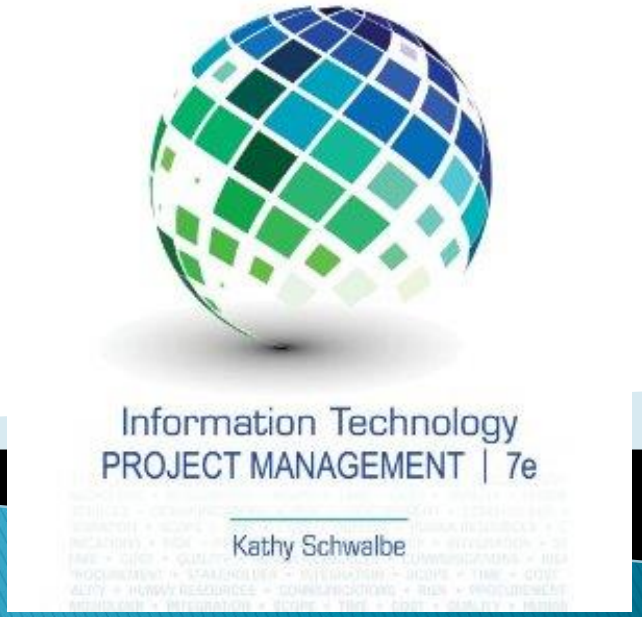
Chapter 6: Project Time Management

Information Technology Project Management, Seventh Edition



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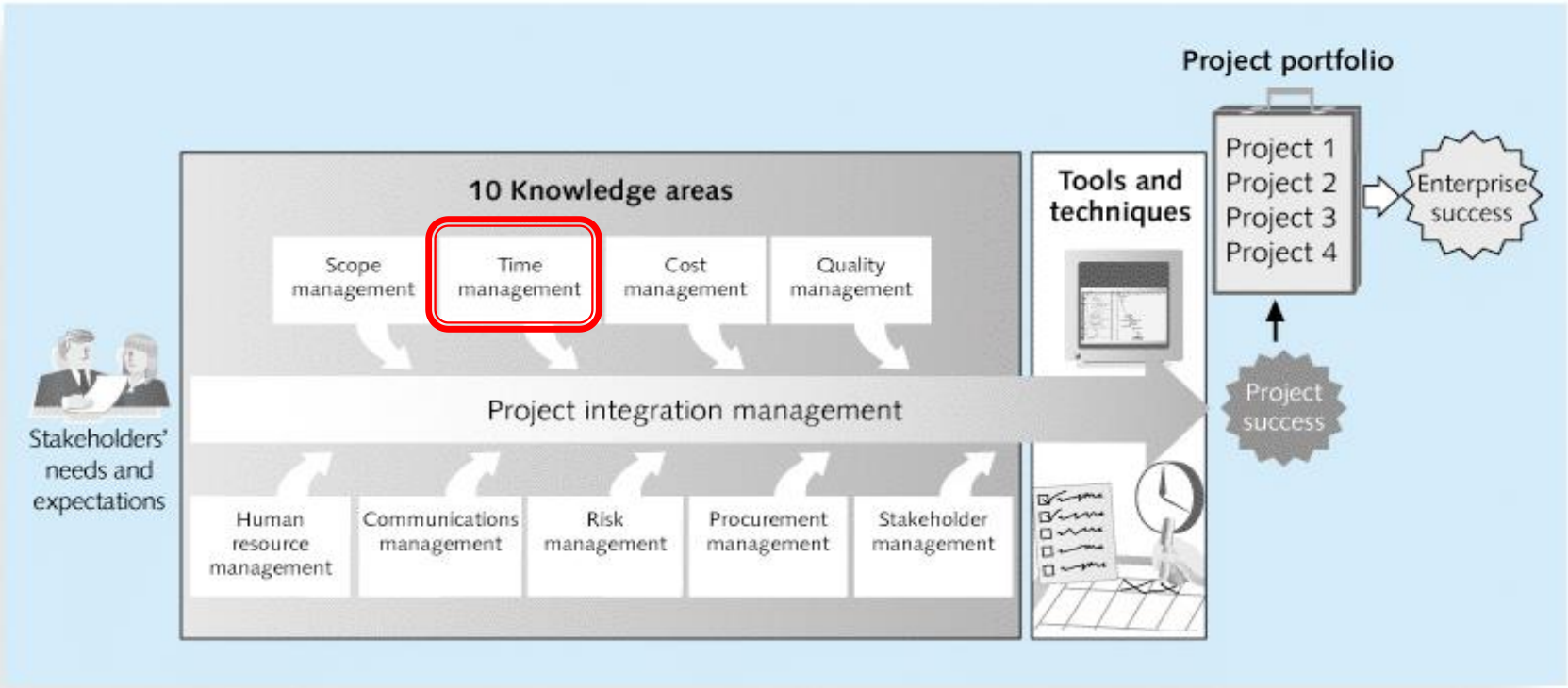

Project portfolio
Project 1
Project 2
Project 3
Project 4
Enterprise success
10 Knowledge areas
Scope management
Time management
Cost management
Quality management
Tools and techniques
Project integration management
Project success
Stakeholders' needs and expectations
Human resource management
Communications management
Risk management
Procurement management
Stakeholder management

Learning Objectives

- Understand the importance of project schedules and good project time management
- Discuss the process of planning schedule management
- Understand the relationship between estimating resources and project schedules
- Explain how various tools and techniques help project managers perform activity duration estimates

Learning Objectives

- Learning some methods for planning and tracking schedule information such as Gantt, PERT, Network Diagram,
- Discuss how reality checks and discipline are involved in controlling and managing changes to the project schedule
- Describe how project management software can assist in project time management.

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

Project Time Management Processes

- **6.1.Planning schedule management:** determining the policies, procedures, and documentation that will be used for planning, executing, and controlling the project schedule
- **6.2.Defining activities:** identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables

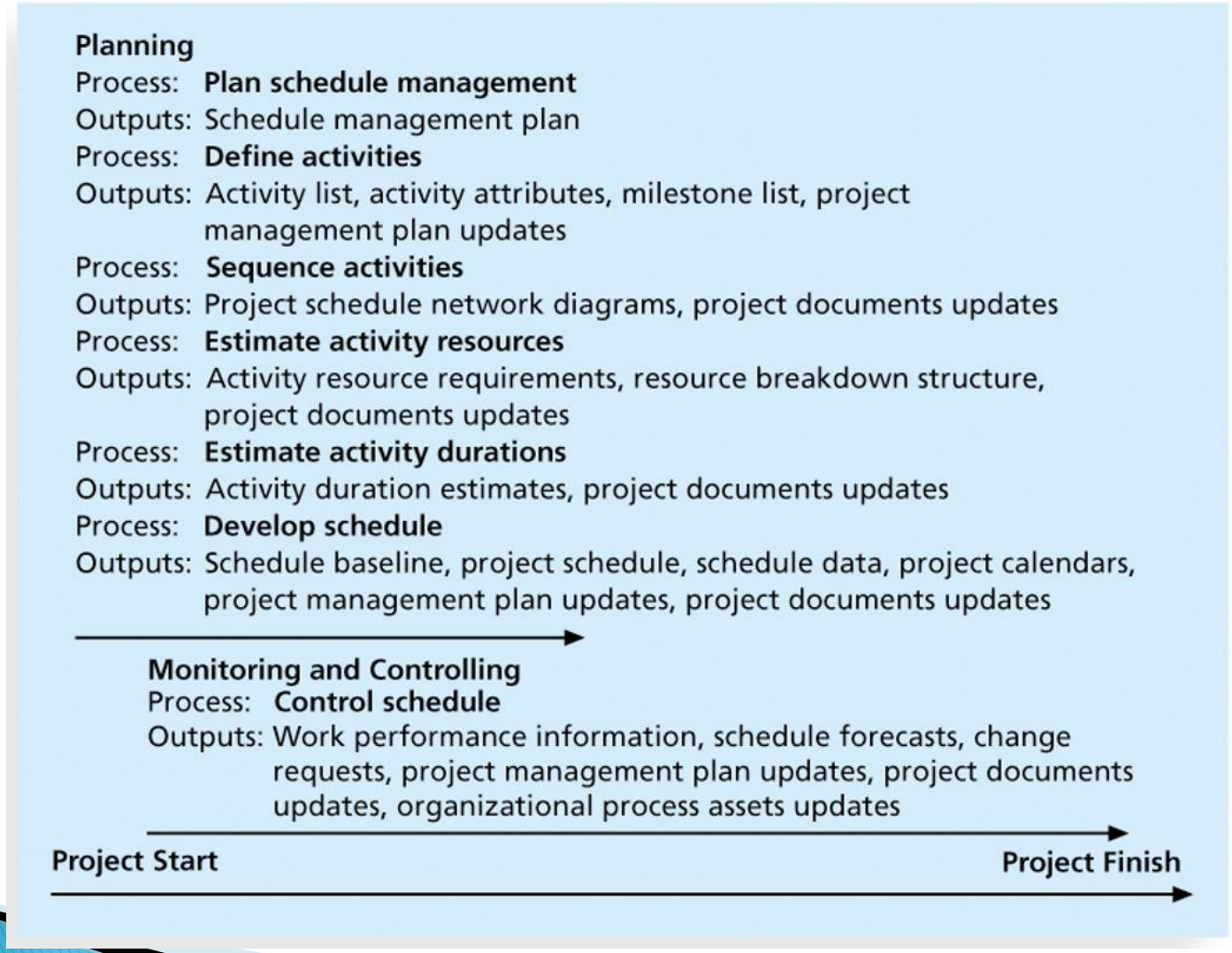
Project Time Management Processes

- **6.3.Sequencing activities:** identifying and documenting the relationships between project activities
- **6.4.Estimating activity resources:** estimating how many **resources** a project team should use to perform project activities
- **6.5.Estimating activity durations:** estimating the number of work periods that are needed to complete individual activities

Project Time Management Processes

- **6.6.Developing the schedule:** analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule
- **6.7.Controlling the schedule:** controlling and managing changes to the project schedule

Figure 6-1. Project Time Management Summary



6.1.Planning Schedule Management

- The project team uses expert judgment, analytical techniques, and meetings to develop the schedule management plan
- A schedule management plan includes:
  - Project schedule model development
  - The scheduling methodology
  - Level of accuracy and units of measure
  - Rules of performance measurement
  - Reporting formats
  - Process descriptions

6.2.Defining 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

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

Milestones

- 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 include obtaining customer sign-off on key documents or completion of specific products

6.3.Sequencing Activities

- Involves reviewing activities and determining dependencies
- A **dependency** or **relationship** is the sequencing of project activities or tasks
- You *must* determine dependencies in order to use critical path analysis

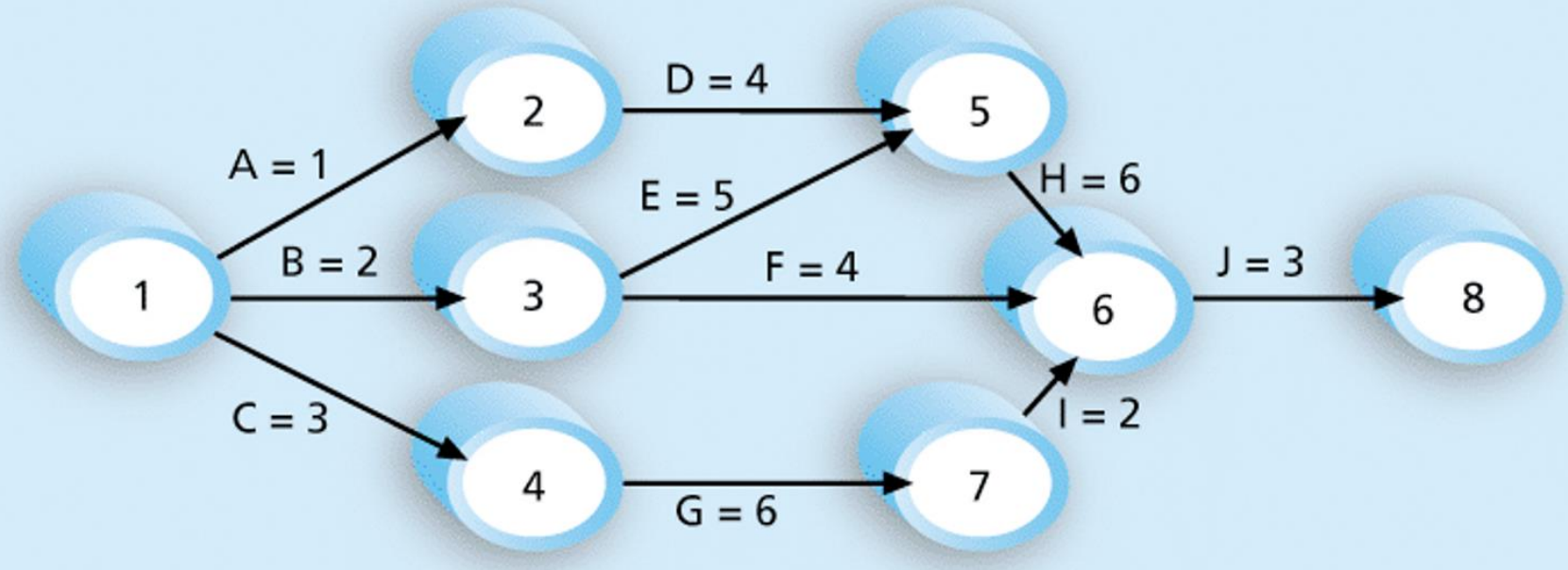
Three types of Dependencies

- **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
- The tools are used to define the type of dependencies: **network diagrams** and **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:
  - the **arrow** diagramming method - ADM
  - and **precedence** diagramming method - PDM

Figure 6-2. Network Diagram for Project X



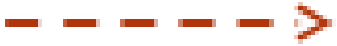
Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

Arrow Diagramming Method (ADM)

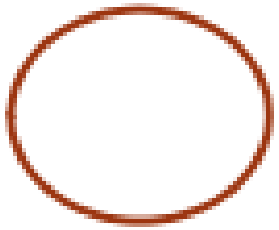
- Also called activity-on-arrow (AOA) network diagrams
- Activities are represented by arrows
- Nodes or circles are the starting and ending points of activities
  - **Starting Value < ending value**
- Can only show finish-to-start dependencies

Process for Creating AOA Diagrams

- Activity or Task



- Virtual Activity (relationship)

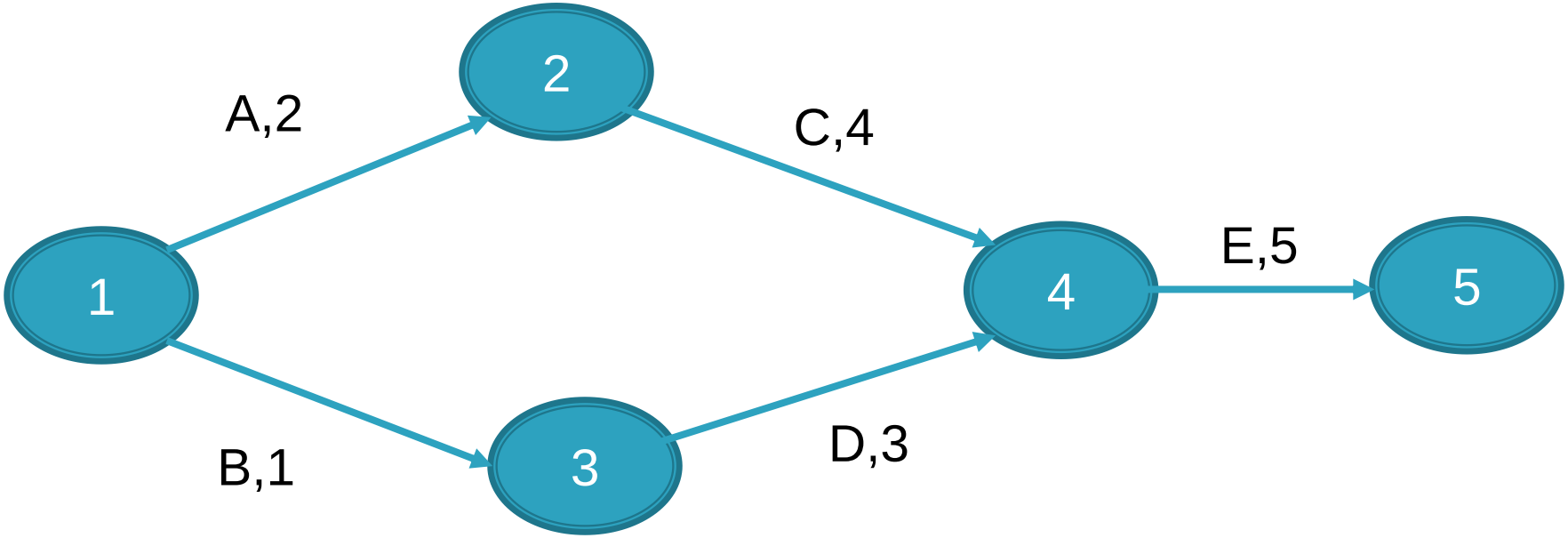


- The starting and ending points of activities

Process for Creating AOA Diagrams

No	Task	Predecessors	Duration
1	A	-	2
2	B	-	1
3	C	A	3
4	D	B	4
5	E	C,D	5

Process for Creating AOA Diagrams



Excersise

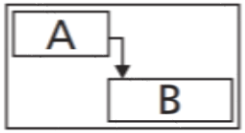
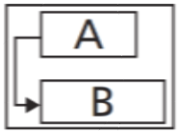
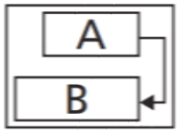
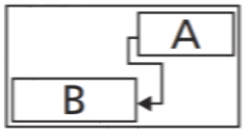
Task	Pre	Duration
A		1
B		5
C		6
D		4
E	A	4
F	B	3
G	C	3
H	D	4
I	E, F	2

Task	Pre	Duration
K	G,I	2
M	I	6
L	I	3
N	K	2
O	L,N	1
P	G,I,H	2
Q	G,I,H	3
R	O,P	2
S	R,Q	1

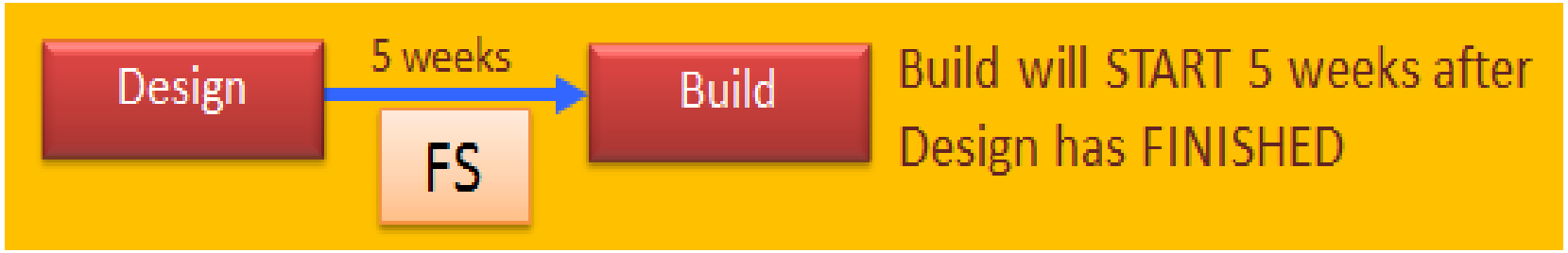
Precedence Diagramming Method (PDM)

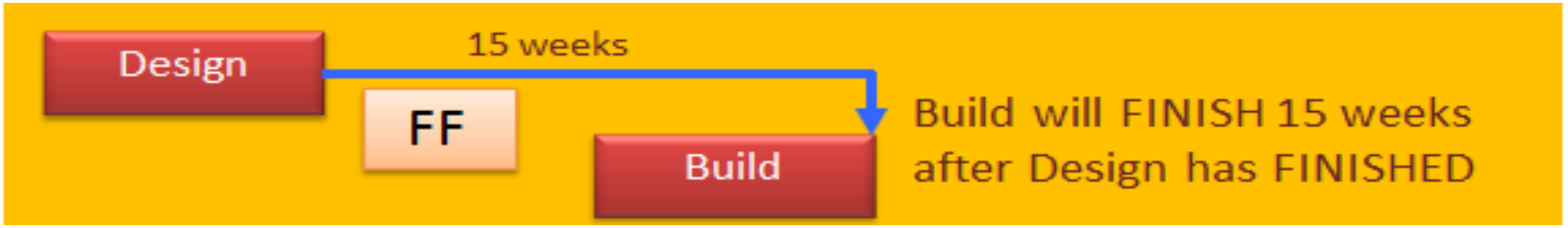
- Activities are represented by boxes
- Arrows show relationships between activities
- More popular than ADM method and used by project management software
- Better at showing different types of dependencies

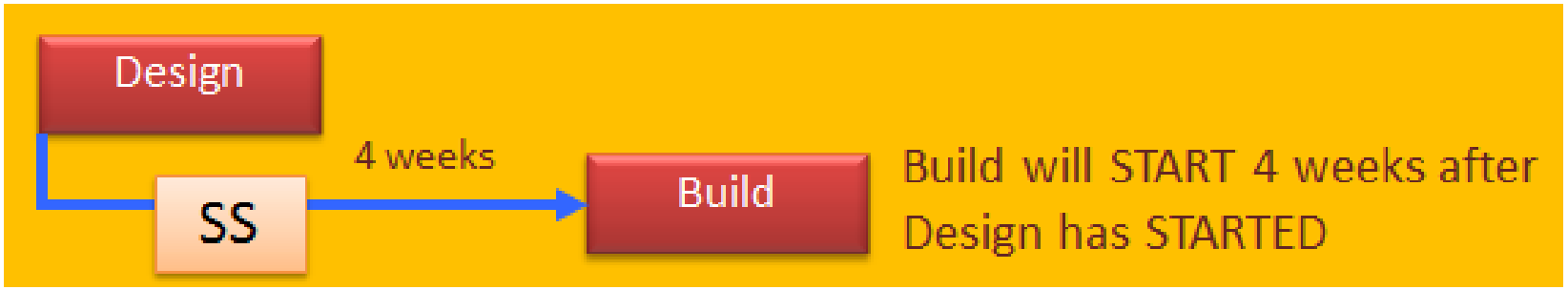
Figure 6-3. Task Dependency Types

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.

Task Dependency Types






Design
SS
4 weeks
Build
Build will START 4 weeks after
Design has STARTED

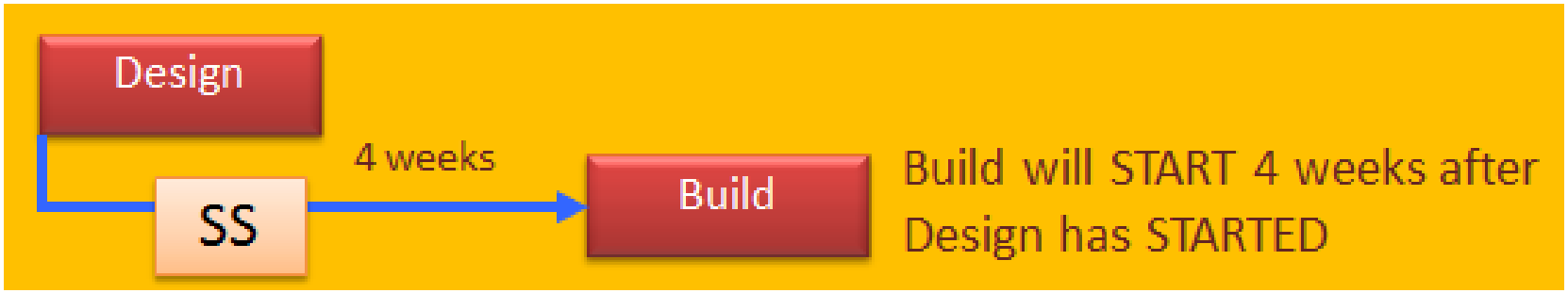
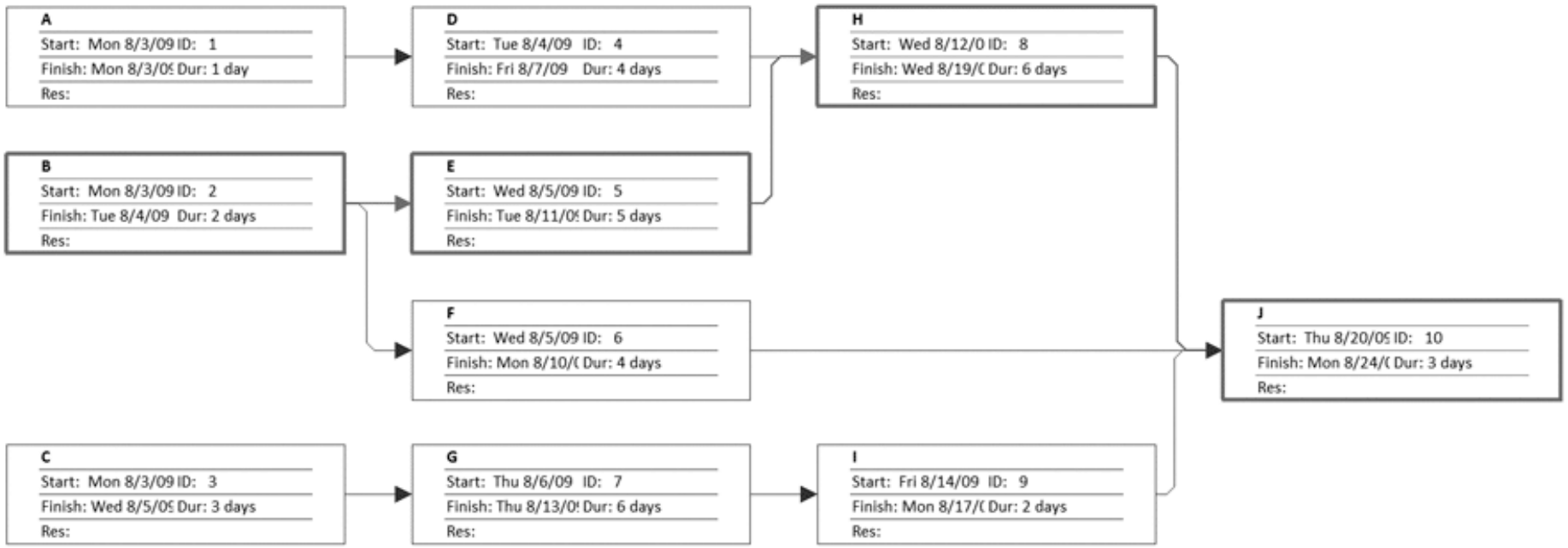

Design
SS
4 weeks
Build
Build will START 4 weeks after
Design has STARTED

Figure 6-4. Sample PDM Network Diagram



6.4.Estimating 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 (Later)
- A **resource breakdown structure** is a hierarchical structure that identifies the project's resources by category and type

6.5.Activity Duration Estimating

- **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
- Effort does **not normally equal** duration
- People doing the work should help create estimates, and an expert should review them

Three-Point Estimates

- 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

6.6.Developing the 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,
  - Critical chain scheduling,
  - PERT analysis

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:
  - A black diamond: a milestones
  - Thick black bars: summary tasks
  - Lighter horizontal bars: durations of tasks
  - Arrows: dependencies between tasks

Figure 6-5. Gantt Chart for Project X

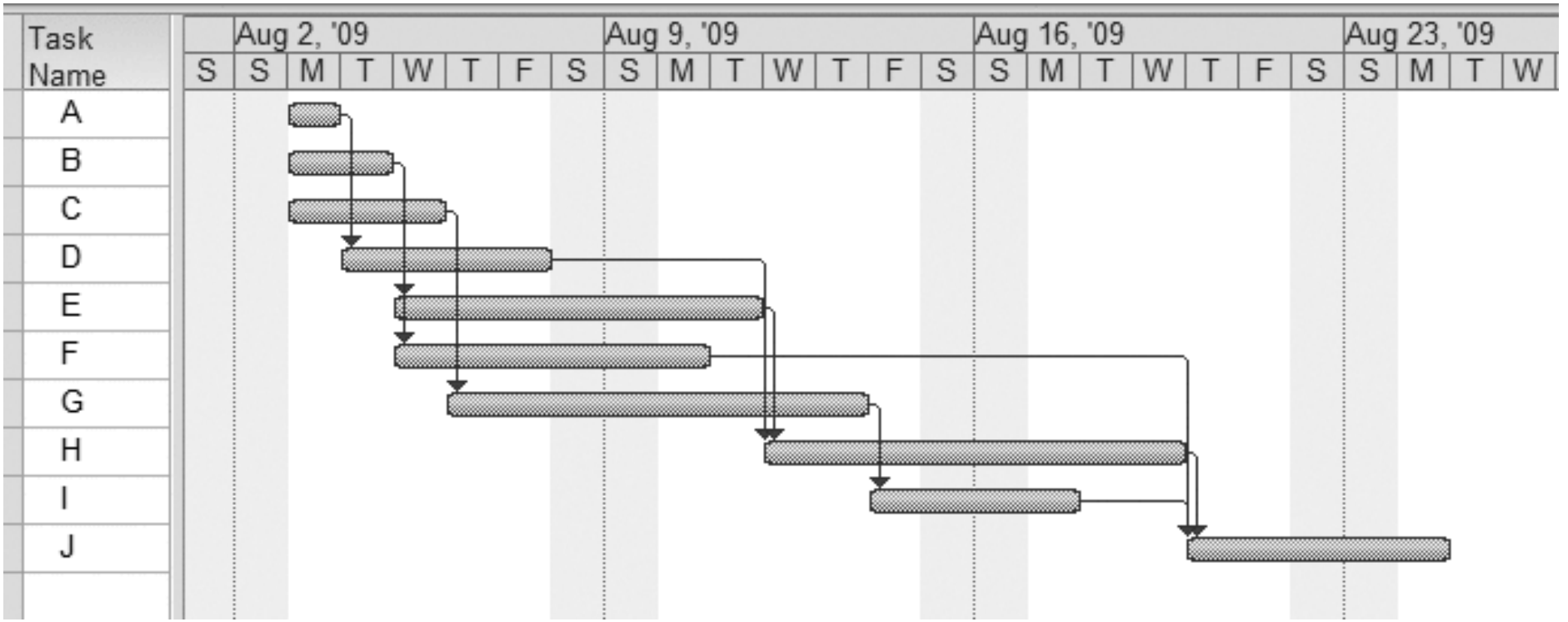
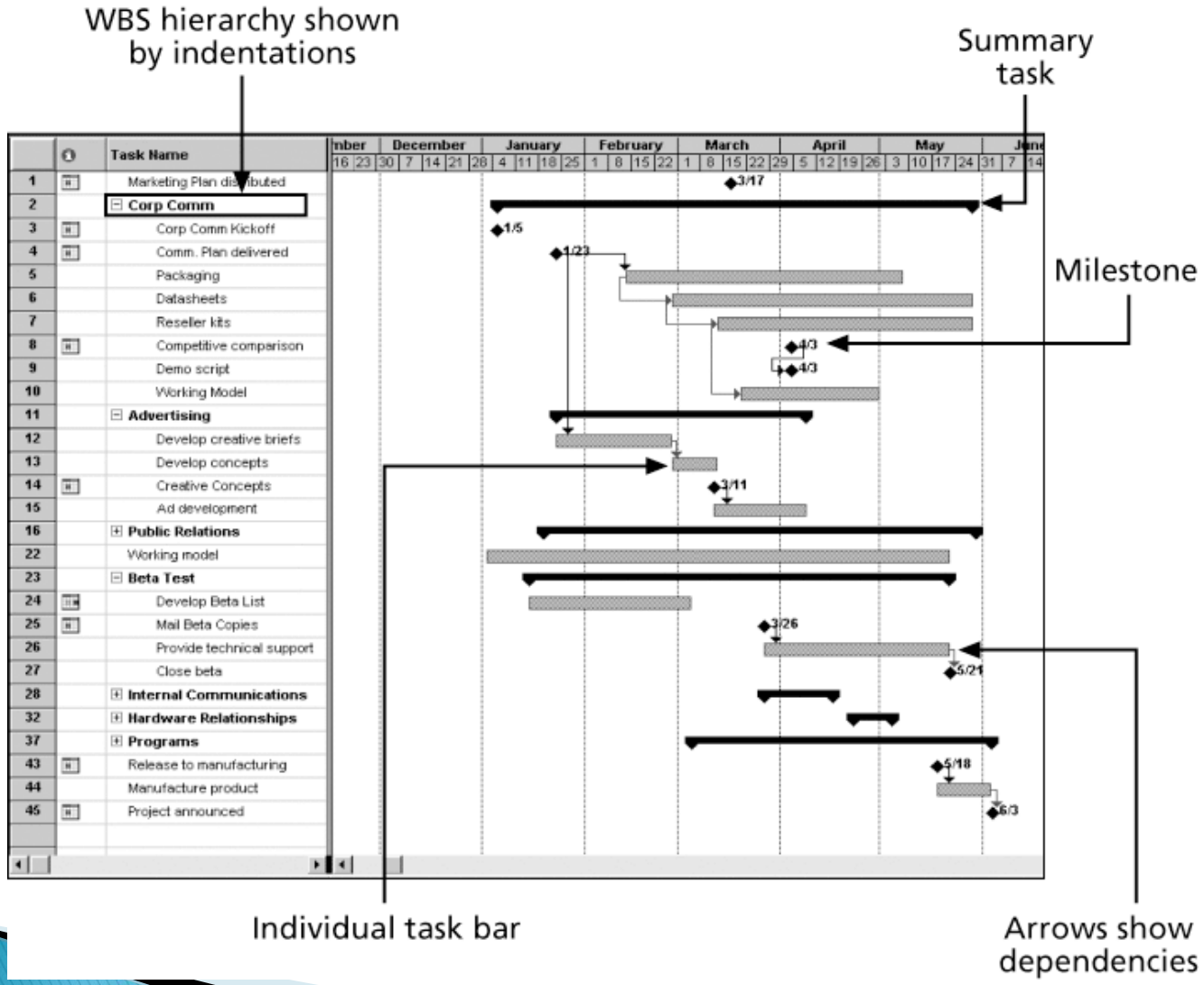


Figure 6-6. Gantt Chart for Software Launch Project



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
- Normally create milestone by entering tasks with a zero duration, or you can mark any task as a milestone

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

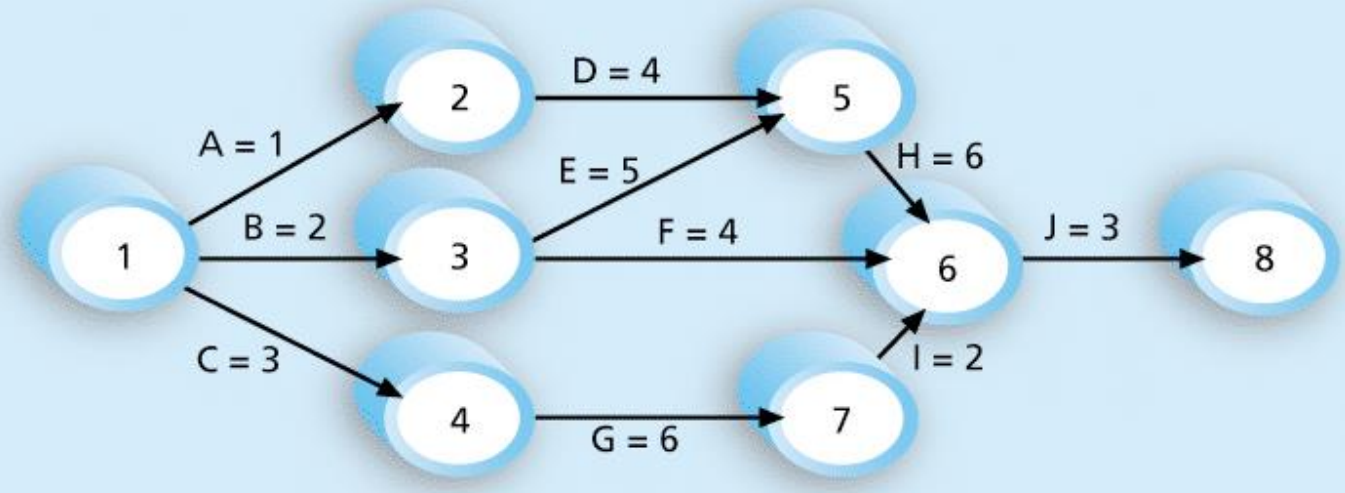
Calculating the Critical Path

- **Slack** or **float** is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date
- Develop a good network diagram (ADM or PDM)
- Add the duration estimates for all activities on each path through the network diagram
- The ***longest path*** is the ***critical path***

Determining the Critical Path for Project X

No	Task	Pre-Activities	Duration
1	A	-	1
2	B	-	2
3	C	-	3
4	D	A	4
5	E	B	5
6	F	B	4
7	G	C	6
8	H	D,E	6
9	I	G	2
10	J	H,F,G	3

ADM

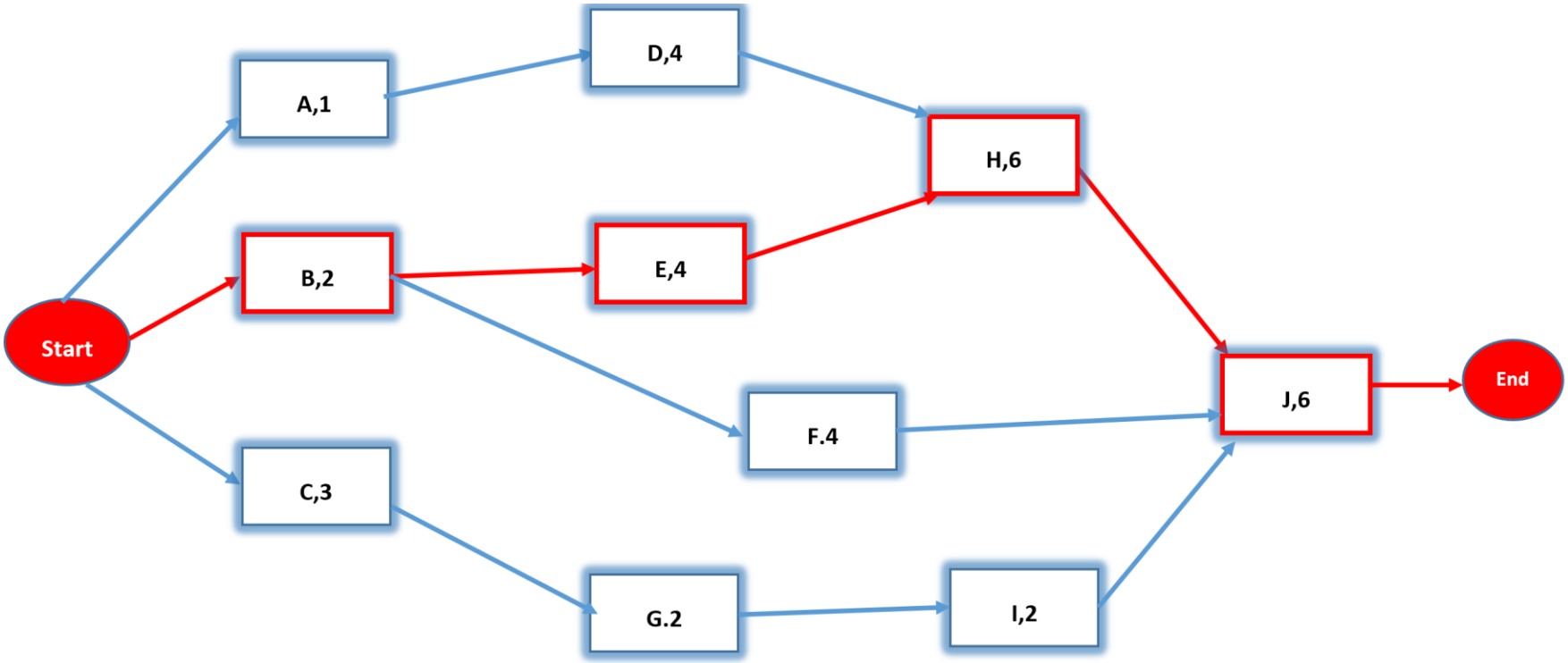


Note: Assume all durations are in days.

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.

PDM



Ex 1:

No	Task	Pre-Tasks	Duration
1	A	-	3
2	B	-	4
3	C	A	4
4	D	A	5
5	E	A	2
6	F	C	3
7	G	B	2
8	H	C,D,E	7
9	I	H,G	6
10	K	F,I	3

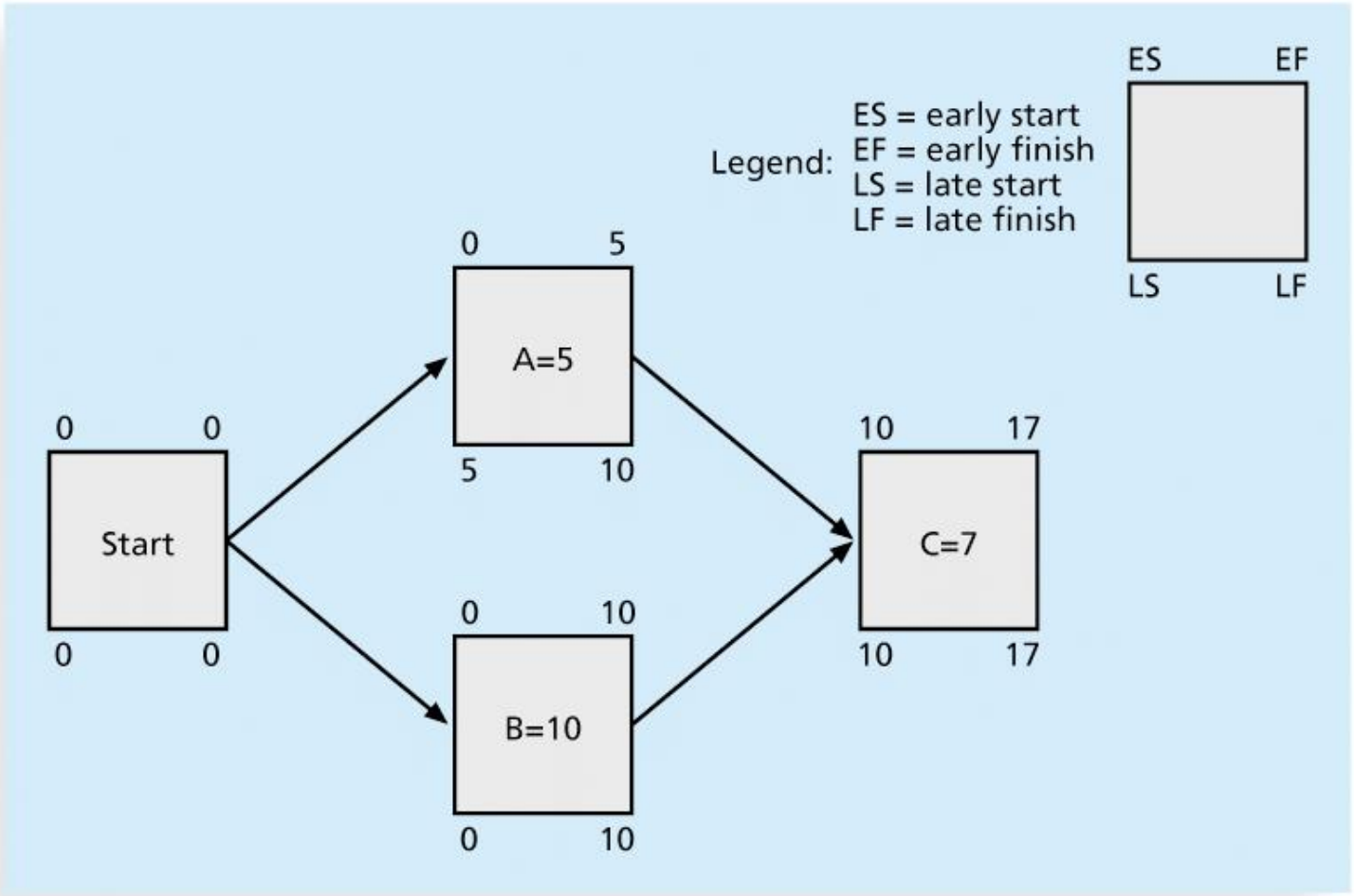
Ex 2

No	Task	Duration	Pre-Tasks
1	A	-	2
2	B	-	3
3	C	A	3
4	D	A	4
5	E	B	3
6	F	C	5
7	G	E, F	2
8	H	D, G	3

Using Critical Path Analysis to Make Schedule Trade-offs

- **Free slack** or **free float** is the amount of time an activity can be delayed without delaying the early start of any immediately following activities
- **Total slack** or **total float** is the amount of time an activity may be delayed from its early start without delaying the planned project finish date
- A **forward pass** through the network diagram determines the early start and finish dates
- A **backward pass** determines the late start and finish dates

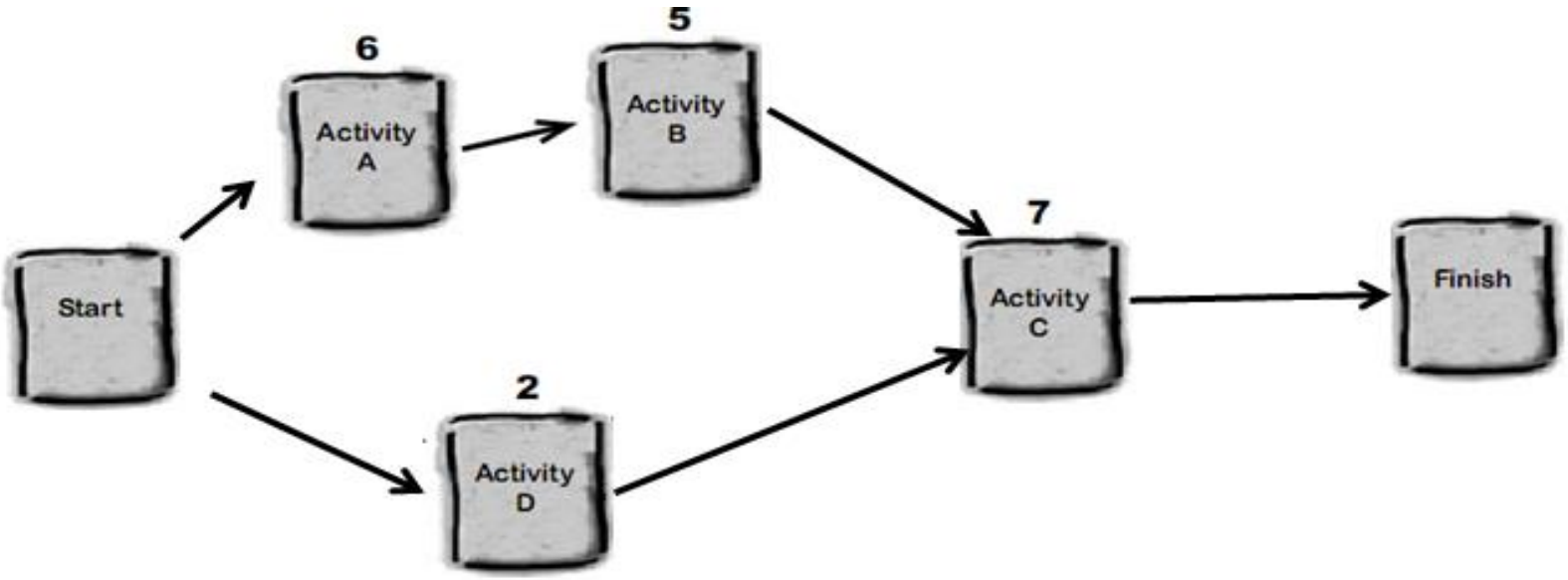
Calculating Early and Late Start and Finish Dates



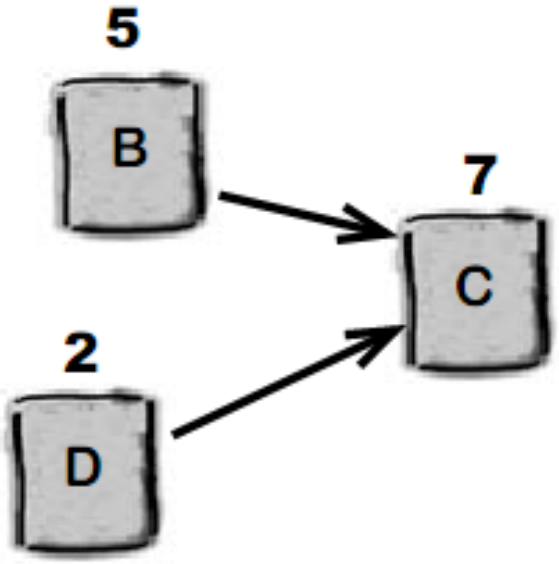
Formular to calculate ES, EF, LS, LF

- A **forward pass**: **ES, EF**
- The First Activity:
  - **ES=1**
  - **EF= ES + duration -1**
- The Next Activity
  - **ES=EF (previous Actiivity) +1**

Example: ES, EF at the first Activity



- CP = ABC = 6+5+7 =18
- Activity A (1st) : ES = 1, EF = 1 + 6 - 1 = 6
- Activity D (1st): ES = 1, EF = 1 + 2 - 1 = 2
- Activity B (previous A): ES = $EF_{(A)}$ + 1 = 6+1=7, EF=7+5-1=11



Activity C (previous B and D)

At B: ES = 7, EF = 11

At D: ES =1, EF = 2

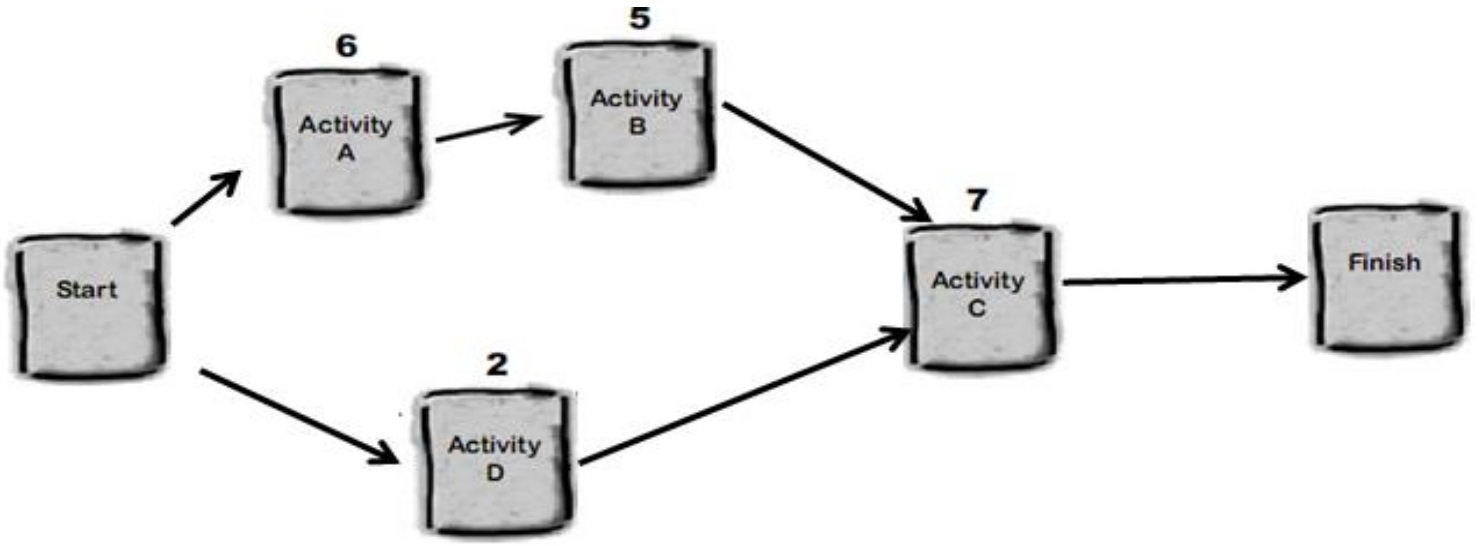
$EF_{(B)} = 11 > EF_{(D)} = 2$ ➔ choose $EF_{(B)} = ES_{(C)} = 11$

At C: ES = 11 + 1 = 12, EF = 12 + 7 – 1 = 18

Formular to calculate ES, EF, LS, LF

- A **backward pass**: **LS, LF**
- The Last Activity:
  - **LF = EF = Total Duration (CP)**
  - **LS = LF - duration + 1**
- The Previous Activity
  - **LF = LS (next Actiivity) – 1**
  - **LS = LF - duration + 1**

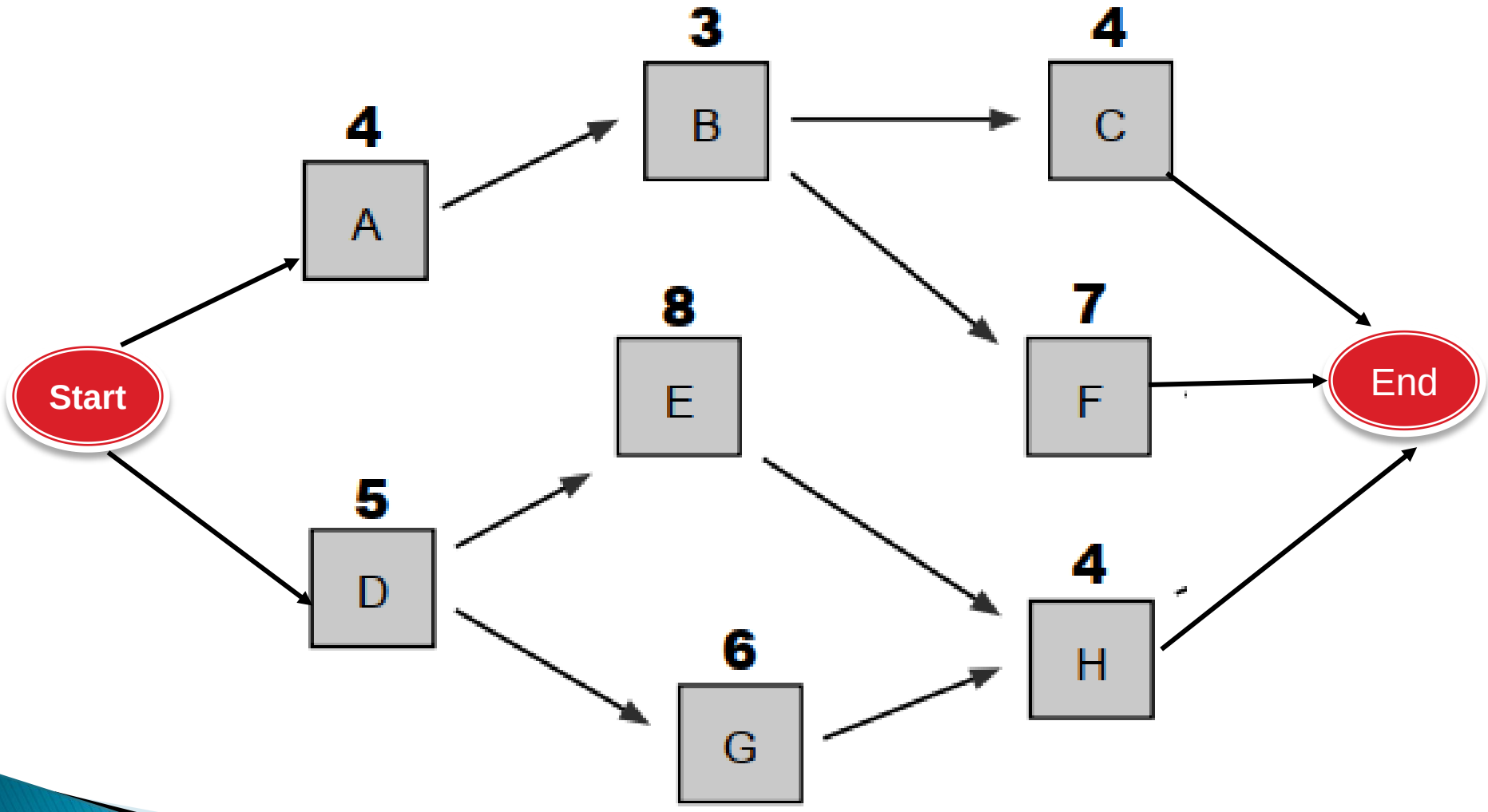
Example: LF, LS at last activity



- **CP = ABC = 6+5+7 =18**
- Activity C (last) : LF = EF = CP = 18, LS = 18-7+1=12
- Activity B(next C): LF= 12-1=11, LS = 11-5+1=7
- Activity D(next C): LF= 12-1=11, LS = 11-2+1=10
- Activity A(next B): LF=7-1=6, LS=6-6+1=1

Task	Duration	Pre	ES	EF	LS	LF	Float
A	6	-	1	6	1	6	0
B	5	A	7	11	7	11	0
C	7	B,D	12	18	12	18	0
D	2	-	1	2	10	11	9

Practice 1:



Practice 2: Calcutate ES, EF, LS,LF

No	Task	Pre Tasks	Duration	ES	EF	LS	LF
1	A		5				
2	B		6				
3	C	A	4				
4	D	A	5				
5	E	B,D	5				
6	F	C	10				
7	G	E, F, A	4				
8	H	G	5				

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

6.7.Controlling the 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
- Tools and techniques include
  - Progress reports
  - A schedule change control system
  - Project management software, including schedule comparison charts like the tracking Gantt chart
  - Variance analysis, such as analyzing float or slack

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

Chapter 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

Exsercies: ES, EF, LS, LF ?

- Ex1:

No	Task	Duration	Pre - Task
1	A	10	-
2	B	8	A
3	C	12	A
4	D	15	A
5	E	21	B,C
6	F	12	D
7	G	8	D
8	H	6	E,F,G
9	I	9	H
10	K	15	I,E

- Ex 2

No	Task	Duration	Pre - Task
1	A	15	-
2	B	22	-
3	C	11	A,B
4	D	31	A
5	E	12	C
6	F	34	C
7	G	22	E,F,H
8	H	24	D
9	I	16	D,H
10	K	21	H,I,G
11	L	25	K
12	M	1	K,G

- Ex 3

No	Task	Duration	Pre - Task
1	A	10	-
2	B	13	A
3	C	21	B
4	D	22	B
5	E	15	A
6	F	31	E
7	G	18	E
8	H	15	C,E,F,G
9	I	22	H
10	J	24	H
11	K	17	J
12	L	20	K,G

- Ex 4

No	Task	Duration	Pre - Task
1	A	10	-
2	B	13	A
3	C	21	A
4	D	22	D
5	E	15	B,C,D
6	F	31	E
7	G	18	E
8	I	22	E
9	J	24	D
10	K	17	F,G,I,J
11	L	20	K
12	M	18	L,F