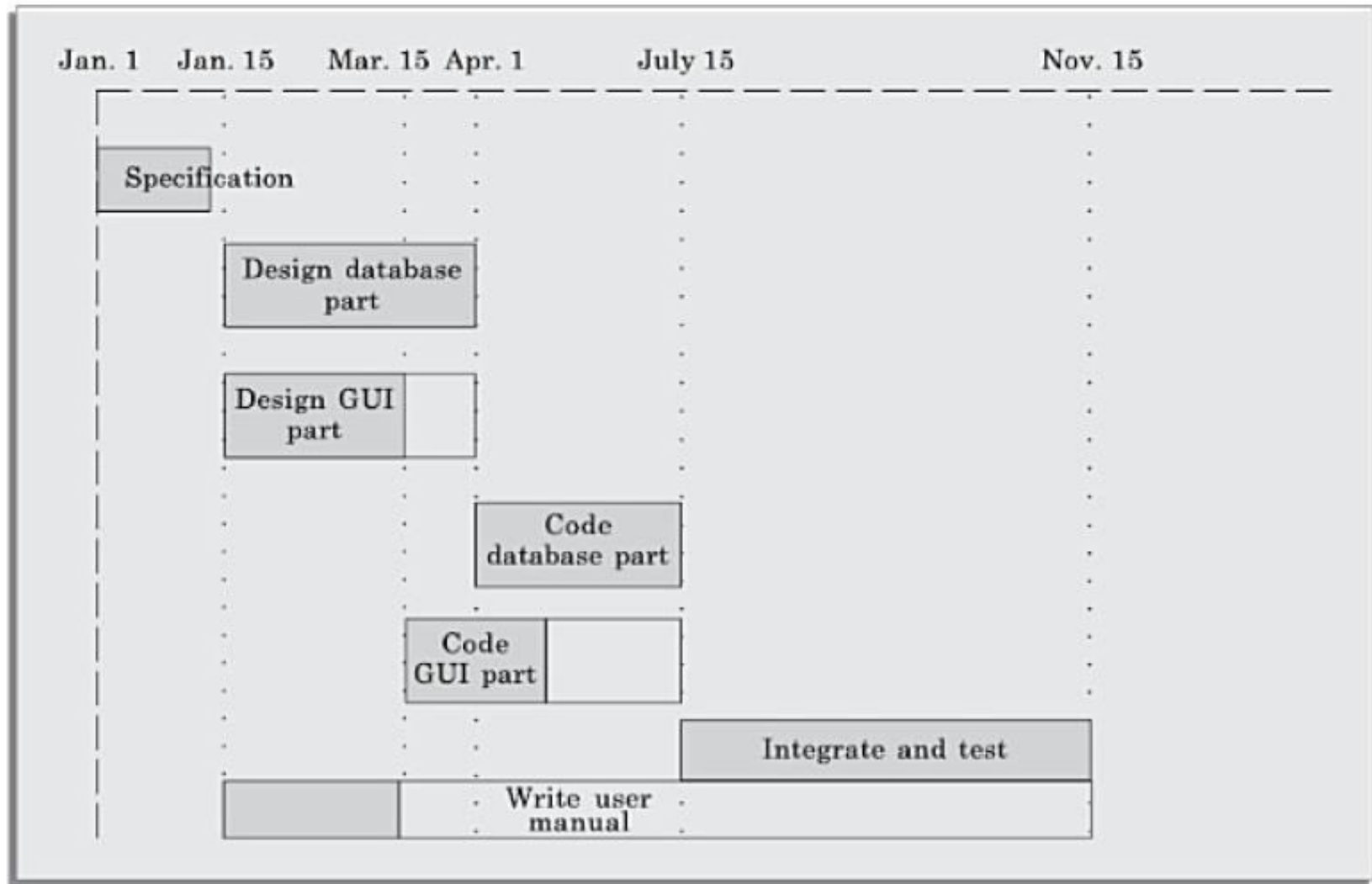
# Gantt Charts

- Named after its developer Henry Gantt.
  - a form of bar chart:
    - each bar represents an activity,
    - bars are drawn against a time line,
    - length of each bar is proportional to the length of time planned for the activity.
    - Vertical axis lists all the tasks to be performed.
    - The bars are drawn along the y-axis, one for each task.

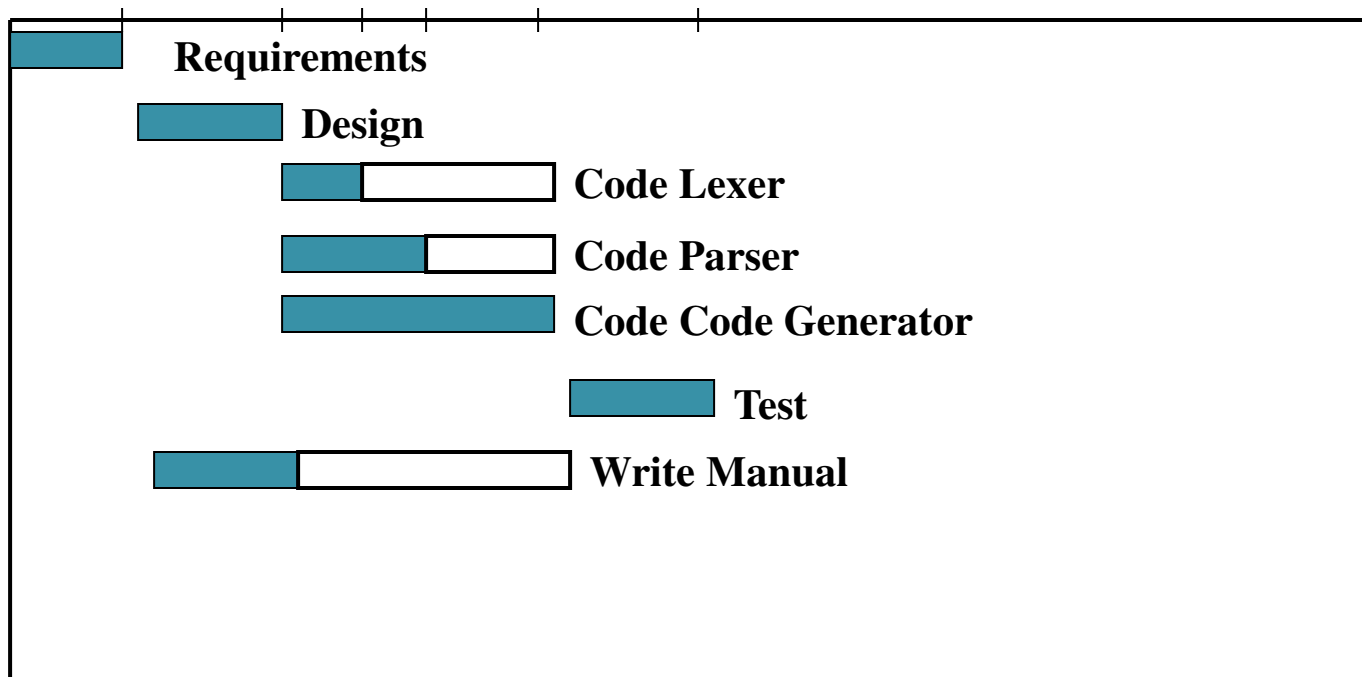
# Gantt Charts cont ...

- Gantt charts are not specific to software engineering.
- Gantt charts used in software project management are:
  - enhanced version of standard Gantt charts.
  - colored (shaded) part of a bar shows the length of time a task is estimated to take.
  - white (unshaded) part shows the slack time or lax time,
    - the latest time by which a task must be finished.

# Gantt chart for MIS problem



# Gantt Chart for Compiler Project





# Gantt Chart cont ...

- Gantt charts are useful for resource planning (i.e. allocate resources to activities).
- The different types of resources that need to be allocated to activities include
  - Staff
  - Hardware
  - Software

# Gantt Chart cont ...

- Gantt chart representation of a project schedule is helpful in planning the utilisation of resources,
  - while PERT is useful for monitoring the timely progress of activities.
- Also, it is easier to identify parallel activities in a project using a PERT chart.
- Project managers need to identify the parallel activities in a project for assignment to different developers.



# Summary

- We have defined activities.
- Discussed the approaches to identify the activities or tasks.
- Discussed the types of Activity Networks
- Explained Gantt Chart.



# References :

1. B. Hughes, M. Cotterell, R. Mall, *Software Project Management*, Sixth Edition, McGraw Hill Education (India) Pvt. Ltd., 2018.
2. R. Mall, *Fundamentals of Software Engineering*, Fifth Edition, PHI Learning Pvt. Ltd., 2018.



Thank you