UNIT-3, Activity Planning AND RISK Management

Software Project Management (Dr. A.P.J. Abdul Kalam Technical University)

UNIT-3, ACTIVITY PLANNING AND RISK MANAGEMENT

Planning includes all the activities required to select a systems analysis team, assign members of the team to appropriate projects, estimate the time required to complete each task, and schedule the project so that tasks are completed in a timely fashion.

A plan must be stated as a set of targets, the achievement or non-achievement of which can be unambiguously measured. The activity plan does it by providing a target start and end date for each activity

Objectives of Activity Planning:

- **Feasibility assessment:** Is the project possible within required timescales and resource constraints? It is not until we have constructed a detailed plan that we can forecast a completion date with any reasonable knowledge of its achievability.
- **Resource allocation:** What are the most effective ways of allocating resources to the project? When should the resources be available? The project plan allows us to investigate the relationship between timescales and resource availability
- **Detailed costing:** How much will the project cost and when is that expenditure likely to take place? After producing an activity plan and allocating specific resources, we can obtain more detailed estimates of costs and their timing.

- **Motivation**: Providing targets and being seen to monitor achievement against targets is an effective way of motivating staff, particularly where they have been involved in setting those targets in the first place.
- **Coordination** : When do the staff in different departments need to be available to work on a particular project and when do staff need to be transferred between projects? The project plan, particularly with large projects involving more than a single project team, provides an effective vehicle for communication and coordination among teams.

Project Schedules

A project plan is developed to the level of showing dates when each activity should start and finish, when and how much of each resource will be required. Once a plan has been refined to this level, it is known as a project schedule.

- A stage of a larger project, the project plan must be developed to the level of showing dates when each activity should start and finish and when and how much of each resource will be required.
- It is an activity that distributes estimated effort across the effort to specific software engineering tasks.
- Once the plan has been refined to this level of detail we call it a project schedule
- It is the culmination of a Project Planning activity that is a primary component of Software Project Management

Four Major Steps involved:

- **First step** in producing the plan is to decide what activities need to be carried out and in what order they are to be done.
- **Second step:** The ideal activity plan will then be the subject of an activity risk analysis, aimed at identifying potential problems. This might suggest alterations to the ideal activity plan and will almost certainly have implications for resource allocation.
- **Third step is resource allocation**. The expected availability of resources might place constraints on when certain activities can be carried out
- **Final step: Schedule Production:** once resources have been allocated to each activity, a project schedule can be drawn and published. It indicates the planned start and completion dates and resource requirements statement for each activity.

ACTIVITIES

- An activity is typically one stage of a project management plan.
- Each activity consists of one or more actions that, upon completion, will lead to the next project stage.

- Taken together as a series, the activities will result in the final deliverable.
- Each activity has a defined start and end, as well as a deadline or time period within which it must be completed.

There are 3 most common approaches or methods for the identification of activities in any software project:

Activity based approach: It consists of creating a list of all the activities that the project is supposed to involve in its life cycle.

It can be done by using a brainstorming process which includes the complete project team and analyzing of the past projects.

Work Breakdown Structure (WBS) is created for the same purpose.

It involves dividing a complex and big scale project into simpler, manageable, independent and smaller tasks which can be completed in approximately few weeks by a single development team working on the project.

The root of the project tree is labelled by the project name itself. Each node (activity) is recursively decomposed and divided into smaller sub-activities, until at the leaf level, the activities require approximately two weeks to develop and can be given to a single development team. It follows top-down approach.

Product based approach: It consists of producing a **Product Breakdown Structure and a Product Flow Diagram.**
A product based structure is very much similar to the work breakdown structure which includes dividing a complex and big scale product into its sub set products until simple, manageable, independent and smaller products are obtained at the

leaf level.

The Product Breakdown Structure is constructed prior to the Work Breakdown Structure and it focuses on generating an ordered list of all the sub products required to successfully complete the project.

This generated structure helps in the creation of the Work Breakdown Structure, which in turn helps in the identification of the activities required to produce the required sub products.

There is a very less probability that a product will be left out in a product breakdown structure than that an activity might be left out of a work breakdown structure.

Hybrid approach:

In this approach, an alternative work breakdown structure is constructed based on: 1. A simple list of final deliverables.

2. For each deliverable, a set of activities required to produce that product.

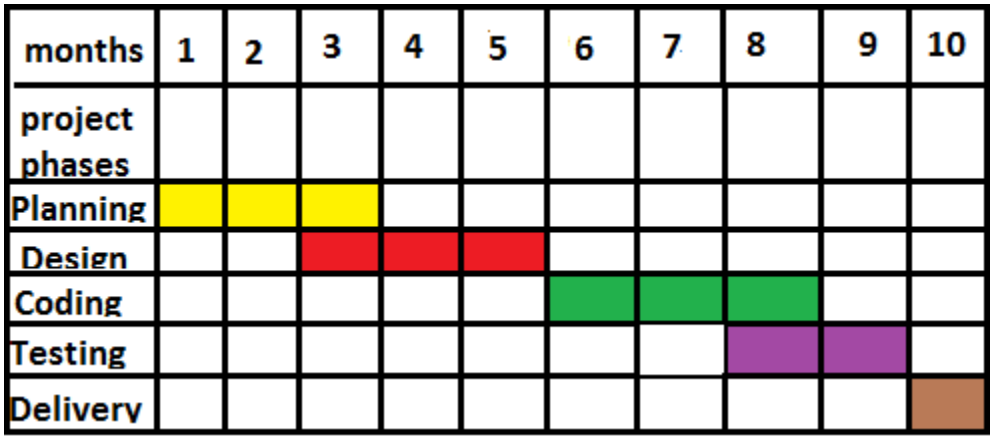
SEQUENCING AND SCHEDULING ACTIVITIES

Sequencing the tasks menas identifying the dependencies among activities dictated by the development process.

Scheduled activities mean specifying when they should take place. The scheduling has had to take account of availability of staff and the way in which the activities have been allocated to them.

A Gantt chart is a bar chart that provides a visual view of project tasks scheduled over time. A Gantt chart is used for project planning: it's a useful way of showing what work is scheduled to be done on specific days. It helps project managers and team members view the start dates, end dates and milestones of a project schedule in one simple stacked bar chart.

To create a Gantt chart, use the vertical axis to list the tasks that need to be completed, and the horizontal axis to depict a timeline. As you input tasks, their start dates, their end dates and their dependencies, bars on the stacked bar chart will populate, which represent task durations.



NETWORK PLANNING MODEL

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 technologies 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.

Now, precedence networks has become popular which use activity-on-node networks where activities are represented as nodes and the links between nodes represents precedence (or sequencing) requirements.

FORMULATING A NETWORK MODEL

- A project network should have only one start node.
- A project network should have only one end node.
- A node has duration.
- Links normally have no duration.
- Precedents are the immediate preceding activities.
- Time moves from left to right.
- A network may not contain loops.
- A network should not contain dangles.

FORWARDS PASS AND BACKWARD PASS

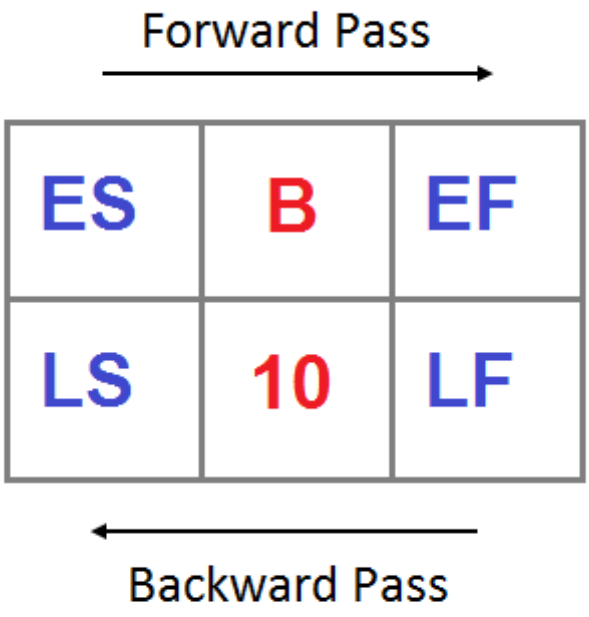
Forward pass is a technique to move forward through network diagram to determining project duration and finding the critical path or Free Float of the project.

Whereas backward pass represents moving backward to the end result to calculate late start or to find if there is any slack in the activity.

Early Start (ES) is plotted on the 1st left corner box at the top. Likewise Early Finish (EF) is plotted on top right corner box.

Late Finish (LF) is on the right corner box at the bottom and Late Start (LS) is plotted on the left bottom corner box.

Example: Activity name “B” is in the 2nd box duration represented by 10 is on the 5th box at the middle.



https://tiemchart.com/

Early Start (ES) represents the earliest start of an activity considering the dependency preceding task. If an activity is having more than one dependency

predecessor, then ES will be the highest Early Finish (EF) of the dependency task.

Early Start = Maximum (or Highest) EF value from immediate Predecessor(s)

How to apply Forward Pass to calculate Early Finish (EF)?

In order to calculate Early Finish, we use forward pass. Means moving from Early Start towards right to come up with Early Finish of the project.

Early Finish (EF) = ES + Duration

If Early Start is 6 days and duration is 10 days, EF = 6 + 10 = 16 Days

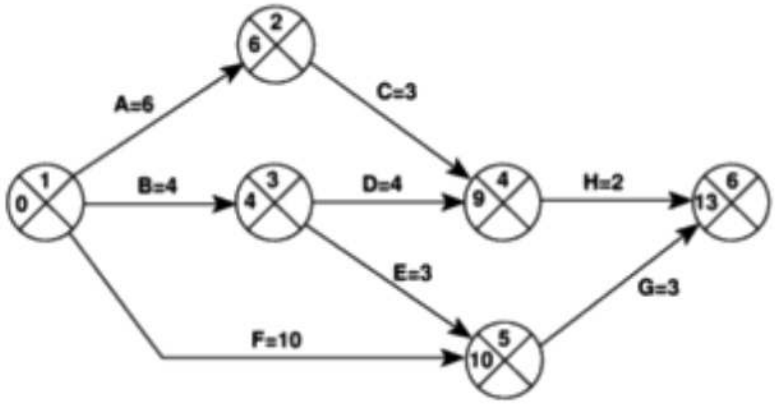
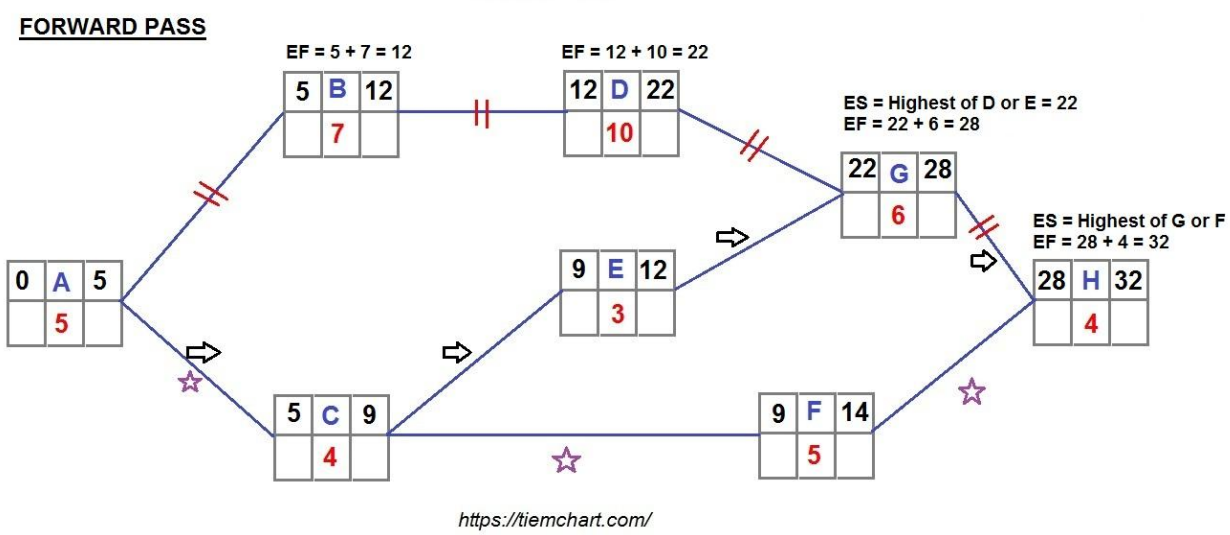


Figure 6.18 *A CPM network after the forward pass.*

Table 6.2 *The activity table after the forward pass*

Activity	*Duration (weeks)*	*Earliest start date*	*Latest start date*	*Earliest finish fate*	*Latest finish date*	*Total float*
A	6	0		6		
B	4	0		4		
C	3	6		9		
D	4	4		8		
E	3	4		7		
F	10	0		10		
G	3	10		13		
H	2	9		11		



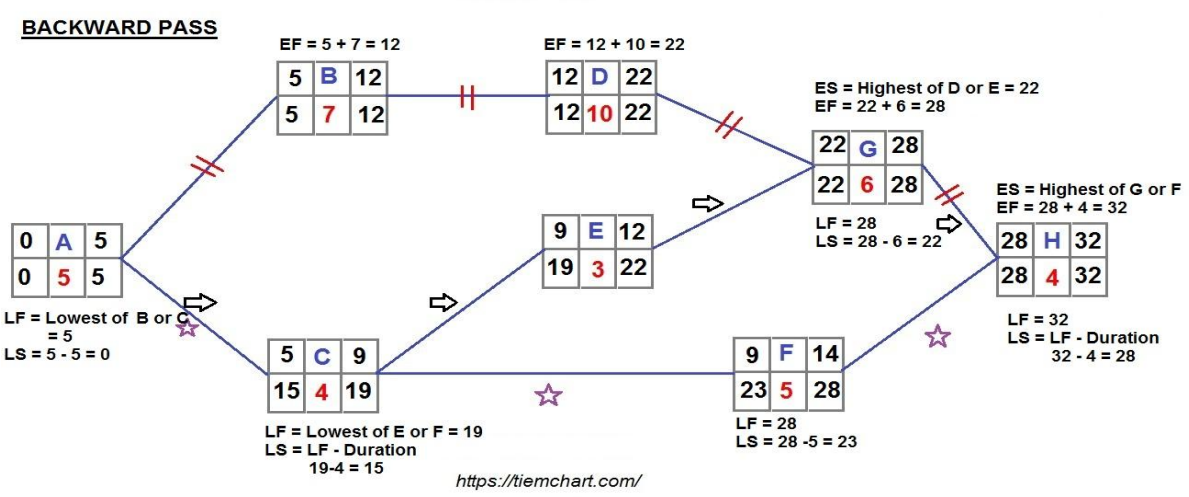
Late Finish (LF): Late finish (LF) is the latest date that the activity can finish without causing a delay to the project completion date.

How to apply Backward Pass to calculate Late Start (LS)?

In order to calculate Late Start (LS), we apply backward Pass moving from Late Finish and deducting from activity duration.

LS = LF – Duration

If Late Finish is 30 days and duration is 10 days, LS = 30 – 10 = 20 Days



Critical Path: Critical Path is the longest sequence of activity on a project that carry zero free float / slack.

Float Calculation

The whole idea of network diagram and finding the project duration is to identify the critical path and total float. Float represents how much each individual activity can be delayed without delaying successor activities or project completion date.

Total Float = LS – ES or LF – EF

Total Float shows the difference between the Earliest Start (ES) and Latest Start (LS) of an activity before the completion date is delayed.

Free Float = Lowest ES of successors – EF

Free Float represents the amount of time that an activity can be delayed before any successor's activity will be delayed. A zero free float represents the activity is in critical path and there is no space to delay the activity without delaying the entire project.

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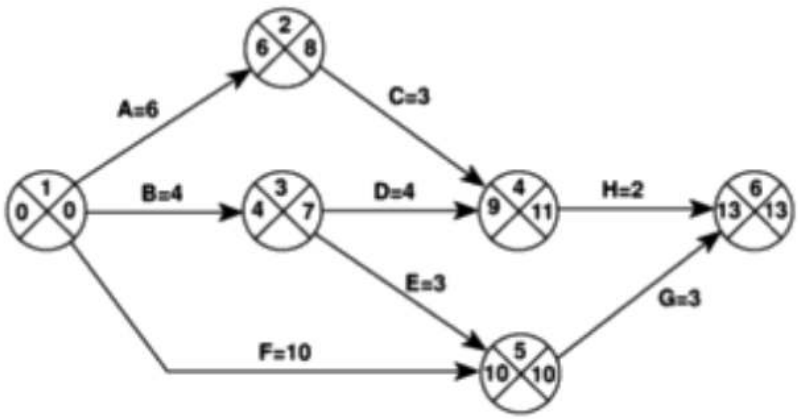

Figure 6.19 *The CPM network after the backward pass.*

Table 6.3 *The activity table following the backward pass*

Activity	*Duration (weeks)*	*Earliest start date*	*Latest start date*	*Earliest finish fate*	*Latest finish date*	*Total float*
A	6	0	2	6	8	
B	4	0	3	4	7	
C	3	6	8	9	11	
D	4	4	7	8	11	
E	3	4	7	7	10	
F	10	0	0	10	10	
G	3	10	10	13	13	
H	2	9	11	11	13	

SLACK: The difference between the earliest date and latest date for an event is known as the slack of that event. It is a measure of how late an event may be without affecting the end of the project. Any event with a slack of zero is a critical event.

ACTIVITY FLOAT: whereas event possess float, activity possess float. It is the difference between the earliest start date of an activity and its latest start or the difference between its earliest finish and latest finish.

Free float: the time by which an activity can be delayed without delaying any subsequent activity. It is calculated as the difference between the earliest completion date of the activity and earliest start date of succeeding activity.

Interfering Float: the difference between total float and free float. The interfering float tells us by how much the activity may be delayed without delaying the project end date.

Table 6.4 *The activity schedule showing total float for each activity*

Activity	*Duration (weeks)*	*Earliest start date*	*Latest start date*	*Earliest finish fate*	*Latest finish date*	*Total float*
A	6	0	2	6	8	2
B	4	0	3	4	7	3
C	3	6	8	9	11	2
D	4	4	7	8	11	3
E	3	4	7	7	10	3
F	10	0	0	10	10	0
G	3	10	10	13	13	0
H	2	9	11	11	13	2

CRITICAL PATH METHOD (CPM)

The critical path method is a technique that allows you to identify tasks that are necessary for project completion.

The critical path in project management is the longest sequence of activities that must be finished on time to complete the entire project.

Any delays in critical tasks will delay the rest of the project.

CPM revolves around discovering the most important tasks in the project timeline, identifying task dependencies, and calculating task durations.

CPM was developed in the late 1950s as a method to resolve the issue of increased costs due to inefficient scheduling.

CPM has become popular for planning projects and prioritizing tasks.

It helps to break down complex projects into individual tasks and gain a better understanding of the project's flexibility.

Other scheduled paths might have slack time to avoid delaying the entire project, unlike the critical path.

There might be multiple critical paths on a project.

The Critical Path is determined when analyzing a project's schedule or network logic diagram and uses the Critical Path Method (CPM).

The CPM provides a graphical view of the project, predicts the time required for the project, and shows which activities are critical to maintaining the schedule.

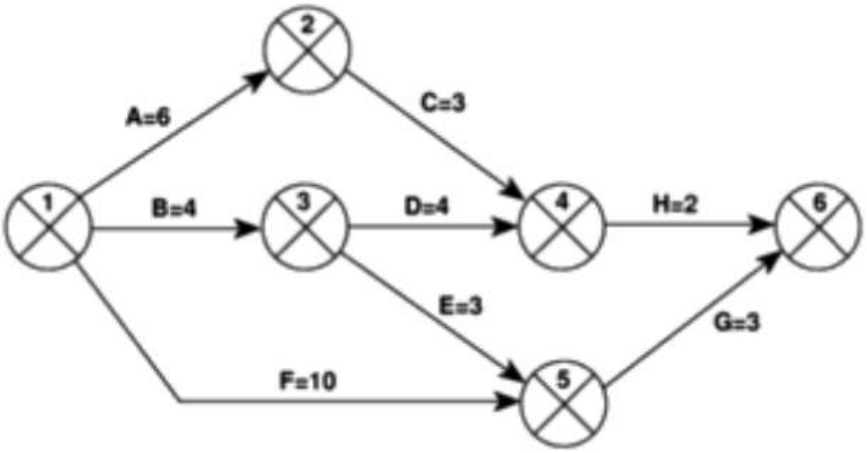

Figure 6.17 *The CPM network for the example project.*

Steps carried out in CPM

1. Activity Specification
2. Activity Sequence Establishment
3. Network Diagram
4. Estimates for each activity
5. Identification of the critical path
6. Critical path diagram to show project measures

Advantages

- Tracking critical activities
- It defines the most important tasks.
- Saves time and helps in the management of deadlines.
- Helps to compare the plan with the real status.
- Identifies all critical activities that need attention.

Disadvantages

- In CPM, it is difficult to estimate the completion time of an activity.

- The critical path is not always clear in CPM.
- For bigger projects, CPM networks can be complicated too.
- Does not handle the scheduling of the resource allocation.

PROJECT EVALUATION AND REVIEW TECHNIQUE(PERT)

Project Evaluation and Review Technique (PERT) is a procedure through which activities of a project are represented in its appropriate sequence and timing.

It is a scheduling technique used to schedule, organize and integrate tasks within a project.

PERT is basically a mechanism for management planning and control which provides blueprint for a particular project.

All of the primary elements or events of a project have been finally identified by the PERT.

In this technique, a PERT Chart is made which represent a schedule for all the specified tasks in the project.

The reporting levels of the tasks or events in the PERT Charts is somewhat same as defined in the work breakdown structure (WBS).

Characteristics of PERT

The main characteristics of PERT are as following :

- It serves as a base for obtaining the important facts for implementing the decision-making.
- It forms the basis for all the planning activities.

- PERT helps management in deciding the best possible resource utilization method.
- PERT take advantage by using time network analysis technique.
- PERT presents the structure for reporting information.
- It helps the management in identifying the essential elements for the completion of the project within time.

Advantages of PERT

It has the following advantages :

- Estimation of completion time of project is given by the PERT.
- It supports the identification of the activities with slack time.
- The start and dates of the activities of a specific project is determined.
- It helps project manager in identifying the critical path activities.
- PERT makes well organized diagram for the representation of large amount of data.

Disadvantages of PERT:

It has the following disadvantages :

- The complexity of PERT is more which leads to the problem in implementation.
- The estimation of activity time are subjective in PERT which is a major disadvantage.
- Maintenance of PERT is also expensive and complex.
- The actual distribution of may be different from the PERT beta distribution which causes wrong assumptions.

- It under-estimates the expected project completion time as there is chances that other paths can become the critical path if their related activities are deferred.