

# MBEYA UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND  
ENGINEERING

Course Code: COB 4116

Course Name: *Software Engineering*

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# LECTURE 2

## Software Project Management

- ❖ The job pattern of an IT company engaged in software development can be seen split in two parts:
  - ✓ Software Creation
  - ✓ Software Project Management
- ❖ A **project** is well-defined task, which is a collection of several operations done in order to achieve a goal (for example, software development and delivery).

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## Characteristics of a Project

- ❖ Every project may has a unique and distinct goal.
- ❖ Project is not routine activity or day-to-day operations.
- ❖ Project comes with a start time and end time.
- ❖ Project ends when its goal is achieved hence it is a temporary phase in the lifetime of an organization.
- ❖ Project needs adequate resources in terms of time, manpower, finance, material and knowledge-bank.

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## Software Project

- ❖ A Software Project is the complete procedure of software development from requirement gathering to testing and maintenance, carried out according to the execution methodologies, in a specified period of time to achieve intended software product.

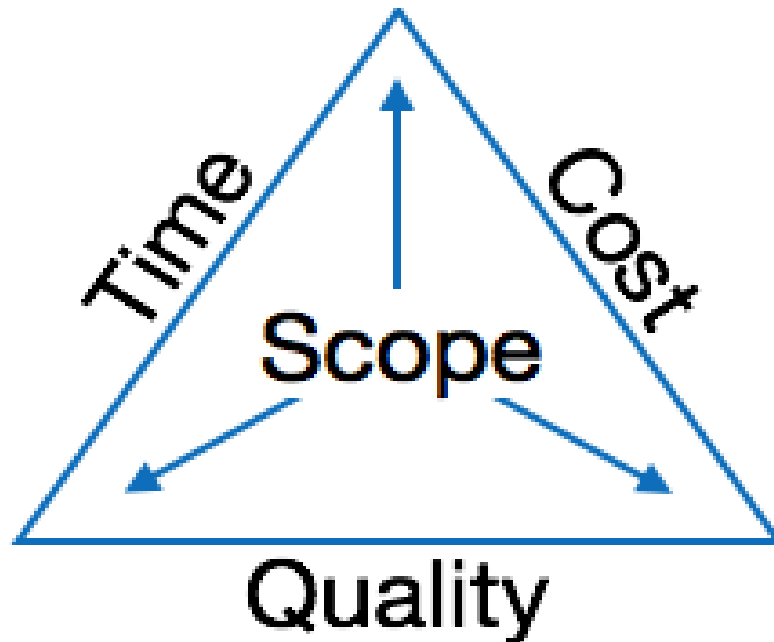
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## Need of software project management

- ❖ Software is said to be an intangible product. Software development is a kind of all new stream in world business and there's very little experience in building software products. Most software products are tailor made to fit client's requirements.
- ❖ The most important is that the underlying technology changes and advances so frequently and rapidly that experience of one product may not be applied to the other one.

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- ❖ All such business and environmental constraints bring risk in software development hence it is essential to manage software projects efficiently.



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- ❖ The image above shows triple constraints for software projects. It is an essential part of software organization to deliver **quality product**, keeping the **cost within client's budget** constrain and deliver the project as per **scheduled**.
- ❖ There are several factors, both internal and external, which may impact this triple constrain triangle. Any of three factor can severely impact the other two.
- ❖ Therefore, software project management is essential to incorporate user requirements along with budget and time constraints.

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## Software Project Manager

- ❖ A software project manager is a person who undertakes the responsibility of **executing the software project**.
- ❖ Software project manager is thoroughly aware of all the phases of **SDLC** that the software would go through.
- ❖ Project manager may never directly involve in producing the end product but he **controls** and **manages** the activities involved in production.



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- ❖ A project manager closely monitors the *development process*, prepares and executes various *plans*, arranges necessary and adequate *resources*, maintains *communication* among all team members in order to address issues of cost, budget, resources, time, quality and customer satisfaction.

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## Responsibilities of a Project Manager

### 1. Managing People

- ✓ Act as project leader
- ✓ Liaison with stakeholders
- ✓ Managing human resources
- ✓ Setting up reporting hierarchy etc.

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## 2. Managing Project

- ✓ Defining and setting up project scope
- ✓ Managing project management activities
- ✓ Monitoring progress and performance
- ✓ Risk analysis at every phase
- ✓ Take necessary step to avoid or come out of problems
- ✓ Act as project spokesperson

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## Software Management Activities

- ❖ Software project management comprises of a number of activities, which contains
  - ✓ Planning of project,
  - ✓ Deciding scope of software product,
  - ✓ Estimation of cost in various terms,
  - ✓ Scheduling of tasks and events, and
  - ✓ Resource management.

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## Project Planning

- ❖ Software project planning is task, which is performed before the production of software actually starts.
- ❖ It is there for the software production but involves no concrete activity that has any direction connection with software production; rather it is a set of multiple processes, which facilitates software production.

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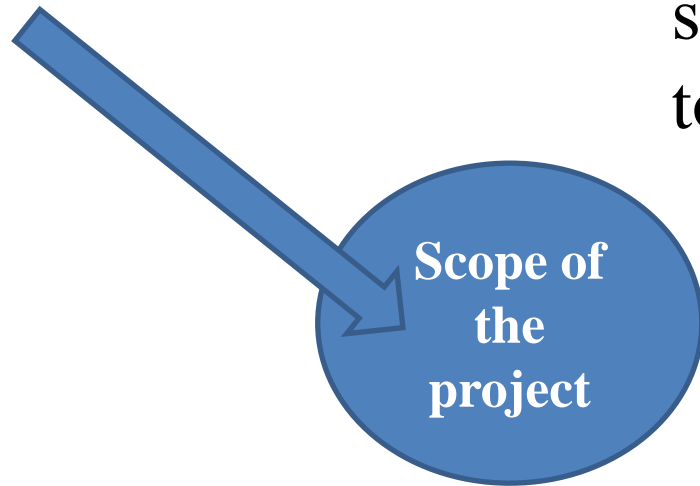
## Scope Management

- ❖ It defines the scope of project; this includes all the activities, process need to be done in order to make a deliverable software product.
- ❖ Scope management is essential because it creates **boundaries** of the project by clearly defining *what would be done in the project* and *what would not be done*.
- ❖ This makes project to contain limited and quantifiable tasks, which can easily be documented and in turn avoids cost and time overrun.

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Everything inside the circle represent the scope of the project

Everything outside the circle is outside the scope....you don't have to do.



In order to define Scope of the project you should have a work break down structure(WBS)- This is the hierarchical grouping of activities.

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## Project Estimation

- ❖ For an effective management accurate estimation of various measures is a must.
- ❖ With correct estimation managers can manage and control the project more efficiently and effectively.



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Project estimation may involve the following:

## 1. Software size estimation

- ❖ Software size may be estimated either in terms of KLOC (Kilo Line of Code) or by calculating number of function points in the software.
- ❖ Lines of code depend upon coding practices and Function points vary according to the user or software requirement.

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## 2. Effort estimation

- ❖ The managers estimate efforts in terms of personnel requirement and man-hour required to produce the software.
- ❖ For effort estimation software size should be known. This can either be derived by managers' experience, organization's historical data or software size can be converted into efforts by using some standard formulae.

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## 3. Time estimation

- ❖ Once size and efforts are estimated, the time required to produce the software can be estimated.
- ❖ Efforts required is segregated into sub categories as per the requirement specifications and interdependency of various components of software.
- ❖ Software tasks are divided into smaller tasks, activities or events by Work Breakthrough Structure (WBS). The tasks are scheduled on day-to-day basis or in calendar months.

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- ❖ The sum of time required to complete all tasks in hours or days is the total time invested to complete the project

## 4. Cost estimation

- ❖ This might be considered as the most difficult of all because it depends on more elements than any of the previous ones. For estimating project cost, it is required to consider -

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- ✓ Size of software
- ✓ Software quality
- ✓ Hardware
- ✓ Additional software or tools, licenses etc.
- ✓ Skilled personnel with task-specific skills
- ✓ Travel involved
- ✓ Communication
- ✓ Training and support

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## Project Estimation Techniques

- ❖ We discussed various parameters involving project estimation such as size, effort, time and cost.
- ❖ Project manager can estimate the listed factors using two broadly recognized techniques –

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## Decomposition Technique

- ✓ This technique assumes the software as a product of various compositions.

There are two main models -

- ❖ **Line of Code** Estimation is done on behalf of number of line of codes in the software product.
- ❖ **Function Points** Estimation is done on behalf of number of function points in the software product.

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## Empirical Estimation Technique

This technique uses empirically derived formulae to make estimation. These formulae are based on LOC or FPs.

### ❖ *Putnam Model*

This model is made by Lawrence H. Putnam, which is based on Norden's frequency distribution (Rayleigh curve). Putnam model maps **time** and **efforts** required with software size.

### ❖ *COCOMO*

COCOMO stands for COConstructive COst MOdel, developed by Barry W. Boehm. It divides the software product into three categories of software: organic, semi-detached and embedded.



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## Project Scheduling

Project Scheduling in a project refers to roadmap of all activities to be done with **specified order** and within **time slot allotted** to each activity.

For scheduling a project, it is necessary to -

- ✓ Break down the project tasks into smaller, manageable form
- ✓ Find out various tasks and correlate them
- ✓ Estimate time frame required for each task
- ✓ Divide time into work-units
- ✓ Assign adequate number of work-units for each task
- ✓ Calculate total time required for the project from start to finish

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## Resource management

- ✓ *All elements used to develop a software product may be assumed as resource for that project.* This may include human resource, productive tools and software libraries.
- ✓ The resources are available in limited quantity and stay in the organization as a pool of assets. The **shortage of resources** hampers the development of project and it can lag behind the schedule.
- ✓ Allocating extra resources increases development cost in the end. It is therefore necessary to **estimate and allocate adequate resources** for the project.

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Resource management includes -

- ✓ Defining proper organization project by creating a project team and allocating responsibilities to each team member
- ✓ Determining resources required at a particular stage and their availability
- ✓ Manage Resources by generating resource request when they are required and de-allocating them when they are no more needed.

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## Project Risk Management

Risk management involves all activities pertaining to identification, analysing and making provision for predictable and non-predictable risks in the project. Risk may include the following:

- ✓ Experienced staff leaving the project and new staff coming in.
- ✓ Change in organizational management.
- ✓ Requirement change or misinterpreting requirement.
- ✓ Under-estimation of required time and resources.
- ✓ Technological changes, environmental changes, business competition.

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## Risk Management Process

There are following activities involved in risk management process:

- ✓ **Identification** - Make note of all possible risks, which may occur in the project.
- ✓ **Categorize** - Categorize known risks into high, medium and low risk intensity as per their possible impact on the project.
- ✓ **Manage** - Analyze the probability of occurrence of risks at various phases. Make plan to avoid or face risks. Attempt to minimize their side-effects.
- ✓ **Monitor** - Closely monitor the potential risks and their early symptoms. Also monitor the effects of steps taken to mitigate or avoid them.

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## Project Execution & Monitoring

In this phase, the tasks described in project plans are executed according to their schedules.

- ✓ Execution needs monitoring in order to check whether everything is going according to the plan.
- ✓ Monitoring is observing to check the probability of risk and taking measures to address the risk or report the status of various tasks.

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These measures include -

- ✓ **Activity Monitoring** - All activities scheduled within some task can be monitored on day-to-day basis. When all activities in a task are completed, it is considered as complete.
- ✓ **Status Reports** - The reports contain status of activities and tasks completed within a given time frame, generally a week. Status can be marked as finished, pending or work-in-progress etc.
- ✓ **Milestones Checklist** - Every project is divided into multiple phases where major tasks are performed (milestones) based on the phases of SDLC. This milestone checklist is prepared once every few weeks and reports the status of milestones.

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## Project Communication Management

- ❖ Effective communication plays vital role in the success of a project. It **bridges gaps** between client and the organization, among the team members as well as other stake holders in the project such as hardware suppliers.
- ❖ Communication can be oral or written. Communication management process may have the following steps:



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- ✓ **Planning** - This step includes the identifications of all the stakeholders in the project and the mode of communication among them. It also considers if any additional communication facilities are required.
- ✓ **Sharing** - After determining various aspects of planning, manager focuses on sharing correct information with the correct person on correct time. This keeps every one involved the project up to date with project progress and its status.

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- ✓ **Feedback** - Project managers use various measures and feedback mechanism and create status and performance reports. This mechanism ensures that input from various stakeholders is coming to the project manager as their feedback.
- ✓ **Closure** - At the end of each major event, end of a phase of SDLC or end of the project itself, administrative closure is formally announced to update every stakeholder by sending email, by distributing a hardcopy of document or by other mean of effective communication.  
After closure, the team moves to next phase or project.

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## Configuration Management

**Configuration management** is a process of tracking and controlling the changes in software in terms of the requirements, design, functions and development of the product.

**Configuration management** is a discipline of organization administration, which takes care of occurrence of any change (process, requirement, technological, strategical etc.) after a phase is baselined

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## Baseline

- ✓ A phase of SDLC is assumed over if it baselined, i.e. baseline is a measurement that defines completeness of a phase.
- ✓ A phase is baselined when all activities pertaining to it are finished and well documented. If it was not the final phase, its output would be used in next immediate phase.

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## Change Control

Change control is function of configuration management, which ensures that all changes made to software system are consistent and made as per organizational rules and regulations.

A change in the configuration of product goes through following steps -

- ✓ **Identification** - A change request arrives from either internal or external source. When change request is identified formally, it is properly documented.
- ✓ **Validation** - Validity of the change request is checked and its handling procedure is confirmed.

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- ✓ **Analysis** - The impact of change request is analyzed in terms of schedule, cost and required efforts. Overall impact of the prospective change on system is analyzed.
- ✓ **Control** - If the prospective change either impacts too many entities in the system or it is unavoidable, it is mandatory to take approval of high authorities before change is incorporated into the system. It is decided if the change is worth incorporation or not. If it is not, change request is refused formally.

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- ✓ **Execution** - If the previous phase determines to execute the change request, this phase take appropriate actions to execute the change, does a thorough revision if necessary.
- ✓ **Close request** - The change is verified for correct implementation and merging with the rest of the system. This newly incorporated change in the software is documented properly and the request is formally is closed.

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## Project Management Tools

- ❖ The risk and uncertainty rises with respect to the size of the project, even when the project is developed according to set methodologies.
- ❖ There are tools available, which aid for effective project management. A few are described –

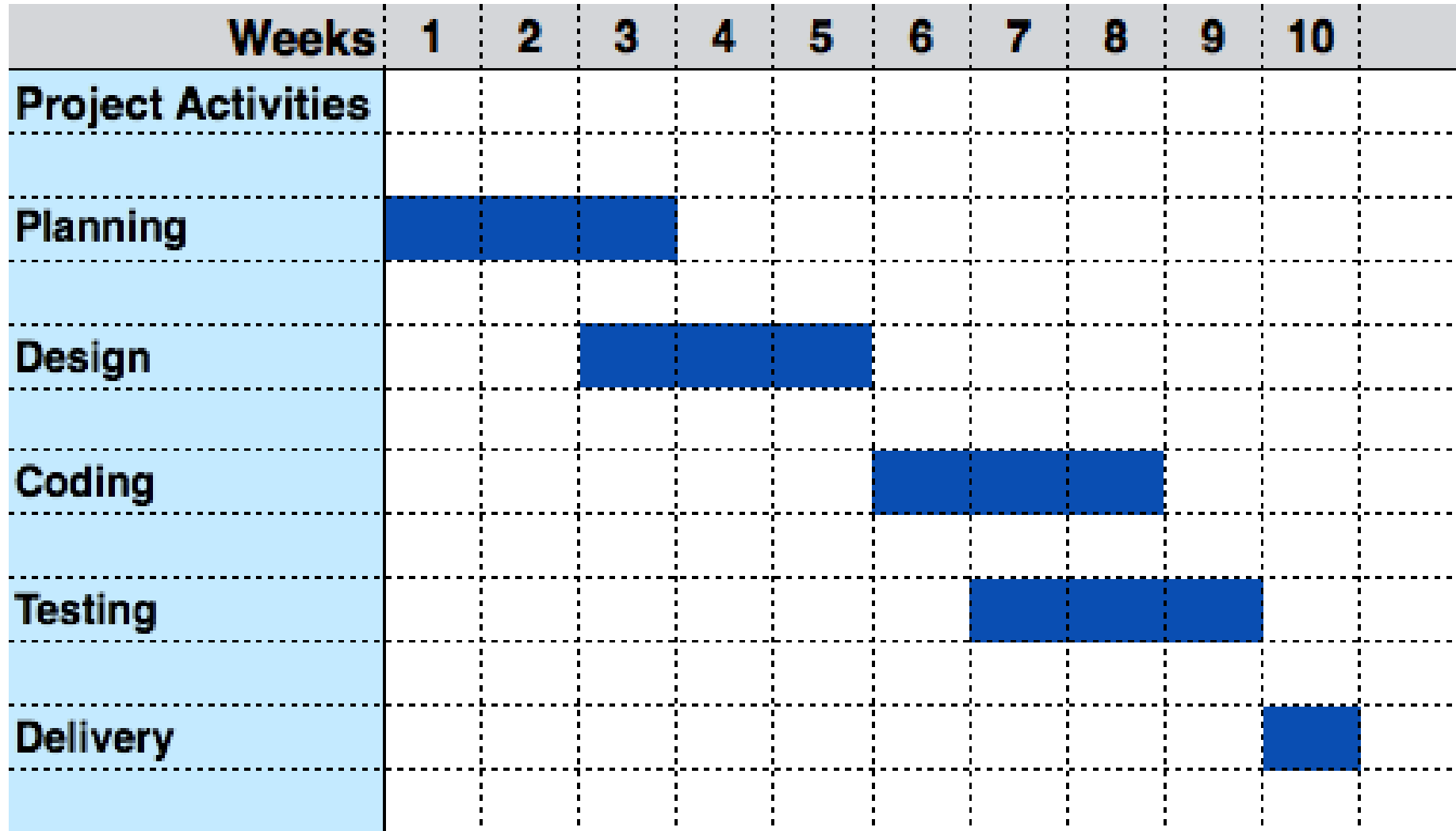
### *Gantt Chart*

- ❖ Gantt charts was devised by Henry Gantt (1917). It represents project schedule with respect to time periods. It is a horizontal bar chart with bars representing activities and time scheduled for the project activities.



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## Gantt Chart



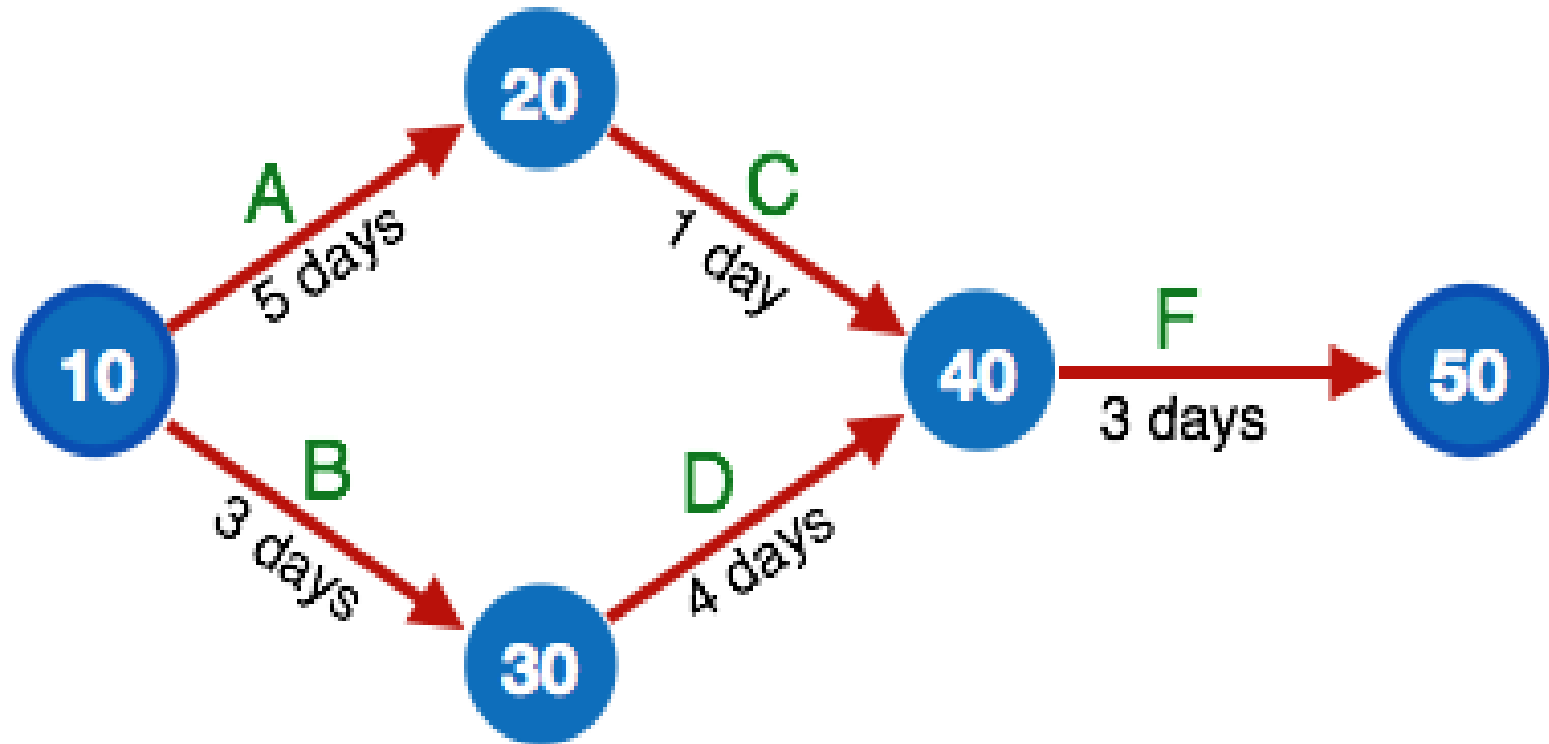
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## *PERT Chart*

- ❖ PERT (Program Evaluation & Review Technique) chart is a tool that depicts project as network diagram.
- ❖ It is capable of graphically representing main events of project in both parallel and consecutive way.
- ❖ Events, which occur one after another, show dependency of the later event over the previous one.

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## PERT Chart



- ✓ Events are shown as numbered nodes. They are connected by labelled arrows depicting sequence of tasks in the project.

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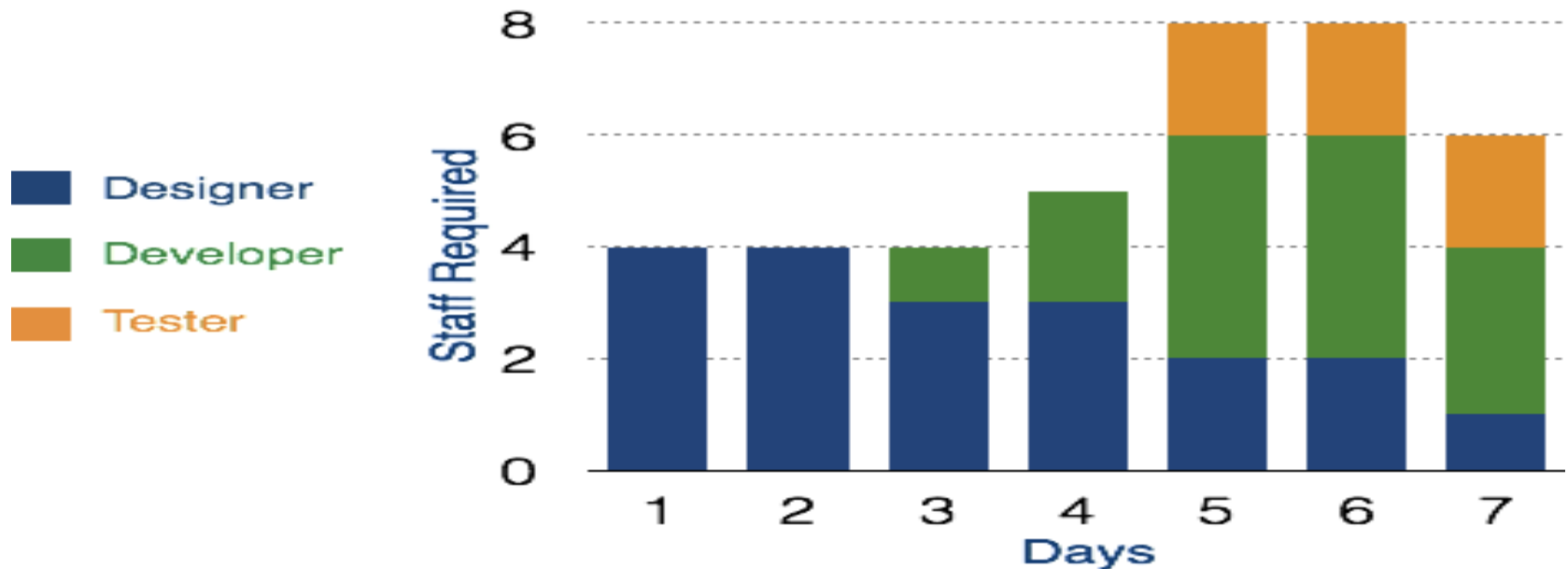
## Resource Histogram

- ❖ This is a graphical tool that contains bar or chart representing number of resources (usually skilled staff) required over time for a project event (or phase).
- ❖ Resource Histogram is an effective tool for staff planning and coordination.

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## Resource Histogram

Staff	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Designer	4	4	3	3	2	2	1
Developer	0	0	1	2	4	4	3
Tester	0	0	0	0	2	2	2
Total	4	4	4	5	8	8	6



# Assignment

1. Explain the following
  - a. Organic System
  - b. Semi-detached System
  - c. Embedded System
  - d. Basic COCOMO Model
  - e. Intermediate COCOMO Model
  - f. Detailed COCOMO Model
2. Assume you are the project manager of software engineering company, the Client requested you to develop the Best software for sales management system in his Supermarket. Use COCOMO model to Estimate the Cost for the project.

Note that the category of the software project is Organic.
3. Use Gantt chart to illustrate how will you accomplish your project.

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End

Thanks for Listening!!