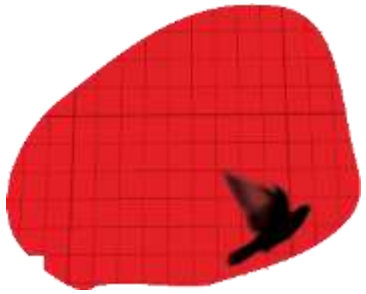
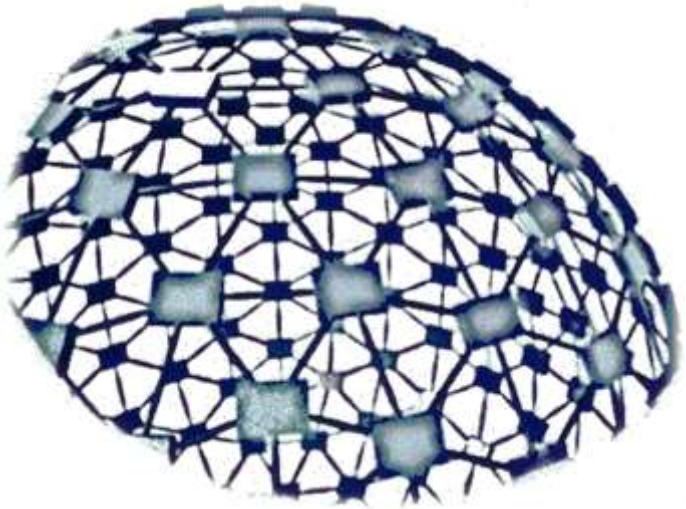




Chapter 6:
Project Schedule Management

Opining Case

Sue Johnson was the project manager for a consulting company contracted to provide a new online registration system at a local college in nine months or less. This system had to be operational by May 1 so students could use it to register for the fall semester. Her company's contract had a stiff penalty clause if the system was not ready by then, and Sue and her team would get nice bonuses for doing a good job on this project and meeting the schedule. Sue knew that it was her responsibility to meet the schedule and manage scope, cost, and quality expectations. She and her team developed a detailed schedule and network diagram to help organize the project. Developing the schedule turned out to be the easy part; keeping the project on track was more difficult. Managing personnel issues and resolving schedule conflicts were two of the bigger challenges. Many of the college's employees took unplanned vacations and missed or rescheduled project review meetings. These changes made it difficult for the project team to follow the planned schedule for the system because the team had to have customer sign-off at various stages of the systems development life cycle. One senior programmer on Sue's project team quit, and she knew it would take extra time for a new person to get up to speed, especially since the exiting programmer did a poor job documenting how his code linked to other systems at the college. It was still early in the project, but Sue knew they were falling behind. What could she do to meet the operational date of May 1?

The Importance of Project Schedules (1 of 3)

من اهم التحديات

- 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
    أنو تخلص كل الوقت
- Individual work styles (i.e., Home office, Mobile office etc.) and cultural differences may also cause schedule conflicts
  - Different cultures and even entire countries have different attitudes about schedules

The Importance of Project Schedules (2 of 3)

- Project time management processes
  1. Planning schedule management — تخطيط
  2. Defining activities — تعريف
  3. Sequencing activities — ترتيب
  4. Estimating activity resources — تقدير موارد
  5. Estimating activity durations — تقدير مدة
  6. Developing the schedule — انشاء
  7. Controlling the schedule — المحافظة

1. Planning Schedule Management

- *Schedule Management Plan defines how the project schedule is managed throughout the project lifecycle. The plan provides guidance and sets expectations for project schedule policies and procedures for planning, developing, managing, executing, and controlling the project schedule.*
- *Elements of a schedule management plan*
  1. *Project schedule model development*
  2. *Scheduling methodology (i.e., CPM, CCM)*
  3. *Level of accuracy and units of measure*
  4. *Control thresholds*
  5. *Rules of performance measurement*
  6. *Reporting formats*
  7. *Process descriptions*

2. Defining Activities (1 of 2)

- *Defining activities involves identifying the specific actions that will produce the project deliverables in enough detail to determine resource and schedule estimates*
  - *Activity list: a tabulation of activities included on a project schedule*
    - *Activity name, activity ID, and brief description of the activity*
  - *Activity attributes provide more information*
    - *Predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity*

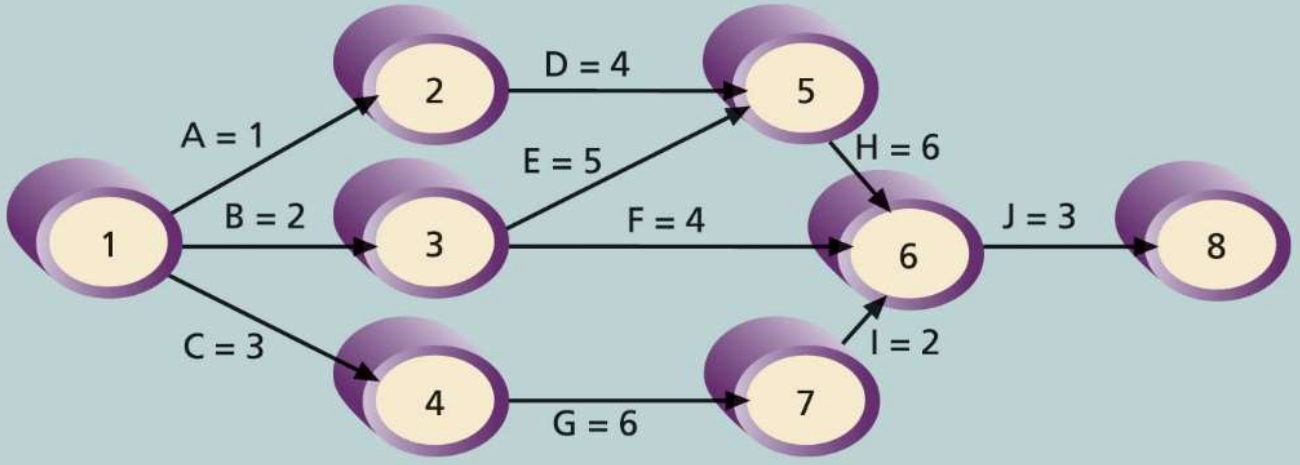
2. Defining Activities (2 of 2)

- *A Milestone is a significant event that normally has no duration*
  - *It often takes several activities and a lot of work to complete a milestone*
  - *They're useful tools for setting schedule goals and monitoring progress*
    - *Examples: obtaining customer sign-off on key documents or completion of specific products*

3. Sequencing Activities (2 of 6)

- *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*

3. Sequencing Activities (3 of 6)



Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

FIGURE 6-2 Network diagram for project X

3. Sequencing Activities (4 of 6)

Arrow diagramming method (ADM) (i.e., activity-on-arrow network diagrams)

1. *Activities are represented by arrows*
2. *Nodes or circles are the start and end points of activities*
3. *Only show finish-to-start dependencies*
4. *text for the step-by-step process of creating AOA diagrams*

Precedence diagramming method (PDM)

- *Network diagramming technique: boxes represent activities*
- *Types of dependencies or relationships between activities*

1. *Finish-to-start*
2. *Start-to-start*
3. *Finish-to-finish*
4. *Start-to-finish*

Sequencing Activities (5 of 6)

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.

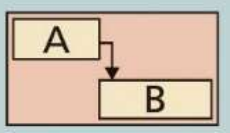
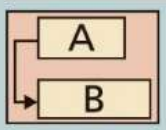
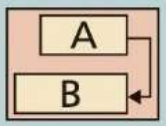
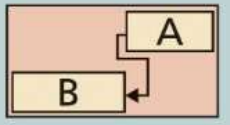
Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A)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

FIGURE 6-3 Task dependency types

3. Sequencing Activities (6 of 6)

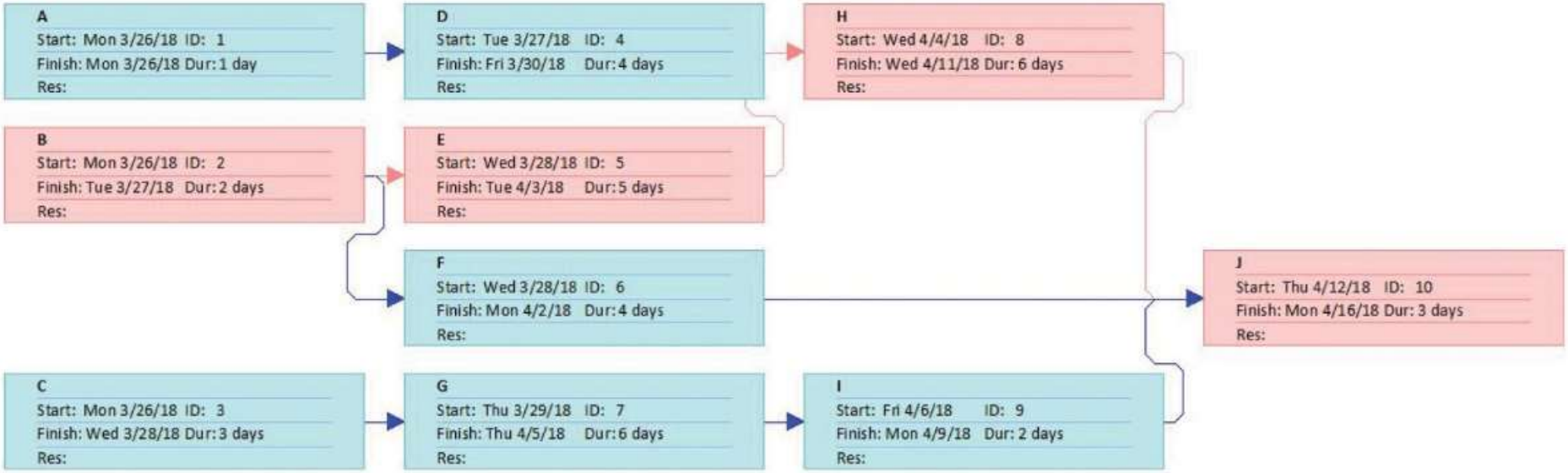


FIGURE 6-4 Precedence diagramming methods (PDM) network diagram for project X

5. Estimating Activity 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*
- *People doing the work should help create estimates*
  - *An expert should review them*
- *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*

$$\text{PERT} = \frac{O + 4M + P}{6}$$

Beta Distribution

6. Developing the Schedule

- *Uses results of the time management processes to determine the start and end date of the project. Goal is to create a realistic project schedule that provides a basis for monitoring project progress for the time dimension of the project*
- *Important tools and techniques*

1– *Gantt charts*

2– *Critical path analysis*

3– *Critical chain scheduling*

4– *PERT analysis*

Gantt Charts (1 of 5)

- Provide a standard format for displaying project schedule information by listing project activities and corresponding start and finish dates in a calendar form
  - Symbols
    - Black diamond: milestones
    - Thick black bars: summary tasks
    - Light gray horizontal bars: durations of tasks
    - Arrows: dependencies between tasks

Gantt Charts (2 of 5)

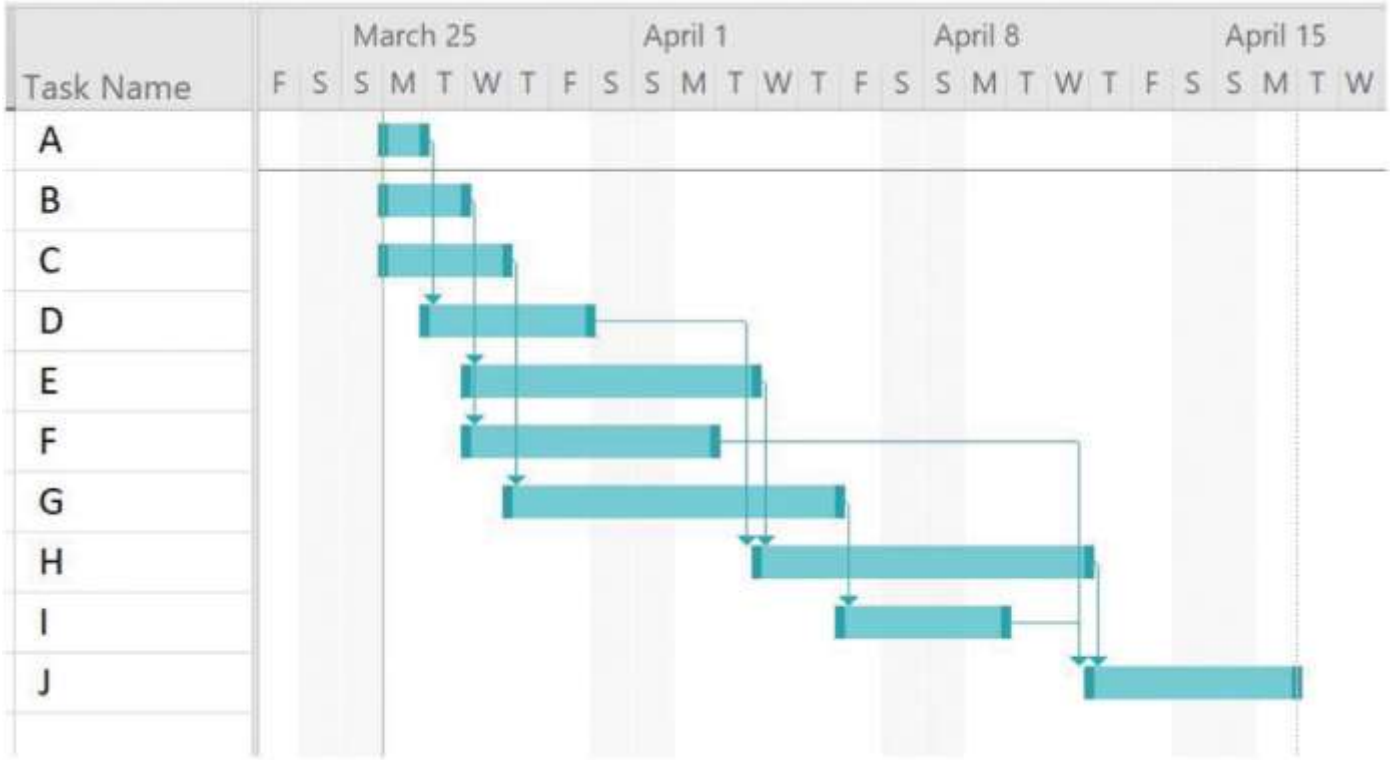


FIGURE 6-5 Gantt chart for project X

Gantt Charts (3 of 5)

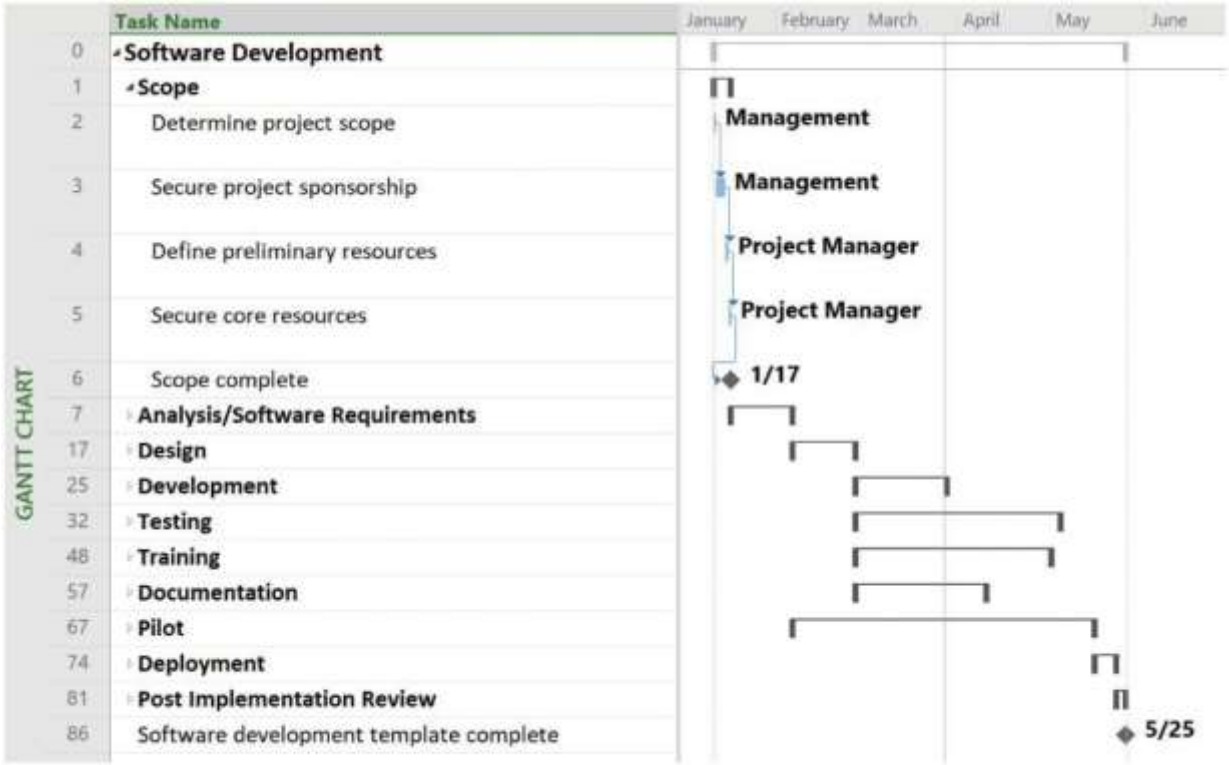


FIGURE 6-6 Gantt chart for software launch project

Gantt Charts (4 of 5)

- *Adding milestones to Gantt charts*
  - *Many people like to focus on meeting milestones, especially for large projects*
    - *Milestones emphasize important events or accomplishments on projects*
- *SMART Criteria for milestones*

1– *Specific*

2 – *Measurable*

3– *Assignable*

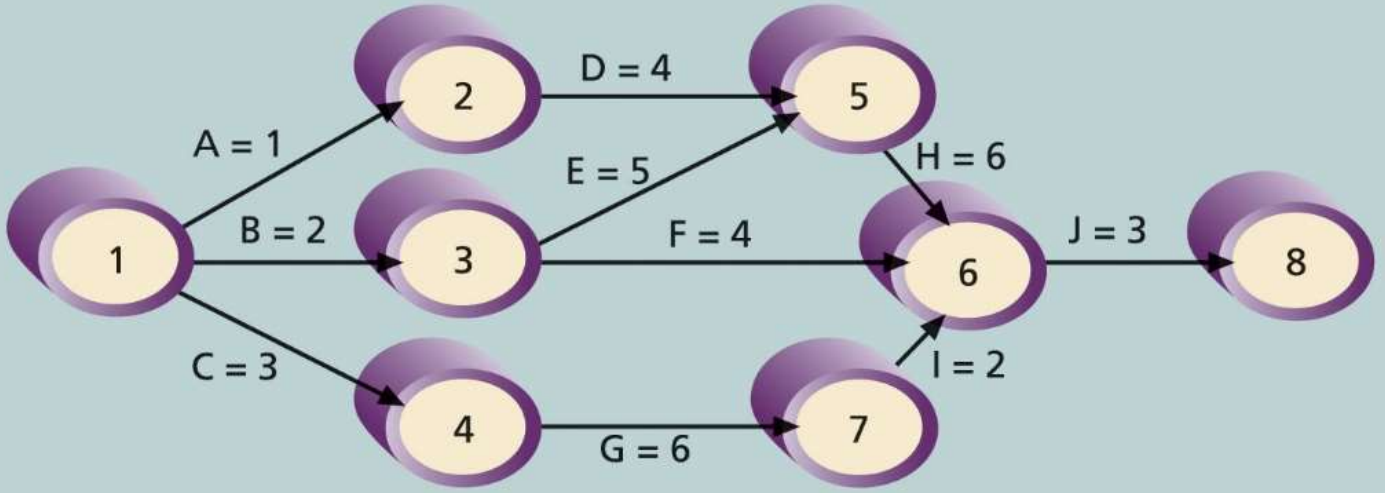
4– *Realistic*

5– *Time-framed*

Critical Path Method (CPM) (1 of 2)

- Network diagramming technique used to predict total project duration
  - 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; 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

Critical Path Method (CPM) (2 of 2)



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

Using Critical Path Analysis to Make Schedule Trade-Offs (1 of 3)

- 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

Using Critical Path Analysis to Make Schedule Trade-Offs (2 of 3)

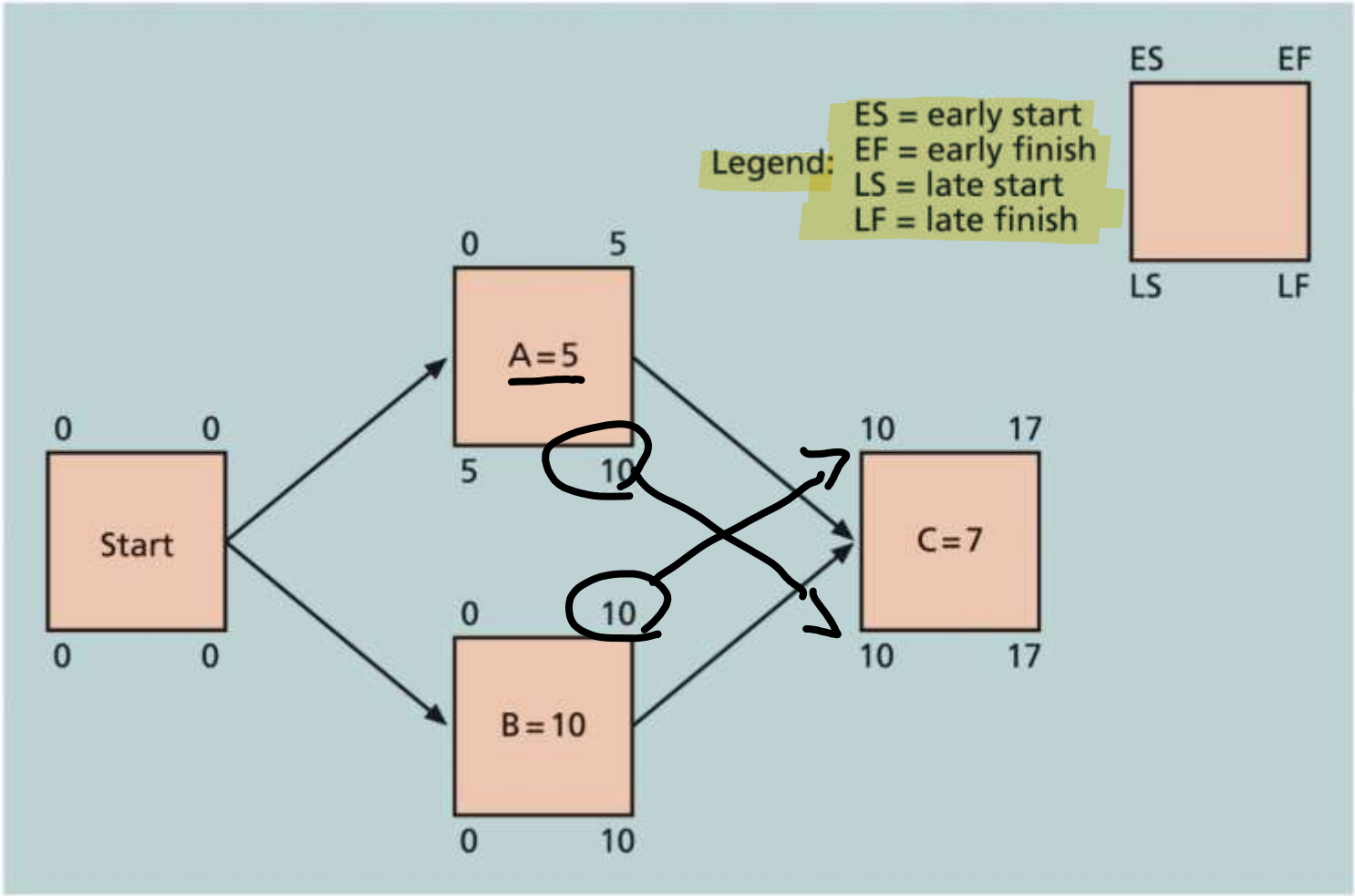


FIGURE 6-9 Calculating early and late start and finish dates

Using Critical Path Analysis to Make Schedule Trade-Offs (1 of 3)

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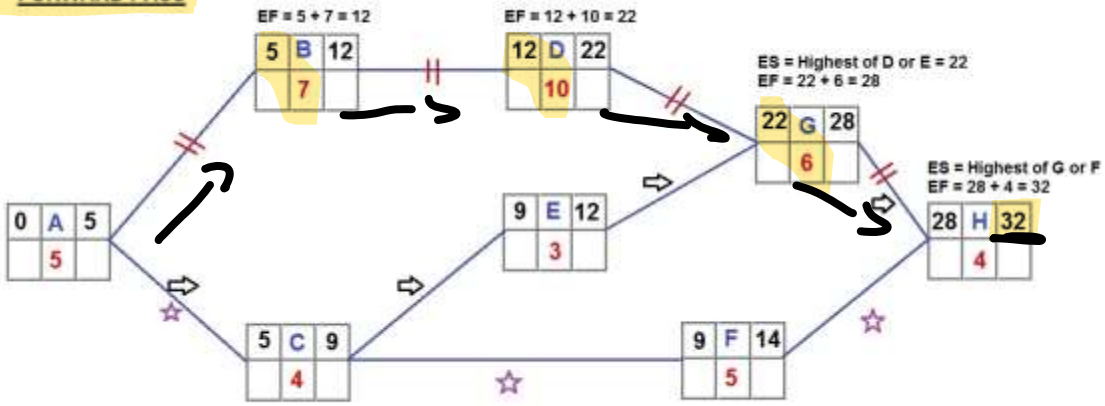
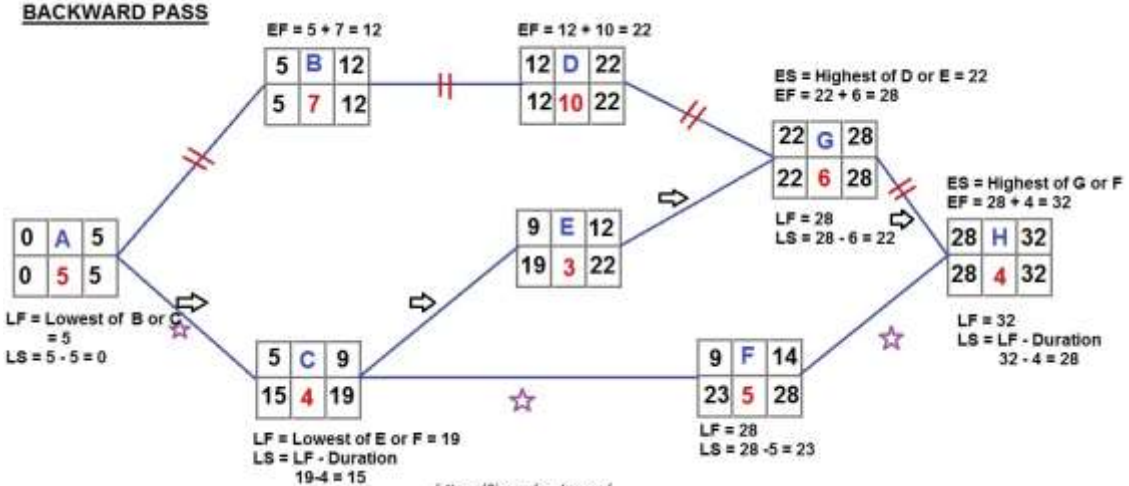
FORWARD PASS



https://tiemchart.com/

BACKWARD PASS



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Importance of Updating Critical Path Data

- It is important to update the schedule with actual data
  - Note actual activity durations as they are completed
  - Revise estimates for activities in progress
  - Monitor changes to make informed decisions

Gantt Charts (5 of 5)

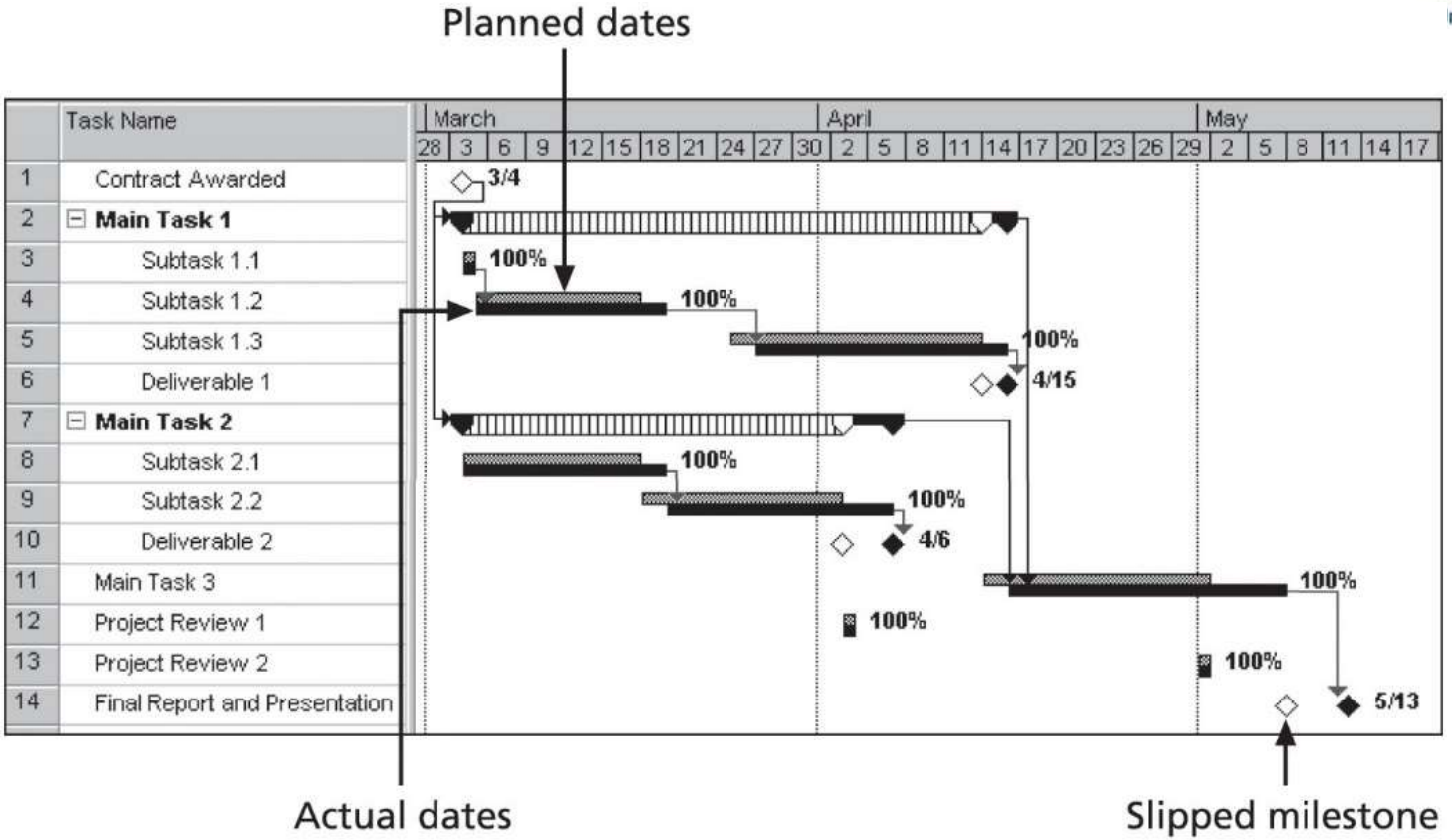

FIGURE 6-7 Sample tracking Gantt chart

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 optimistic, most likely, and pessimistic estimates of activity durations*
  - *By using the PERT weighted average for each activity duration estimate, total project duration estimate considers the risk or uncertainty in the individual activity estimates*

$$\underset{\text{Beta Distribution}}{\text{PERT}} = \frac{O + 4M + P}{6}$$

Considerations for Agile/Adaptive Environments

Schedule management is radically different using Agile & 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*