

Ch-8

Managing Software Project

Software Project Management

- Concerned with activities involved in ensuring that software is delivered on time and on schedule and in accordance with the requirements of the organisations developing and procuring the software.
- Project management is needed because software development is always subject to budget and schedule constraints that are set by the organisation developing the software.
- Software project management is an art and discipline of planning and supervising software projects.
- It is a sub-discipline of software project management in which software projects planned, implemented, monitored and controlled.
- Software Project Management is the process of planning, organizing, staffing, monitoring , controlling and leading the software project.
- Time, cost and quality are the three main attributes that need to consider in software project management.

Needs for the proper management of software project

- software project management is necessary to incorporate user requirements along with budget and time constraints.
- Deliver the software to the customer at the agreed time.
- Keep overall costs within budget.
- Deliver software that meets the customer's expectations.
- Maintain a coherent and well-functioning development team.
- **Software Project Management consists of several different type of managements:**

1. Conflict Management:

- Conflict management is the process to restrict the negative features of conflict while increasing the positive features of conflict.
- The goal of conflict management is to improve learning and group results including efficacy or performance in an organizational setting.
- Properly managed conflict can enhance group results.

2. Risk Management:

- Risk management is the analysis and identification of risks that is followed by synchronized and economical implementation of resources to minimize, operate and control the possibility or effect of unfortunate events or to maximize the realization of opportunities.

3. Requirement Management:

- It is the process of analyzing, prioritizing, tracing and documenting on requirements and then supervising change and communicating to pertinent stakeholders.
- It is a continuous process during a project.

Needs for the proper management of software project

4. Change Management:

- Change management is a systematic approach for dealing with the transition or transformation of an organization's goals, processes or technologies.
- The purpose of change management is to execute strategies for effecting change, controlling change and helping people to adapt to change.

5. Software Configuration Management:

- Software configuration management is the process of controlling and tracing changes in the software, part of the larger cross-disciplinary field of configuration management.
- Software configuration management include revision control and the inauguration of baselines.

6. Release Management:

- Release Management is the task of planning, controlling and scheduling the build in deploying releases.
- Release management ensures that organization delivers new and enhanced services required by the customer, while protecting the integrity of existing services.

- **Advantages of Software Project Management:**
 - It helps in planning of software development.
 - Implementation of software development is made easy.
 - Monitoring and controlling are aspects of software project management.
 - It overall manages to save time and cost for software development.
- **Factor influencing Software Project Management**
 - Company size
 - Software customers
 - Software size
 - Software type
 - Organizational culture
 - Software development processes
 - These factors mean that project managers in different organizations may work in quite different ways.

Software Project Management Distinctions

(Why SPM is difficult ?)

(What are the difficulties that are faces by project manager during SPM?)

- **The product is intangible.**
 - Software cannot be seen or touched. Software project managers cannot see progress by simply looking at the artefact that is being constructed.
- **Many software projects are 'one-off' projects or Software Systems' uniqueness**
 - Large software projects are usually different in some ways from previous projects. Even managers who have lots of previous experience may find it difficult to anticipate problems.
- **Software processes are variable and organization specific.**
 - We still cannot reliably predict when a particular software process is likely to lead to development problems.
- **Possibility of Multiple solutions**
- **Individuality of Programmers**
- **Speed of technological Advancements**
- **There are no standard s/w process.**
- **The product is uniquely flexible.**
- **s/w engineering process learning phase of engineering.**
- **Requirement change rapidly.**

Project Management Activities

- Project Planning
- Estimating Costs
- Project Scheduling
- Risk Management
- Managing People

Project Planning

- Project planning involves breaking down the work into parts and assign these to project team members, anticipate problems that might arise and prepare tentative solutions to those problems.
- The project plan, which is created at the start of a project, is used to communicate how the work will be done to the project team and customers, and to help assess progress on the project.
- It is probably the most time consuming project management activity.
- It is a continuous activity from initial concept through to system delivery.
- Plans must be revised as new information becomes available.
- Software project planning involves developing estimates for the work to be performed, establishing the necessary commitments and defining the plan to perform work.
- Project Planning consists of following essential activities:
 - 1.Estimate the various attributes of Project like project size, cost, duration and effort
 - 2.Scheduling manpower and other resources
 - 3.Staff organization and staffing plans
 - 4.Risk identification analysis and abatement planning
 - 5.Miscellaneous plans such as quality assurance plan, configuration management plan etc.

Planning stages

- At the **proposal stage**, when you are bidding for a contract to develop or provide a software system.
- During the **project startup phase**, when you have to plan who will work on the project, how the project will be broken down into increments, how resources will be allocated across your company, etc.
- Periodically throughout the **Project Development Phase**, when you modify your plan in the light of experience gained and information from **monitoring the progress** of the work.
- **Proposal planning**
 - Planning may be necessary with only outline software requirements.
 - The aim of planning at this stage is to provide information that will be used in setting a price for the system to customers.
 - Project pricing involves estimating how much the software will cost to develop, taking factors such as staff costs, hardware costs, software costs, etc. into account

- **Project Startup planning**

- At this stage, you know more about the system requirements but do not have design or implementation information
- Create a plan with enough detail to make decisions about the project budget and staffing.
 - This plan is the basis for project resource allocation
- The startup plan should also define project monitoring mechanisms
- A startup plan is still needed for agile development to allow resources to be allocated to the project

- **Development Planning**

- The project plan should be regularly amended as the project progresses and you know more about the software and its development
- The project schedule, cost-estimate and risks have to be regularly revised

Plan-Driven Development

- Plan-driven or plan-based development is an approach to software engineering where the development process is planned in detail.
 - Plan-driven development is based on engineering project management techniques and is the 'traditional' way of managing large software development projects.
- A project plan is created that records the work to be done, who will do it, the development schedule and the work products.
- Managers use the plan to support project decision making and as a way of measuring progress.

• **Pros and Cons of PDD**

- The arguments in favor of a plan-driven approach are that early planning allows organizational issues (availability of staff, other projects, etc.) to be closely taken into account, and that potential problems and dependencies are discovered before the project starts, rather than once the project is underway.
- The principal argument against plan-driven development is that many early decisions have to be revised because of changes to the environment in which the software is to be developed and used.

Project Plan

In a plan-driven development project, a project plan sets out the resources available to the projects, the work breakdown and a schedule for carrying out the work.

- **Plan Sections**

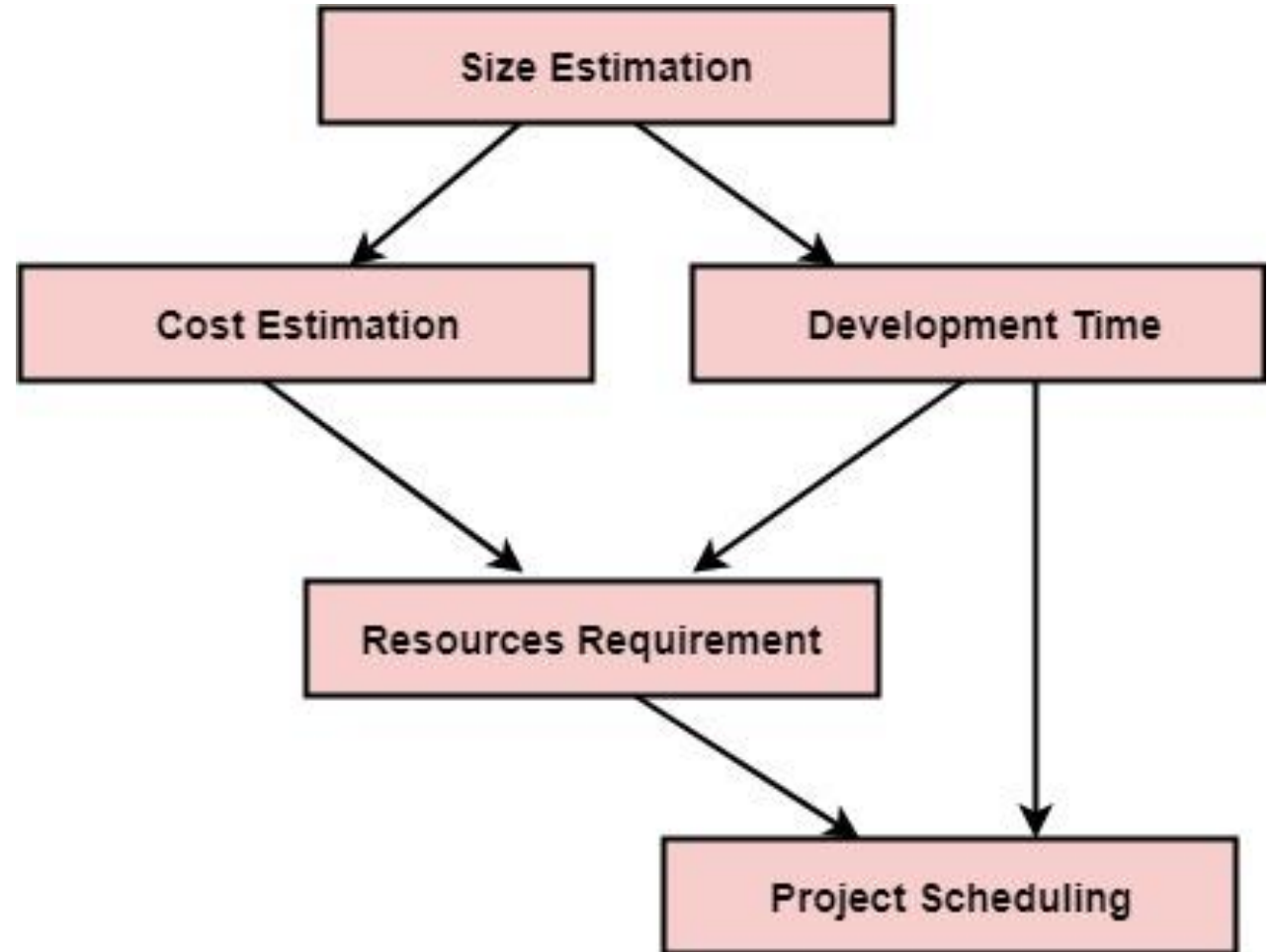
- Introduction
- Project organization
- Risk analysis
- Hardware and software resource requirements
- Work breakdown
- Project schedule
- Monitoring and reporting mechanisms

Project plan supplements/Project Plan Type

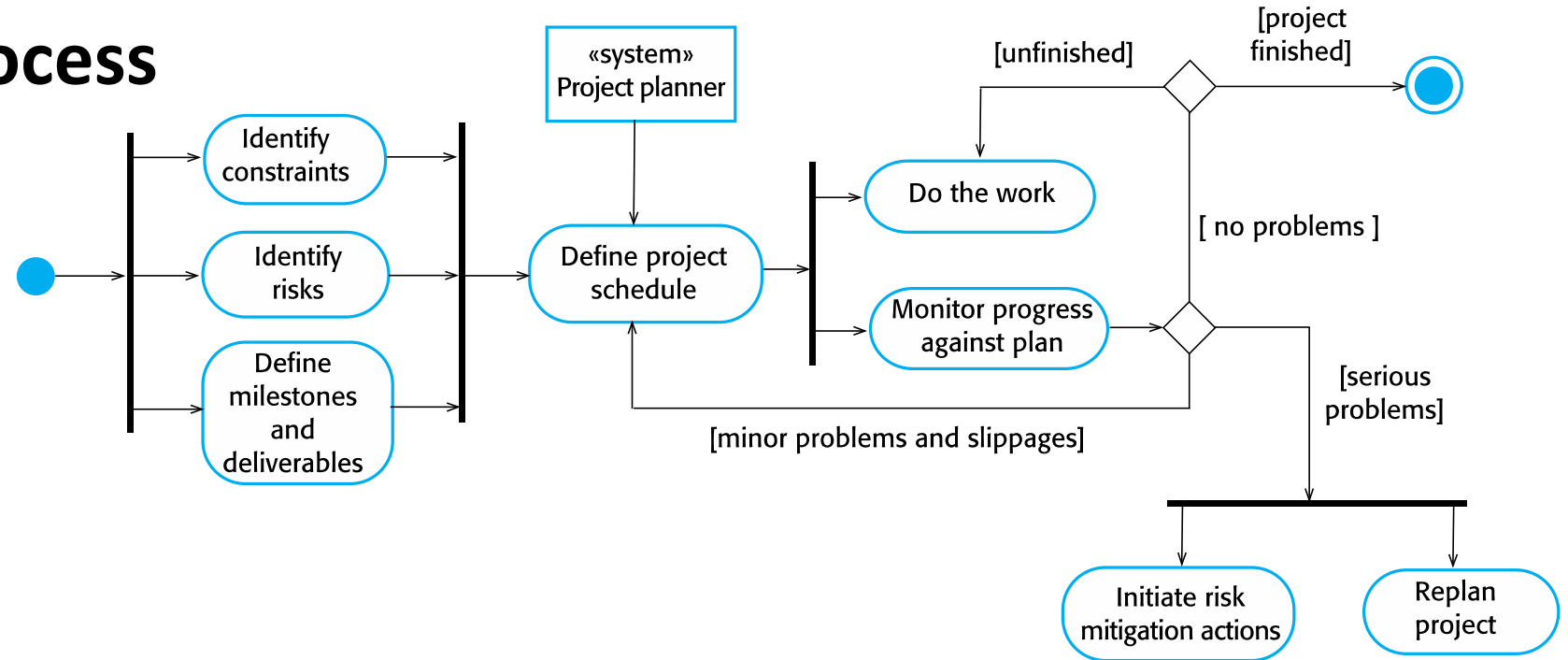
Plan	Description
Configuration management plan	Describes the configuration management procedures and structures to be used.
Deployment plan	Describes how the software and associated hardware (if required) will be deployed in the customer's environment. This should include a plan for migrating data from existing systems.
Maintenance plan	Predicts the maintenance requirements, costs, and effort.
Quality plan	Describes the quality procedures and standards that will be used in a project.
Validation plan	Describes the approach, resources, and schedule used for system validation.

Project Planning Process

- Project planning is an iterative process that starts when you create an initial project plan during the project startup phase.
- Plan changes are inevitable.
 - As more information about the system and the project team becomes available during the project, you should regularly revise the plan to reflect requirements, schedule and risk changes.
 - Changing business goals also leads to changes in project plans. As business goals change, this could affect all projects, which may then have to be re-planned.



The planning process



Planning Assumptions

- You should make realistic rather than optimistic assumptions when you are defining a project plan.
- Problems of some description always arise during a project, and these lead to project delays.
- Your initial assumptions and scheduling should therefore take unexpected problems into account.
- You should include contingency in your plan so that if things go wrong, then your delivery schedule is not seriously disrupted.

Estimating Costs

- Estimation is the techniques of guessing, identifying and planning the various projects parameters like project size, effort required to develop the software, project duration and the cost.
- The estimates help to quoting the project cost to customer as well as resource planning and scheduling.
- Generally there are two types of technique that can be used to do this:
 - *Experience-based techniques* The estimate of future effort requirements is based on the manager's experience of past projects and the application domain. Essentially, the manager makes an informed judgment of what the effort requirements are likely to be.
 - *Algorithmic cost modeling* In this approach, a formulaic approach is used to compute the project effort based on estimates of product attributes, such as size, and process characteristics, such as experience of staff involved.

Cost Estimation Techniques

1. Empirical Estimation Techniques

- Based on making the educated guess of the project parameters.
- The estimate of future effort requirements is based on the manager's experience of past projects and the application domain.
- Essentially, the manager makes an informed judgment of what the effort requirements are likely to be.
- Examples are Expert Judgement Techniques and Delphi cost Estimation Techniques
- **Expert judgement Techniques**
 - Expert makes an educated guess of the problem size after analyzing the problem thoroughly.
 - This technique is subject to human errors and individual biasness.
 - Expert may have lack of knowledge and experience on may lead to wrong estimation.
 - Group of Experts may be formed but this may increase time and cost and domination factor may still exists.
- **Delphi Cost Estimation**
 - Carried out by a team comprising of a group of experts and coordinator. The coordinator provides each estimator with a copy of the software requirements specifications (SRS) documents and the form for recording his cost estimates. The coordinator prepares and distributes the summary of the responses of all the estimators and includes any unusual rationale noted by any of the estimators.
 - After the completion of several iterations of estimations, the coordinator takes the responsibility of compiling the results and preparing the final estimates thus reducing the influencing factor.

Cost Estimation Techniques

2.Heuristic Estimation Techniques

- It is the *Algorithmic cost modeling* approach in which a formulaic approach is used to compute the project effort based on estimates of product attributes, such as size, and process characteristics, such as experience of staff involved. Eg:COCOMO
- In this techniques the relationships among the different project parameters can be modeled using suitable mathematical expressions. There consists of basic (independent) parameters and other(dependent) parameters.
- Heuristics estimations can be of single variable model as well as multiple variable model
- A single variable models takes the form:
- **Estimated parameters= $c1 * e^{d1}$** where e is the dependent variables,estimated parameters is the dependent parameter to be calculated like staff size,effort,durations etc ,c1 and d1 are constants collected from past projects(historical data).
- **Effectiveness of Algorithmic Cost Estimation**
 - Algorithmic cost models are a systematic way to estimate the effort required to develop a system. However, these models are complex and difficult to use.
 - There are many attributes and considerable scope for uncertainty in estimating their values.
 - This complexity means that the practical application of algorithmic cost modeling has been limited to a relatively small number of large companies, mostly working in defense and aerospace systems engineering.

3.Analytical Estimation Techniques

- It derives the required results starting with basic assumptions regarding the projects
- It has the scientific basis .example Halstead's Software science.
- The cost of a new project is estimated by a completed project in the same application domain.
- Can combine both empirical as well as heuristics techniques
- Estimation is based on research and may take large time to reach to final estimates.

Other Estimation Techniques

4.Pricing To win Estimation

- This approach may seem unethical and un-business like.
- However, when detailed information is lacking it may be the only appropriate strategy.
- The project cost is agreed on the basis of an outline proposal and the development is constrained by that cost.
- A detailed specification may be negotiated or an evolutionary approach used for system development.

5.Parkinson's Law estimation

- work expands to fill the time available and the cost is determined by the resources used. If the software have to be delivered in 12 months and 5 people are available then the effort required is 60 persons months.

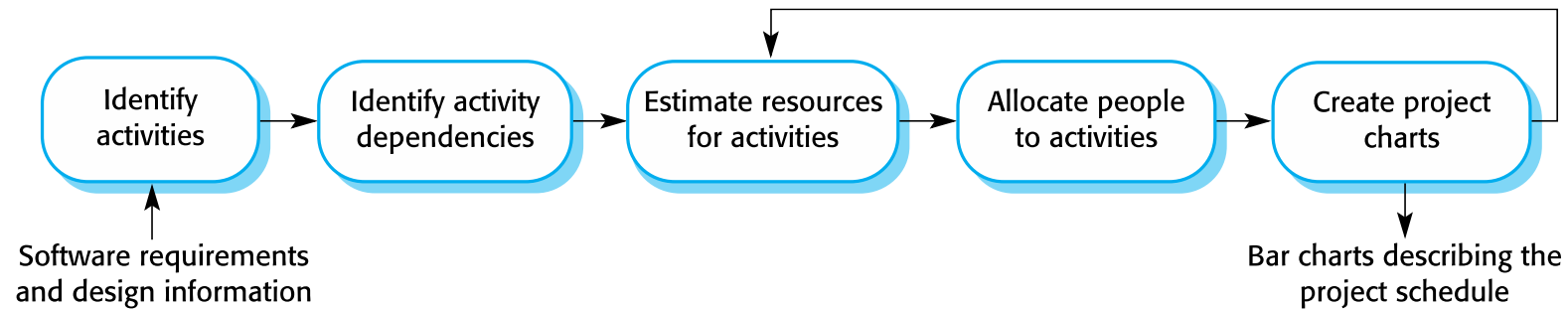
Project scheduling

- Why are project late?
 - an **unrealistic deadline** established by someone outside the software development group
 - **changing customer requirements** that are not reflected in schedule changes;
 - an **honest underestimate** of the amount of effort and/or the number of resources that will be required to do the job;
 - **predictable and/or unpredictable risks** that were not considered when the project commenced;
 - **technical difficulties** that could not have been foreseen in advance;
 - **human difficulties** that could not have been foreseen in advance;
 - **miscommunication** among project staff that results in delays;
 - a failure by project management to recognize that **the project is falling behind schedule** and **a lack of action to correct the problem**
- Project scheduling is the process of deciding how the work in a project will be organized as separate tasks, and when and how these tasks will be executed.
- You estimate the calendar time needed to complete each task, the effort required and who will work on the tasks that have been identified.
- You also have to estimate the resources needed to complete each task, such as the disk space required on a server, the time required on specialized hardware, such as a simulator, and what the travel budget will be.

Project scheduling activities

- Split project into tasks and estimate time and resources required to complete each task.
- Organize tasks concurrently to make optimal use of workforce.
- Minimize task dependencies to avoid delays caused by one task waiting for another to complete.
- Dependent on project managers intuition and experience.

The project scheduling process



Software Project Scheduling Techniques

- In order to schedule the project activities ,Software Project manager needs to do following activities:
 1. Identify all the tasks needed to complete the project
 2. Breakdown the large task into small activities
 3. Determine the dependency among different activities
 4. Establish the most likely estimates for the time durations necessary to complete the activities
 5. Allocate resources to activities
 6. Plan the starting and ending dates for various activities.
 7. Determine the Critical Paths. A critical path is the chain of activities that determines the duration of the projects.

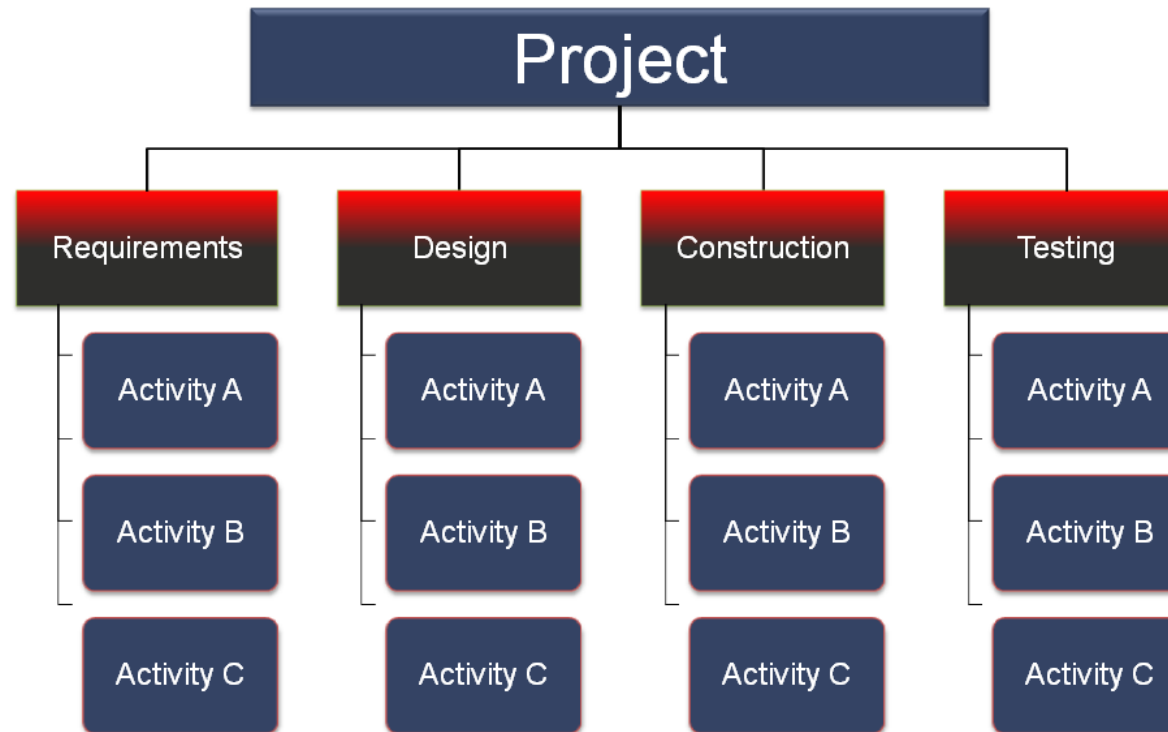
Software Project Scheduling Tools and Techniques

- **Work Breakdown Structure(WBS):**task breakdown
- **Activity Charts:** Dependency among activities
- **Gantt Charts:** Resource allocation
- **PERT(Program/Project Evaluation and Review Techniques):**Program Monitoring and Control
- **Critical Path Methods(CPM):**to determine the critical path for the duration of the project.

WBS:Work Breakdown Structure

- A work breakdown structure (WBS), in project management and systems engineering, is a deliverable-oriented decomposition of a project into smaller components. A work breakdown structure is a key project deliverable that organizes the team's work into manageable sections.
- Dividing complex projects to simpler and manageable tasks is the process identified as Work Breakdown Structure (WBS).
- Usually, the project managers use this method for simplifying the project execution.
- In WBS, much larger tasks are broken down to manageable chunks of work. These chunks can be easily supervised and estimated.
- Following are a few reasons for creating a WBS in a project:
 - Accurate and readable project organization and structure.
 - Accurate assignment of responsibilities to the project team.
 - Indicates the project milestones and control points.
 - Helps to estimate the cost, time and risk.
 - Illustrate the project scope, so the stakeholders can have a better understanding of the same.
- **Construction of a WBS**
 - The root of the tree is labelled by the problem name.
 - Each node of the tree is broken down into smaller activities that are made the children of the node.
 - Each activities is recursively decomposed into smaller sub-activities until at the leaf level.

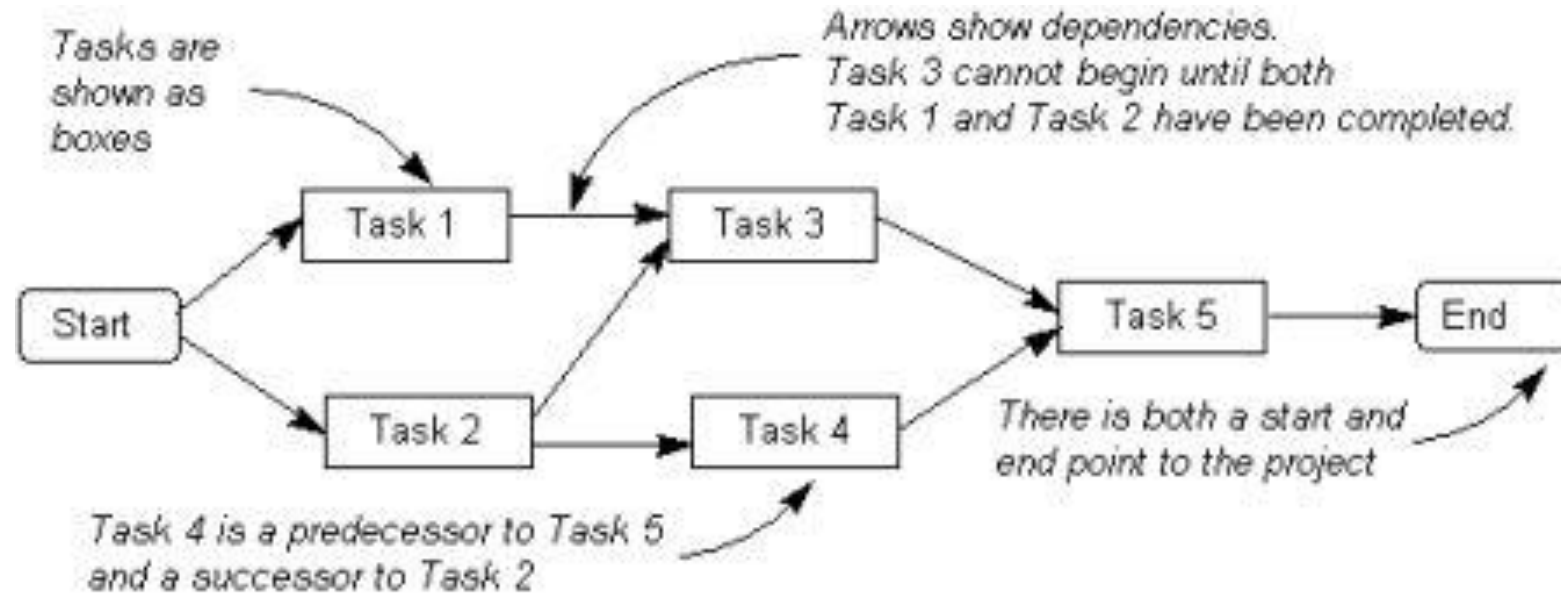
WBS Structure of MIS Problem



Activity Chart:

- When it comes to a project, the entire project is divided into many interdependent tasks. In this set of tasks, the sequence or the order of the tasks is quite important.
- If the sequence is wrong, the end result of the project might not be what the management expected.
- Some tasks in the projects can safely be performed parallel to other tasks. In a project activity diagram, the sequence of the tasks is simply illustrated.
- These diagrams can be created with a minimum effort and gives you a clear understanding of interdependent tasks.
- **The Workflow**
 - Usually there are two main shapes in activity diagrams, boxes and arrows.
 - Boxes of the activity diagram indicate the tasks and the arrows show the relationships. Usually, the relationships are the sequences that take place in the activities.

Activity Chart



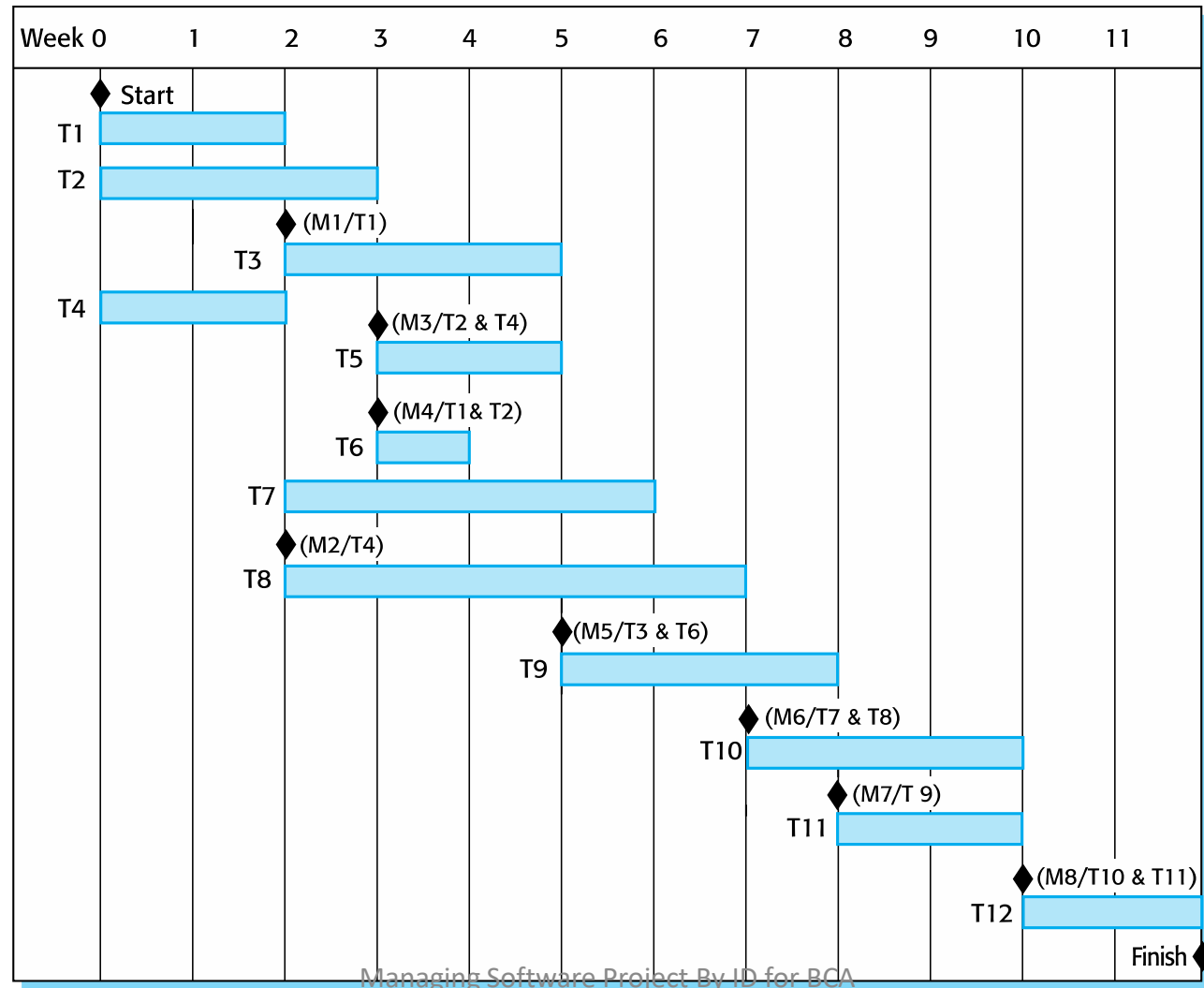
Project activities

- Project activities (tasks) are the basic planning element. Each activity has:
 - a duration in calendar days or months,
 - an effort estimate, which shows the number of person-days or person-months to complete the work,
 - a deadline by which the activity should be complete,
 - a defined end-point, which might be a document, the holding of a review meeting, the successful execution of all tests, etc.

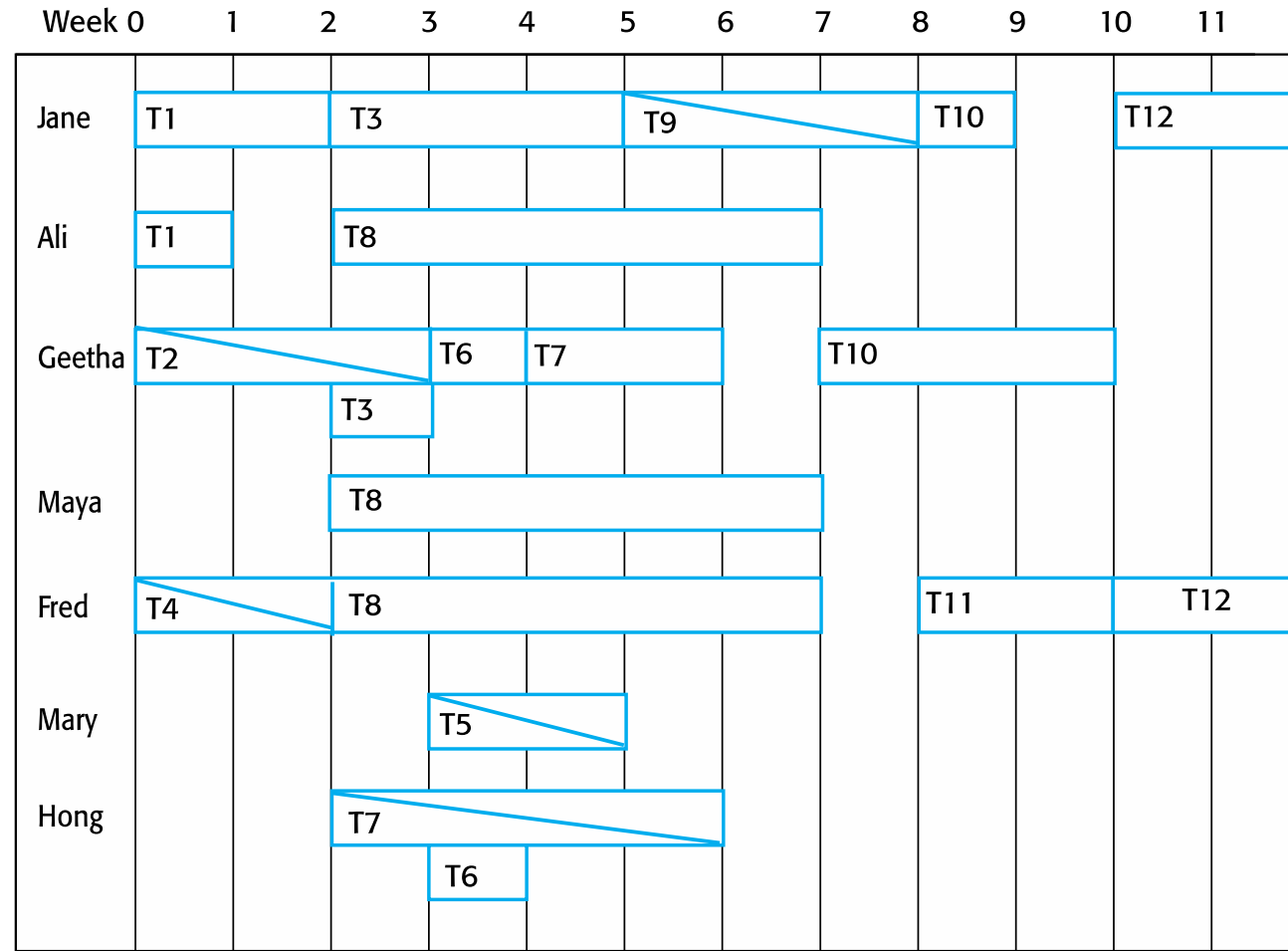
Tasks, durations, and dependencies

Task	Effort (person-days)	Duration (days)	Dependencies
T1	15	10	
T2	8	15	
T3	20	15	T1 (M1)
T4	5	10	
T5	5	10	T2, T4 (M3)
T6	10	5	T1, T2 (M4)
T7	25	20	T1 (M1)
T8	75	25	T4 (M2)
T9	10	15	T3, T6 (M5)
T10	20	15	T7, T8 (M6)
T11	10	10	T9 (M7)
T12	20	10	T10, T11 (M8)

Activity bar chart



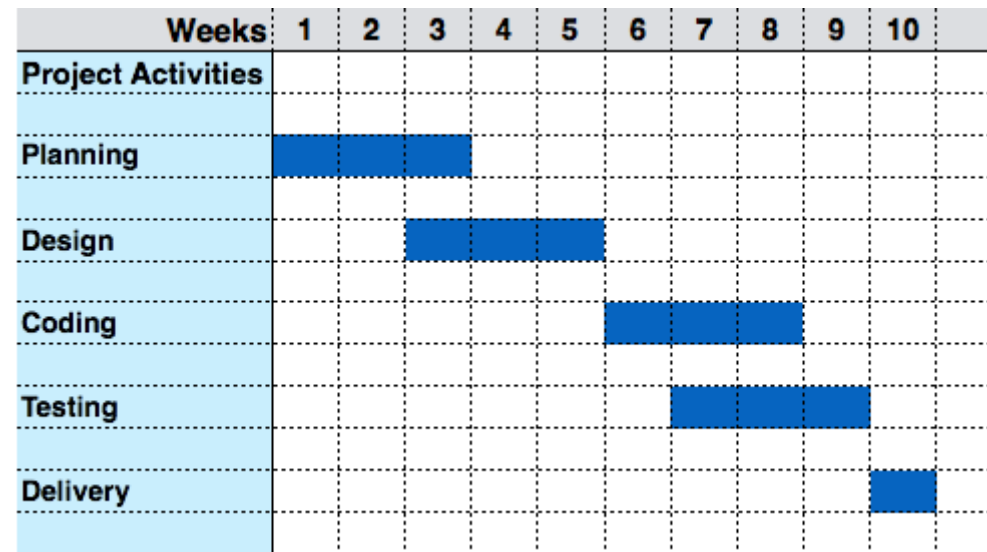
Staff allocation chart



Gantt Charts

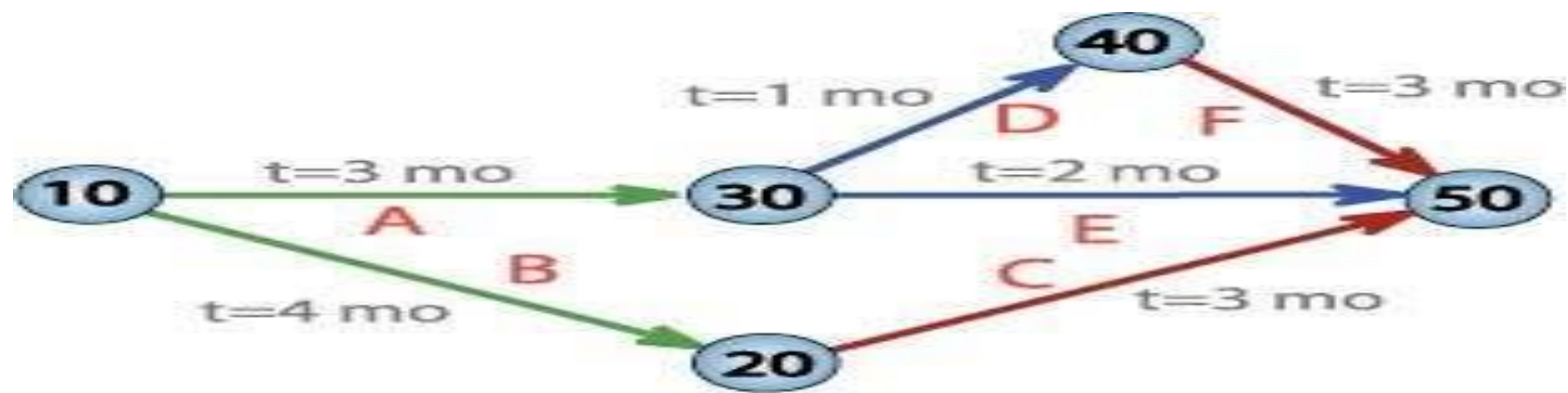
- Gantt chart was invented by a mechanical engineer named Henry Gantt in 1910. Since the invention, Gantt chart has come a long way.
- Gantt chart is a type of a bar chart that is used to allocate resources to activities including staff, hardware and software.
- Gantt charts allow project managers to track the progress of the entire project. Through Gantt charts, the project manager can keep a track of the individual tasks as well as of the overall project progression.
- In addition to tracking the progression of the tasks, Gantt charts can also be used for tracking the utilization of the resources in the project. These resources can be human resources as well as materials used.
- The bars in the Gantt are drawn along a time line and the length of each bar is proportional to the duration of time planned for the corresponding activity.
- The White Part in Gantt chart shows the slack time(latest time by which the task must be finished) and the shaded part shows the length of the time each task is estimated to take.
- Advantages and Disadvantages:
 - ability to grasp the overall status of a project and its tasks at once
 - helps to identify and maintain the critical path of a project schedule
 - For large projects, the information displayed in Gantt charts may not be sufficient for decision making.
 - it does not elaborate on the project size or size of the work elements

Gantt Chart :

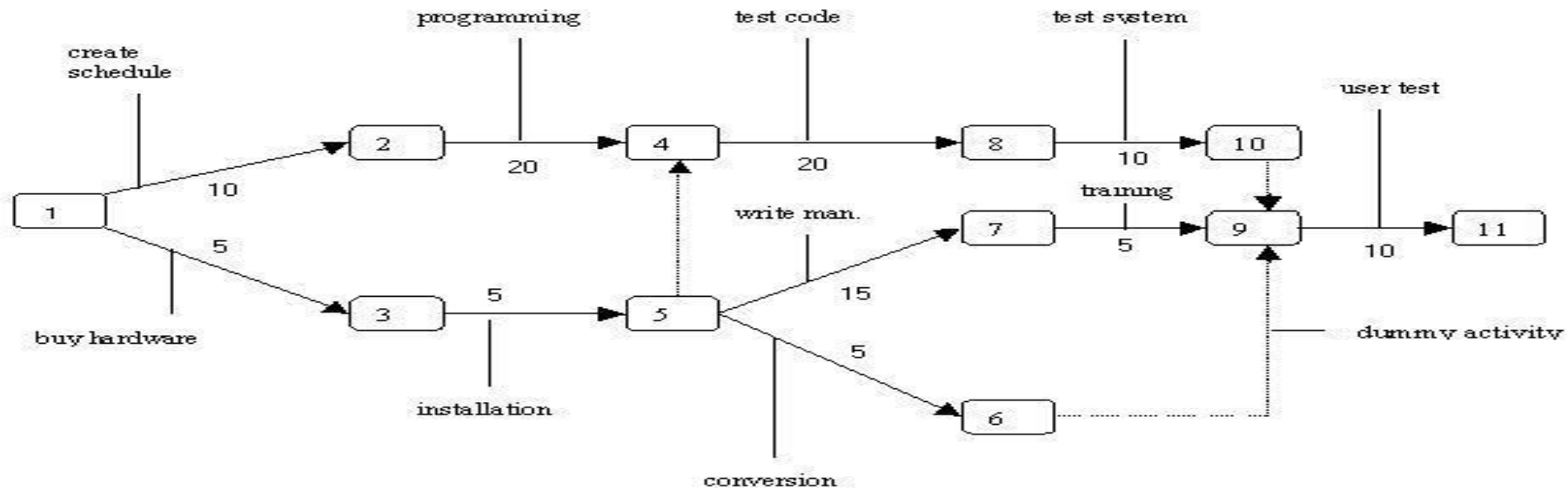


PERT(Program Evaluation and Review Techniques)

- PERT (Program Evaluation and Review Technique) is a project management tools used to schedule, organize and coordinate tasks within a project.
- PERT was initially created by the US Navy in the late 1950s. The pilot project was for developing Ballistic Missiles and there have been thousands of contractors involved.
- PERT chart consists of networks of boxes and arrows. The boxes represent activities and the arrows represents task dependencies.
- PERT chart represents the statistical variations in the project estimates assuming normal distribution. So instead of making single estimates for each task ,pessimistic(p),optimistic(o) and most likelihood(m) estimates are made. That is
 - $Estimates(te)=(o+4*m+p)/6.$
 - *Where optimistic time(o) means the minimum possible period of time for an activity to be completed*
 - *Pessimistic time(p) means the maximum possible period of time for an activity to be completed*
 - *Most likelihood or realistic time(m) is the project manager's best guess of the amount of time that the activity actually will require for the completion*
- Same as most of other estimation techniques, PERT also breaks down the tasks into detailed activities.
- PERT consists of Milestones and Activities.
- Advantages:
 - Simple graphical representations helps to show the task interrelationships.
 - It has the ability to highlights the project's critical path and slack time.
 - It also shows which tasks must be completed before other are begun.
 - It exposes all possible parallelism in the activities and thus help in allocating resources .
- Limitations:
 - Project task has to be clearly defined as well as their relationships
 - It does not deal very well with task overlapping case.
 - It does not help in deciding which activities are necessary or how long each will take.



PERT network chart for a seven-month project with five milestones (10 through 50) and six activities (A through F)



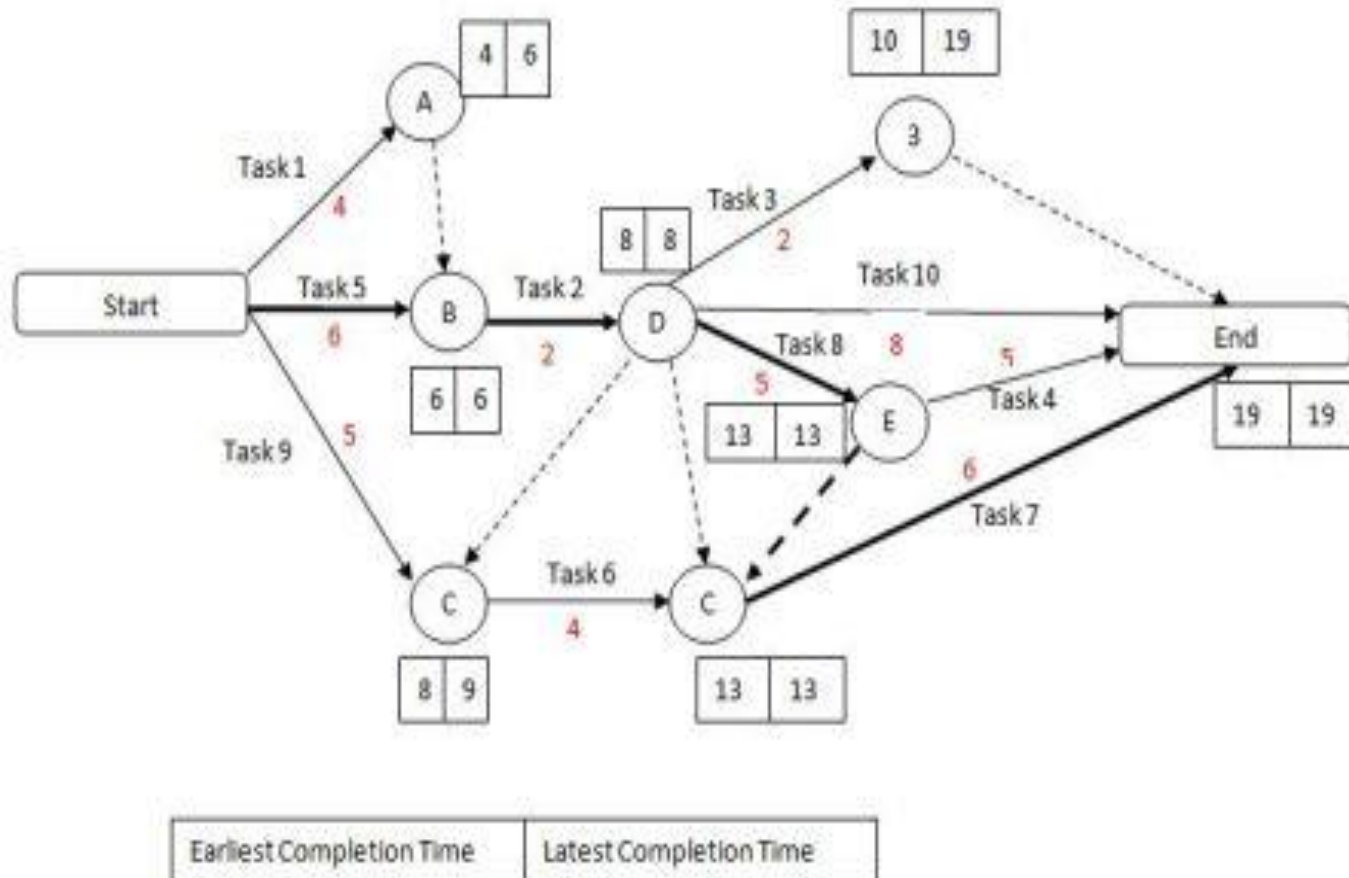
**Fig. 1:
PERT Chart**

- * Numbered rectangles are nodes and represent events or milestones.
- * Directional arrows represent dependent tasks that must be completed sequentially.
- * Diverging arrow directions [e.g. 1-2 & 1-3] indicate possibly concurrent tasks
- * Dotted lines indicate dependent tasks that do not require resources.

CPM(Critical Path Methods)

- CPM allows to monitor the achievements of the project goals and help to find the remedial actions need to be taken to get the project back on course.
- Critical path is the sequential activities from start to the end of a project ie the path of longest duration as determined on the project network diagram(total duration of the project).
- Although many projects have only one critical path, some projects may have more than one critical paths depending on the flow logic used in the project.
- If there is a delay in any of the activities under the critical path, there will be a delay of the project deliverables.
- The path is critical because the task that followed the critical path can not be started until all of the previous task on the critical paths are completed.
- Most of the times, if such delay is occurred, project acceleration or re-sequencing is done in order to achieve the deadlines.
- Critical path method is based on mathematical calculations and it is used for scheduling project activities. This method was first introduced in 1950s as a joint venture between Remington Rand Corporation and DuPont Corporation.
- In the critical path method, the critical activities of a program or a project are identified. These are the activities that have a direct impact on the completion date of the project.
- The critical task will have starting time and finishing time and task not in critical path can have flexibility of starting and finishing the task known as slack time or float time.
- **Advantages/Limitations of Critical Path Method**
 - Offers a visual representation of the project activities.
 - Presents the time to complete the tasks and the overall project.
 - Tracking of critical activities.
 - Difficult to understand and manage.

ES: Earliest start time
 EF: Earliest finish time
 LS: late start time
 LF: late finished time
 $ES = EF + \text{activity duration}$
 $LS = LF - \text{activity duration}$



Scheduling problems

- Estimating the difficulty of problems and hence the cost of developing a solution is hard.
- Productivity is not proportional to the number of people working on a task.
- Adding people to a late project makes it later because of communication overheads.
- The unexpected always happens. Always allow contingency in planning.

Risk Management

- A "risk" is a problem that could cause some loss or threaten the progress of the project, but which has not happened yet.
- These potential issues might harm cost, schedule or technical success of the project and the quality of our software device, or project team morale.
- Risk:
 - The possibility of suffering harm or loss;danger.
 - Risk always involves two characteristics:
 - Uncertainty:risk may or may not happen
 - Loss:if the risk become reality,unwanted consequences or losses will occur.
- Risk management is the process of identifying, assessing and controlling threats to an organization's capital and earnings
- It is concerned with identifying risks and drawing up plans to minimize their effort on a project
- Effective risk management makes it easier to cope with problem and to ensure that these do not lead unacceptable budget or schedule slippage.

Categories of Risk

- **Project risk** are risks that affect the project schedule or resources.
 - Project risks concern different forms of budgetary, schedule, personnel, resource, and customer-related problems.
 - Eg. Project complexity, size and the degree of structural uncertainty.
- **Product risk(Technical risk)** are risks that affect the quality or performance of the s/w being developed.
 - Eg. Specification ambiguity, technical uncertainty, technical obsolescence etc.
- **Business risk** are risks that affect the organization developing or procuring the s/w.eg. Market risks, strategic risks, management risks, budget risks etc.
- **Other categories of risk can be:**
 - Known risk, predictable risk, unpredictable risks
 - Tangible risks, intangible risks etc.

Examples of project, product, and business risks

Risk	Affects	Description
Staff turnover	Project	Experienced staff will leave the project before it is finished.
Management change	Project	There will be a change of organizational management with different priorities.
Hardware unavailability	Project	Hardware that is essential for the project will not be delivered on schedule.
Requirements change	Project and product	There will be a larger number of changes to the requirements than anticipated.
Specification delays	Project and product	Specifications of essential interfaces are not available on schedule.
Size underestimate	Project and product	The size of the system has been underestimated.
CASE tool underperformance	Product	CASE tools, which support the project, do not perform as anticipated.
Technology change	Business	The underlying technology on which the system is built is superseded by new technology.
Product competition	Business	A competitive product is marketed before the system is completed.

Risk Management Process

Risk identification

Identify project, product and business risks;

Risk analysis

Assess the likelihood and consequences of these risks;

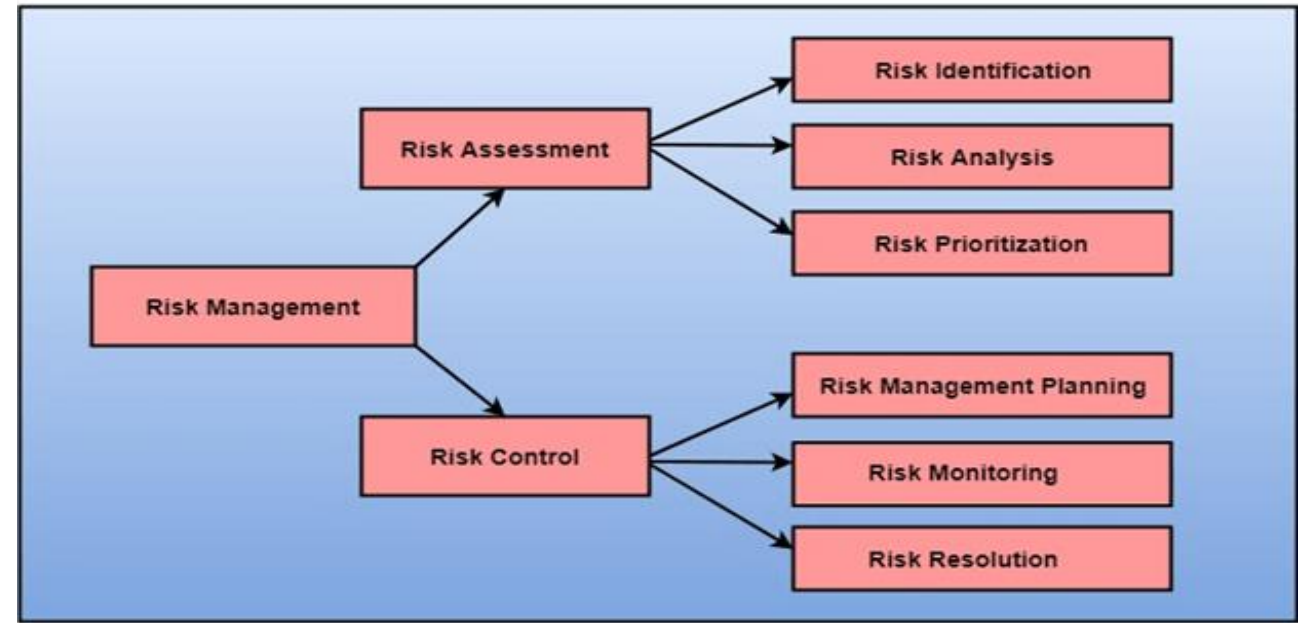
Risk planning

Draw up plans to avoid or minimise the effects of the risk;

Risk monitoring

Monitor the risks throughout the project;

Risk Management Activities



• Risk Assessment

- For risk assessment, first, every risk should be rated in two methods:
 - The possibility of a risk coming true (denoted as r).
 - The consequence of the issues relates to that risk (denoted as s).
- Based on these two methods, the priority of each risk can be estimated:
 - $p = r * s$
- Where p is the priority with which the risk must be controlled, r is the probability of the risk becoming true, and s is the severity of loss caused due to the risk becoming true. If all identified risks are set up, then the most likely and damaging risks can be controlled first, and more comprehensive risk abatement methods can be designed for these risks.

• Risk Identification:

- The project organizer needs to anticipate the risk in the project as early as possible so that the impact of risk can be reduced by making effective risk management planning. It is necessary to categorize risks into different risk classes. There are different types of risks which can affect a software project:
 1. Technology risks
 2. People risks
 3. Organizational risks
 4. Tools risks
 5. Requirement risks
 6. Estimation risks

Risk Analysis:

- Consider every identified risk and make a perception of the probability and seriousness of that risk.
- from the perception and experience of previous projects and the problems that arise in them.
- The probability of the risk might be determined as very low (0-10%), low (10-25%), moderate (25-50%), high (50-75%) or very high (>75%).
- the effect of the risk might be determined as : **catastrophic** (threaten the survival of the plan), **serious** (would cause significant delays), **tolerable** (delays are within allowed contingency), or insignificant.

Risk Control

- The identified risks of a plan are determined; the project must be made to include the most harmful and the most likely risks.

-**Risk avoidance**

-**Risk transfer**

-**Risk reduction**

Risk Planning:

- Consider each risk and develop a strategy to manage that risk.
- Avoidance strategies:
 - The probability that the risk will arise is reduced;
- Minimization strategies:
 - The impact of the risk on the project or product will be reduced;
- Contingency plans:
 - If the risk arises, contingency plans are plans to deal with that risk;

Risk Monitoring

- Assess each identified risks regularly to decide whether or not it is becoming less or more probable.
- Also assess whether the effects of the risk have changed.
- Each key risk should be discussed at management progress meetings.

Risk Indicators

Risk type	Potential indicators
Estimation	Failure to meet agreed schedule; failure to clear reported defects.
Organizational	Organizational gossip; lack of action by senior management.
People	Poor staff morale; poor relationships amongst team members; high staff turnover.
Requirements	Many requirements change requests; customer complaints.
Technology	Late delivery of hardware or support software; many reported technology problems.
Tools	Reluctance by team members to use tools; complaints about CASE tools; demands for higher-powered workstations.

Managing People

- People are an organisation's most important assets.
- The tasks of a manager are essentially people-oriented. Unless there is some understanding of people, management will be unsuccessful.
- Poor people management is an important contributor to project failure.
- People management Factors:
 - Consistency
 - Team members should all be treated in a comparable way without favourites or discrimination.
 - Respect
 - Different team members have different skills and these differences should be respected.
 - Inclusion
 - Involve all team members and make sure that people's views are considered.
 - Honesty
 - You should always be honest about what is going well and what is going badly in a project.

Motivating People

- An important role of a manager is to motivate the people working on a project.
- Motivation means organizing the work and the working environment to encourage people to work effectively.
 - If people are not motivated, they will not be interested in the work they are doing. They will work slowly, be more likely to make mistakes and will not contribute to the broader goals of the team or the organization.
- Motivation is a complex issue but it appears that there are different types of motivation based on:
 - Basic needs (e.g. food, sleep, etc.);
 - Personal needs (e.g. respect, self-esteem);
 - Social needs (e.g. to be accepted as part of a group).