INFO 6245 Planning & Managing Information Systems Development

Module 5

Project Schedule Management

Topics of Discussion

- Schedule Management
- Gantt Charts
- Critical Path
- Agile Schedule Management

Why is it important?

Managers often cite delivering projects on time as one of their biggest challenges

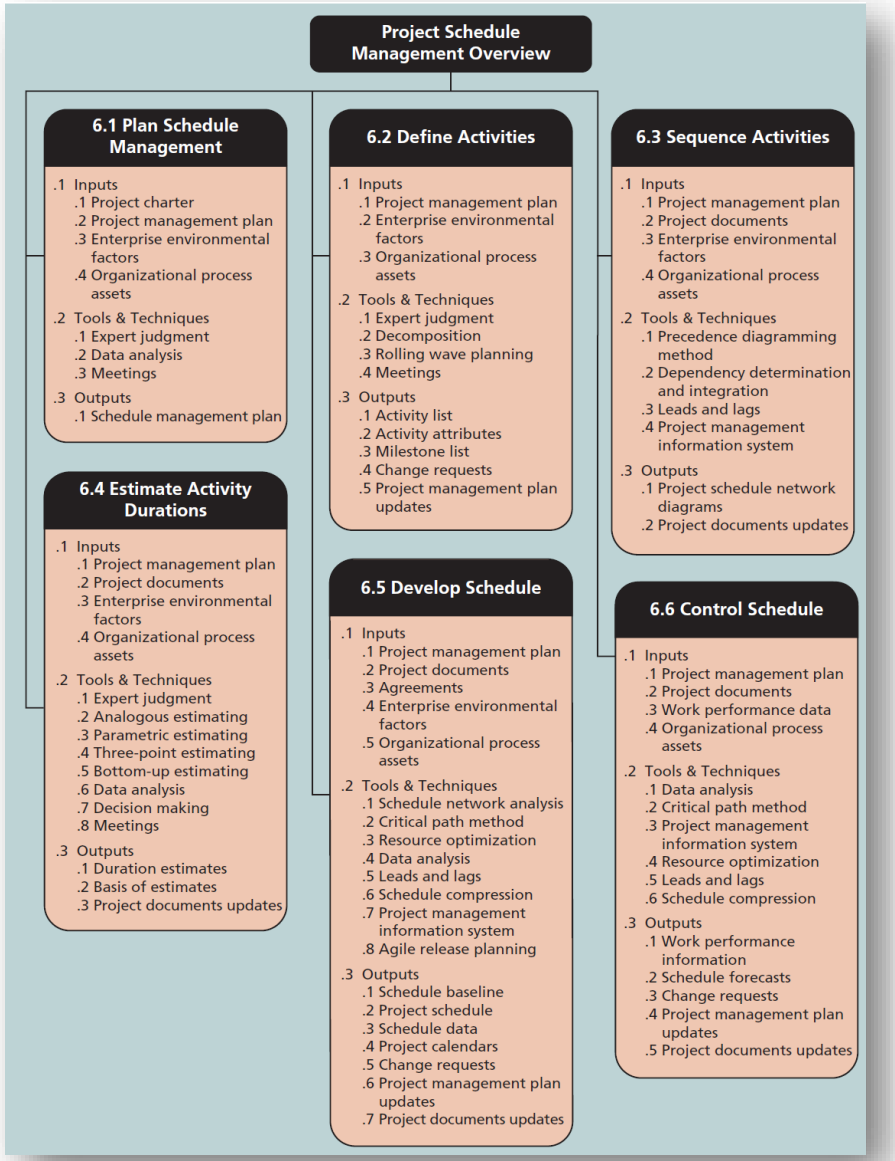
Time has the least amount of flexibility; it passes no matter what happens on a project

Individual work styles and cultural differences may also cause schedule conflicts

Different cultures and even entire countries have different attitudes about schedules

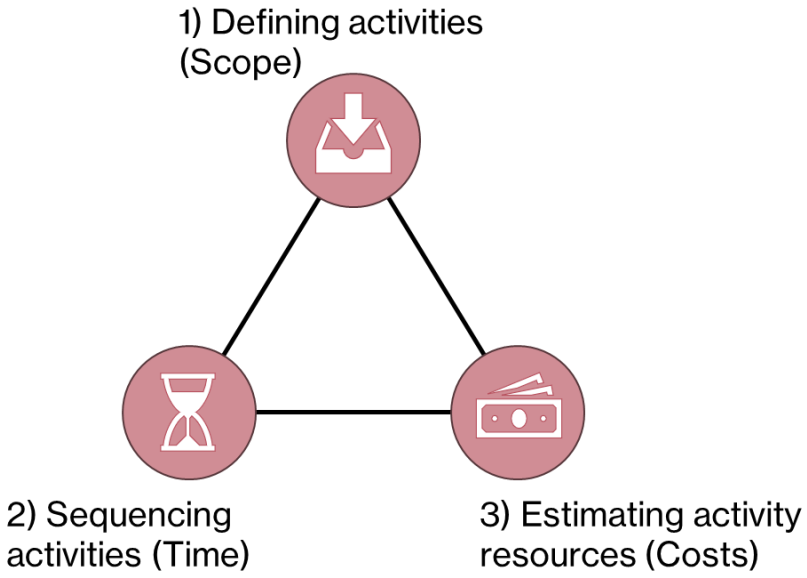
PMI Summary

1. **Planning schedule management** involves determining the policies, procedures, and documentation that will be used for planning, executing, and controlling the project schedule.
2. **Defining activities** involves identifying the specific activities that the project deliverables. An activity or task is an element of work normally found on the work breakdown structure (WBS) that has expected duration, cost, and resource requirements.
3. **Sequencing activities** involves identifying and documenting the relationships between project activities. Requirements, a resource breakdown structure, and project documents updates.
4. **Estimating activity durations** involves estimating the number of work periods that are needed to complete individual activities.
5. **Developing the schedule** involves analyzing activity sequences, resource requirements, and activity duration estimates to create the project schedule.
6. **Controlling the schedule** involves controlling and managing changes to the project schedule.



Schedule Management Plan

- **Project schedule model development:** Many projects include a schedule model, which contains project activities with estimated durations, dependencies, and other planning information that can be used to produce a project schedule.
- **Level of accuracy and units of measure:** This section discusses how accurate schedule estimates should be and determines whether time is measured in hours, days, or another unit.
- **Control thresholds:** Variance thresholds, such as ±10 percent, are established for monitoring schedule performance.
- **Rules of performance measurement:** For example, if team members are expected to track the percentage of work completed, this section specifies how to determine the percentages.
- **Reporting formats:** This section describes the format and frequency of schedule reports required for the project.
- **Process descriptions:** The schedule management plan also describes how all of the schedule management processes will be performed.



Triple Constraint

- Ideally, the project team and key stakeholders first define the project scope, then the time or schedule for the project, and then the project's cost.
- The order of these three items reflects the basic order of the processes in project schedule management:
- Defining activities (further defining the scope)
- Sequencing activities (further defining the time)
- Estimating activity resources and activity durations (further defining the time and cost).
- These processes are the basis for creating a project schedule.

Defining Activities

Goal

- The goal of defining activities is to ensure that the project team completely understands all the work to be done as part of the project scope so they can start scheduling the work.
- The project team must understand what the WBS product/service means before making schedule related decisions.
- The WBS item is dissected further as the project team members continue to define the activities required for performing the work.
- E.g., the WBS item “Study report” might be broken down into several subtasks describing smaller deliverables required to produce the report, such as survey development, survey administration, draft report, report edits, and final report.
- This process of progressive elaboration is usually called “rolling wave planning” in an Agile setting

Activities

Identify the specific actions that will produce the project deliverables in enough detail to determine resource and schedule estimates.

Activities are elements of work performed throughout a project; also known as tasks in some PM software tools; They have expected durations, costs, and resource requirements.

Gathers the supporting detail that helps document important product information as well as related assumptions and constraints.

Activity list: A tabulation of activities to be included on a project schedule; includes the activity name, activity identifier or number, and brief description of the activity.

Activity attributes: Additional characteristics to provide more information; Predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity.

Milestones

- A significant event on a project that normally has no duration
- Often takes several activities and a lot of work to complete a milestone
- Use the milestone as a marker to help in identifying necessary activities
- Useful tools for setting schedule goals and monitoring progress; e.g., obtaining customer sign-off on key documents or completion of specific products
- Only consider the most important and visible events, and not all deliverables as milestones

Sequencing Activities

Dependencies

Sequencing process involves evaluating the reasons for dependencies and the different types of dependencies

A dependency or relationship is the sequencing of project activities or task

Mandatory dependencies: Inherent in the nature of the work being performed on a project, sometimes referred to as hard logic

Discretionary dependencies: Defined by the project team, sometimes referred to as soft logic. and should be used with care since they may limit later scheduling options

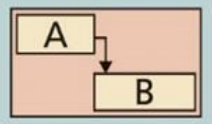
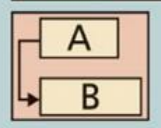
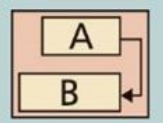
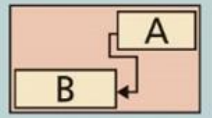
External dependencies: Involve relationships between project and non-project activities

Internal dependencies: Involve relationships between project activities that are generally inside the project team's control.

Types of Dependencies

Task dependencies

The nature of the relationship between two linked tasks. You link tasks by defining a dependency between their finish and start dates. For example, the "Contact caterers" task must finish before the start of the "Determine menus" task. There are four kinds of task dependencies in Microsoft Project.

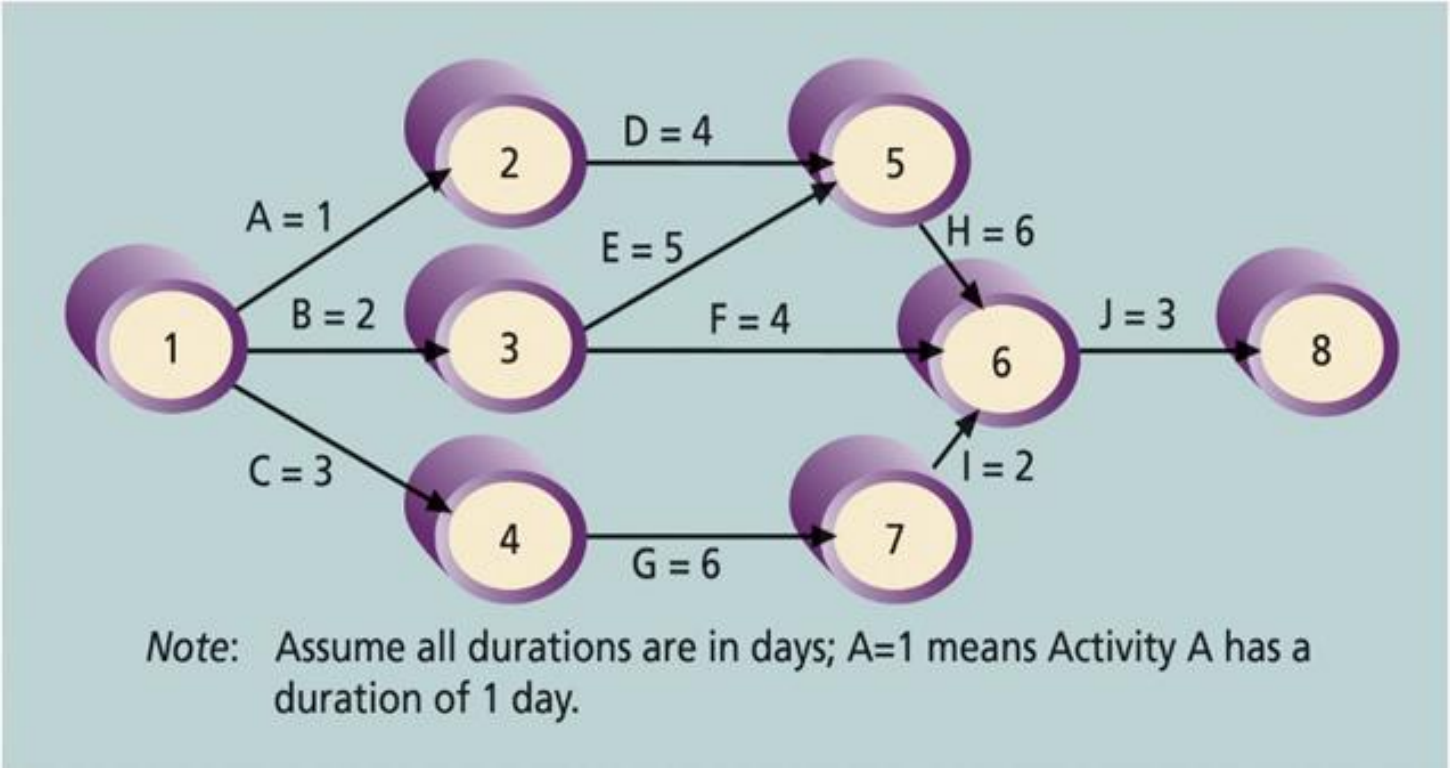
Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A) starts.

Network Diagrams

- Network diagrams are the preferred technique for showing activity sequencing
- Schematic display of the logical relationships among, or sequencing of, project activities
- Two main formats are the arrow and precedence diagramming methods

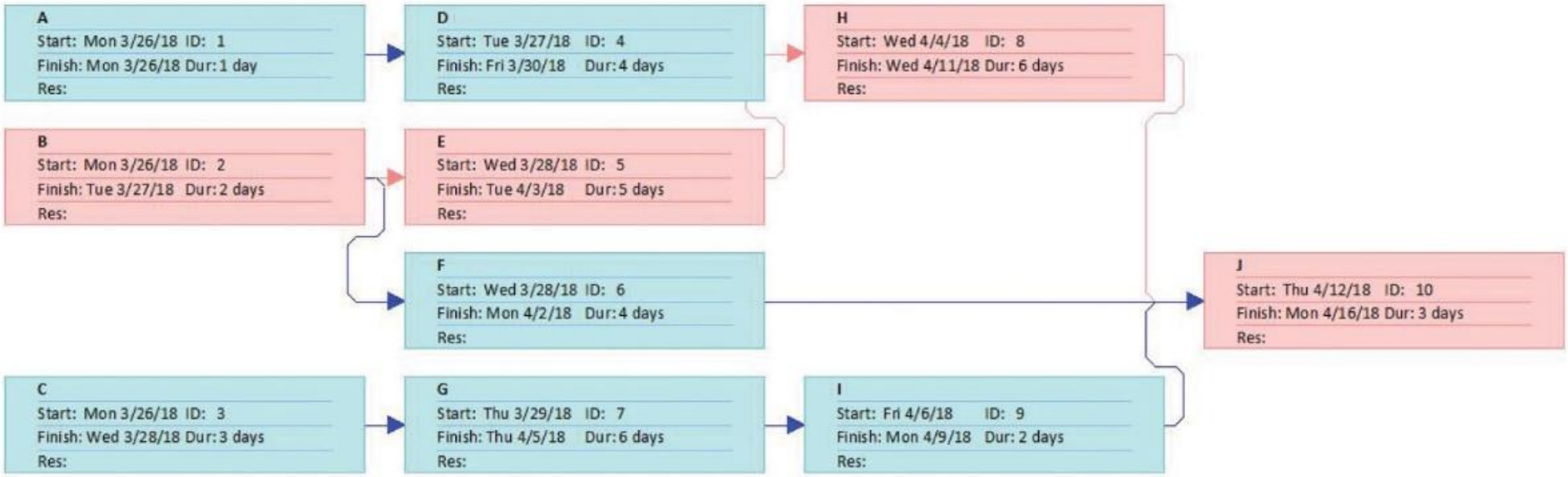
Arrow Diagramming Method (ADM)

- Arrow diagramming method (ADM)
  - Activities are represented by arrows
  - Nodes or circles are the starting and ending points of activities
  - Only show finish-to-start dependencies
  - Refer to the text for the step-by-step process of creating AOA diagrams



Precedence Diagramming Method (PDM

- Network diagramming technique in which boxes represent activities



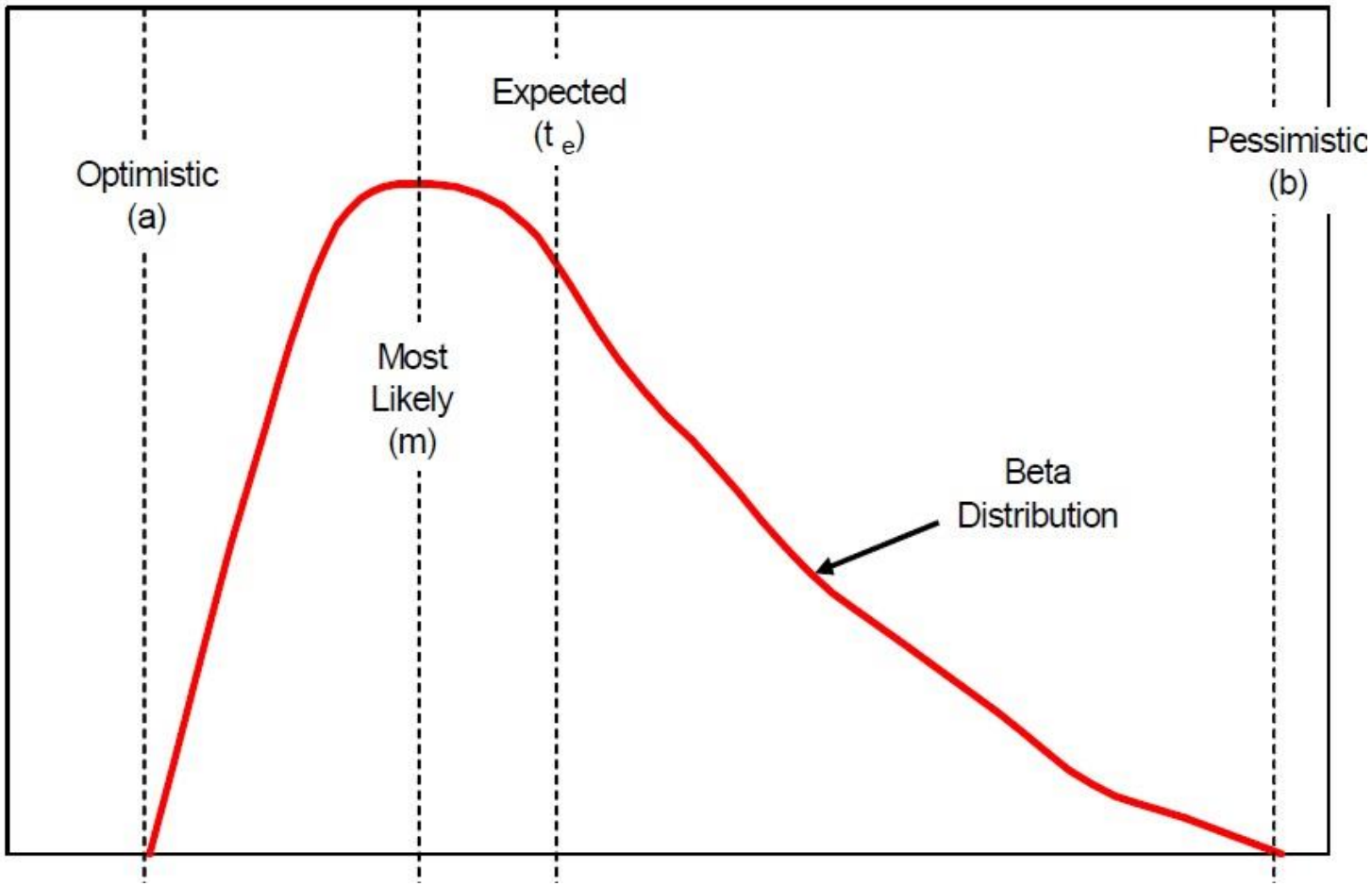
Estimating Durations

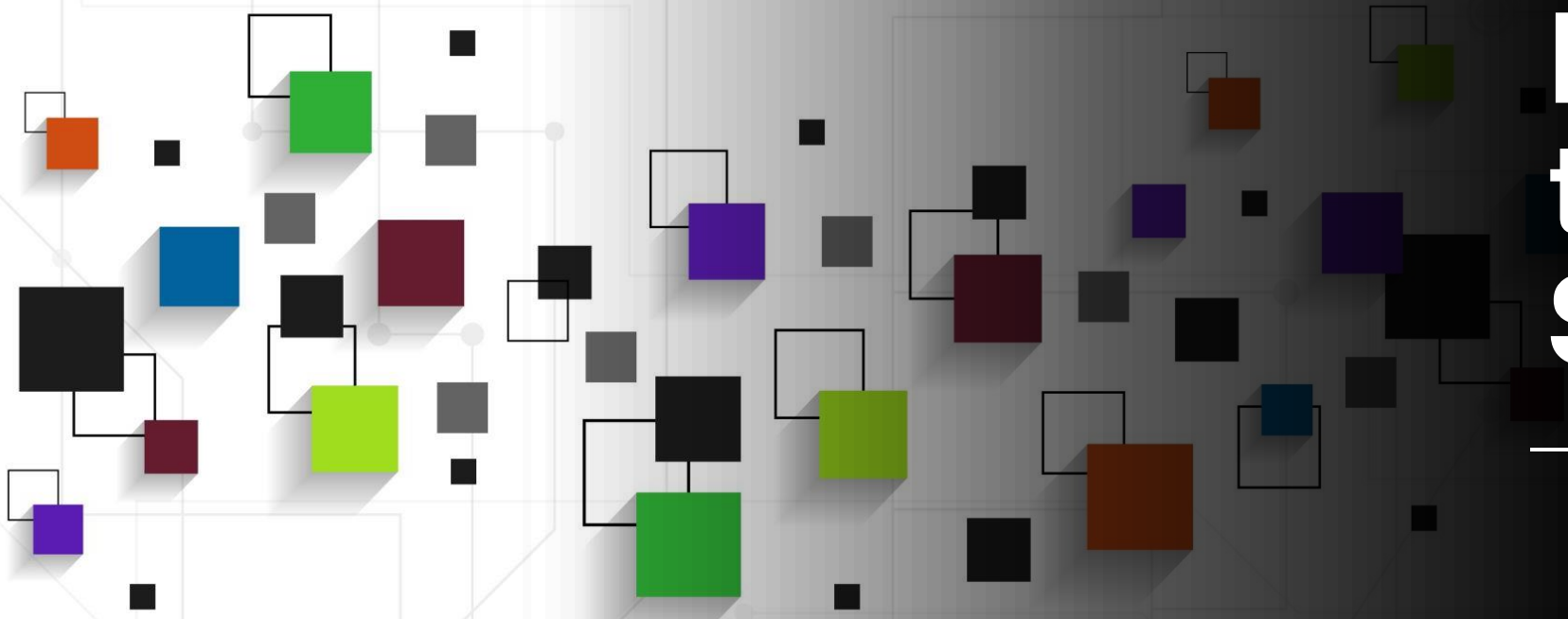
Durations

- Duration includes the actual amount of time worked on an activity plus elapsed time
- Effort is the number of workdays or work hours required to complete a task and does not normally equal duration
- Project team members actually doing the work should help create estimates and update them as the project progresses
- To estimate activity durations, team should use inputs such as the project management plan, project documents, enterprise environmental factors, and organizational process assets
- Most important consideration is the availability of resources, especially human resources, including availability, skill levels, etc.
- The outputs include the estimated activities durations, the basis of estimates, and project documents updates.
- Duration estimates are often provided as a discrete number, such as four weeks; as a range, such as three to five weeks; or as a three-point estimate.

Three-Point Estimate

- A three-point estimate is an estimate that includes an optimistic, most likely, and pessimistic estimate
- Three-point estimates are needed for PERT and Monte Carlo simulations





Developing the Schedule

Goal

- Goal is to create a realistic project schedule that provides a basis for monitoring project progress for the time dimension of the project
- First step is to determine the start and end dates of the project and its activities
- main outputs are a schedule baseline, project schedule, schedule data, project calendars, change requests, project management plan updates, and project documents updates
- Important tools and techniques
  - Gantt charts
  - Critical path analysis
  - Critical chain scheduling
  - PERT analysis

Gantt Charts

- Provide a standard format for displaying project schedule information by listing project activities and corresponding start and finish dates in a calendar form
- Many people like to focus on meeting milestones, especially for large projects
- Milestones emphasize important events or accomplishments on projects
- SMART Criteria for milestones
  - Specific
  - Measurable
  - Assignable
  - Realistic
  - Time-framed

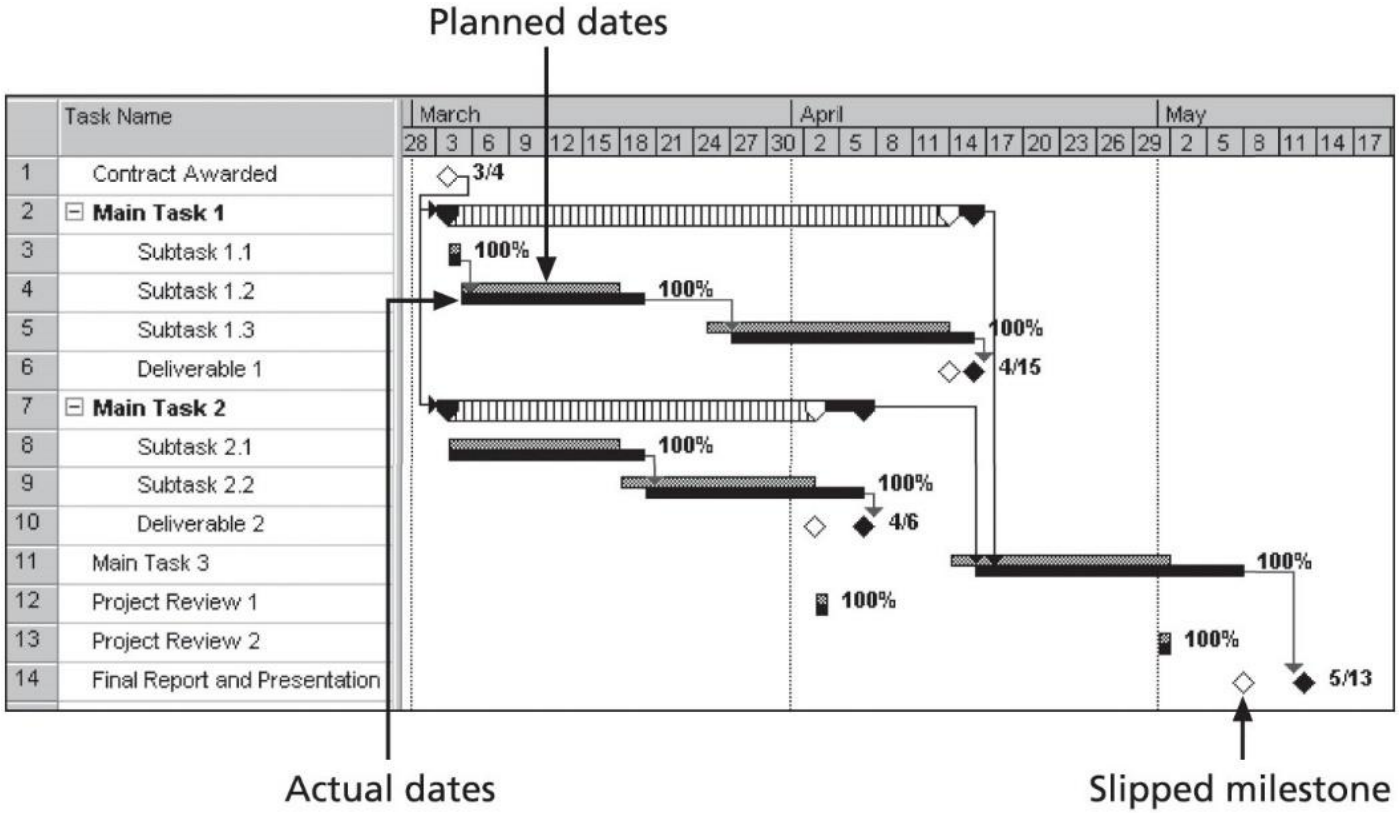
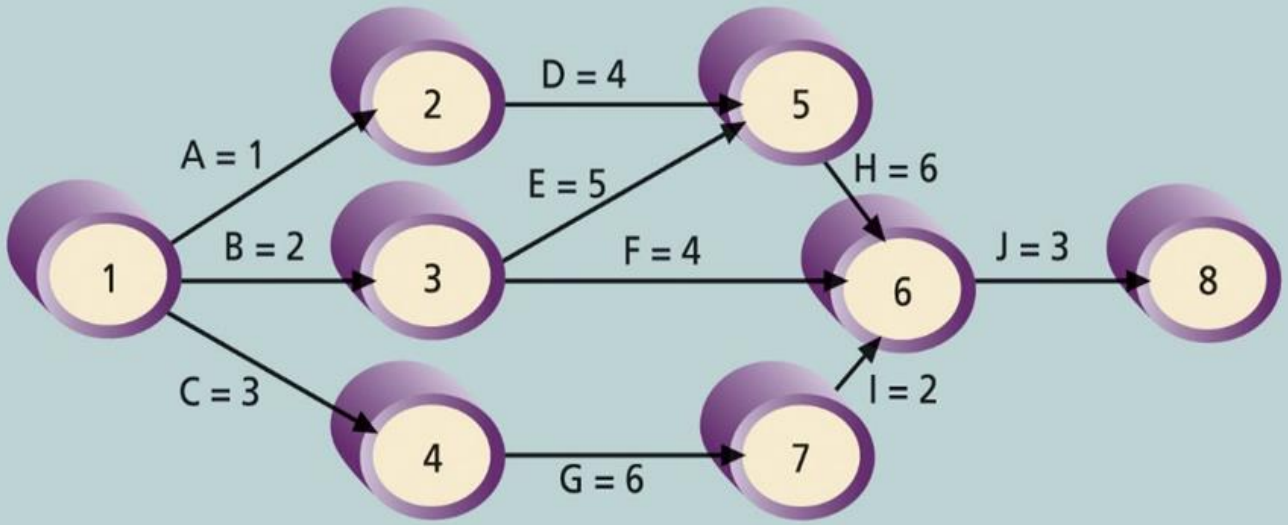


FIGURE 6-7 Sample tracking Gantt chart

Critical Path Method (CPM)

- Critical path: Series of activities that determine the earliest time by which the project can be completed; The longest path through the network diagram and has the least amount of slack or float
- Slack/Float: amount of time an activity may be delayed without delaying a succeeding activity or the project finish date
- Calculating the critical path
  - Develop a good network diagram and add the duration estimates for all activities on each path through the network diagram; Longest path is the critical path
  - If one or more of the activities on the critical path takes longer than planned, the whole project schedule will slip unless the project manager takes corrective action



Note: Assume all durations are in days.

Path 1:	A-D-H-J	Length = 1+4+6+3 = 14 days
Path 2:	B-E-H-J	Length = 2+5+6+3 = 16 days
Path 3:	B-F-J	Length = 2+4+3 = 9 days
Path 4:	C-G-I-J	Length = 3+6+2+3 = 14 days

Since the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.

FIGURE 6-8 Determining the critical path for project X

Critical Path Importance

The fact that its name includes the word critical does not mean that it includes all critical activities

Only accounts for time.

E.g.: growing grass for Disney's Animal Kingdom

There can be more than one critical path if the lengths of two or more paths are the same

PMs should monitor performance of activities on the critical path to avoid late project completion

Critical path can change as the project progresses

Schedule Tradeoffs

- Free slack or free float
  - Amount of time an activity can be delayed without delaying the early start of any immediately following activities
- Total slack or total float
  - Amount of time an activity may be delayed from its early start without delaying the planned project finish date
- Forward pass
  - Determines the early start and finish dates
- Backward pass
  - Determines the late start and finish dates

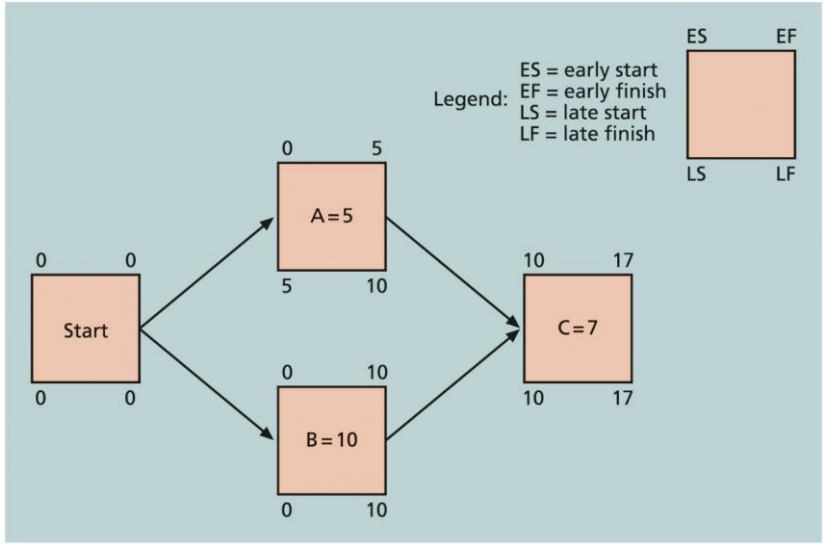


FIGURE 6-9 Calculating early and late start and finish dates

Task Name	Start	Finish	Late Start	Late Finish	Free Slack	Total Slack
A	8/3/15	8/3/15	8/5/15	8/5/15	0d	2d
B	8/3/15	8/4/15	8/3/15	8/4/15	0d	0d
C	8/3/15	8/5/15	8/5/15	8/7/15	0d	2d
D	8/4/15	8/7/15	8/6/15	8/11/15	2d	2d
E	8/5/15	8/11/15	8/5/15	8/11/15	0d	0d
F	8/5/15	8/10/15	8/14/15	8/17/15	7d	7d
G	8/6/15	8/13/15	8/10/15	8/17/15	0d	2d
H	8/12/15	8/19/15	8/12/15	8/19/15	0d	0d
I	8/14/15	8/17/15	8/18/15	8/19/15	2d	2d
J	8/20/15	8/24/15	8/20/15	8/24/15	0d	0d

Shortening Project Schedule

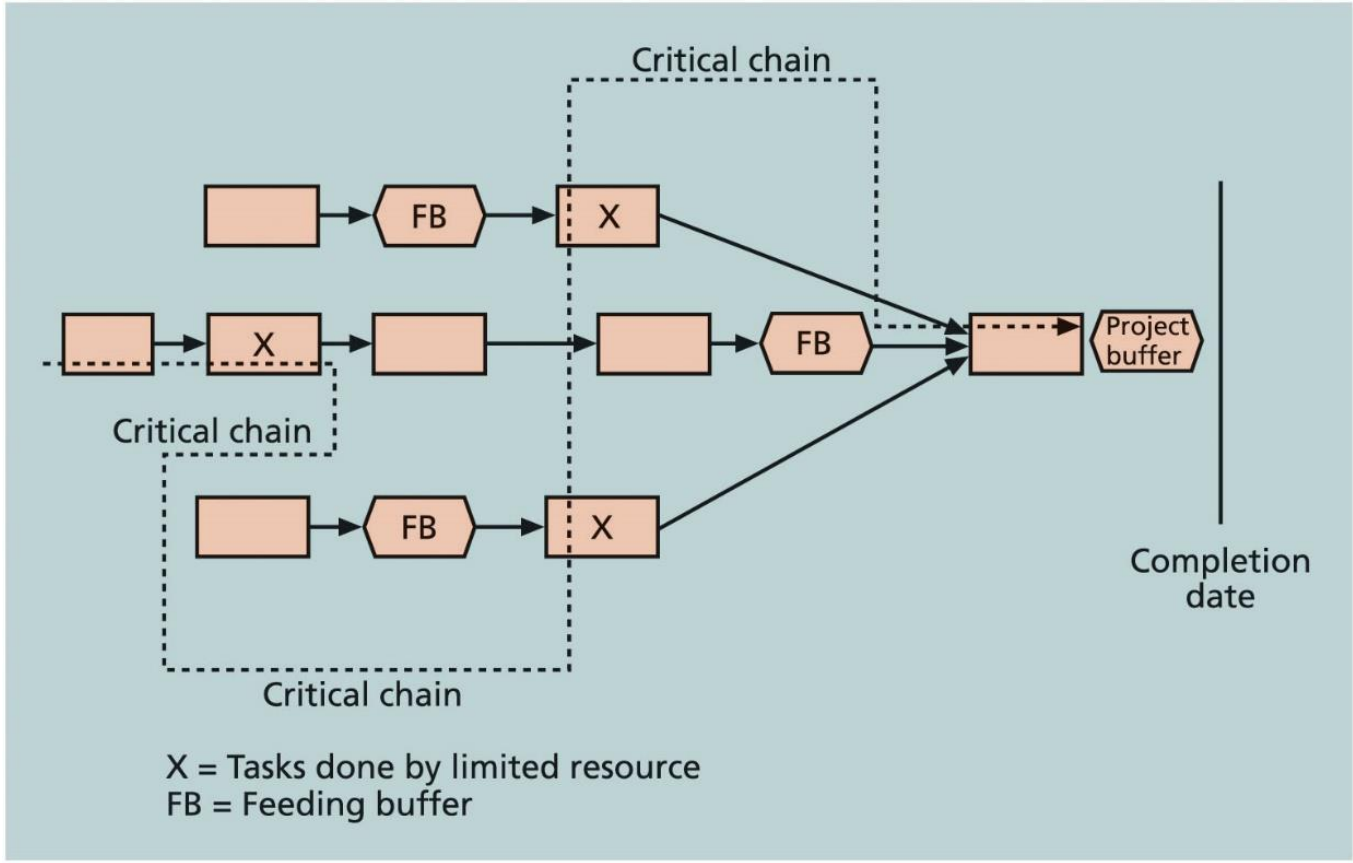
SHORTENING DURATIONS OF CRITICAL ACTIVITIES/TASKS BY ADDING MORE RESOURCES OR CHANGING THEIR SCOPE

CRASHING ACTIVITIES BY OBTAINING THE GREATEST AMOUNT OF SCHEDULE COMPRESSION FOR THE LEAST INCREMENTAL COST

FAST TRACKING ACTIVITIES BY DOING THEM IN PARALLEL OR OVERLAPPING THEM

Critical Chain Scheduling

- Considers limited resources when creating a project schedule and includes buffers to protect the project completion date
- Uses the Theory of Constraints (TOC): management philosophy developed by Eliyahu M. Goldratt; attempts to minimize multitasking when a resource works on more than one task at a time
- Additional concepts
  - Buffer: additional time to complete a task
  - Murphy's Law: if something can go wrong, it will
  - Parkinson's Law: work expands to fill the time allowed
  - Project buffer: additional time added before the project's due date
  - Feeding buffers: additional time added before tasks on the critical path



Source: Eliyahu Goldratt, *Critical Chain*

FIGURE 6-11 Example of critical chain scheduling[8]

Multitasking is bad

- Multitasking occurs when a resource works on more than one task at a time
- Multitasking is not a good thing to do if you want to finish a project in a timely manner
- Critical chain scheduling assumes that resources do not multitask or at least minimize multitasking.
- Project team members should not be assigned to two tasks simultaneously on the same project when critical chain scheduling is in effect.
- Likewise, projects should be prioritized so that people who are working on more than one project at a time know which tasks take priority.
- Preventing multitasking avoids resource conflicts and wasted setup time caused by shifting between multiple tasks over time

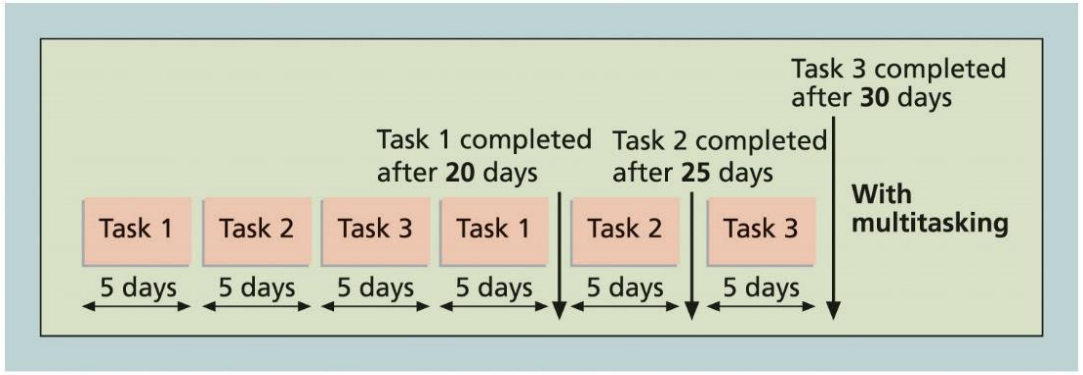


FIGURE 6-10b Three tasks with multitasking

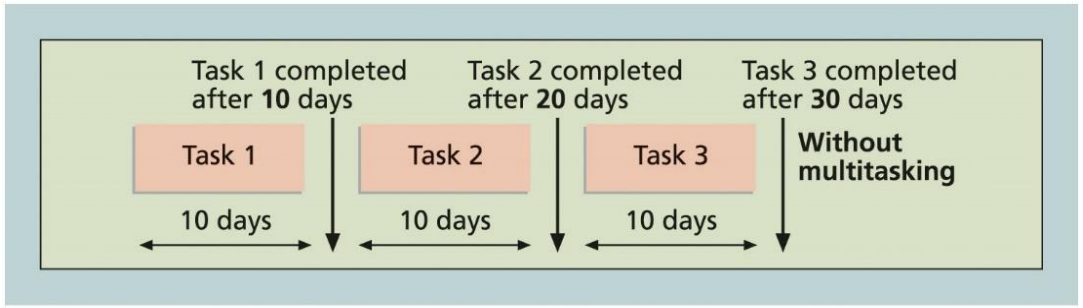


FIGURE 6-10a Three tasks without multitasking

Program Evaluation and Review Technique (PERT)

Network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates

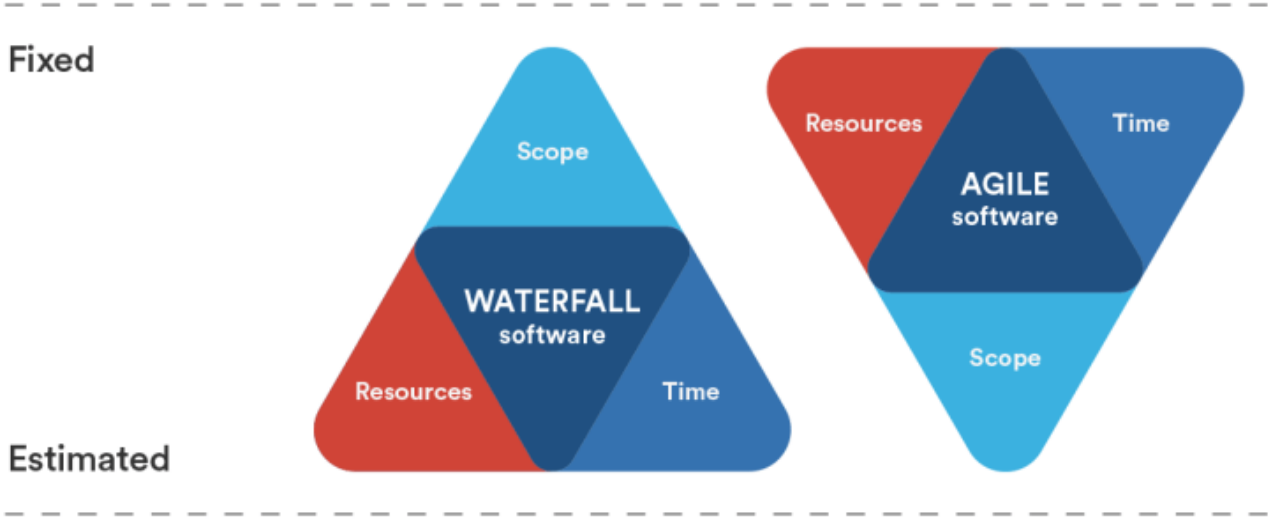
Uses probabilistic time estimates: duration estimates based on using optimistic, most likely, and pessimistic estimates of activity durations

By using the PERT weighted average for each activity duration estimate, total project duration estimate takes into account the risk or uncertainty in the individual activity estimates

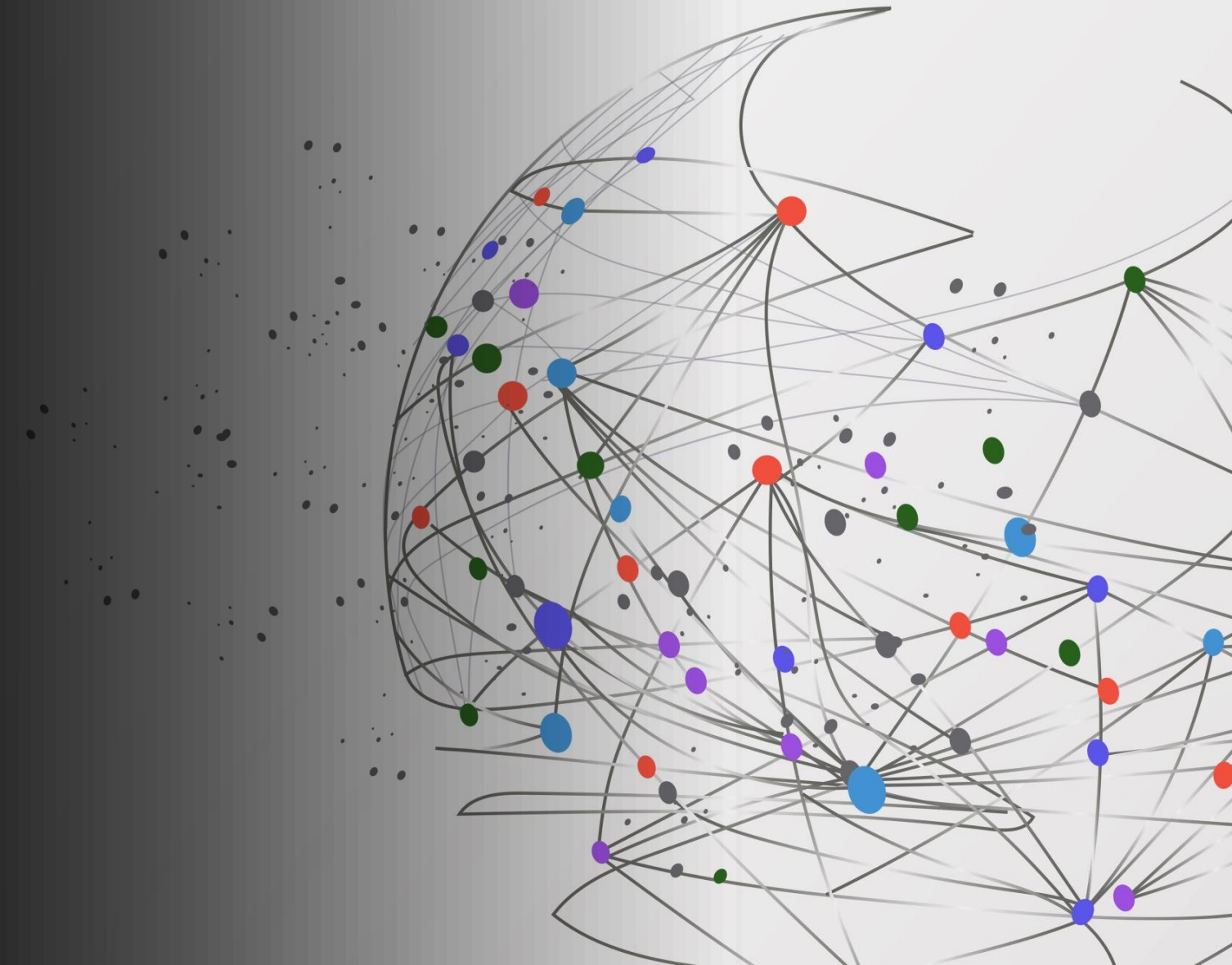
$$\text{PERT weight average} = \frac{\text{optimistic time} + 4 * \text{most likely time} + \text{pessimistic time}}{6}$$

Agile Schedule Management

- Agile methods are designed to address collaboration and flexibility, especially on projects with a complex scope of work.
- Example: product owner defines and prioritizes the work to be done within a sprint; Collaboration and time management are designed into the process
- Schedule management is radically different using Agile and Scrum
  - Projects that rely heavily on the critical path method consider meeting the project's estimated completion date as a crucial component of success
  - Agile projects may not even need to estimate activity durations or project schedules at all; overall project completion time is not important



Controlling the Schedule



Goals

Goals of schedule control

Know the status of the schedule
Influence the factors that cause schedule changes
Determine that the schedule has changed
Manage changes when they occur

Main inputs to schedule control

Project management plan
Project documents
Work performance data
Organizational process assets

Important activities

Consider the estimated completion date in the project charter
Prepare a more detailed schedule with the project team
Make sure the schedule is realistic and followed
Alert top management proactively on schedule problems

In-Class Group Exercise

Create a Gantt Chart for your Project

Identify & define your activities

Consider dependencies and lay down a sequence of the activities

Assume you have 4 resources employed full time (8/5 by norms) and estimate your activity resources

Allow the project duration to organically manifest based on activity resources

Use the provided template on Canvas Module 6

Submit on Discussion Board on Canvas Module 6