SCHEDULE MANAGEMENT

Done when needed.

Please note that this tutorial is based on the PMBOK Version 6 which were released by PMI in September 2017. This article is revised in January 2020.

The notes below contains ALL the concepts that any PMP aspirants should know, however; should not be limited. It is recommended to refer linked articles for detailed understanding.

Before we proceed, let's take a look at WHY we need Schedule Management:

> You are working building a hydro power dam in Mongolia
>
> The bricks are to be imported from Bangkok, steel from London, cement from Ukraine, workforce is local, architect from Spain
>
> All the labours had reached the site to start the work but the raw material is not there
>
> Once steel comes in, the labourers are sitting idle as they cannot proceed unless the

Project Schedule: The art & science of scheduling the work such that the project is completed on time. And all the tasks are aligned with the planned timelines throughout.
Here is a snippet of various processes that are distributed across multiple phases of a project:

	INITIATION	-
	PLANNING	Plan Schedule Management
		Define Activities
		Sequence Activities
		Estimate Activity Durations
		Develop Schedule
	EXECUTING	-
	MONITORING & CONTROLLING	Control Schedule

	CLOSURE	-

PLAN SCHEDULE MANAGEMENT

Phase: **PLANNING** Knowledge Area: **SCHEDULE MANAGEMENT**

The process of strategizing and documenting on how to plan, manage and control the schedule of a project. This also requires the manager sequence the activities and measure their progress vs time throughout the project.

Schedule Management Plan: The output of this process is the Schedule Management Plan, which is a document that helps to estimating and scheduling faster. This helps to determine:

- What shall be parameter for scheduling like Hours, Days, Weeks etc
- What are the tools & techniques needed to plan and achieve the schedule
- Determine the acceptable variance
- Identify schedule change procedures
- Duration of releases, milestones & iterations

For your reference here is the template for Schedule Management Plan

DEFINE ACTIVITIES

Phase: **PLANNING** Knowledge Area: **SCHEDULE MANAGEMENT**

The Define Activities process takes the work packages that we created in the Create WBS process (scope management) and decompose them into activities that is required to achieve the deliverable.

IMPORTANT: Decomposition of work into smaller work packages is part of Scope Management, however decomposing them further to identify the activities to be done is part of Schedule. Hence, it is important to understand in exam what context is the question referring to.

Milestones: The Milestone are events in the define scope. They are no activities, not events and they DO NOT have any time durations. These are mere check points in the schedule.

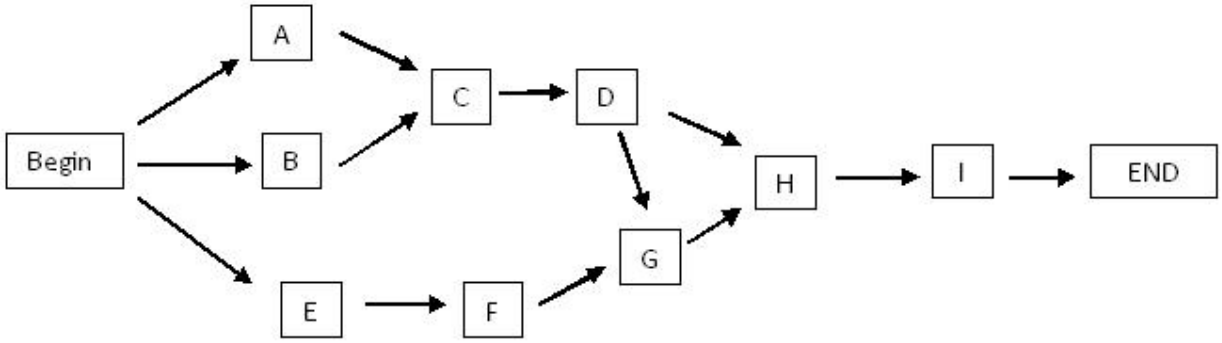
At times, as the project progresses, there are multiple requirements that come up. Or at times initially the requirements are not clear and when the project proceeds; the requirements gets clearer.

SEQUENCE ACTIVITIES

Phase: **PLANNING** Knowledge Area: **SCHEDULE MANAGEMENT**

The activities that we defined in the last process are required to be sequenced in order which they will be performed; so that we can determine the schedule well.

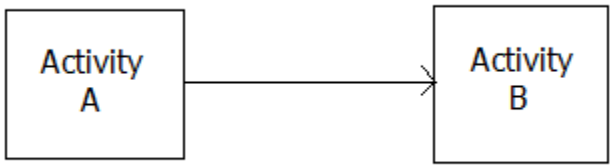
For this, we need to create a network diagram that graphically shows the activities that are to be done in parallel or sequential manner.



There are multiple ways to make a network diagram, earlier was

- ADM: Arrow Diagramming Method
- GERT: Graphical Evaluation and Review Technique
- PDM: Precedence Diagramming Method

For now, most of the projects use PDM; which looks like this:

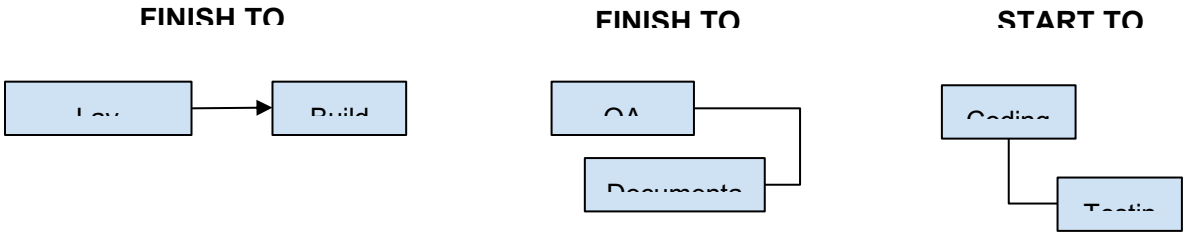


Nodes/boxes represent the activities
Arrows represent the dependence of activity

There are 4 types of logical relationship between the Activities:

- FS - Finish to Start: The first activity should be completed then only next activity can be started
- SS - Start to Start: The first activity should be started so as to start the next activity

- FF - Finish to Finish: First activity should finish so that the next activity can be finished
- SF - Start to Finish: First activity should start so as to complete the next activity (hypothetical)



There are multiple types of dependencies:

- **Mandatory** (Hard Logic): When it is explicitly needed to do one work in order to perform next actions. Ex: As per the contract we need to first complete the design mock up and get approved before we start the coding.
- **Discretionary** (Soft Logic/Preferential): This represents there are multiple ways of doing a work however your organization chooses one is a preferred approach. This can be changed. Ex: When you try to compress the project schedule; you can use any of the feasible methods as per your judgement
- **External**; This is the dependency based on external factors like contractors, suppliers etc
- **Internal**: This is depend on the needs of the project and can be worked on by the project team themselves.

LEADS: When Activity-B can be started in parallel with Activity-A rather than waiting for Activity-A to complete. This will save time.
LAGS: There is some gap time added between 2 activities for some mandatory reason. Like some days needed after activity-A is completed so that we can start activity-B. For example, the concrete is poured but we need to wait for it to dry so that we can paint.

[IMP] ESTIMATE ACTIVITY DURATION

Phase: **PLANNING** Knowledge Area: **SCHEDULE MANAGEMENT**

Since the past processes had defined the activities and sequenced them, now we need to estimate each of these activities so as to get an estimate for the project.
There are multiple methods of estimating the duration of the activity:

One Point Estimation: In this, the estimator gives one single estimated time to each activity.
For example: The coding for payment integration in website will take 2 weeks.
As you may notice; the above estimation is based on historical data or expert judgement.

However, there are few things that are few other points to be noted:

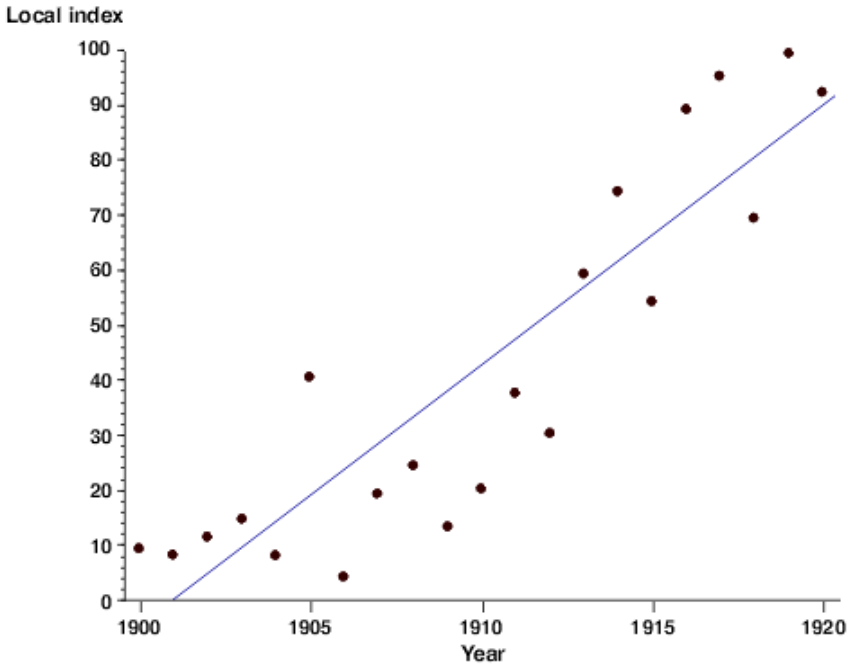
Since there is just one estimation, hence the estimator may include some additional buffer just in case - it is called PADDING. The project manager should avoid that.

This also does not provide important info on risks, assumptions etc

Analogous Approach (Top Down): Based on the historical data, the timelines are provided, such that the home page design took 2 days to create in past 5 similar projects, hence it will take the same.

Parametric Approach: The process uses a mathematical equation based on the previous historical data:

Regression Analysis (Scatter Diagram): This checks various data sets and plot them on the graph to see for similarity between 2 variables



Learning Curve: This approach says that the time needed for an activity reduces if done again and again. Such that time needed to build the first wall would be 3 days, but it will take 1.5 days to build the 100th wall as the learning and skills are enhanced.

Bottoms Up Estimation: This estimation requires estimating each small activity individually. You need WBS for this, then estimate all activity/work package from it.

Heustiristics: This basically means using the best practice. There is no thumb-rule to use that practice however in general if something is widely accepted so it becomes a standard. For example; if there are 3 programmers in a team, there should be atleast 1 QA.

Three Point Estimation: The triangular distribution actually requires 3 sets of estimation for the same activity.

TRIANGULAR ESTIMATION

First we pick an activity and estimate the time it will take to work on that if things go right (T-optimist), then estimating same activity considering what can go wrong (T-Pessimist) and then under generic conditions as most probable time (T-likely).
All these values are then taken average using the formula below:

$$Tmost\ \ likely = [T\ optimist + T\ likely + T\ pessimist] / 3$$

[IMP] PERT/BETA DISTRIBUTION

The 3 estimates that we considered in above example can be used with a more precise formula considering their probability of occurrence.

$$Tmost\ \ likely = [T\ optimist + 4\ (T\ likely) + T\ pessimist] / 6$$

Standard Deviation refers to the bracket of deviation from the most likely estimate. For example a project is estimated to be finished in 100 Hours, it may take $\pm 8\ Hours$ which means the project will be completed in 92 to 108 Hours. The formula for Standard Deviation is:

$$S.D = [T\ pessimist\ -\ T\ optimist] / 6$$

DATA ANALYSIS

Alternative Analysis: In order to meet the projected schedule, at times the PM and team can look for options that can help to achieve the timeline. For example: instead of building QR scanner, PM can purchase an existing QR feature library which can save 5 days worth of time.

[IMP] Reserve Analysis: Every project has additional reserves in order to accomodate the risks. This is the responsibility of the PM to maintain a reserve. The types of reserves are:

- Contingency Reserves: This is additional reserves (time, cost etc) in order to ensure that all known risks can be covered. This is controlled by Project Manager.
- Management Reserves: This is the reserve that is with Management and these are ONLY for any unknown risks. If a project is casually delayed without any unknown risk then the PM cannot ask the management for this reserve, it is ONLY for unknown risks.