Time Management

Learning Objectives

- Understand the importance of project schedules and good project time management
- Define activities as the basis for developing project schedules
- Describe how project managers use network diagrams and dependencies to assist in activity sequencing
- Understand the relationship between estimating resources and project schedules
- Explain how various tools and techniques help project managers perform activity duration estimating
- Use a Gantt chart for planning and tracking schedule information, find the critical path for a project, and describe how critical chain scheduling and the Program Evaluation and Review Technique (PERT) affect schedule development
- Explain the importance of controlling schedule

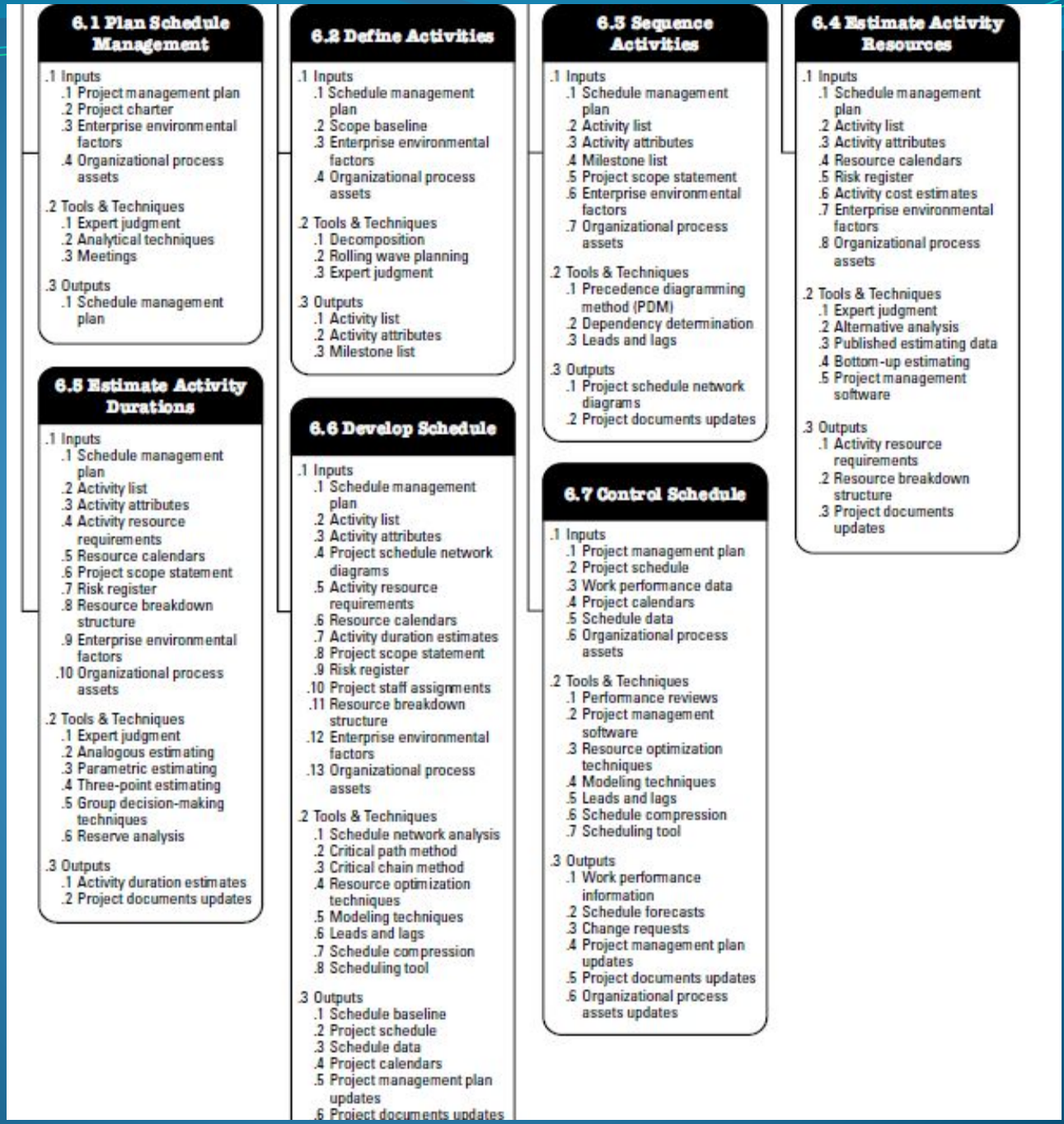
Importance of Project Schedules

- 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
- Schedule issues are the main reason for conflicts on projects, especially during the second half of projects

Individual Work Styles and Cultural Differences Cause Schedule Conflicts

- One dimension of the Meyers-Briggs Type Indicator focuses on peoples' attitudes toward structure and deadlines
- Some people prefer to follow schedules and meet deadlines while others do not
- Difference cultures and even entire countries have different attitudes about schedules
  - Hours, Holidays, Religion, Work ethic

Overview



6.1 Plan Schedule Management

.1 Inputs
- .1 Project management plan
- .2 Project charter
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Analytical techniques
- .3 Meetings

.3 Outputs
- .1 Schedule management plan

6.2 Define Activities

.1 Inputs
- .1 Schedule management plan
- .2 Scope baseline
- .3 Enterprise environmental factors
- .4 Organizational process assets

.2 Tools & Techniques
- .1 Decomposition
- .2 Rolling wave planning
- .3 Expert judgment

.3 Outputs
- .1 Activity list
- .2 Activity attributes
- .3 Milestone list

6.3 Sequence Activities

.1 Inputs
- .1 Schedule management plan
- .2 Activity list
- .3 Activity attributes
- .4 Milestone list
- .5 Project scope statement
- .6 Enterprise environmental factors
- .7 Organizational process assets

.2 Tools & Techniques
- .1 Precedence diagramming method (PDM)
- .2 Dependency determination
- .3 Leads and lags

.3 Outputs
- .1 Project schedule network diagrams
- .2 Project documents updates

6.4 Estimate Activity Resources

.1 Inputs
- .1 Schedule management plan
- .2 Activity list
- .3 Activity attributes
- .4 Resource calendars
- .5 Risk register
- .6 Activity cost estimates
- .7 Enterprise environmental factors
- .8 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Alternative analysis
- .3 Published estimating data
- .4 Bottom-up estimating
- .5 Project management software

.3 Outputs
- .1 Activity resource requirements
- .2 Resource breakdown structure
- .3 Project documents updates

6.5 Estimate Activity Durations

.1 Inputs
- .1 Schedule management plan
- .2 Activity list
- .3 Activity attributes
- .4 Activity resource requirements
- .5 Resource calendars
- .6 Project scope statement
- .7 Risk register
- .8 Resource breakdown structure
- .9 Enterprise environmental factors
- .10 Organizational process assets

.2 Tools & Techniques
- .1 Expert judgment
- .2 Analogous estimating
- .3 Parametric estimating
- .4 Three-point estimating
- .5 Group decision-making techniques
- .6 Reserve analysis

.3 Outputs
- .1 Activity duration estimates
- .2 Project documents updates

6.6 Develop Schedule

.1 Inputs
- .1 Schedule management plan
- .2 Activity list
- .3 Activity attributes
- .4 Project schedule network diagrams
- .5 Activity resource requirements
- .6 Resource calendars
- .7 Activity duration estimates
- .8 Project scope statement
- .9 Risk register
- .10 Project staff assignments
- .11 Resource breakdown structure
- .12 Enterprise environmental factors
- .13 Organizational process assets

.2 Tools & Techniques
- .1 Schedule network analysis
- .2 Critical path method
- .3 Critical chain method
- .4 Resource optimization techniques
- .5 Modeling techniques
- .6 Leads and lags
- .7 Schedule compression
- .8 Scheduling tool

.3 Outputs
- .1 Schedule baseline
- .2 Project schedule
- .3 Schedule data
- .4 Project calendars
- .5 Project management plan updates
- .6 Project documents updates

6.7 Control Schedule

.1 Inputs
- .1 Project management plan
- .2 Project schedule
- .3 Work performance data
- .4 Project calendars
- .5 Schedule data
- .6 Organizational process assets

.2 Tools & Techniques
- .1 Performance reviews
- .2 Project management software
- .3 Resource optimization techniques
- .4 Modeling techniques
- .5 Leads and lags
- .6 Schedule compression
- .7 Scheduling tool

.3 Outputs
- .1 Work performance information
- .2 Schedule forecasts
- .3 Change requests
- .4 Project management plan updates
- .5 Project documents updates
- .6 Organizational process assets updates

Project Time Management Processes

- Plan Schedule Management: process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule
- Define activities: identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables
- Sequence activities: identifying and documenting the relationships between project activities
- Estimate activity resources: estimating how many resources a project team should use to perform project activities
- Estimate activity durations: estimating the number of work periods that are needed to complete individual activities
- Develop schedule: analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule
- Control schedule: controlling and managing changes to the project schedule

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
- Key benefit of this process is that it provides guidance and direction on how the project schedule will be managed throughout the project

Define Activities

- An activity or task is an element of work normally found on the work breakdown structure (WBS) that has an expected duration, a cost, and resource requirements
- Activity definition involves developing a more detailed WBS and supporting explanations to understand all the work to be done so you can develop realistic cost and duration estimates
- Key benefits – a basis for estimating, scheduling, executing, monitoring, and controlling the project work

- Rolling wave planning: iterative planning technique in which the work to be accomplished in the near term is planned in details, while the work in the future is planned at a higher level

Activity Lists and Attributes

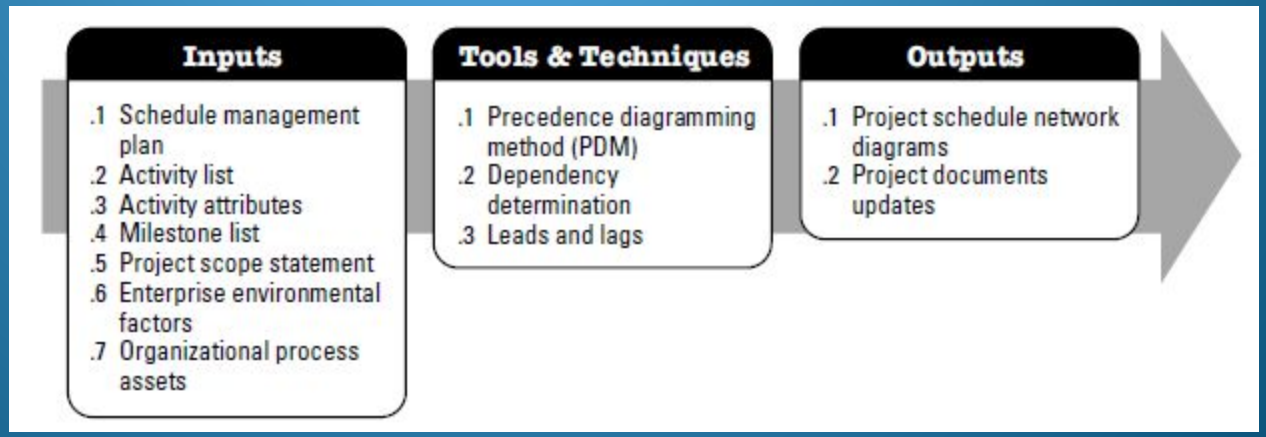
- An activity list is a tabulation of activities to be included on a project schedule that includes:
  - The activity name
  - An activity identifier or number
  - A brief description of the activity
- Activity attributes provide more information such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity
- They should be in agreement with WBS and WBS dictionary

Milestone List

- 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
- They have zero duration because milestones represent a moment in time
- Examples include obtaining customer sign-off on key documents or completion of specific products

Sequence Activities

- Involves reviewing activities and determining dependencies
- Key benefit – defines the logical sequence of work to obtain the greatest efficiency given all project constraints
- A dependency or relationship is the sequencing of project activities or tasks
  - Dependency
  - Parallel
  - Overlap
- You *must* determine dependencies in order to use critical path analysis



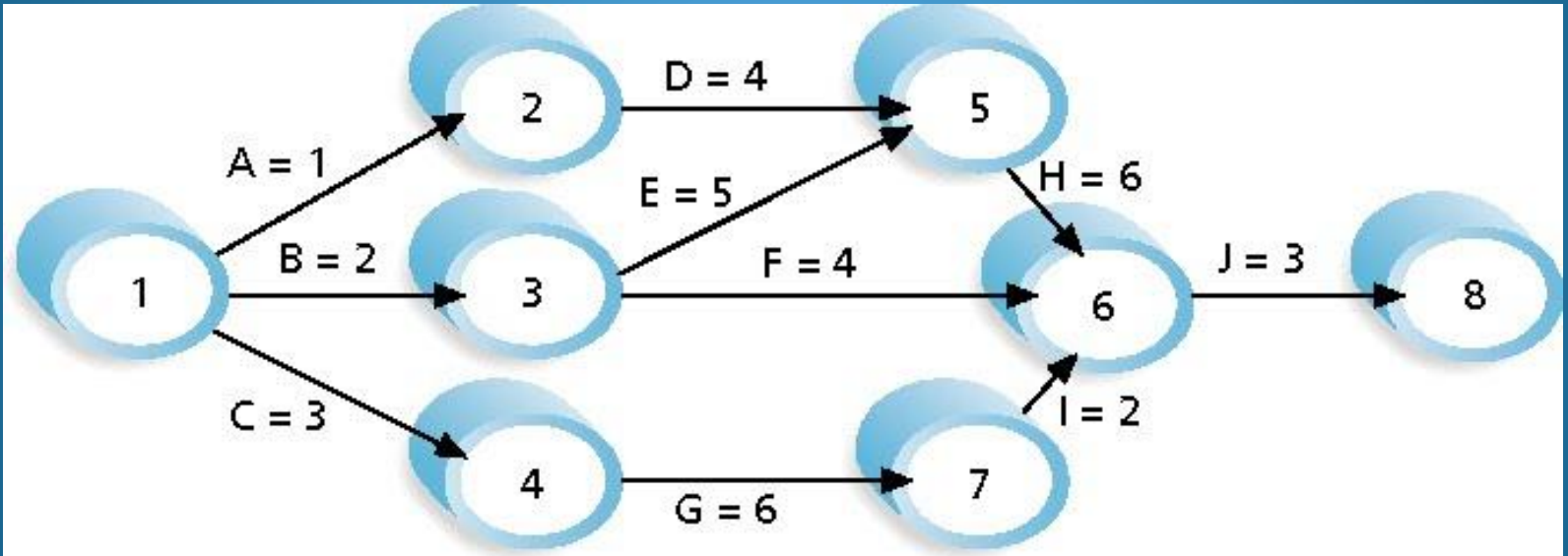
Network Diagrams

- Network diagrams are the preferred technique for showing activity sequencing
- A network diagram is a 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)

- Also called activity-on-arrow (AOA) network diagrams
- Activities are represented by arrows
- Nodes or circles are the starting and ending points of activities
- Can only show finish-to-start dependencies
- Uses dummy activities which are represented by dotted lines
- Dummy activities = no work

Sample Activity-on-Arrow (AOA) Network Diagram for Project X

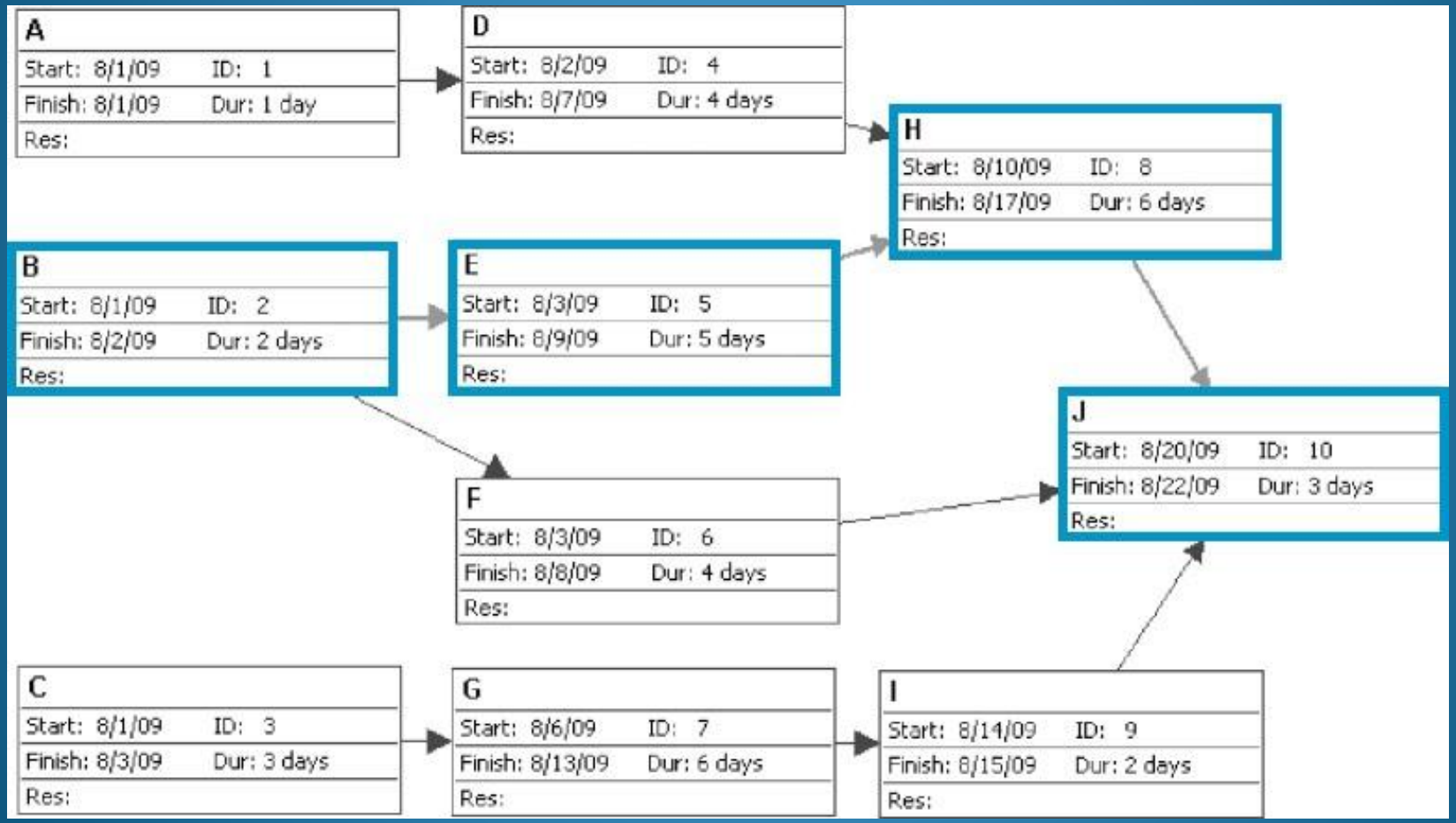


Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

Precedence Diagramming Method (PDM)

- Activities are represented by boxes
- Arrows show relationships between activities
- More popular than ADM method and used by project management software
- Better at showing different types of dependencies
- It's also called Activity on Node (AON)

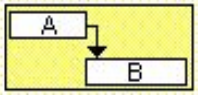
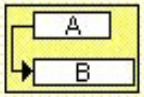
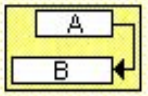
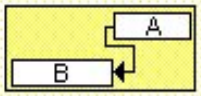
Sample PDM Network Diagram



Task Dependency Types

Task dependencies

The nature of the dependencies between 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:

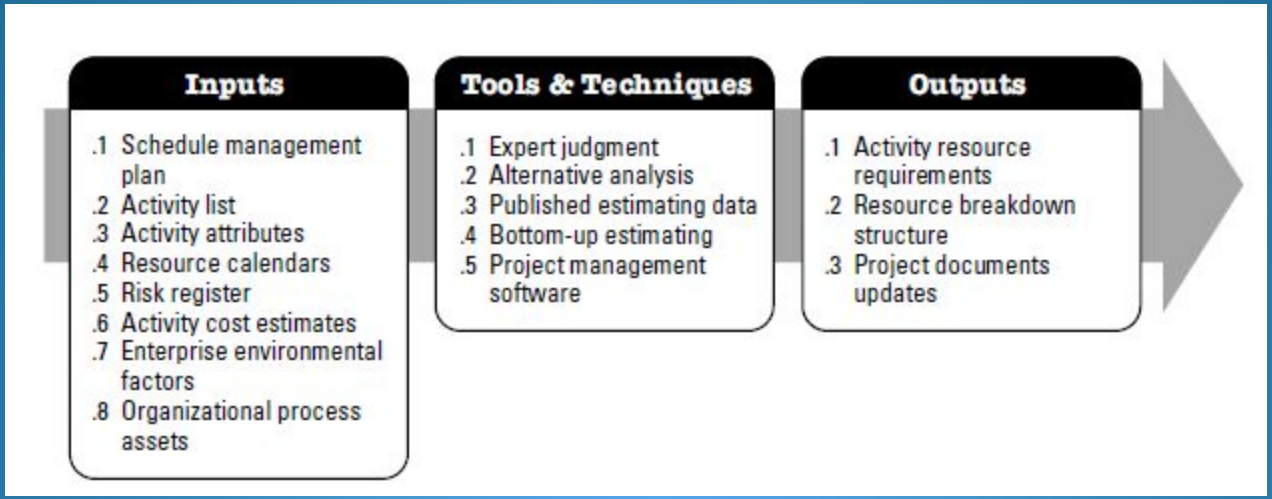
Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A)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

- Examples:
  - Finish-To-Start: Pour Foundation -> Build the room, Race -> Award ceremony
  - Start-To-Start: While clean the living room = Start painting the dinning hall
  - Finish-To-Finish: Coding finish -> Before testing can be completed, writing a document -> editing a document
  - Start-To-Finish: Task 2 -> Task 1, Security guard shifts

Estimate Activity Resources

- Before estimating activity durations, you must have a good idea of the quantity and type of resources that will be assigned to each activity; resources are people, equipment, and materials
- Consider important issues in estimating resources
  - How difficult will it be to do specific activities on this project?
  - What is the organization's history in doing similar activities?
  - Are the required resources available?

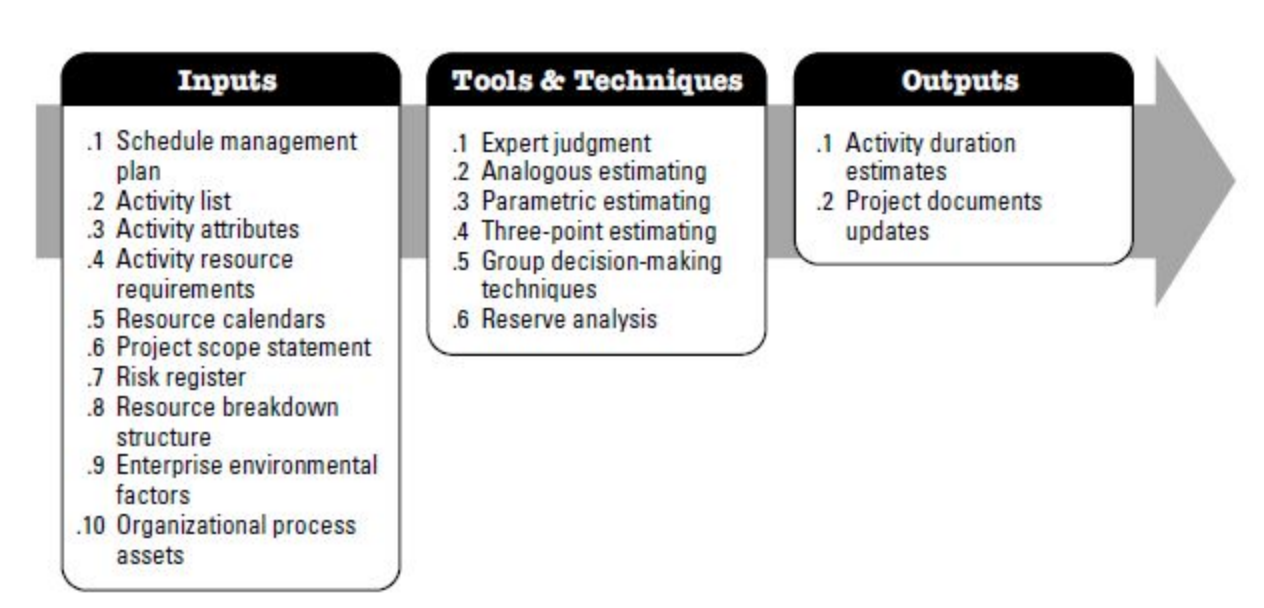
Estimate Activity Resources



- A resource breakdown structure is a hierarchical structure that identifies the project's resources by category and type

Estimate Activity Duration

- Process of estimating the number of work periods needed to complete individual activities with estimated resources

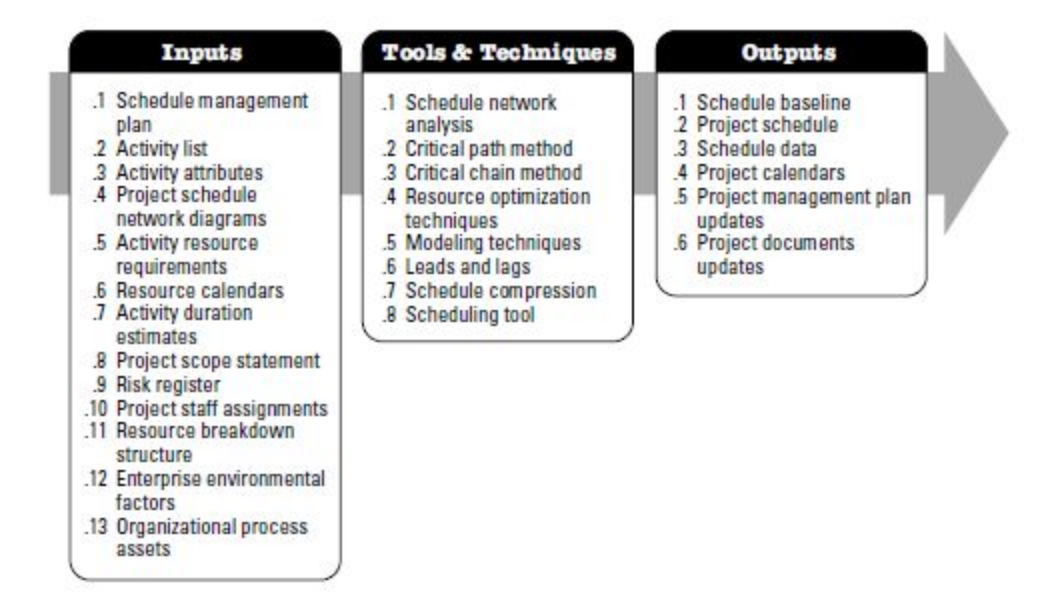


Estimates

- Analogous estimating: Is a technique for estimating the duration or cost of an activity or a project using historical data from a similar activity or project
- Parametric estimating: Uses a mathematical model as a basis of estimation
- Three-point estimating (Program Evaluation and Review Technique):
  - Instead of providing activity estimates as a discrete number, such as four weeks, it's often helpful to create a **three-point estimate**
    - An estimate that includes an optimistic, most likely, and pessimistic estimate, such as three weeks for the optimistic, four weeks for the most likely, and five weeks for the pessimistic estimate
  - Three-point estimates are needed for PERT and Monte Carlo simulations

Develop Schedule

- Uses results of the other time management processes to determine the start and end date of the project
- Ultimate 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 include Gantt charts, critical path analysis, and critical chain scheduling, and PERT analysis



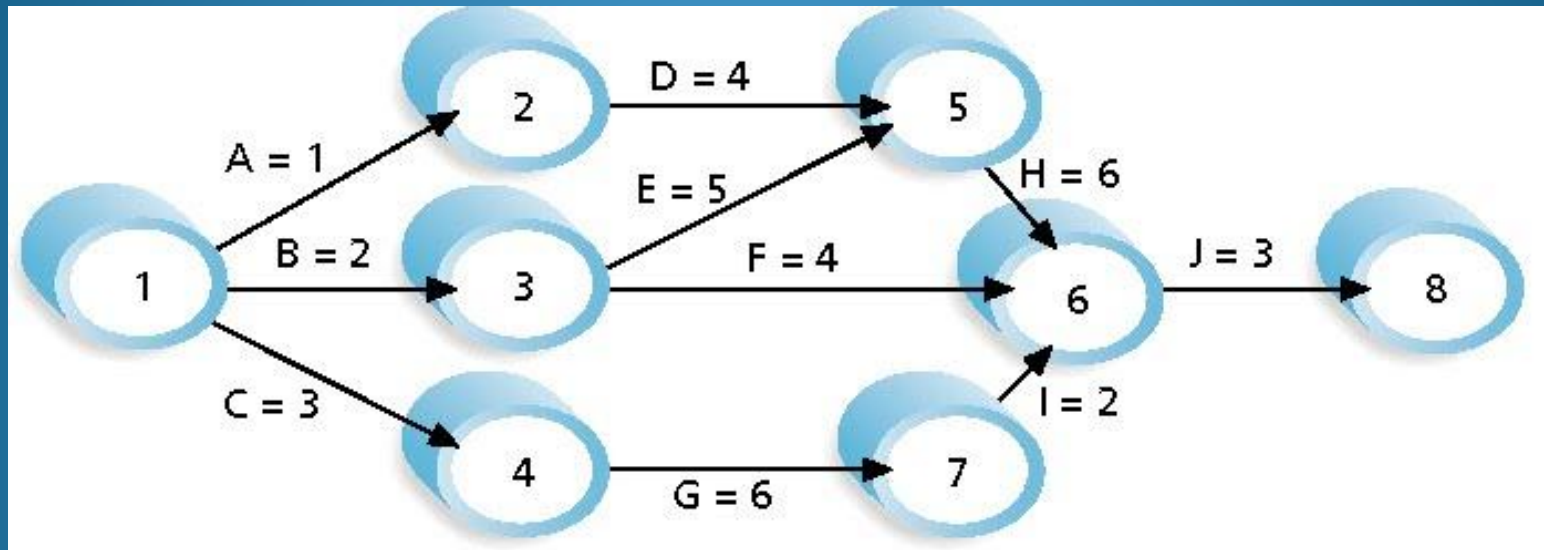
Critical Path Method (CPM)

- CPM is a network diagramming technique used to predict total project duration
- A critical path for a project is the series of activities that determines the *earliest time* by which the project can be completed
- The critical path is the *longest path* through the network diagram and has the least amount of slack or float
- Slack or float is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date

Calculating the Critical Path

- First develop a good network diagram
- Add the duration estimates for all activities on each path through the network diagram
- The 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

Determining the Critical Path for Project X



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.

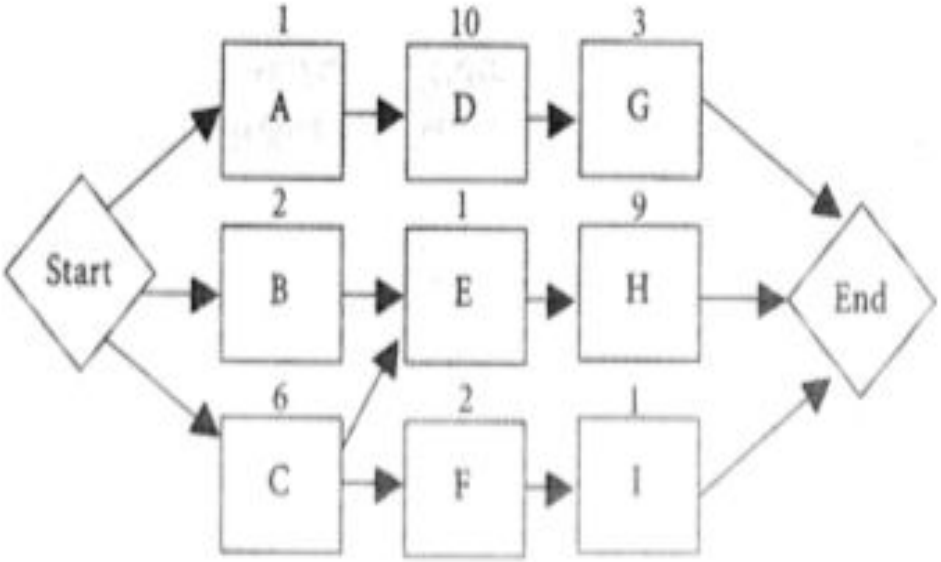
23. Based on the following, if you needed to shorten the duration of the project, which activity would you try to shorten?

Activity	Preceding Activity	Duration in Weeks
Start	None	0
A	Start	1
B	Start	2
C	Start	6
D	A	10
E	B, C	1
F	C	2
G	D	3
H	E	9
I	F	1
End	G, H, I	0

A. Activity B
B. Activity D
C. Activity H
D. Activity C

Explanation This is an example of a two-stage question you may find on the exam. First you need to draw the network diagram and find the critical path, and then make a decision. The network diagram would be:

Paths	Duration in Weeks
Start, A, D, G, End	14
Start, B, E, H, End	12
Start, C, E, H, End	16
Start, C, F, I, End	9



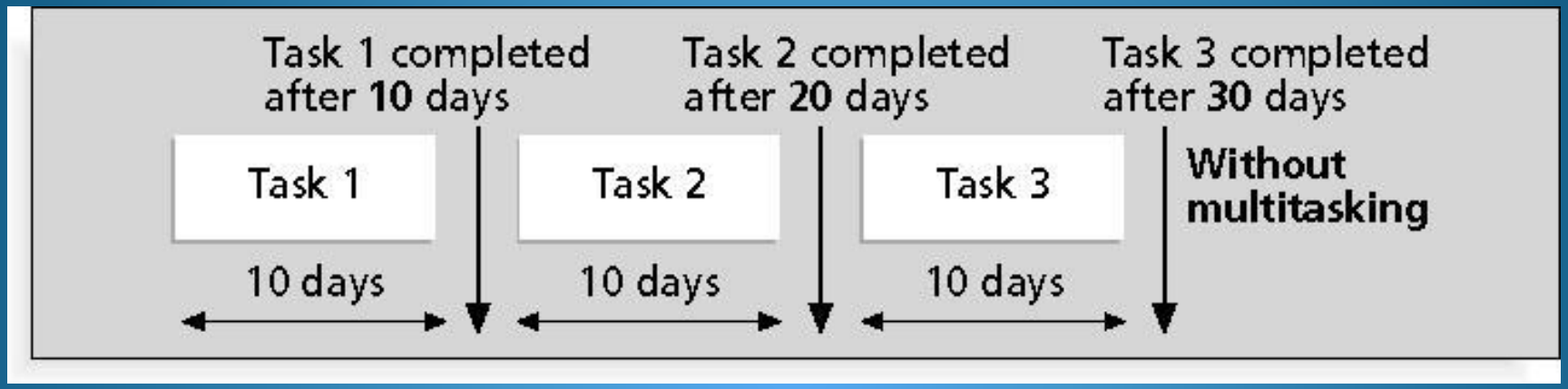
Using the Critical Path to Shorten a Project Schedule

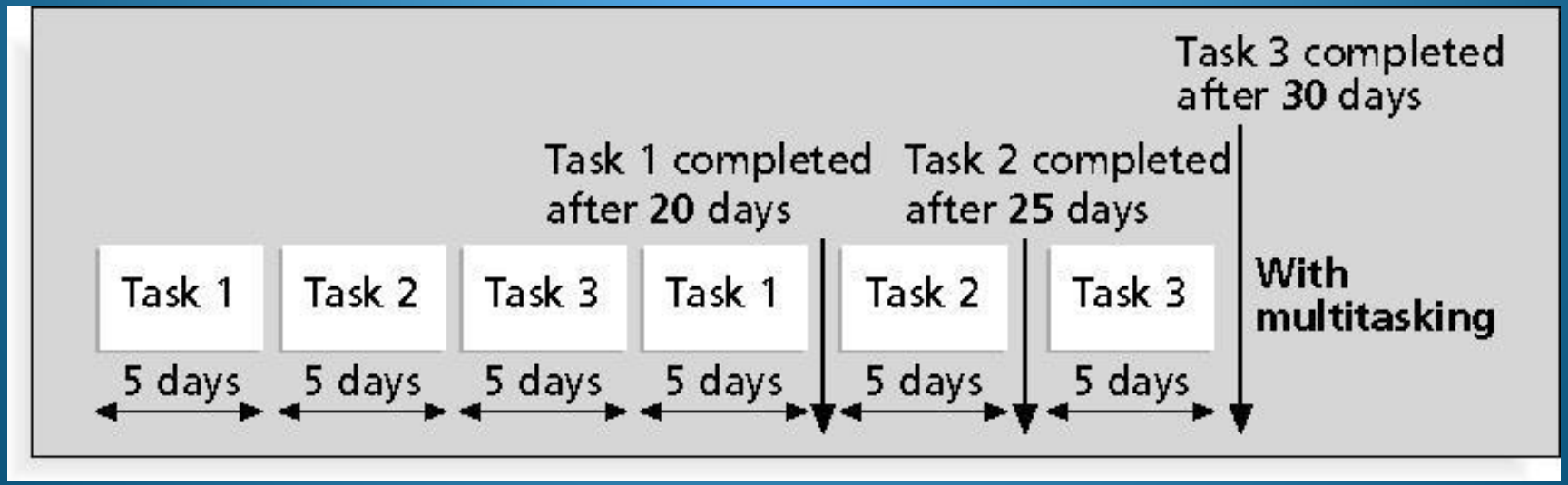
- Three main techniques for shortening schedules
  - Shortening durations of critical activities/tasks by adding more resources or changing their scope
  - Crashing activities by obtaining the greatest amount of schedule compression for the least incremental cost
  - Fast tracking activities by doing them in parallel or overlapping them

Importance of Updating Critical Path Data

- It is important to update project schedule information to meet time goals for a project
- The critical path may change as you enter actual start and finish dates
- If you know the project completion date will slip, negotiate with the project sponsor

Multitasking Example





Program Evaluation and Review Technique (PERT)

- PERT is a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates
- PERT uses probabilistic time estimates
  - Duration estimates based on using optimistic, most likely, and pessimistic estimates of activity durations, or a three-point estimate

PERT Formula and Example

- PERT weighted average =

$$\frac{\text{optimistic time} + 4\text{X most likely time} + \text{pessimistic time}}{6}$$

- Example:

PERT weighted average =

$$\frac{8 \text{ workdays} + 4 \text{ X } 10 \text{ workdays} + 24 \text{ workdays}}{6} = \textbf{12 days}$$

where optimistic time = 8 days

most likely time = **10 days**, and

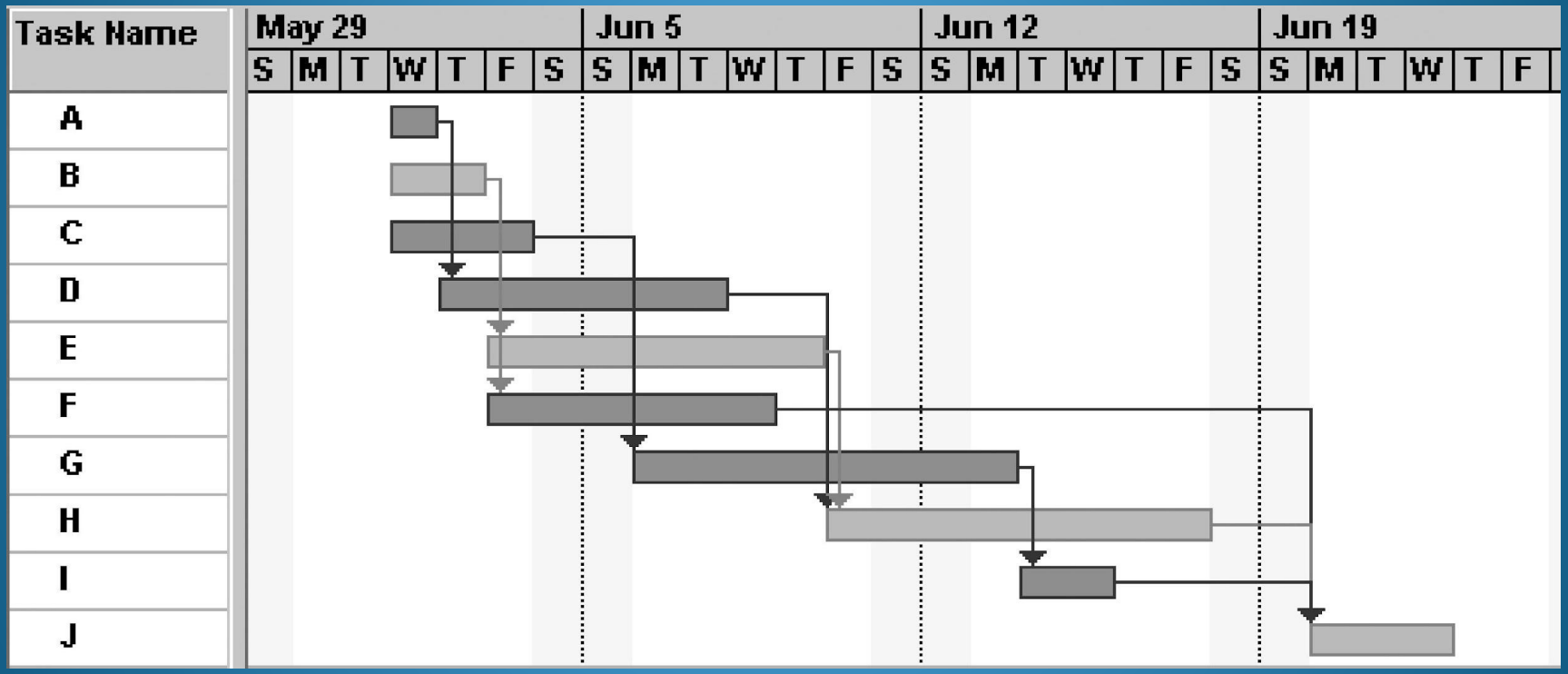
pessimistic time = 24 days

Therefore, you'd use **12 days** on the network diagram instead of 10 when using PERT for the above example

Gantt Charts

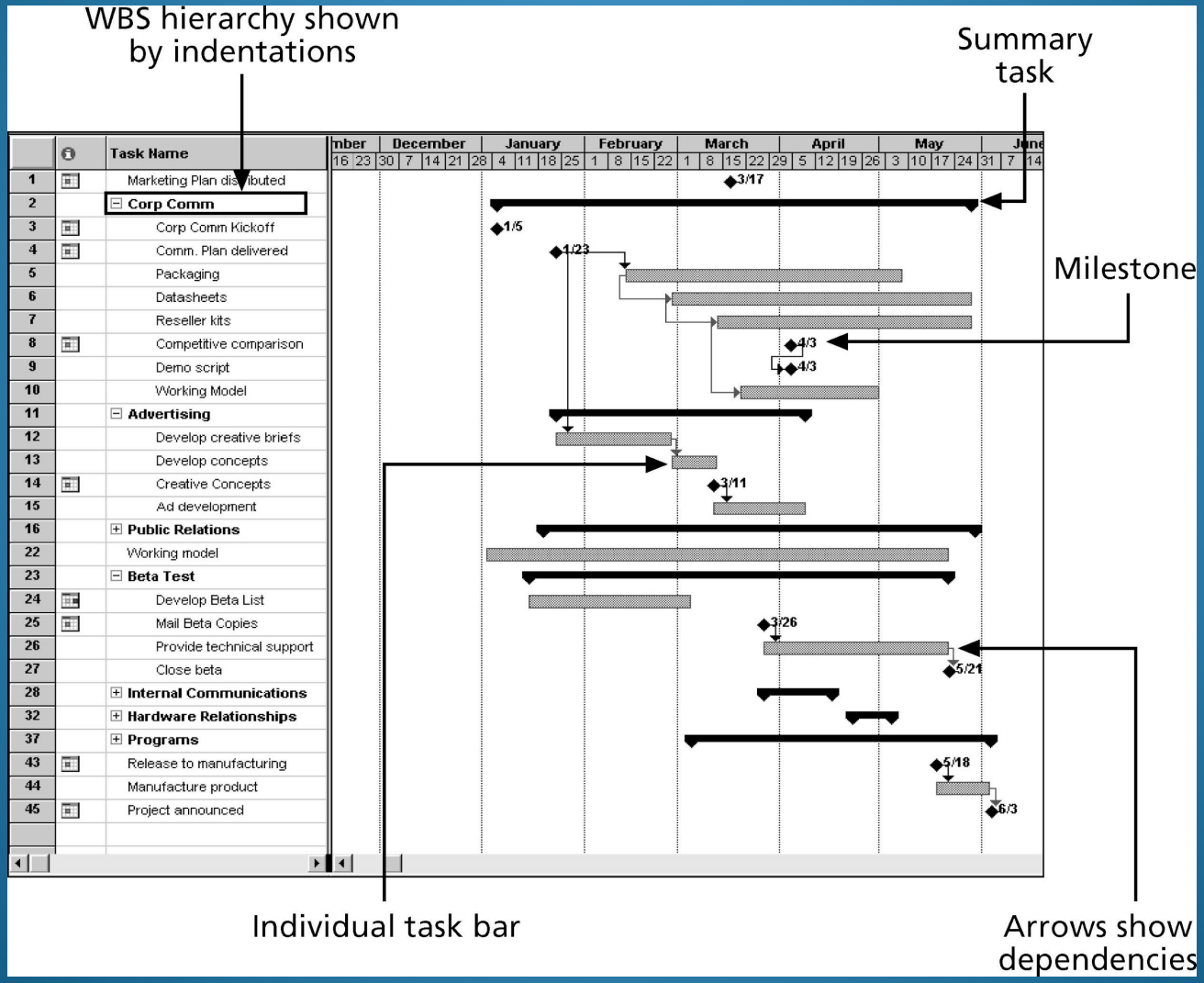
- Gantt charts provide a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format
- Symbols include:
  - Black diamonds: milestones
  - Thick black bars: summary tasks
  - Lighter horizontal bars: durations of tasks
  - Arrows: dependencies between tasks

Gantt Chart for Project X



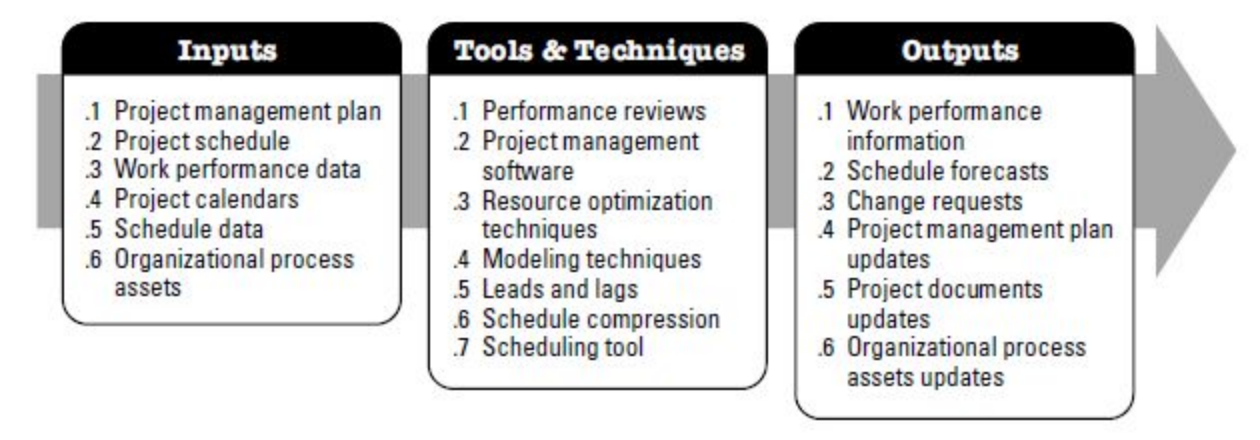
Note: Darker bars would be red in Project 2007 to represent critical tasks.

Gantt Chart for Software Launch Project



Control Schedule

- Goals are to know the status of the schedule, influence factors that cause schedule changes, determine that the schedule has changed, and manage changes when they occur



Schedule Control Suggestions

- Perform reality checks on schedules
- Allow for contingencies
- Don’t plan for everyone to work at 100% capacity all the time
- Hold progress meetings with stakeholders and be clear and honest in communicating schedule issues

Reality Checks on Scheduling

- First review the draft schedule or 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 well in advance if there are schedule problems

Working with People Issues

- Strong leadership helps projects succeed more than good PERT charts
- Project managers should use:
  - Empowerment
  - Incentives
  - Discipline
  - Negotiation

Summary

- Project time management is often cited as the main source of conflict on projects, and most IT projects exceed time estimates
- Main processes include:
  - Plan Schedule Management
  - Define activities
  - Sequence activities
  - Estimate activity resources
  - Estimate activity durations
  - Develop schedule
  - Control schedule