ICT Project Management

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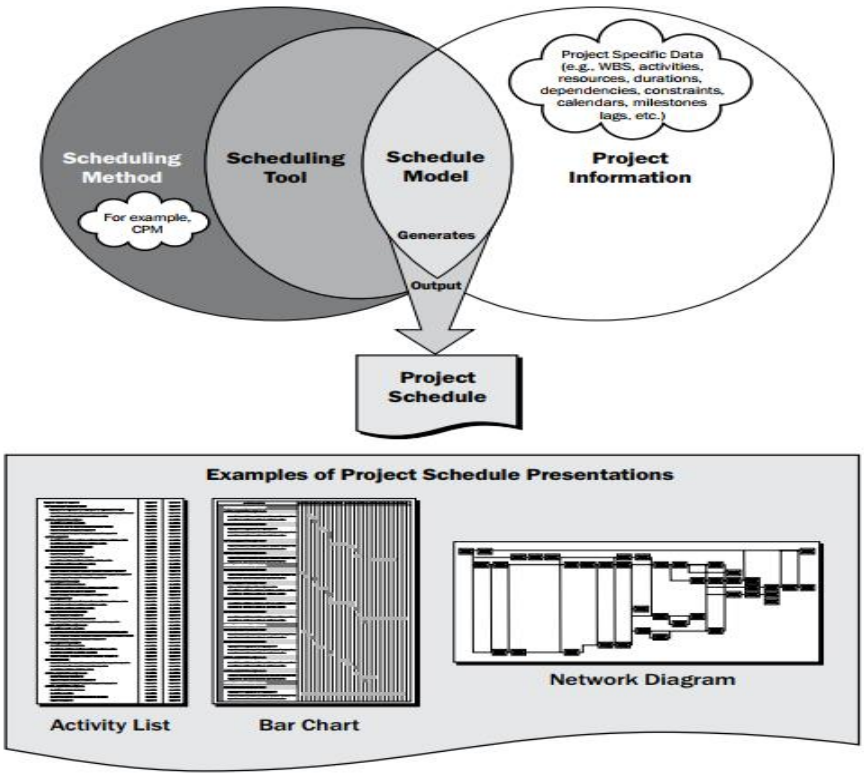
Unit 6: Project Time Management

Time is not on your side when it comes to project management.

Project time / schedule management is the project management process of analyzing work and developing a timeline to ensure you complete a project within a particular schedule.

- ✓ Project scheduling provides a detailed plan that represents how and when the project will deliver the products, services, and results defined in the project scope and serves as a tool for communication, managing stakeholders' expectations, and as a basis for performance reporting.
- ✓ The project management team selects a scheduling method, such as critical path or an agile approach.
- ✓ Then, the project-specific data, such as the activities, planned dates, durations, resources, dependencies, and constraints, are entered into a scheduling tool to create a schedule model for the project.
- ✓ For smaller projects, defining activities, sequencing activities, estimating activity durations, and developing the schedule model are so tightly linked that they are viewed as a single process that can be performed by a person over a relatively short period of time

Project Scheduling Overview:



- ✓ **Figure:** Scheduling Overview: (Shows how the scheduling method, scheduling tool, and outputs from the Project Schedule Management processes interact to create a schedule model) [IS: PMBOK Guide]

6.1. Project Time Management Process

Generally 6 Steps:

1. Plan Schedule Management

- ✓ The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.

2. Define Activities

- ✓ The process of identifying and documenting the specific actions to be performed to produce the project deliverables.

3. Sequence Activities

- ✓ The process of identifying and documenting relationships among the project activities.

4. Estimate Activity Durations

- ✓ The process of estimating the number of work periods needed to complete individual activities with the estimated resources.

5. Develop Schedule

- ✓ The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model for project execution and monitoring and controlling.

6. Control Schedule

- ✓ The process of monitoring the status of the project to update the project schedule and manage changes to the schedule baseline.

6.2. Plan Schedule Management

- ✓ Plan Schedule Management is the process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.
- ✓ Plan schedule management provides guidance and direction on how the project schedule will be managed throughout the project.
- ✓ This process is performed once or at predefined points in the project
- ✓ A project schedule is much more than a basic calendar
- ✓ The project schedule must be accessible to every team member.

Inputs, Tools and Techniques and Outputs of Plan Schedule Management Process

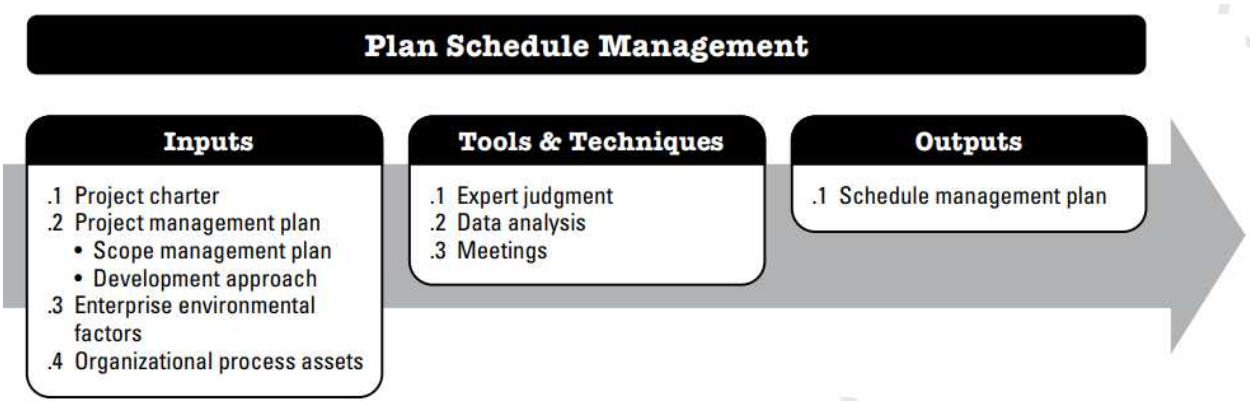


Figure: Inputs, Tools and Techniques and Outputs of Plan Schedule Management Process

6.3. Defining Event, Activity and Activity Attributes

Event

- ✓ Event refers to any particular or specific occurrence within the project life cycle.
- ✓ Event is a step that leads to the action or status change
- ✓ Event can refer to a particular activity that takes place within the project, it can refer to any particular meeting that may be conducted for the purposes of discussing anything related to the project.
- ✓ Event can refer to a specific occurrence related to the actual provision of the final deliverable to the client.
- ✓ The project management checks the event effects on the project to obviate or minimize the project risks such as unforeseeable and occurred events.
- ✓ There are two types of the events
  - ➢ The actor-initiating events and
  - ➢ System events.
- ✓ The system events are not always impacted by the actors. They represent marketing development and law changes.
- ✓ An event is a specific instant of time, which makes the start or end of an activity. Event consumes neither time nor resources.

Activity:

- ✓ Activity An activity is the actual performance of the task and requires time and resources for its completion. It is the work required to complete a specific task.

Define Activities is the process of identifying and documenting the specific actions to be performed to produce the project deliverables.

The goal of defining activities is to ensure that the project team completely understands all the work it must do as part of the project scope so the team can start scheduling the work. Activity information is a required input to the other time management processes.

- ✓ Defining activity decomposes work packages into schedule activities that provide a basis for estimating, scheduling, executing, monitoring, and controlling the project work.
- ✓ Defining activity requires sufficient data and a proper work breakdown structure to provide the end result.
- ✓ By creating an activity list for a project, you are ensuring proper functioning and the systematic progress of your project
- ✓ This process is performed throughout the project.

Predecessor activity: The activity proceeding to any given activity is called the predecessor activity.

Successor activity: The activity succeeding to any given activity is called the successor activity.

Duration: Duration is the estimated or actual time required to complete a task or an activity.

Earliest start time (EST): It is defined as the earliest possible time at which an activity can start. It is calculated by moving from first to last event in a network diagram.

Earliest finish time (EFT): It is the earliest possible time at which an activity can finish.

EFT = EST + duration of that activity.

Latest finish time (LFT): It is calculated by moving from last event to the first event of the network diagram.

Latest start time: It is the latest possible time by which an activity can start.

LST = LFT – duration of that activity.

Float or Slack: Stack is with reference to an event and float is with reference to an activity.

Float is the difference between time available for completing an activity and the time necessary to complete an activity.

Total Float: It is the time span by which the starting and finishing an activity can be delayed without delaying the completion of the project. It is the additional time, which a non-critical activity can consume without increasing the project duration.

Activity List:

- ✓ The activity list is a tabulation of activities to be included on a project schedule.
- ✓ The list should include the activity identifier and scope of work description (i.e. Activity name, an activity identifier or number, and a brief description of the activity) to ensure the project team members understand what work needs their attention.

Following are five-time management processes of the Activity list as per the PMBOK® guide:

- Sequence Activities
- Estimate Activity Resources
- Estimate Activity Durations
- Develop Schedule
- Control Schedule

Activity Attributes:

- ✓ Activity attributes extend the description of the activity by identifying the components associated with each one.
- ✓ The components for each activity evolve over time.
- ✓ Activity attributes identify the resource responsible for executing the work, where the work will be performed, and the activity type.
- ✓ They are used for schedule development and for selecting, ordering, and sorting the planned activities in various ways within reports.
- ✓ During the initial stages of the project, they include the unique activity identifier (ID), WBS ID, and activity label or name.
- ✓ When completed, they may include activity descriptions, predecessor activities and successor activities, logical relationships, leads and lags, resource requirements, imposed dates, constraints, and assumptions.
- ✓ Activity attributes can be used to identify the place where the work has to be performed, the project calendar the activity is assigned to, and the type of effort involved.

Input, Tools and Techniques, Output of Time management Process: Define Activities

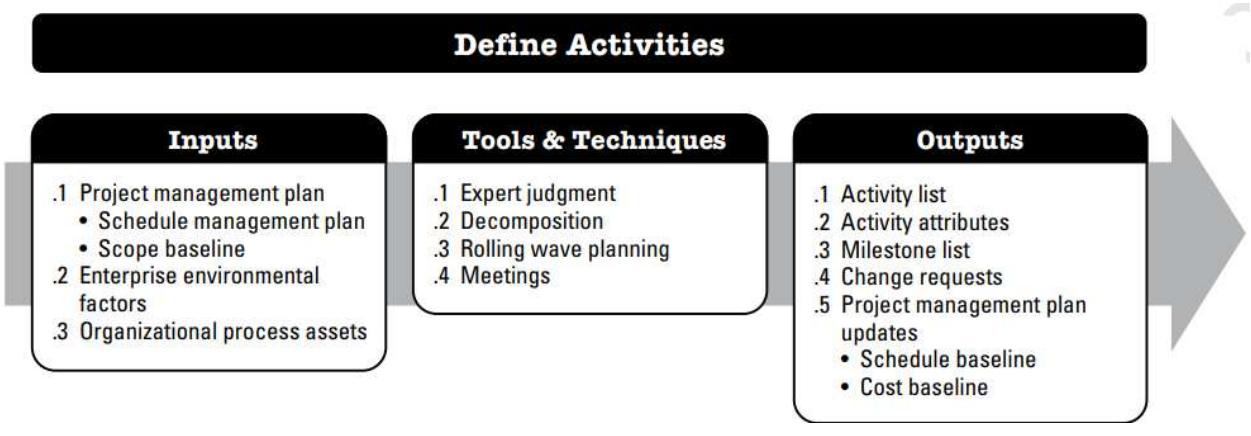


Figure: Input, Tools and Techniques, Output of Time management Process: Define Activities [by PMBOK]

6.4. Activity Sequencing

- ✓ After defining project activities, the next step in project time management is sequencing them or determining their dependencies.
- ✓ Activity Sequencing is the process of identifying and documenting relationships among the project activities.
- ✓ It defines the logical sequence of work to obtain the greatest efficiency given all project constraints.
- ✓ The sequencing process involves evaluating the reasons for dependencies and the different types of dependencies.
- ✓ In project time management, the main outputs of the sequencing activities process are an activity list, activity attributes, a milestone list, and project management plan updates.
- ✓ This process is performed throughout the project

For Example: If you're building a house, you can't put the roof on until the frame is completed. (i.e. once you have all the project activities listed, think through each one carefully to identify which tasks rely on others to be completed. It's important to correctly define all your project dependencies so you can schedule accurately and avoid delays)

Inputs, Tools and Techniques, Outputs of time scheduling process: Sequence Activities

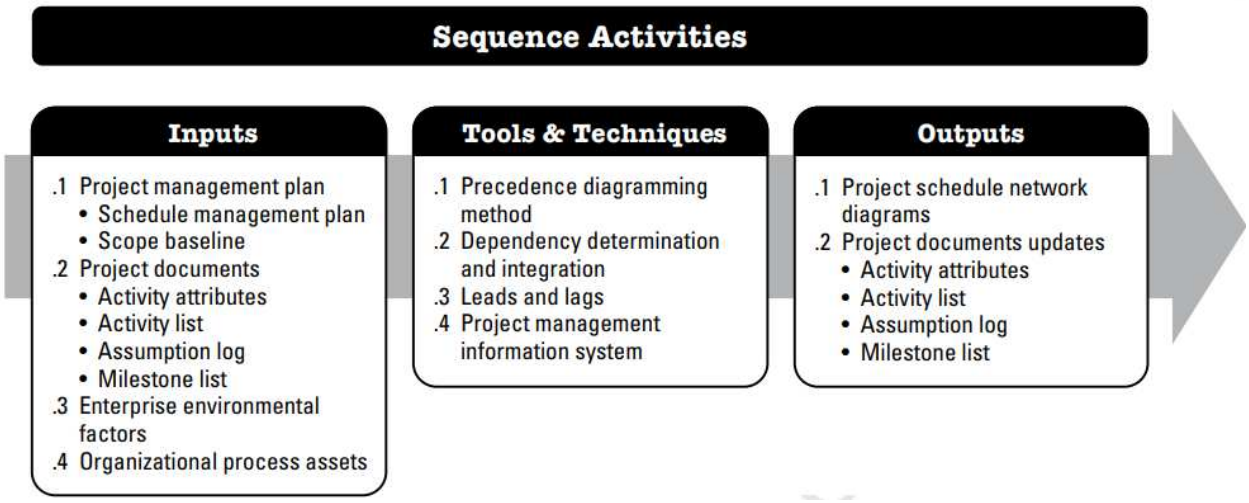


Figure: Inputs, Tools and Techniques, Outputs of time scheduling process: Sequence Activities by A Guide to PMBOK.

1. Precedence Diagramming Method (PDM)

- ✓ Also called Activity on Node (AON) method
- ✓ PDM is a graphical tool used for scheduling activities in a project plan.

- ✓ PDM maps out project development by creating a visual representation of critical paths and dependencies.
- ✓ The primary output of PDM is a project schedule network diagram.
- ✓ The project schedule network diagram is an input in new projects' "develop schedule" process.
- ✓ Precedence diagramming uses nodes to represent activities and links them with lines and arrows illustrating paths and dependencies.
- ✓ It's a quick and easy visual scheduling tool for project managers.

Predecessor activity is an activity that logically comes before a dependent activity in a schedule.

Successor activity is a dependent activity that logically comes after another activity in a schedule.

Dependencies in project management can occur in four different ways:

1. Finish to Start **(FS):** Task B cannot begin until task A has been completed

2. Start to Start **(SS):** Task B cannot begin until task A begins

3. Finish to Finish **(FF):** Task B cannot be completed until task A is completed

4. Start to Finish **(SF):** Task B cannot be completed until task A begins

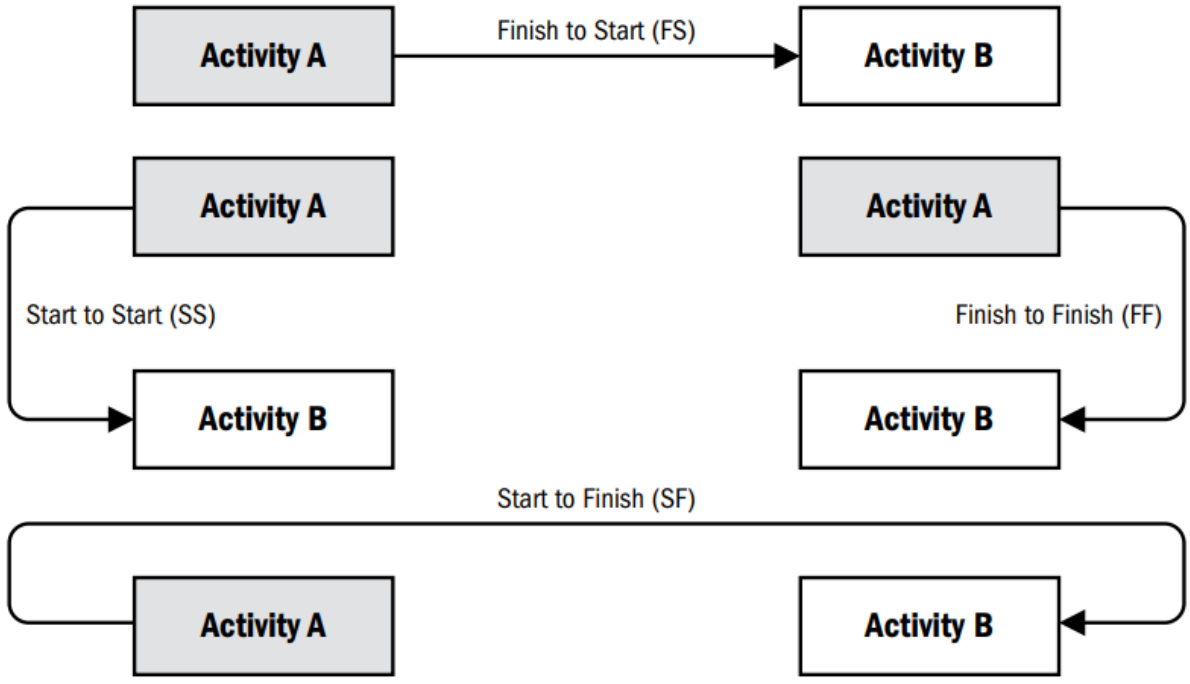


Figure: Dependency / Relationship type in Precedence Diagram

In PDM, FS is the most commonly used type of precedence relationship. The SF relationship is very rarely used, but is included to present a complete list of the PDM relationship types.

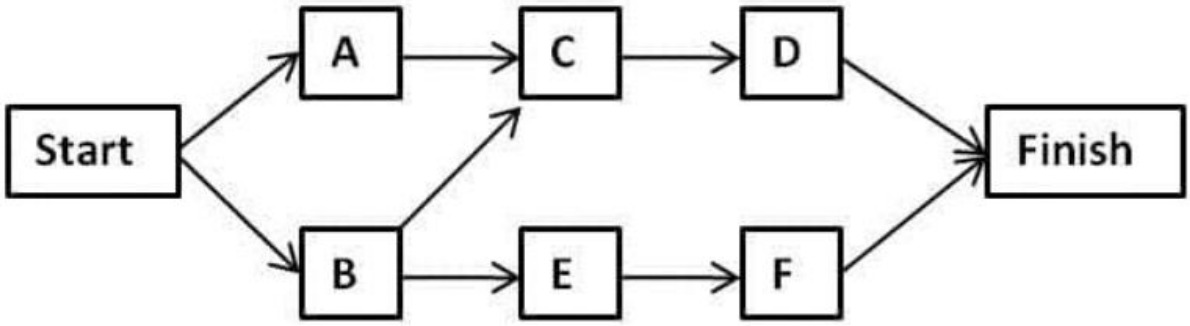


Figure: Precedence Diagram Method (PDM)

2. Dependency Determination and Integration

Dependencies may be characterized by the following attributes: mandatory or discretionary, internal or external.

Mandatory Dependency

- ✓ Mandatory dependency has a physical necessity for dependency.
- ✓ **For example**, workers cannot add doors to a car until they have built the doors, or a chef cannot test the flavor of a new soup until they have made it.
- ✓ This is also known as a logical dependency because the steps logically must follow one after the other.

Discretionary Dependency

- ✓ Discretionary dependency is a dependency is set based on the preferences of the project manager.
- ✓ **For example**, generally accepted best practices recommend that during construction, the electrical work should start after finishing the plumbing work.

External Dependency

- ✓ External dependency is when a group or organization outside of the project team has control over the completion of a step.
- ✓ **For example**, a project manager may be waiting on a supplier to deliver hardware or waiting for governmental agency approval.

Internal Dependency

- ✓ Internal dependency occurs when a step still occurs within the organization, but on a different project.

- ✓ **For example**, if a construction team only has one electrician, and that electrician is working on another project, then electrical work will need to wait until the electrician is available.

3. Lead and Lag

- ✓ Lead and lag are both used in the development of the project schedule.
- ✓ Lead is an acceleration of the successor activity and can be used only on finish-to-start activity relationships.
- ✓ Lag is a delay in the successor activity and can be found on all activity relationship types

It is lead when the first activity is still running when the second activity starts. Lead time is the overlap between the first and second activities.

For Example: Assuming that the time duration for the first activity is 10 days and 5 days for the second activity, the first activity is on its 5th day, and you have started the second activity. Remember that the first activity still has five days to be finished. In this case, we would say that the lead time is five days.

Lag occurs when the first activity completes, and there is a delay before the second activity starts.

For example, the duration of the first activity is 3 days and 2 days for the second activity. After completing the first activity, you wait for 1 day and then start the second. Here, we say that the lag time is one day.

6.5. Network Analysis and Network Diagram

Network:

- ✓ Graphic representation of a project's operations is called a **network**.
- ✓ It is the combination of activities and events which are require to reach the end objective of a project.
- ✓ A number of nodes (typically shown as small circles or rectangles) and a number of arcs (shown as arrows) that connect two different nodes exist in a project network (figure).

Network analysis

- ✓ It involves a group of techniques which are used for presenting information about the time and resources involved in the project so as to assist in the planning, scheduling and controlling of the project.
- ✓ The information usually represented by a network includes the sequences, interdependencies, interrelationships and critical activity of various activities of the project.

Two common Techniques used in Network Analysis are:

- ✓ CPM and
- ✓ PERT

Network Diagram:

- ✓ A project schedule network diagram visualizes the sequential and logical relationship between tasks in a project setting.
- ✓ A network diagram allows a project manager to track each element of a project and quickly share its status with others.

Two main Types:

1. Arrow Diagram Method (ADM)
2. Precedence Diagram Method (PDM)

Arrow Diagram Method (ADM)

- ✓ Also known as "activity network diagram" or "activity on arrow (AOA)"
- ✓ It uses arrows to represent activities associated with the project.
- ✓ Due to the ADM's limitations, it is no longer widely used in project management.

In ADM:

- ✓ The tail of the arrow represents the start of the activity and the head represents the finish.
- ✓ The length of the arrow typically denotes the duration of the activity.
- ✓ Each arrow connects two boxes, known as "nodes."
- ✓ The nodes are used to represent the start or end of an activity in a sequence.
- ✓ The starting node of an activity is sometimes called the "i-node," with the final node of a sequence sometimes called the "j-node."
- ✓ The only relationship between the nodes and activity that an ADM chart can represent is "finish to start (FS)".
- ✓ The diagram may also contain dummy tasks that are used to show the inter-dependency between tasks.
- ✓ Dummy tasks do not represent any real sequenced activity but they are more of check-points or milestones that may need to be completed on the way to moving forward with the next task

Example:

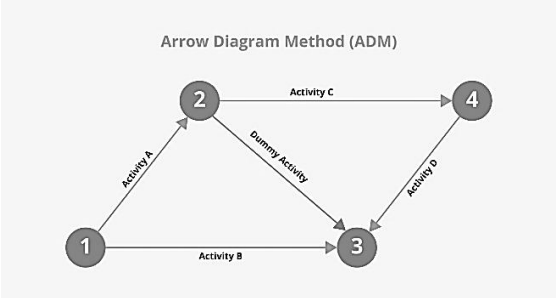


Figure: Arrow Diagram Method

Precedence Diagram Method (PDM)

Note: *See on page number 7.*

6.6. Activity Resource and Activity Duration Estimating

- ✓ Estimate Activity Durations is the process of estimating the number of work periods needed to complete individual activities with estimated resources.
- ✓ Estimate activity duration it provides the amount of time each activity will take to complete.
- ✓ This process is performed throughout the project
- ✓ Activity duration estimates are approximations of how much time a project task will take.
- ✓ They can be in the form of different time periods, such as hours, days, weeks or months, and usually refer to work or business periods.
- ✓ Estimating the duration of specific activities can help a project manager to guess the overarching project timeline and create a detailed project schedule.
- ✓ It can also help them predict the costs of project activities and inform stakeholders about project goals.
- ✓ In order to make activity duration estimates, project managers typically study the scope of the project, the characteristics of its individual activities, the resources accessible to complete the work and historical data from past projects.
- ✓ The length of project activities often depends on the availability and skill sets of team members who can complete them.
- ✓ Project managers can also make activity duration estimates based on their own expert opinions, or those of other technical experts in their field.

Inputs, Tools and Techniques and Outputs of the process: Activity Duration Estimating

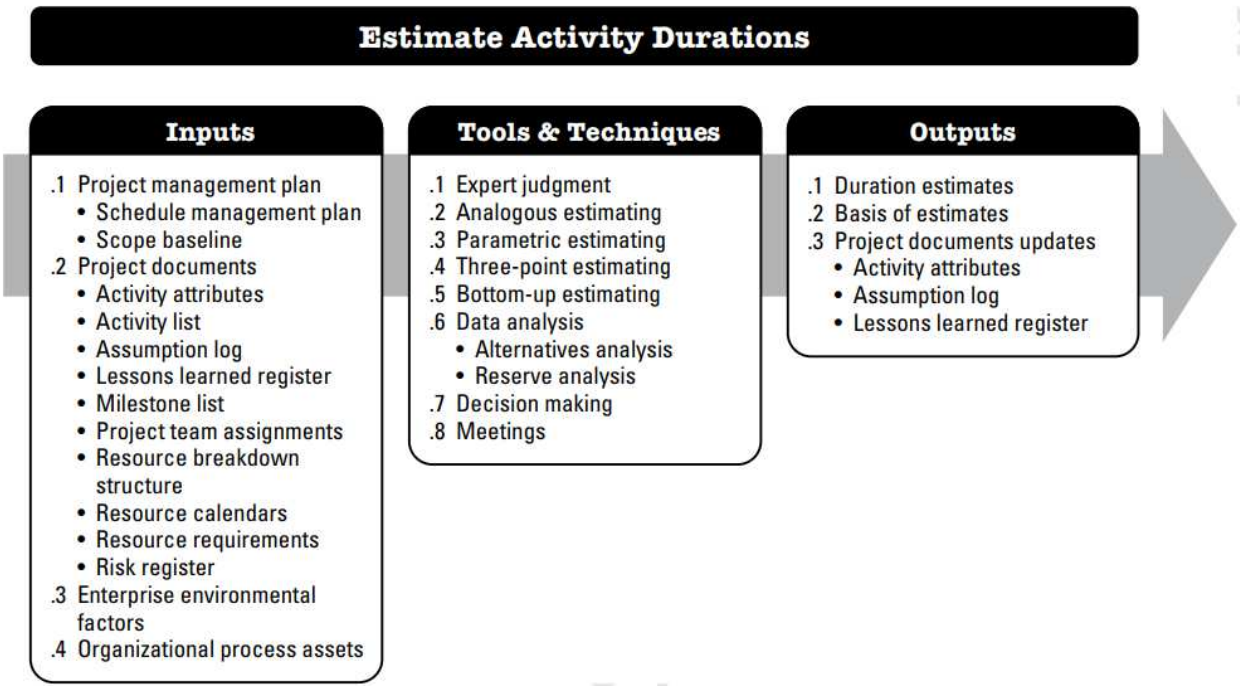


Figure: Inputs, Tools and Techniques and Outputs of the process: Activity Duration Estimating

Analogous Estimation: Estimation based on historical data, the duration values of previous similar projects. Use these past observations as an "analogy" or comparison to guess how long the current activities will take.

Parametric Estimation: Estimation based on guesses on statistical calculations by studying the values of work time per unit in past projects and extrapolate a duration estimate.

Bottom-up estimating: Estimates the duration of the minor components of project activity and adds them together to get a final activity duration.

Three-point estimating: Three data points - optimistic, pessimistic and most likely. "Most likely" is an estimate of a realistic project duration, which a project manager can create using a different technique. "Optimistic" is the ideal duration, and "pessimistic" is the worst-case scenario. These represent upper and lower bounds that an activity is not likely to exceed unless there is a major, unexpected situation.

Depending on the assumed distribution of values within the range of the three estimates, the expected duration can be calculated as:

$$E = (O + M + P) / 3$$

Where, **E** is the expected duration estimate, **O** is the optimistic duration estimate, **M** is the most likely duration estimate and **P** is the pessimistic duration estimate.

6.7. Schedule Development

- ✓ Develop Schedule is the process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create a schedule model for project execution and monitoring and controlling.
- ✓ It generates a schedule model (like CPM, CCM) with planned dates for completing project activities.
- ✓ This process is performed throughout the project.
- ✓ At this point, PM have all the information needed to develop the project schedule.
- ✓ Taking into consideration the duration and resource requirements of each activity, as well as their dependencies and proper sequence, PM can assign start dates and due dates for each activity.

For example, don't ignore the calendar. Check vacation requests from team members. Don't forget to include factors like national holidays, corporate functions, stakeholder events, and other occasions that may affect your schedule. If the whole company shuts down for a holiday week, you'll need to add that time to your due dates and manage customer expectations accordingly.

Inputs, tools and techniques, and outputs of this process Develop Schedule:

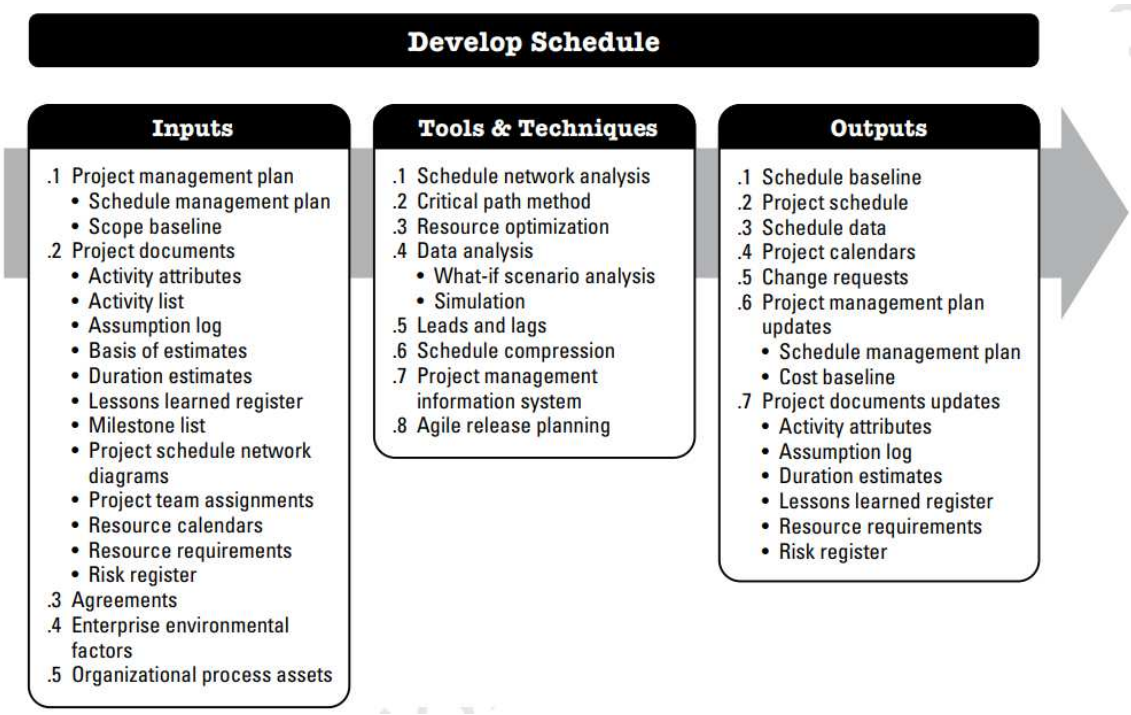


Figure: Inputs, tools and techniques, and outputs of this process Develop Schedule

Schedule Compression

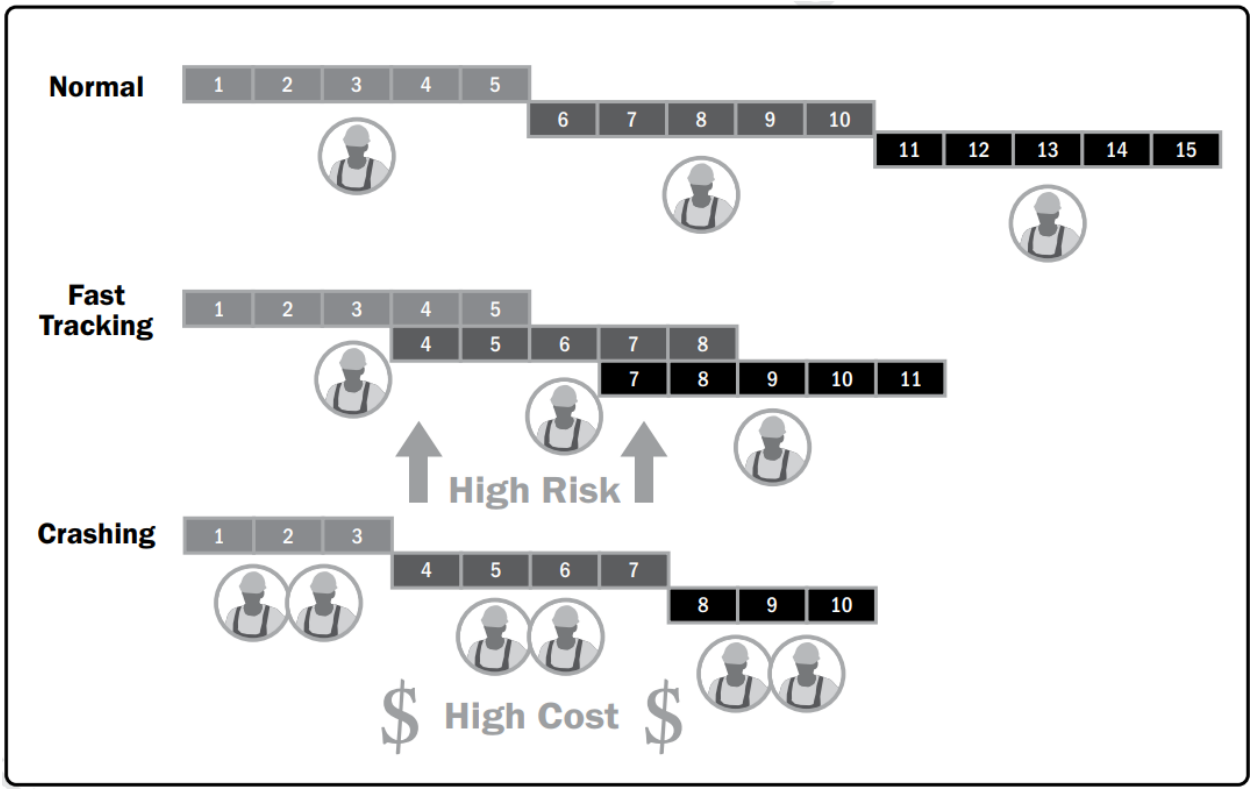


Figure: Schedule Compression Techniques (2 type- Fast Tracking and Crashing)

6.8. Milestones and Gantt Charts

- ✓ Milestones are points established within the timeline of project that helps to keep track of important tasks.
- ✓ Milestones are used to determine if you're on schedule to finish your project by its ultimate deadline.
- ✓ A milestone indicates significant progress, and the more milestones you reach, the closer you are to completing your project.

A milestone chart is a project management chart that helps project managers visualize project milestones.

- ✓ It typically shows each milestone and when it needs to be completed, the status of the milestone (complete or incomplete) and sometimes the priority of the milestone.
- ✓ Many milestone charts use specific colors of symbols to show the most critical milestones.

A milestone chart only shows you the end date for completing a task or for achieving particular objectives.

Milestone charts are typically created using Gantt charts,

Examples of Gantt chart milestones: Meetings, Sign-offs, Approvals, tests etc.

Gantt chart is a horizontal bar chart that represents project tasks and milestones over a project timeline.

Why Gantt chart Milestones?

1. Visualize project
2. Identify bottleneck
3. Separate phases
4. Provide motivation
5. Assist in noticing risks
6. Informative for stakeholders

How to create Gantt chats?

1. Create a task list
2. Assemble a schedule
3. Separate tasks into phases
4. Mark milestones

6.9. Forward 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.

- ✓ The forward pass helps to understand the project duration and calculate the ***early start*** and ***early finish*** values (meaning, the earliest day each project task can begin and wrap up)

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

- ✓ The backward helps to understand the project duration and Calculate ***late start*** and ***late finish*** values, and eventually find the critical path

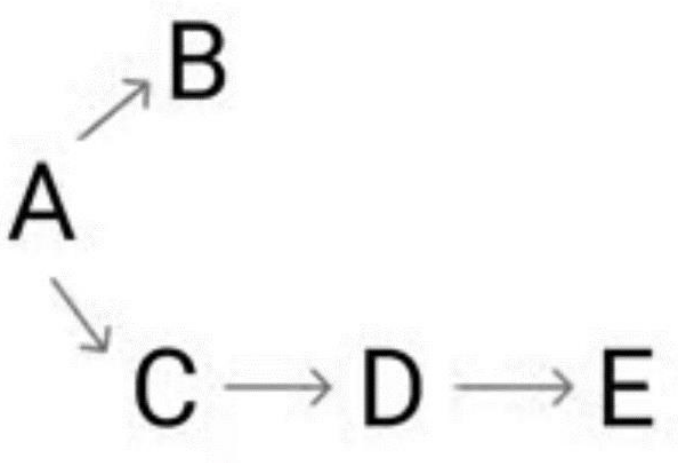
Both the forward pass and backward pass in project management are useful for identifying your critical path, meaning the longest string of dependent activities.

Forward Pass:

Consider a project that has five different tasks or activities (A, B, C, D, and E), Dependent on activities and activity duration as below:

Activity	Dependent on	Duration (in days)
A	-	2
B	A	5
C	A	3
D	C	1
E	D	4

Network Diagram from given schedule:



Let's make project activity grid:

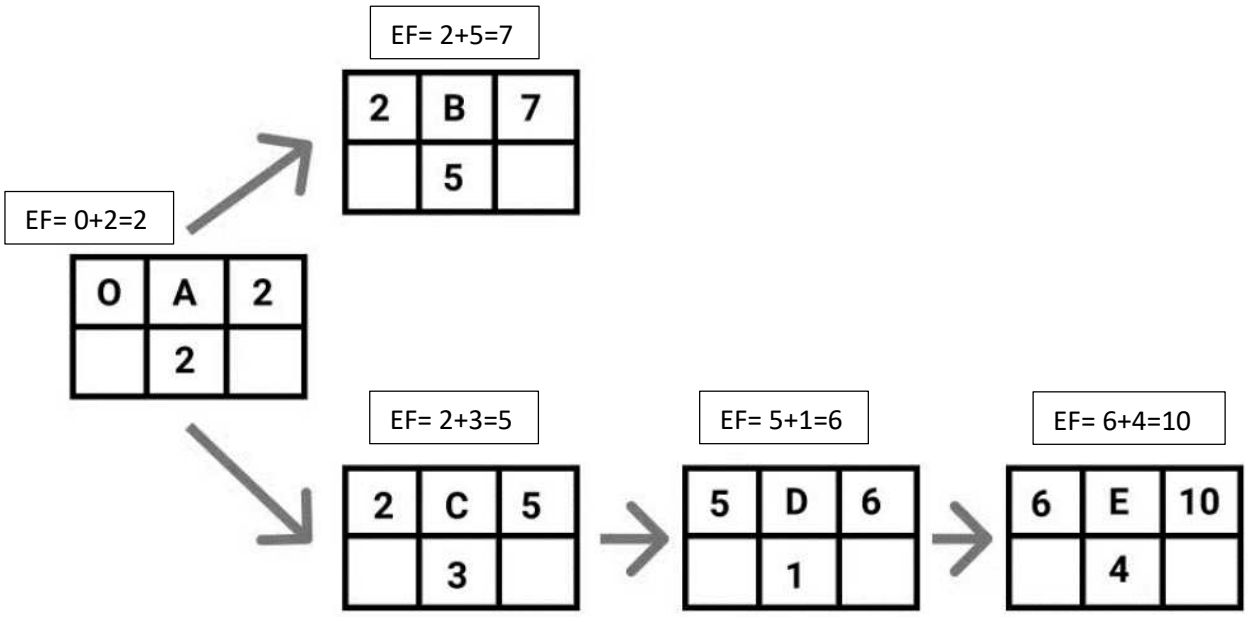
Early start	Activity	Early finish
Late start	Duration	Late finish

Forward Pass Calculation:

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

Here, move left to right through the diagram to add the duration to early start value.

Early Finish (EF) = ES + Activity Duration



i.e. The earliest project can be completed is 10 days after the project start date. That's what the forward pass identifies.

Remember:

ES-Earliest date the activity can start

EF-Earliest date that the activity can finish

LF-Latest date that the activity can finish without causing a delay to the project completion date (the Late Finish date of the last activity on all paths will be the same because no activities can continue once the project is completed)

LS-Latest date that the activity can start without causing a delay to the project completion date.

Backward Pass:

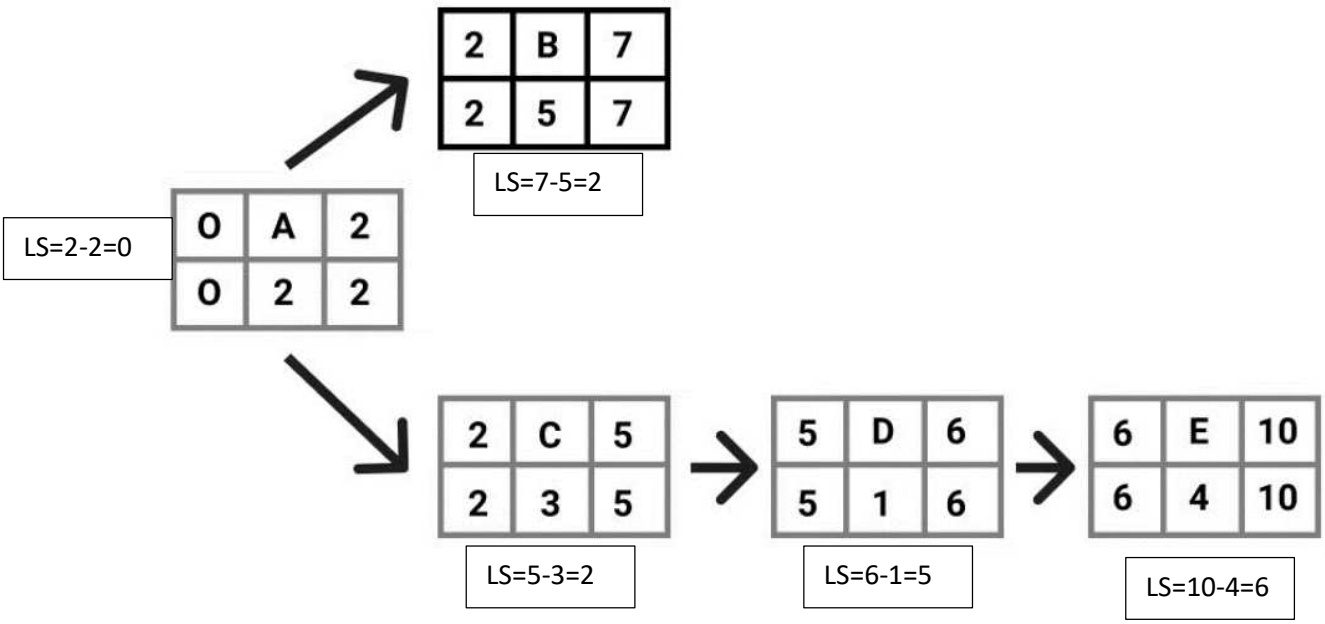
In backward pass, we identify the late start and for same, move right to left, by subtracting the duration from the late finish date.

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

LS = LF – Activity Duration

Example:

Calculating the Late Start from above example:



6.10. CPM

- ✓ Critical path method (CPM) is a resource-utilization algorithm for scheduling a set of project activities.
- ✓ The essential technique for using CPM is to construct a model of the project that includes the list of all tasks required to complete the project , dependencies between the tasks , and the duration that each activity will take to complete

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

- ✓ Once you've identified which activities are on the longest, or critical path, you can more easily observe which have total float or can be delayed without making the project longer

How to find Critical Path?

1. List all activities
2. Identify dependencies
3. Create a network diagram
4. Estimate task duration (use forward and backward pass)
5. Calculate critical path

   5.1. Write down the start and end time next to each activity
   - ♦ The first activity has a start time of 0, and the end time is the duration of the activity.
   - ♦ The next activity's start time is the end time of the previous activity, and the end time is the start time plus the duration.
   - ♦ Do this for all the activities

   5.2. Look at the end time of the last activity in the sequence to determine the duration of the entire sequence

   5.3. The sequence of activities with the longest duration is the critical path.

6. Calculate the float (Critical tasks have zero float, which means their dates are set.)
   - ♦ Float, or slack, refers to the amount of flexibility of a given task. It indicates how much the task can be delayed without impacting subsequent tasks or the project end date.
   - ♦ Two Types of float.
     - **Total Float:** This is the amount of time that an activity can be delayed from the early start date without delaying the project finish date or violating a schedule constraint. **Total float = LS - ES or LF - EF**
     - **Free Float:** This refers to how long an activity can be delayed without impacting the following activity. There can only be free float when two or more activities share a common successor. On a network diagram, this is where activities converge. **Free float = ES (next task) - EF (current task)**

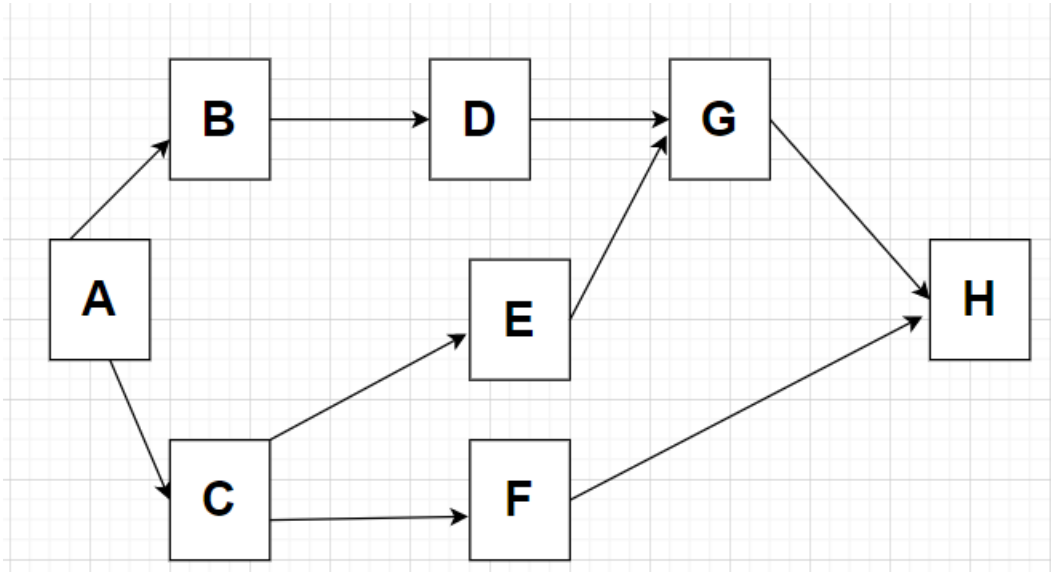
7. End

Example of CPM:

Consider a given Project Activity:

Activity	Predecessor	Duration (in days)
A	-	5
B	A	7
C	A	4
D	B	10
E	C	3
F	C	5
G	D,E	6
H	F,G	4

Draw network diagram from given data, we get



Make project activity grid of the following form for all activity on network diagram

Early start	Activity	Early finish
Late start	Duration	Late finish

Assign duration and Calculate forward and backward pass to find critical path

1. For Forward Pass:

   Calculate Early Finish (EF) = ES + duration
   First activity has a start time of 0.
   For A, EF= 0+5=5
   For B, B is dependent on A so Finish of activity A is Start of Activity B.
   Therefore EF of B = 5+7=12
   Similarly for remaining activity.

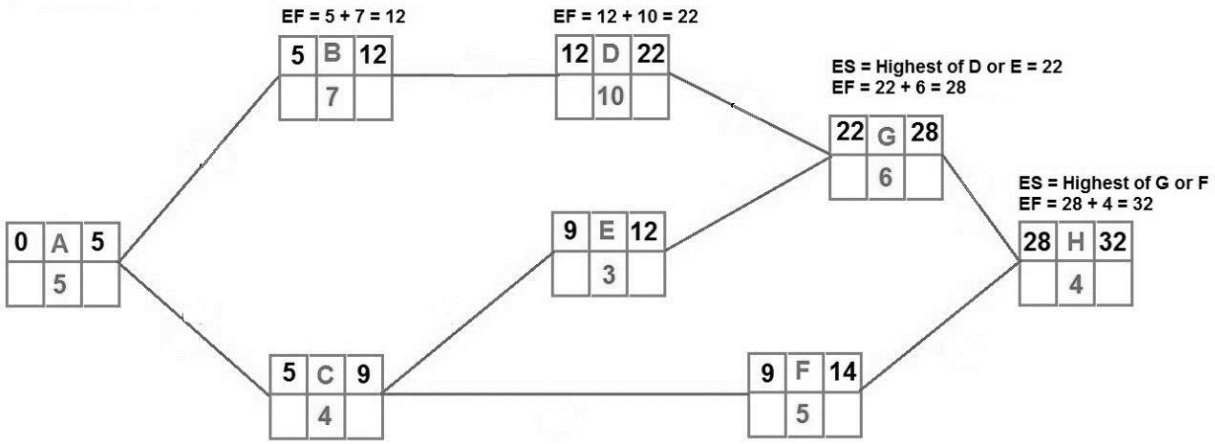
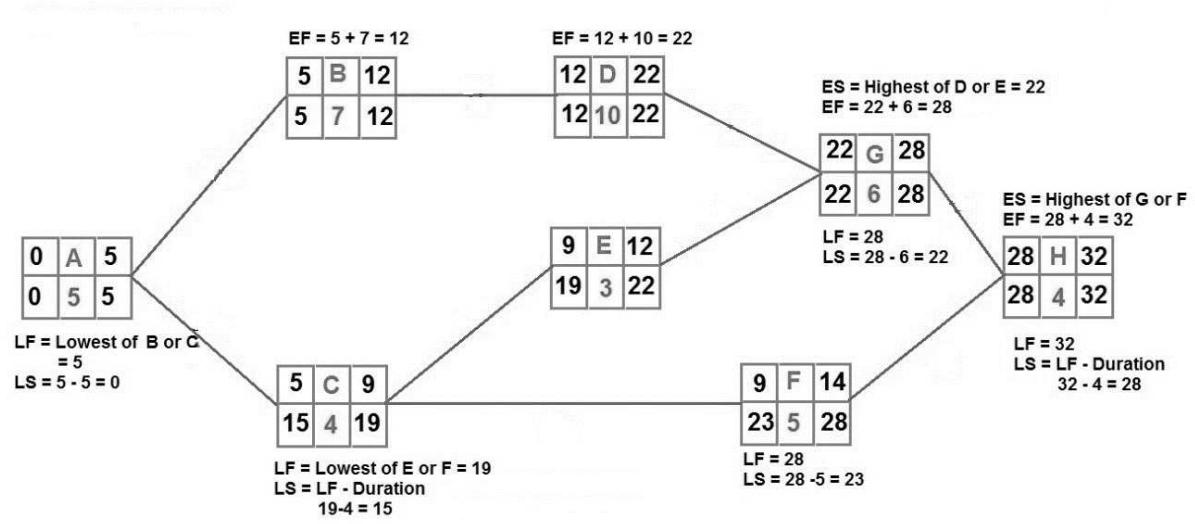


Figure: Forward pass Calculation on Network Diagram.

2. For Backward Pass



Now, to find critical path, observe the slack or free float.

Then, Free Float = ES-LS

For A, Float= 0-0=0

For B, Float= 5-5=0 (i.e. 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.)

For C, Float= 5-15=10 (i.e. we can delay this task by 10 days, not critical)

For D, Float= 12-12=0

For E, Float=9-19=10

For F, Float= 9-23=14

For G, Float= 22-22=0

For H, Float= 28-28=0

Therefore, the critical path is A→B→D→G→H

6.11. PERT

- ✓ Commonly called A PERT chart / PERT Diagram
- ✓ PERT charts are used by project managers to create realistic schedules by coordinating tasks and estimating their duration by assigning three time estimates for each- optimistic, most likely and pessimistic. This makes PERT charts useful when planning projects where the duration of activities is uncertain.
- ✓ They're used in the Program Evaluation Review Technique (PERT) to represent a project timeline, estimate the duration of tasks, identify task dependencies and find the critical path of a project.
- ✓ Use PERT charts during the planning phase of a project. When planning a project, having an accurate forecast of its duration is crucial for resource scheduling
- ✓ They can help you determine the project's critical path and the ideal time to start or finish tasks, which allows you to know which tasks need to be prioritized when creating your project schedule.
- ✓ PERT charts show the dependent tasks in project.
- ✓ The PERT chart is a tool that can help you estimate the amount of time you'll need to complete the project. It's also very helpful when you're working on more complex or larger projects.

How to make a PERT chart?

1. Break down project scope
2. Create PERT chart
3. Estimate project duration
4. Find critical path and slack

PERT Formula:

The PERT method employs simple statistic calculations. It uses three-time estimations.

- ✓ Optimistic Estimate: The shortest time required to complete the task.

- ✓ Pessimistic Estimate: The longest time required to complete the task.
- ✓ Most Likely Estimate: The most possible time (probable duration) required to complete the task.

Expected time is calculated with the help of the PERT Analysis formula below

Expected time = (**O**ptimistic + 4 * **M**ost likely + **P**essimistic) / 6

i.e**. E= (O+4M+P)/6**

Difference between CPM and PERT

S.N	PERT	CPM	Constrain
1.	Project management technique, used to manage uncertain activities of a project.	Statistical technique of project management that manages well defined activities of a project	***meaning***
2.	Technique of planning and control of time.	Method to control cost and time	***What is?***
3.	Research and Development Project	Non-research projects like civil construction, ship building etc.	***Suitable for***
4.	Time	Time and Cost	***Focus***

Example:

Identify all the activities that make up the project and determine the immediate predecessors for each as shown as below table:

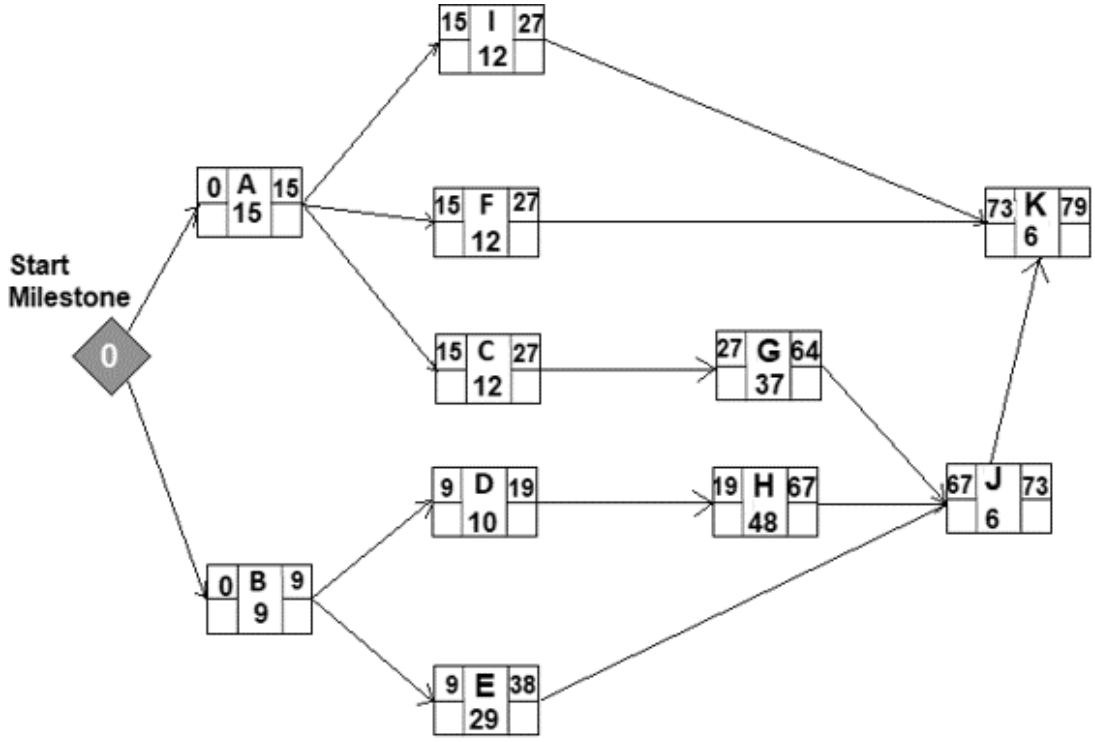
Activity	Description	Predecessors	Optimistic Duration (To)	Pessimistic Duration (Tp)	Most likely Duration (Tm)
0	Start Milestone	-	0	0	0
A	Select Technical Staff	0	12	18	15
B	Site Survey	0	6	12	9
C	Select Equipments	A	9	15	12
D	Prepare Designs	B	6	18	9
E	Bring Utilities to the Site.	B	18	36	30
F	Interview Applicants and Fill Positions	A	9	15	12
G	Purchase the Equipment.	C	36	42	36
H	Construct the Power Plant	D	42	54	48
I	Develop an Information System.	A	6	18	12
J	Install the Equipment.	H,G,E	3	9	6
K	Train the Staff to Run the System	F,J,I	3	9	6

Now, Calculate PERT weighted Average

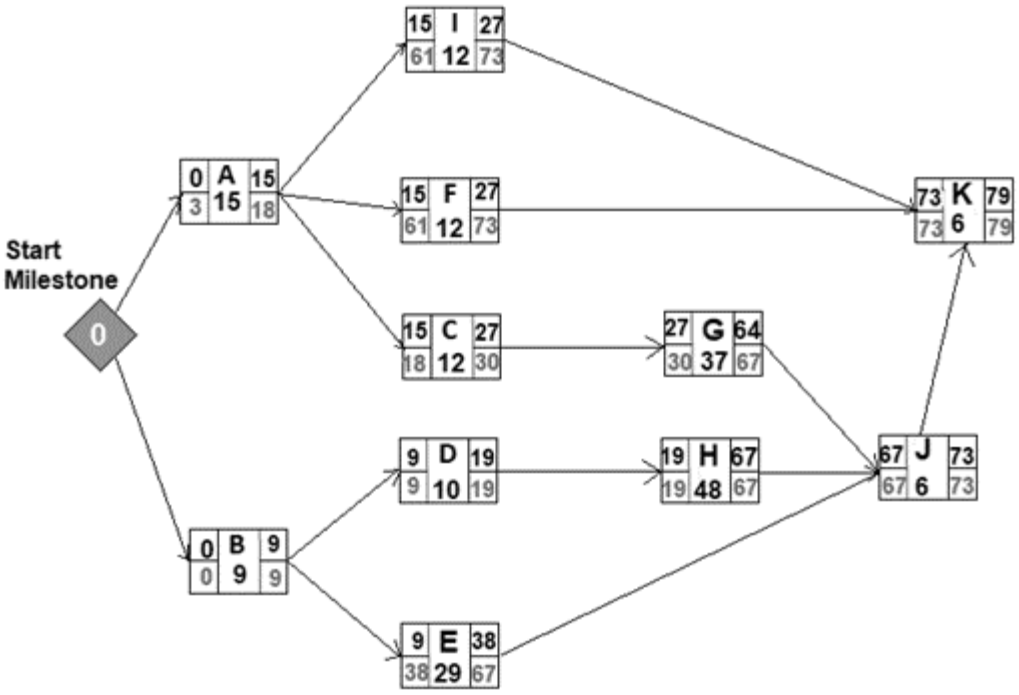
E= (O+P+4M) / 6

Activity	Description	Predecessors	Optimistic Duration (To)	Pessimistic Duration (Tp)	Most likely Duration (Tm)	Expected Duration (To + 4Tm + Tp)/6
0	Start Milestone	-	0	0	0	0
A	Select Technical Staff	0	12	18	15	15
B	Site Survey	0	6	12	9	9
C	Select Equipments	A	9	15	12	12
D	Prepare Designs	B	6	18	9	10
E	Bring Utilities to the Site.	B	18	36	30	29
F	Interview Applicants and Fill Positions	A	9	15	12	12
G	Purchase the Equipment.	C	36	42	36	37
H	Construct the Power Plant	D	42	54	48	48
I	Develop an Information System.	A	6	18	12	12
J	Install the Equipment.	H,G,E	3	9	6	6
K	Train the Staff to Run the System	F,J,I	3	9	6	6

Draw network diagram and calculate Forward pass

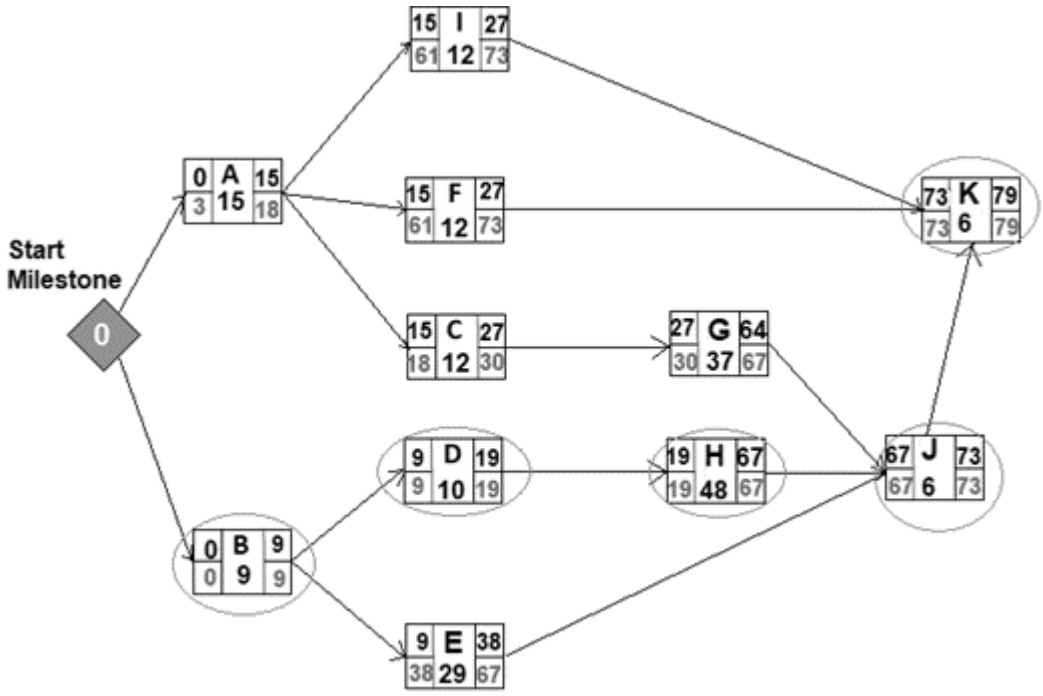


Calculate Backward Pass:



Finally,

Determine free float, having zero float means critical path.



Hence, Critical path is 0→B→D→H→J→K

Example-2 (PERT chart)

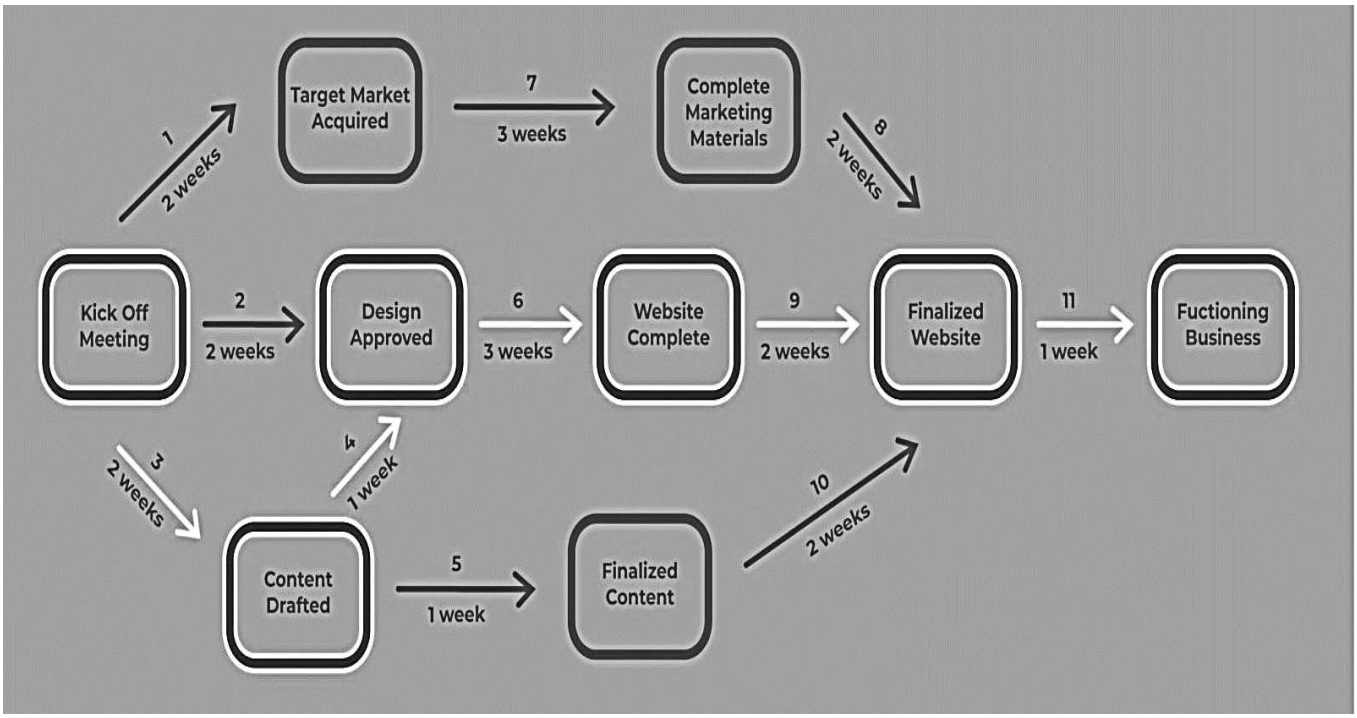


Figure: PERT chart with different Activities and estimated duration (start node is 'kick off meeting' then representation of the initial activities with arrows and connect them to their

corresponding milestone nodes. Process is continue until we get to the final milestone node of project.)

6.12. Schedule Control

- ✓ Control Schedule is the process of monitoring the status of the project to update the project schedule and managing changes to the schedule baseline.
- ✓ The key benefit of this process is that the schedule baseline is maintained throughout the project.
- ✓ This process is performed throughout the project.
- ✓ Any change to the schedule baseline can only be approved through the Perform Integrated Change Control process

Control Schedule, is concerned with:

- ✓ Determining the current status of the project schedule,
- ✓ Influencing the factors that create schedule changes,
- ✓ Reconsidering necessary schedule reserves,
- ✓ Determining if the project schedule has changed, and
- ✓ Managing the actual changes as they occur

Inputs, tools and techniques, and outputs of Schedule Control process

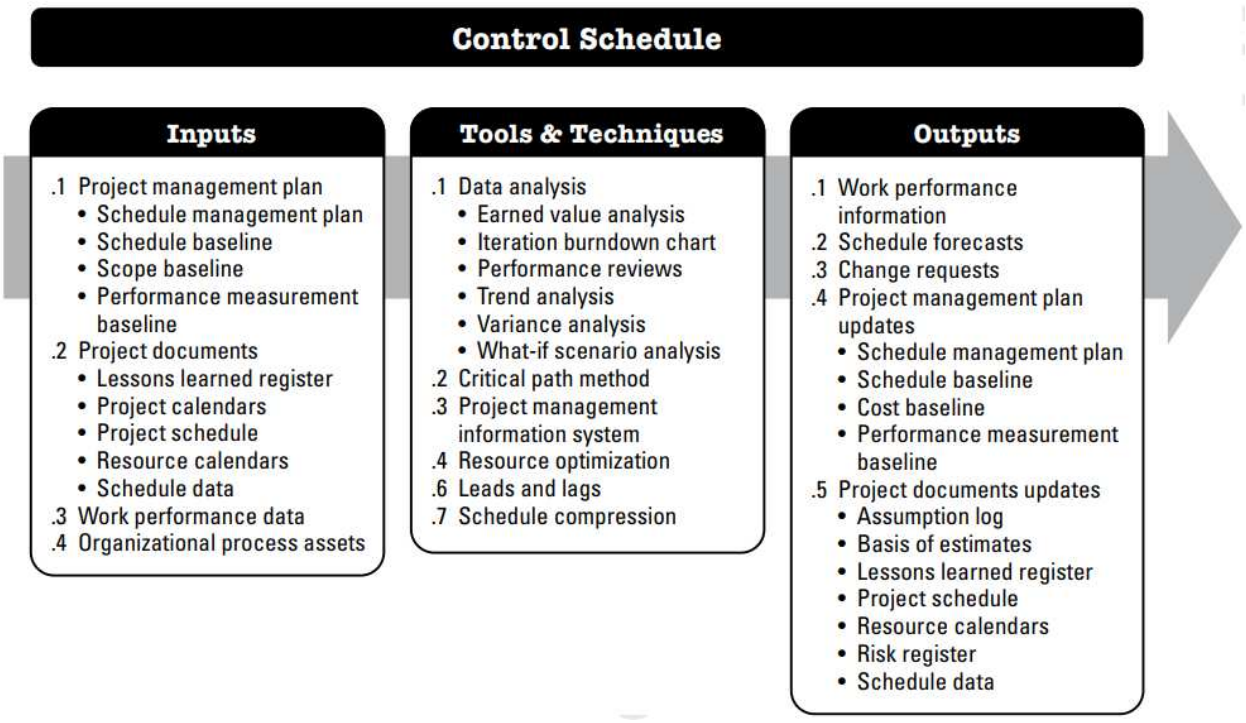


Figure: Inputs, tools and techniques, and outputs of Schedule Control process

End of Unit-6