Project scheduling

Chapter 10

Lags in Precedence Relationships

The logical relationship between the start and finish of one activity and the start and finish of another activity.

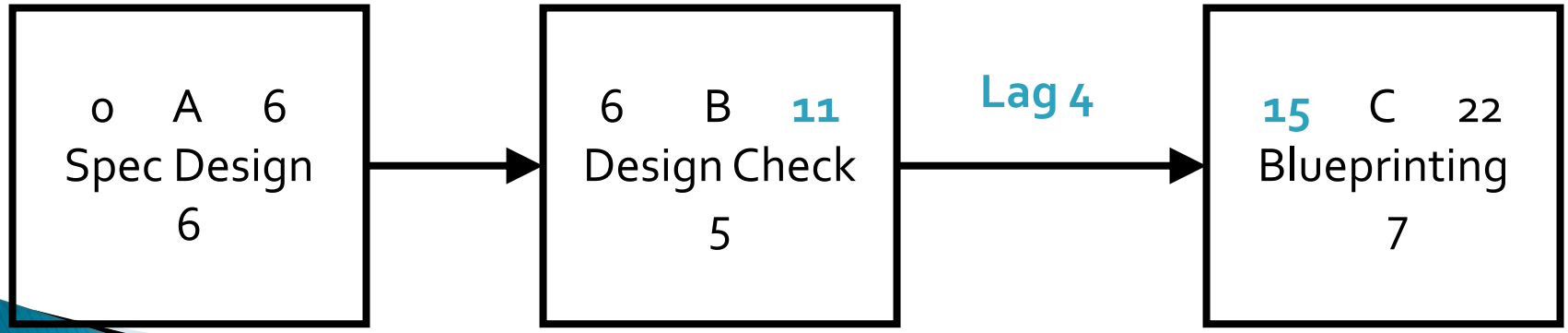
Four logical relationships between tasks:

1. Finish to Start
2. Finish to Finish
3. Start to Start
4. Start to Finish

Finish to Start Lag

- Most common type of sequencing
- Shown on the line joining the modes
  - Added during forward pass
  - Subtracted during backward pass

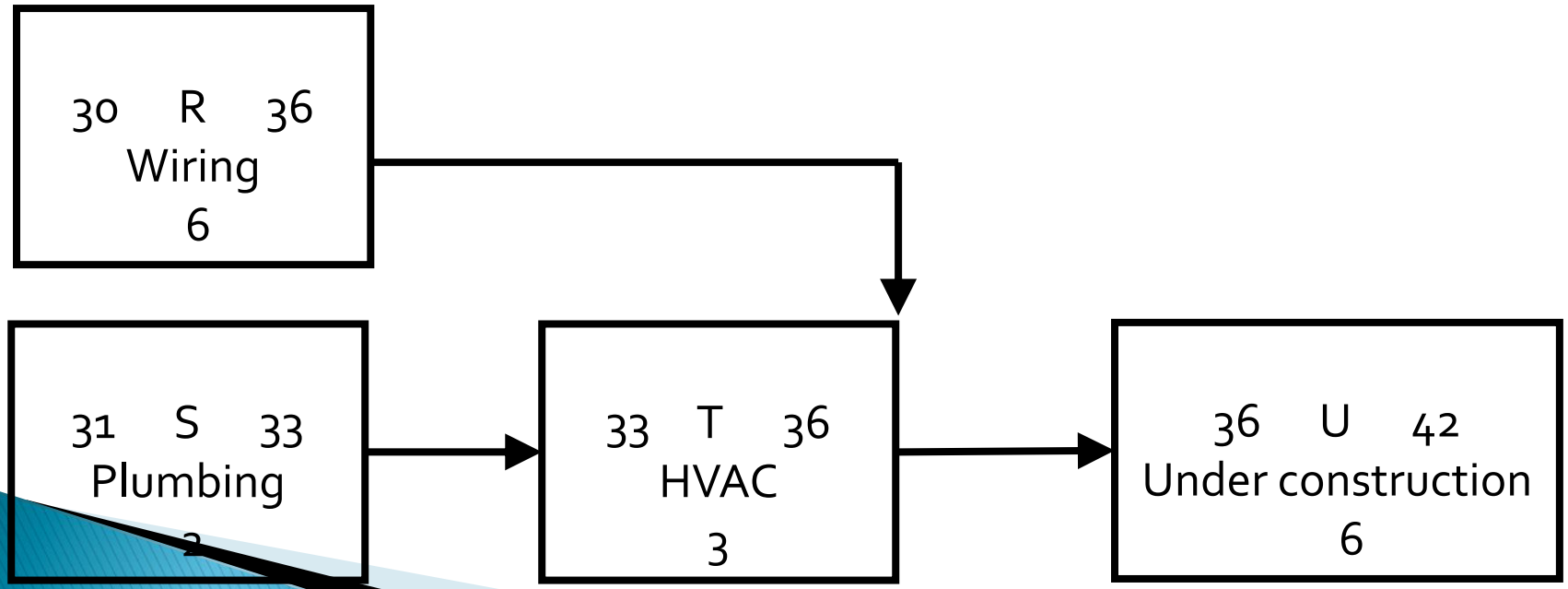
This lag is not the same as activity slack.



Finish to Finish

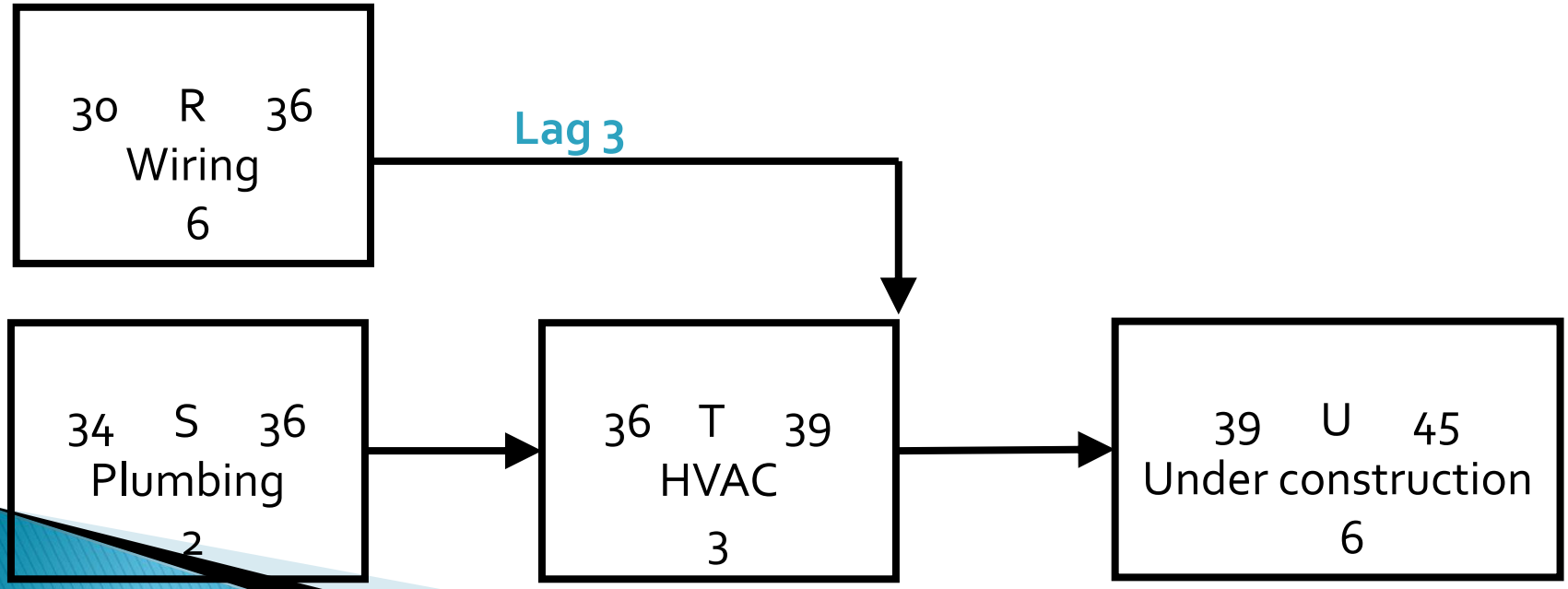
Two activities share a similar completion point (wiring and HVAC).

- The under construction cannot happen until wiring, plumbing, and HVAC installation are complete.

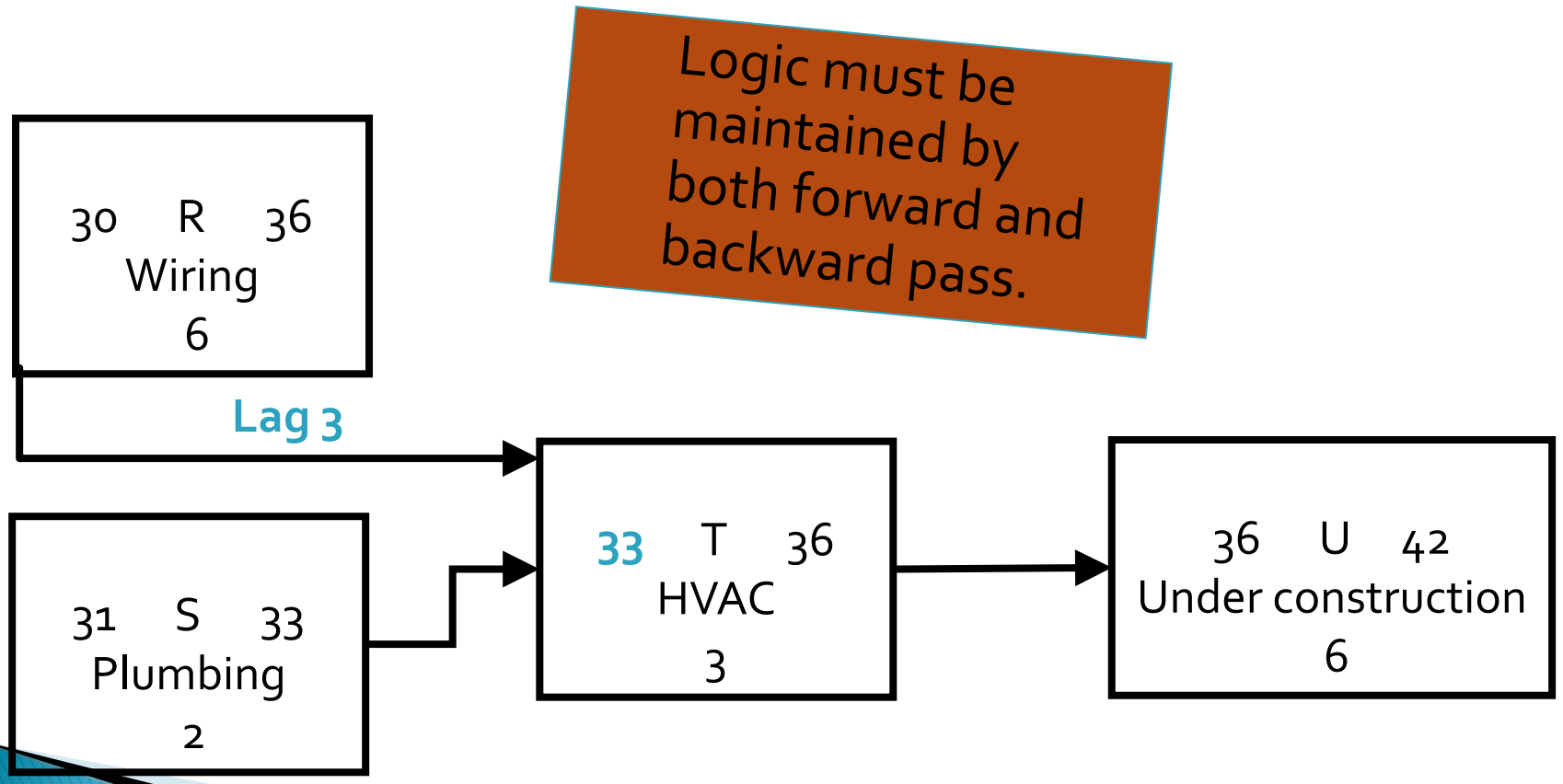


Finish to Finish Lag

It may be appropriate for two or more activities to conclude at the same time. For example, a contractor building an office complex cannot begin interior wall construction until all wiring, plumbing, and HVAC have been installed; she may include lag to ensure the completion of all preceding activities all occur at the same time.

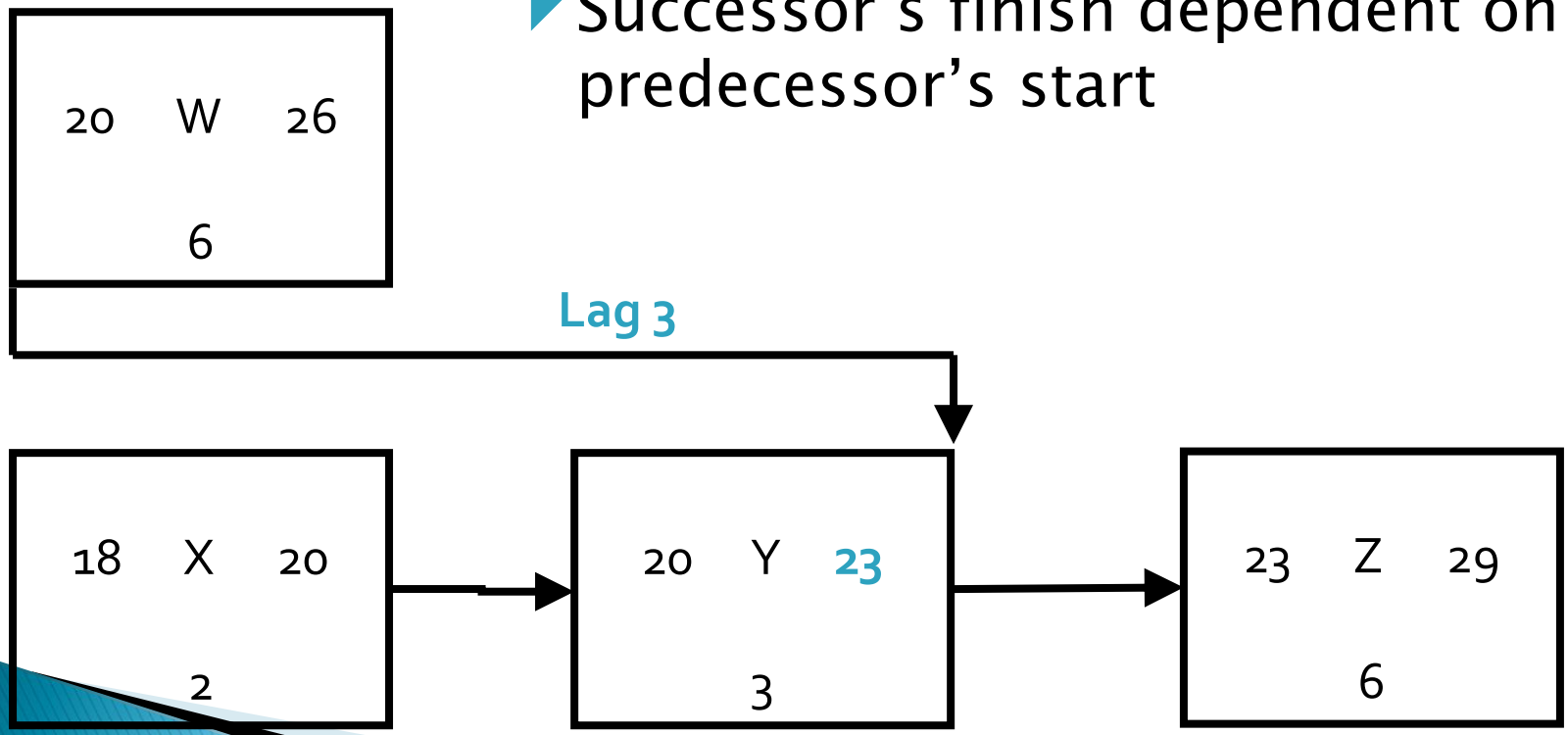


Start to Start Lag



Start to Finish Lag

- Least common type of lag relationship
- Successor's finish dependent on predecessor's start



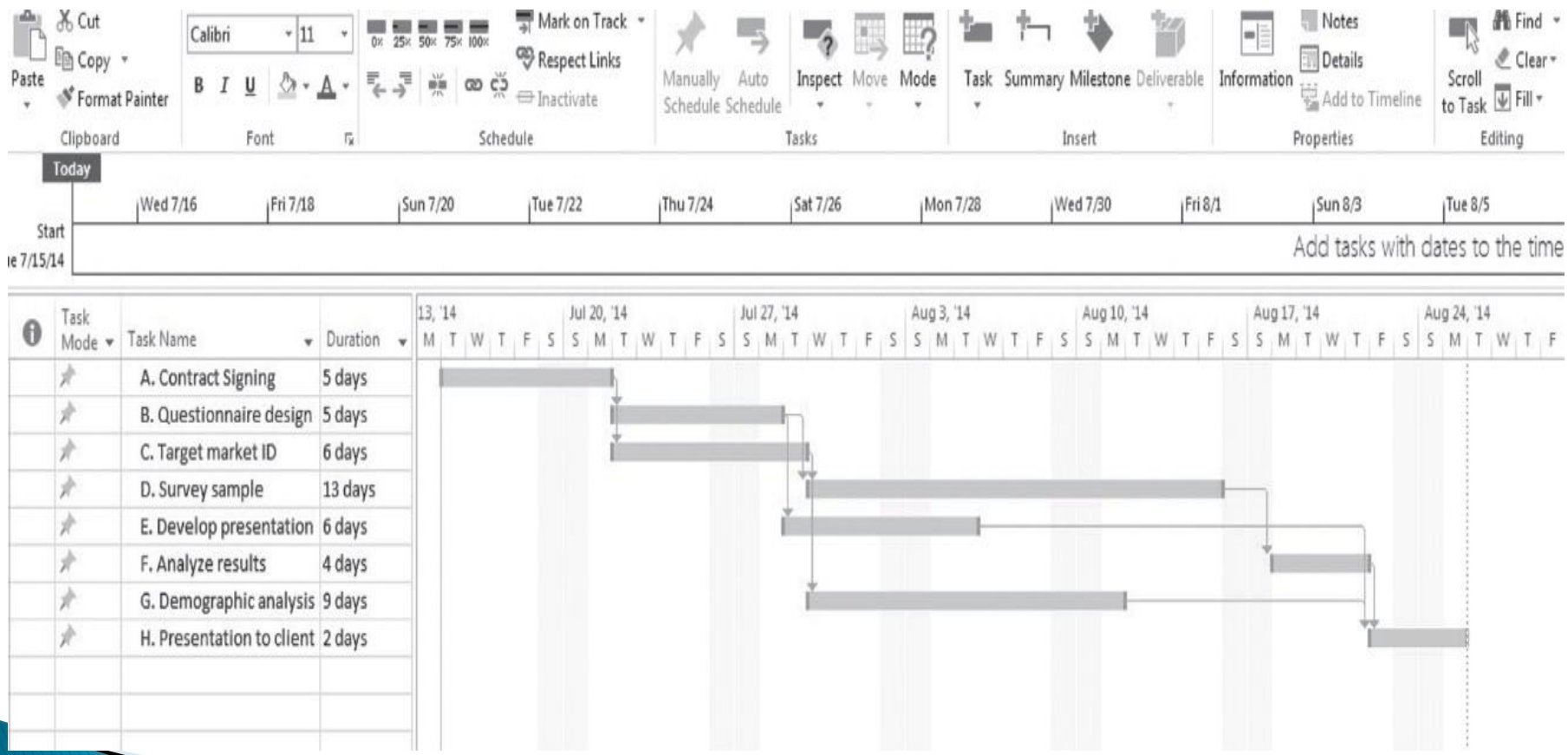
Gantt Charts

- ✓ Establish a *time-phased network*
- ✓ Can be used as a *tracking tool*

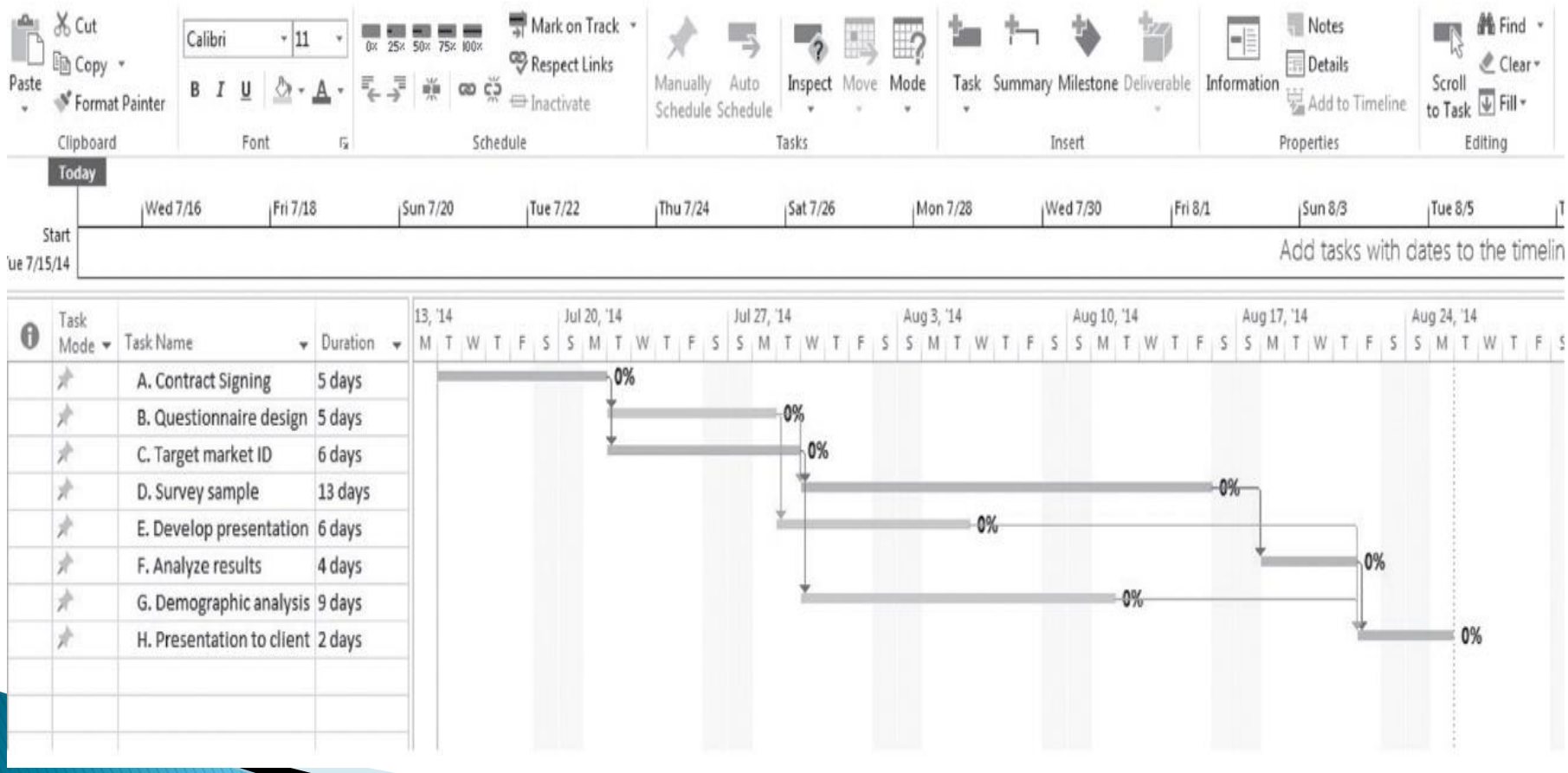
Benefits of Gantt charts

1. Easy to *comprehend*
2. Identify the schedule *baseline* network
3. Allow for *updating* and *control*
4. Identify *resource needs*
5. Easy to *create*

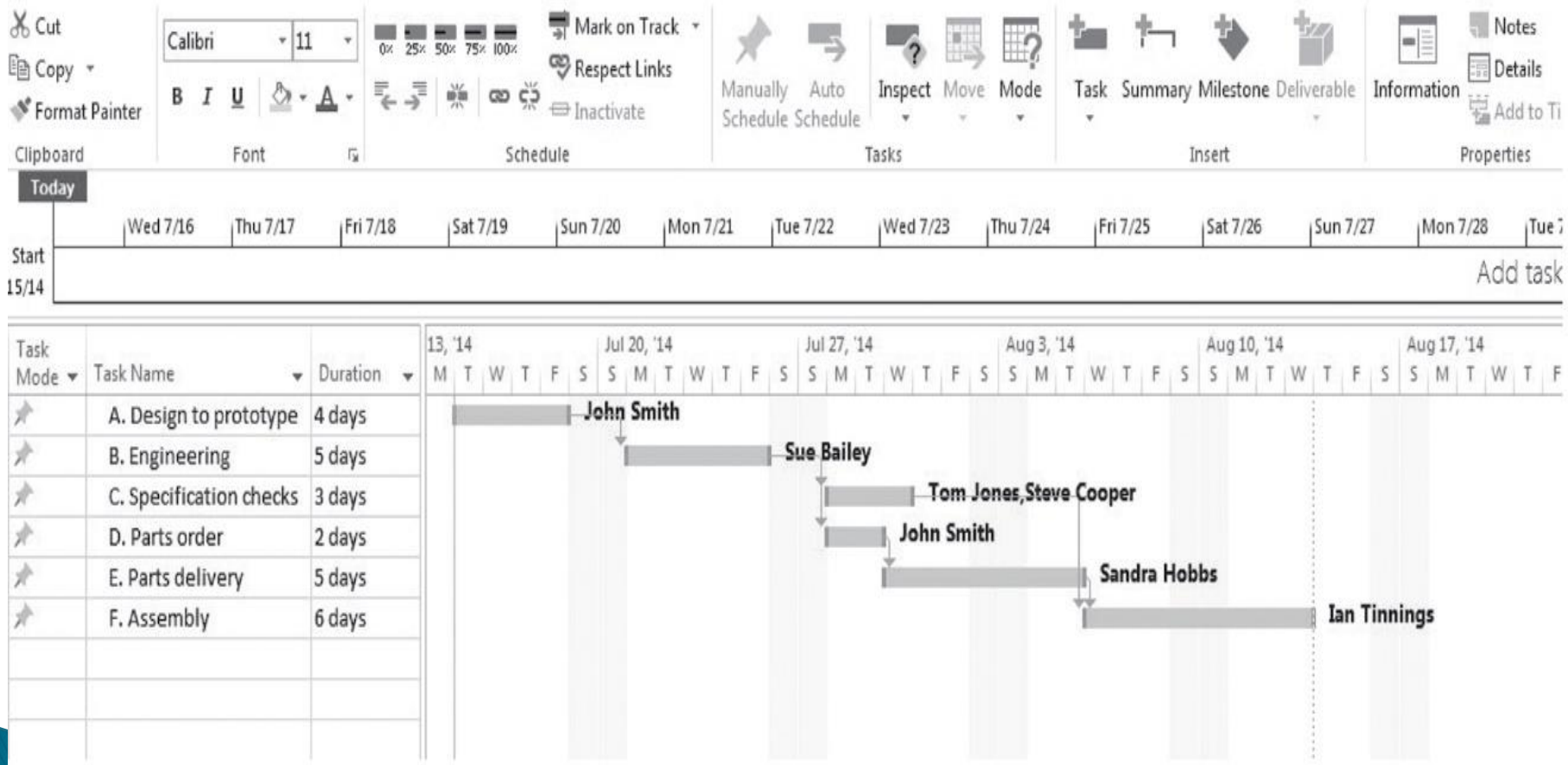
Completed Gantt Chart for Project Delta



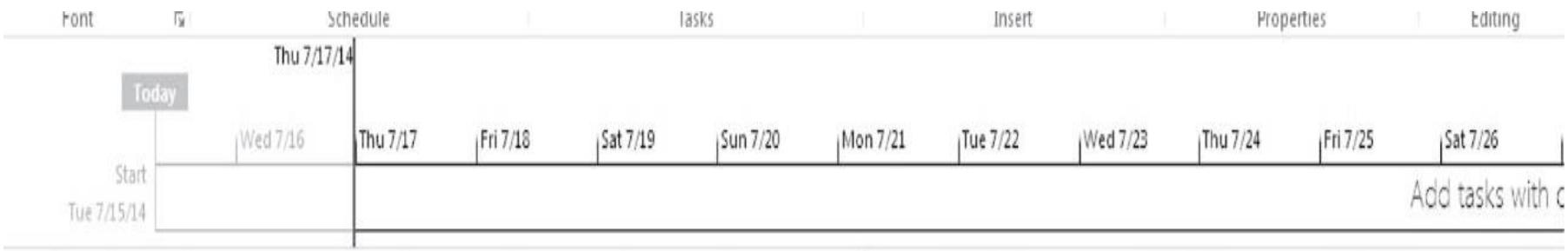
Gantt Chart for Project Delta with Critical Path Highlighted



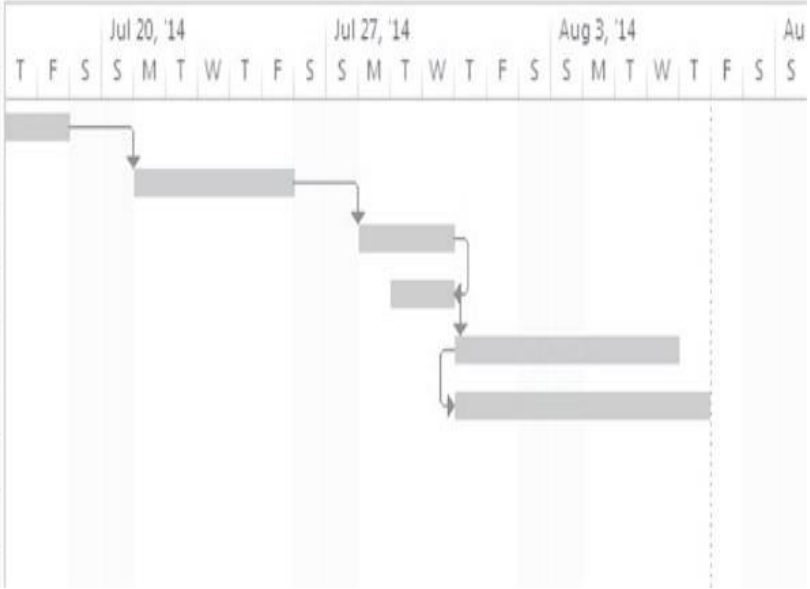
Gantt Chart with Resources Specified



Gantt Chart with Lag Relationships



	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		A. Design to prototype	4 days	Tue 7/15/14	Fri 7/18/14	
2		B. Engineering	5 days	Mon 7/21/14	Fri 7/25/14	1
3		C. Specification checks	3 days	Mon 7/28/14	Wed 7/30/14	2
4		D. Parts order	2 days	Tue 7/29/14	Wed 7/30/14	3FF
5		E. Parts delivery	5 days	Thu 7/31/14	Wed 8/6/14	4
6		F. Assembly	6 days	Thu 7/31/14	Thu 8/7/14	5SS



Crashing

The *process of accelerating* a project

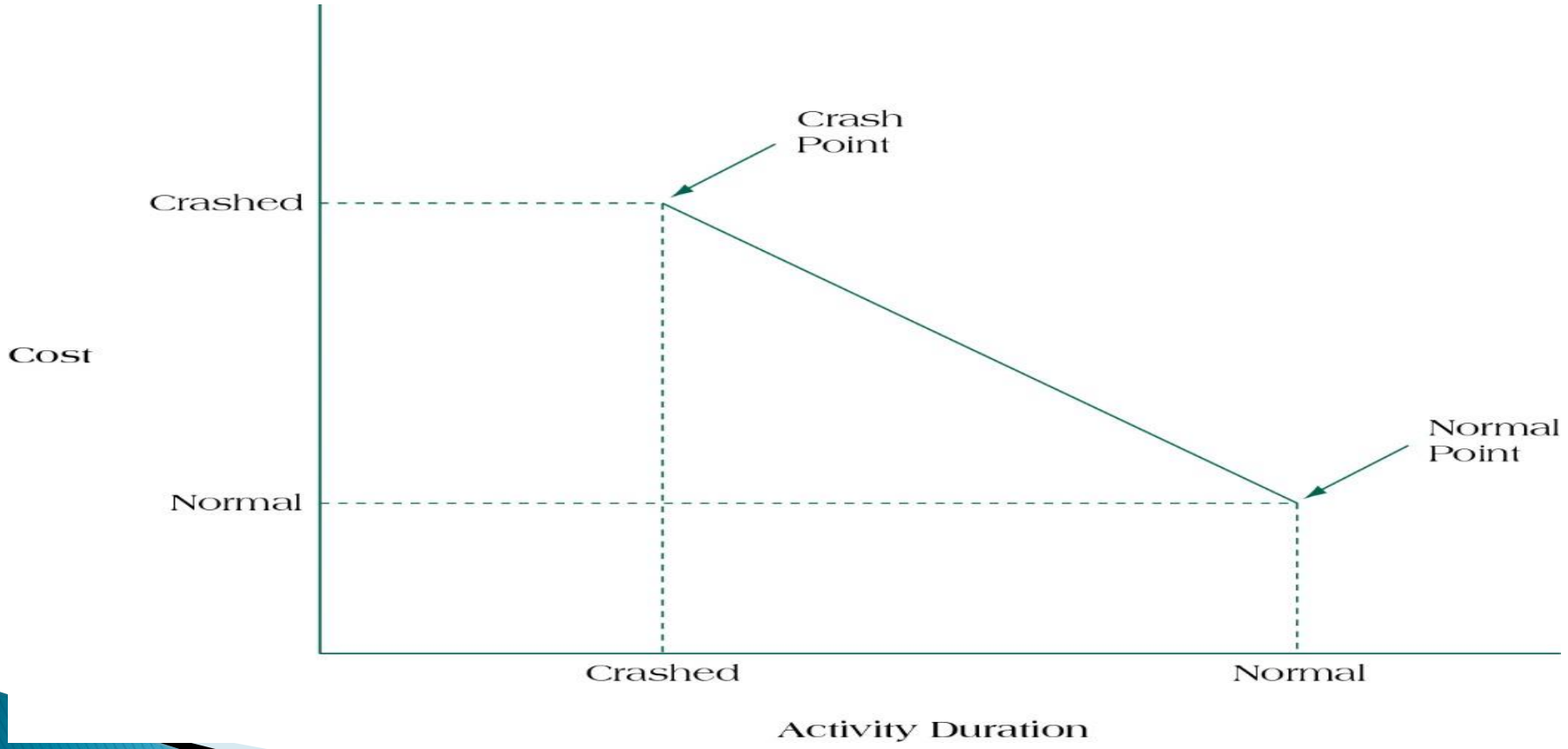
Primary methods for crashing:

1. Improving existing resources' *productivity*
2. Changing work *methods*
3. Compromise *quality* and/or reduce *project scope*
4. Institute *fast-tracking*
5. Work *overtime*
6. Increasing the *quantity* of resources

Crash process

- Determine activity **fixed and variable costs**
- The **crash point** is the fully expedited activity
- Optimize **time-cost tradeoffs**
- Shorten activities on the **critical path**
- Cease crashing when:
  - the **target completion time** is reached
  - the **crashing cost exceeds the penalty cost**

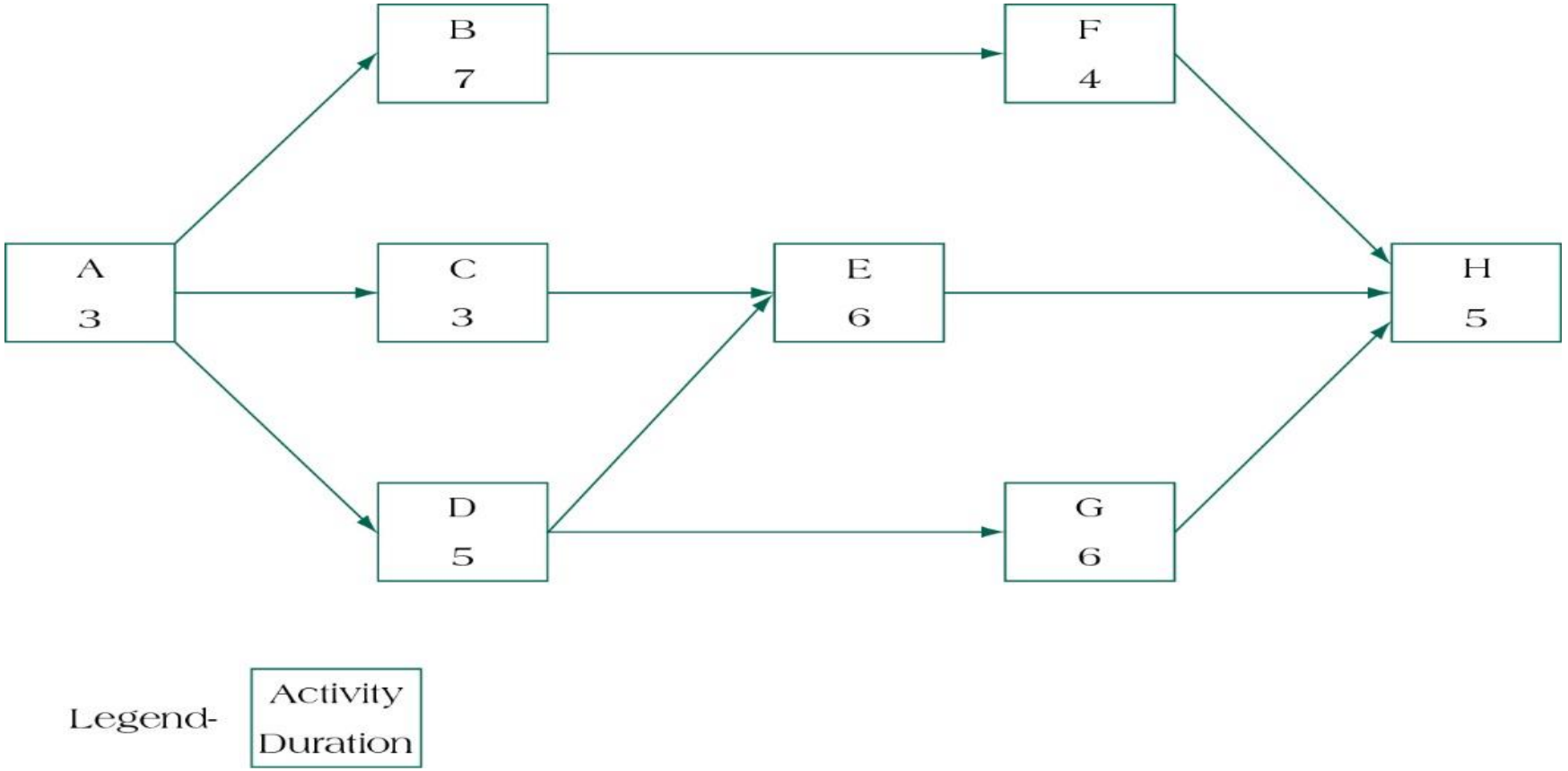
Time/cost trade-offs for crashing activities



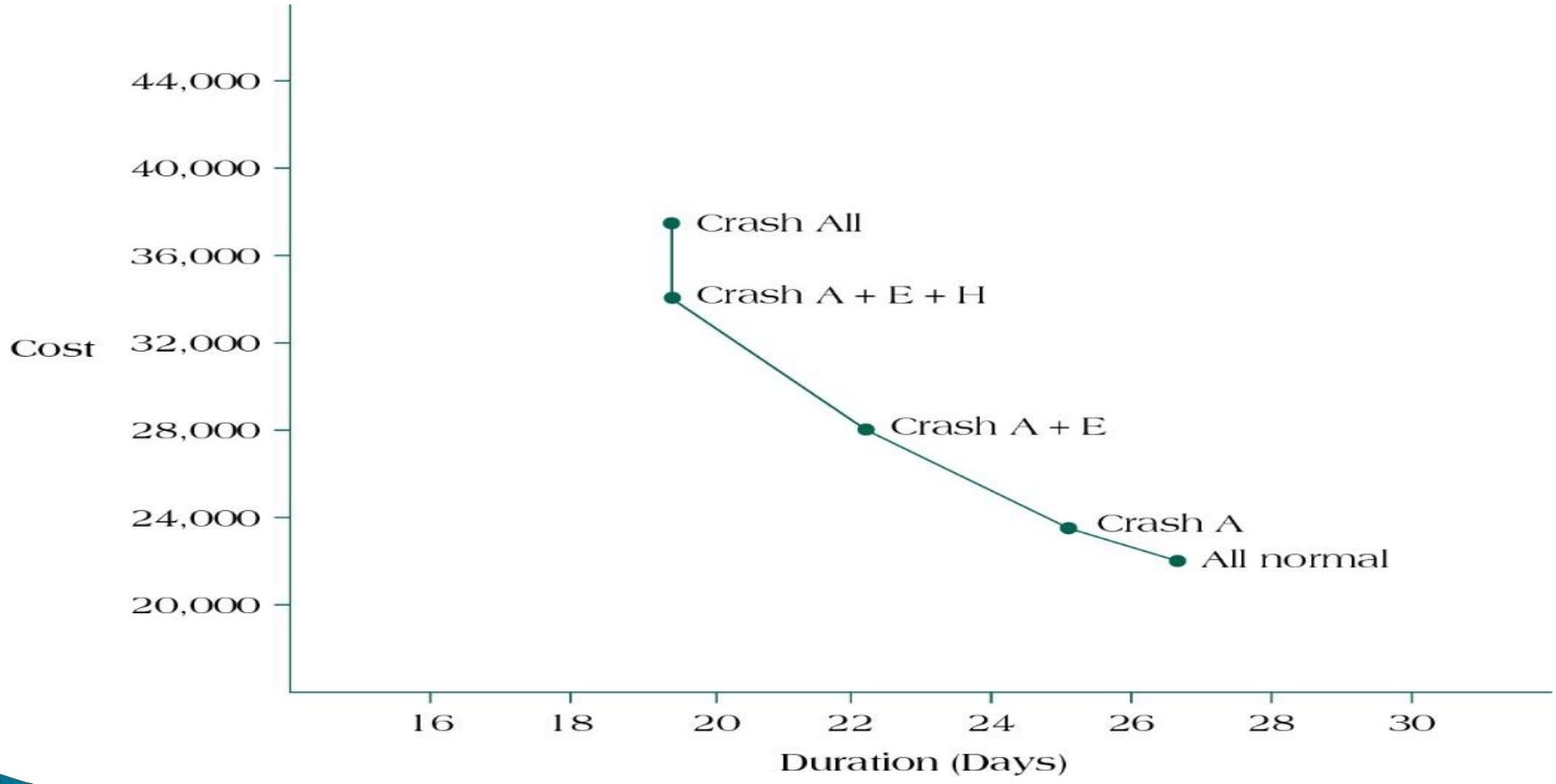
Project Activities and Costs

		Normal		Crashed	
Activity	Predecessors	Duration	Cost	Duration	Cost
A	—	5 days	$ 1,000	3 days	$ 1,500
B	A	7 days	700	6 days	1,000
C	A	3 days	2,500	2 days	4,000
D	A	5 days	1,500	5 days	1,500
E	C, D	9 days	3,750	6 days	9,000
F	B	4 days	1,600	3 days	2,500
G	D	6 days	2,400	4 days	3,000
H	E, F, G	8 days	9,000	5 days	15,000
Total costs =			$22,450		$37,500

Fully crashed project activity network



Relationship between cost and days saved in crashed project

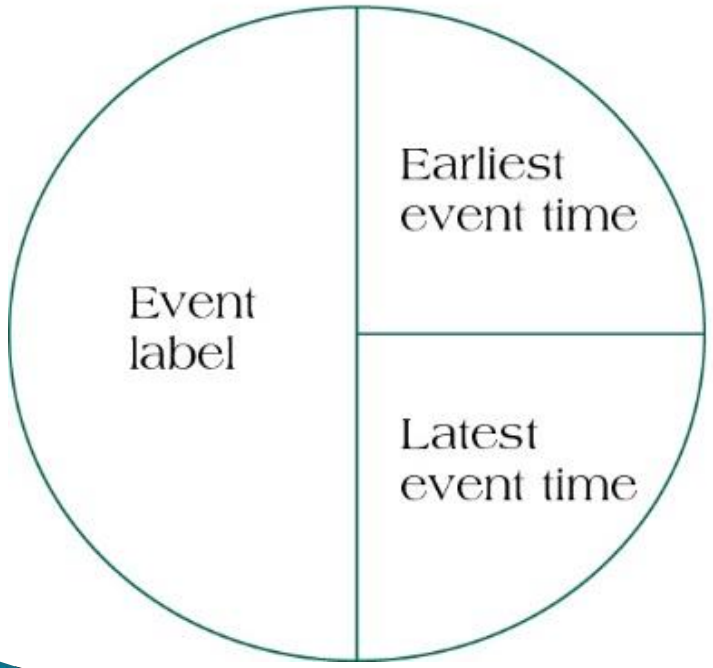


Activity on Arrow Networks

- *Activities* represented by *arrows*
- Widely used in *construction*
- *Event nodes* easy to flag
- Forward and backward pass *logic similar to AON*
- Two activities may not begin and end at *common nodes*
- *Dummy activities* may be required

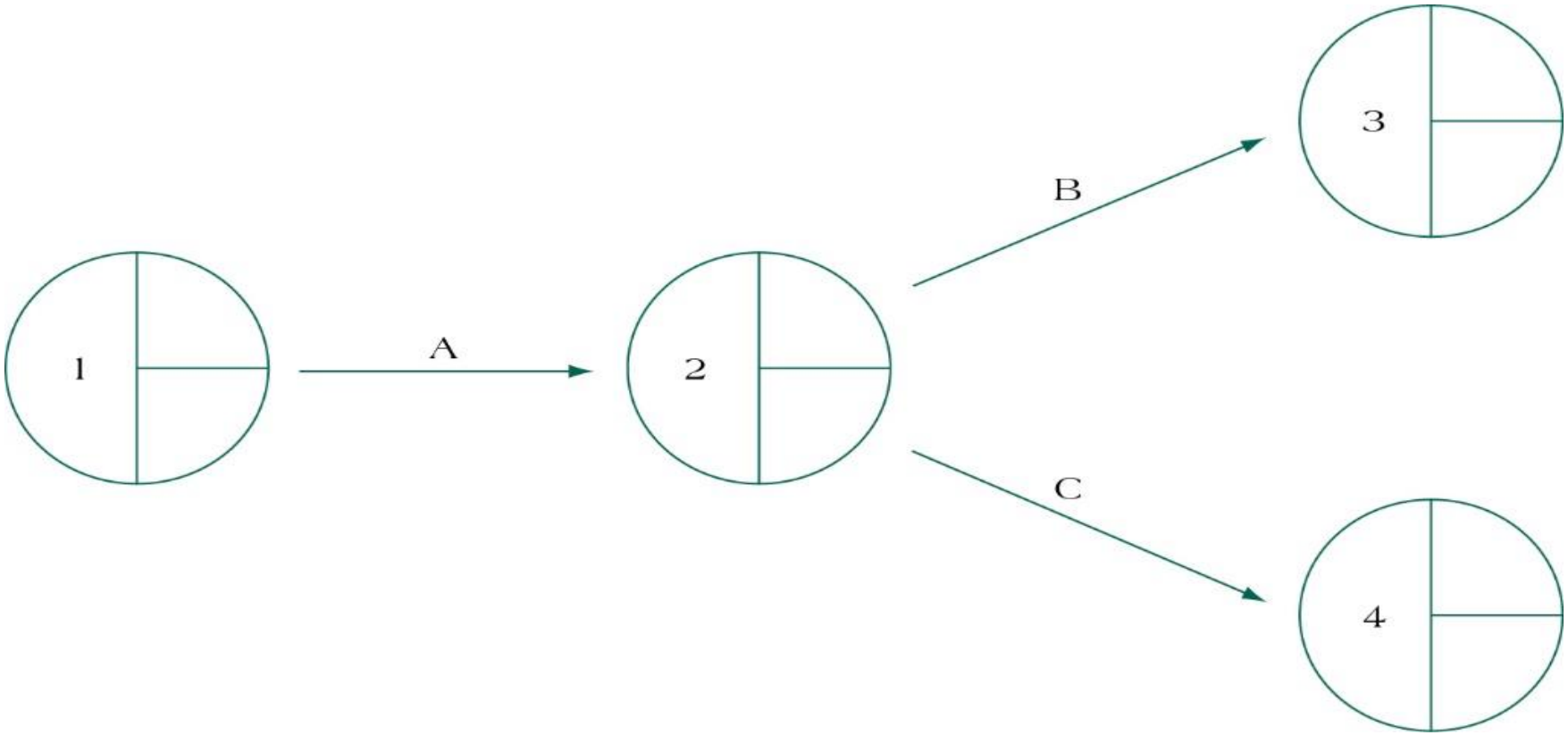
Notation for Activity-on-Arrow (AOA) Networks

Events shown in node

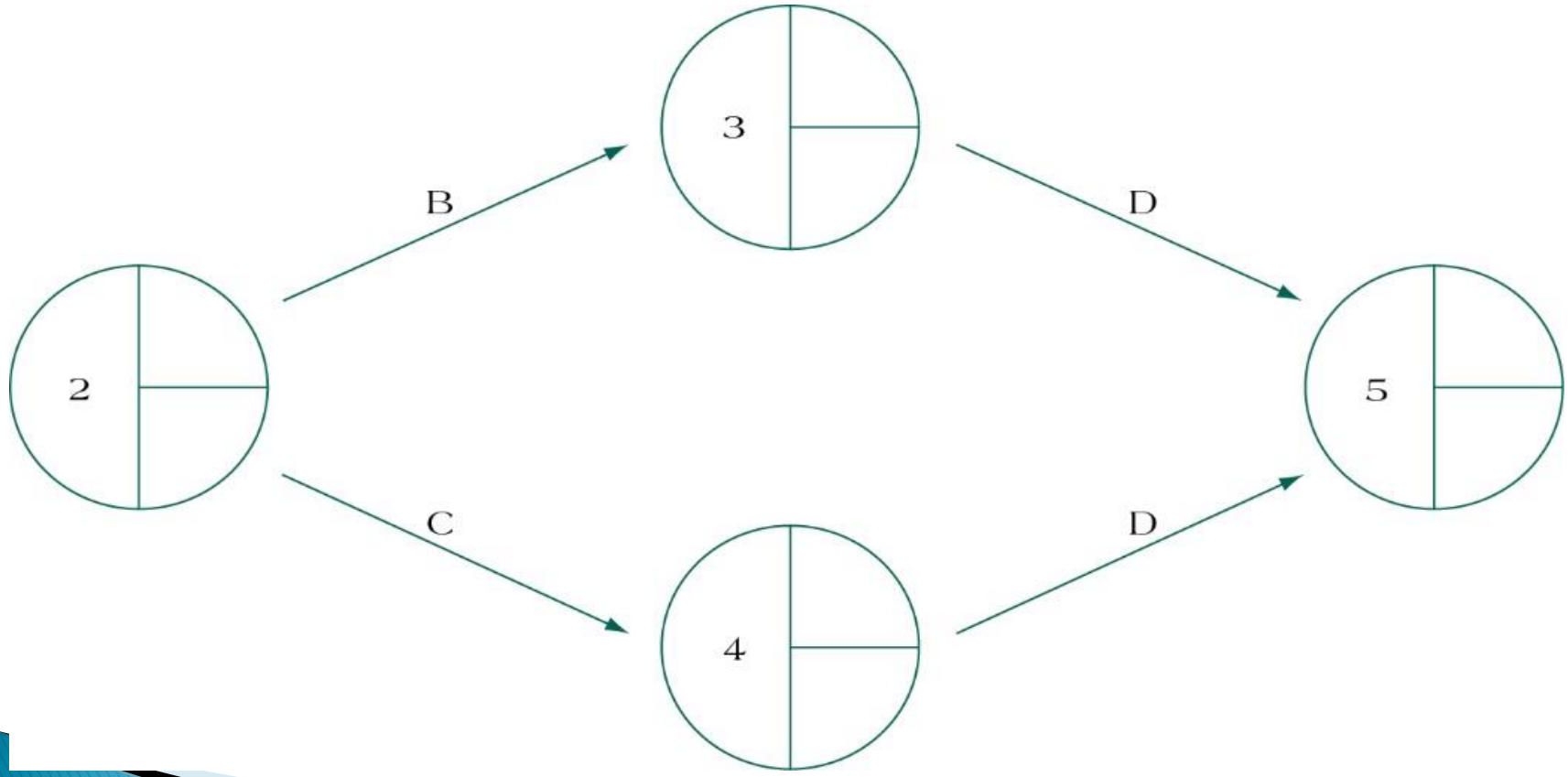


Activity shown on arrow

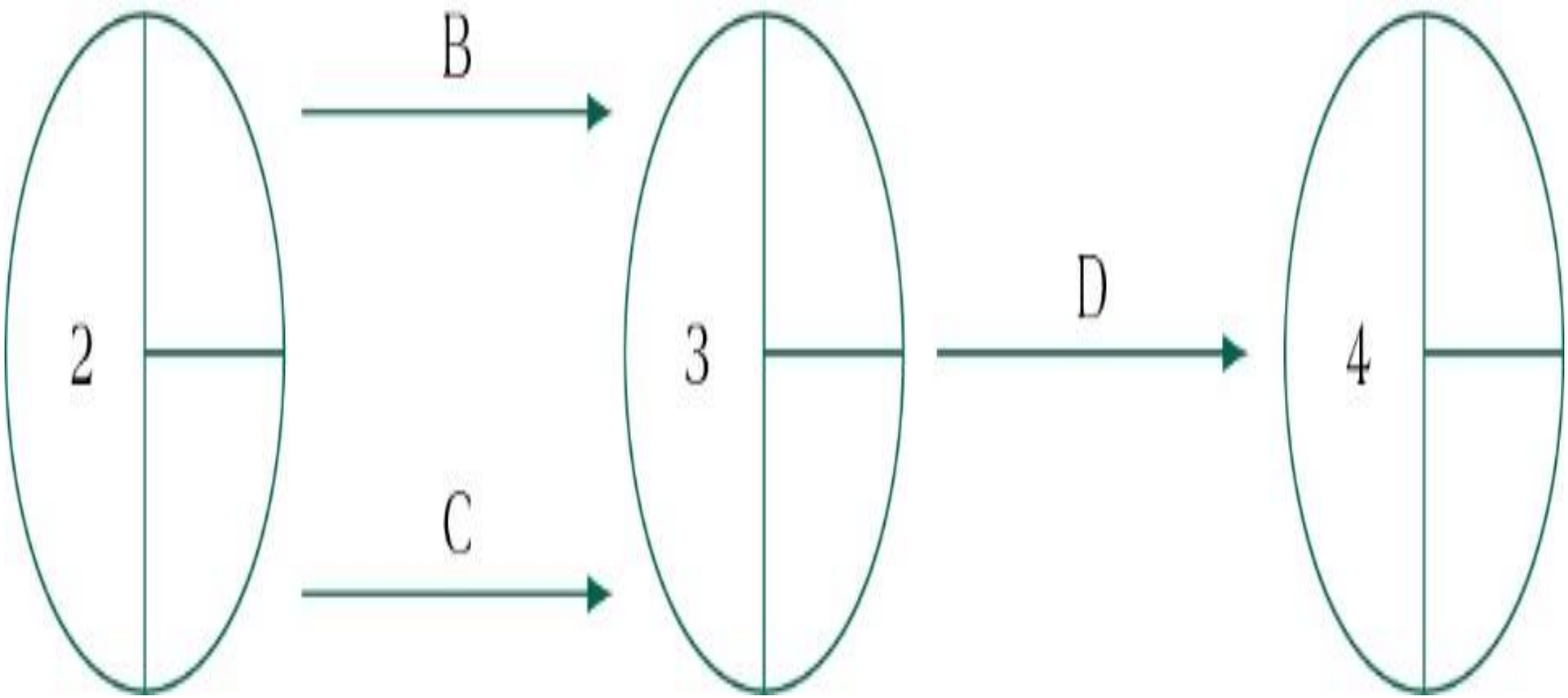
Sample Network Diagram Using AOA Approach



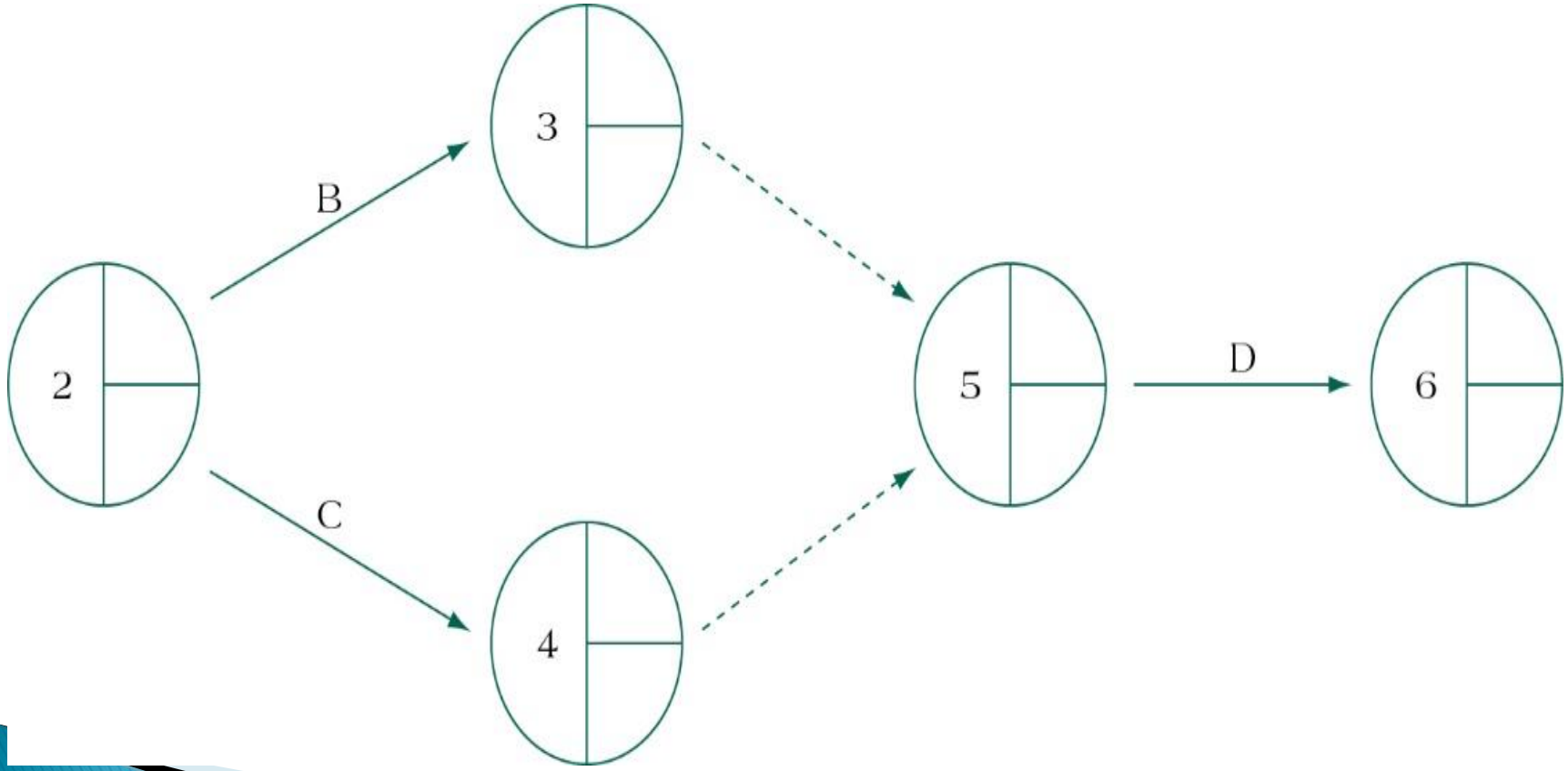
Representing Activities with Two or More Immediate Successors (Wrong)



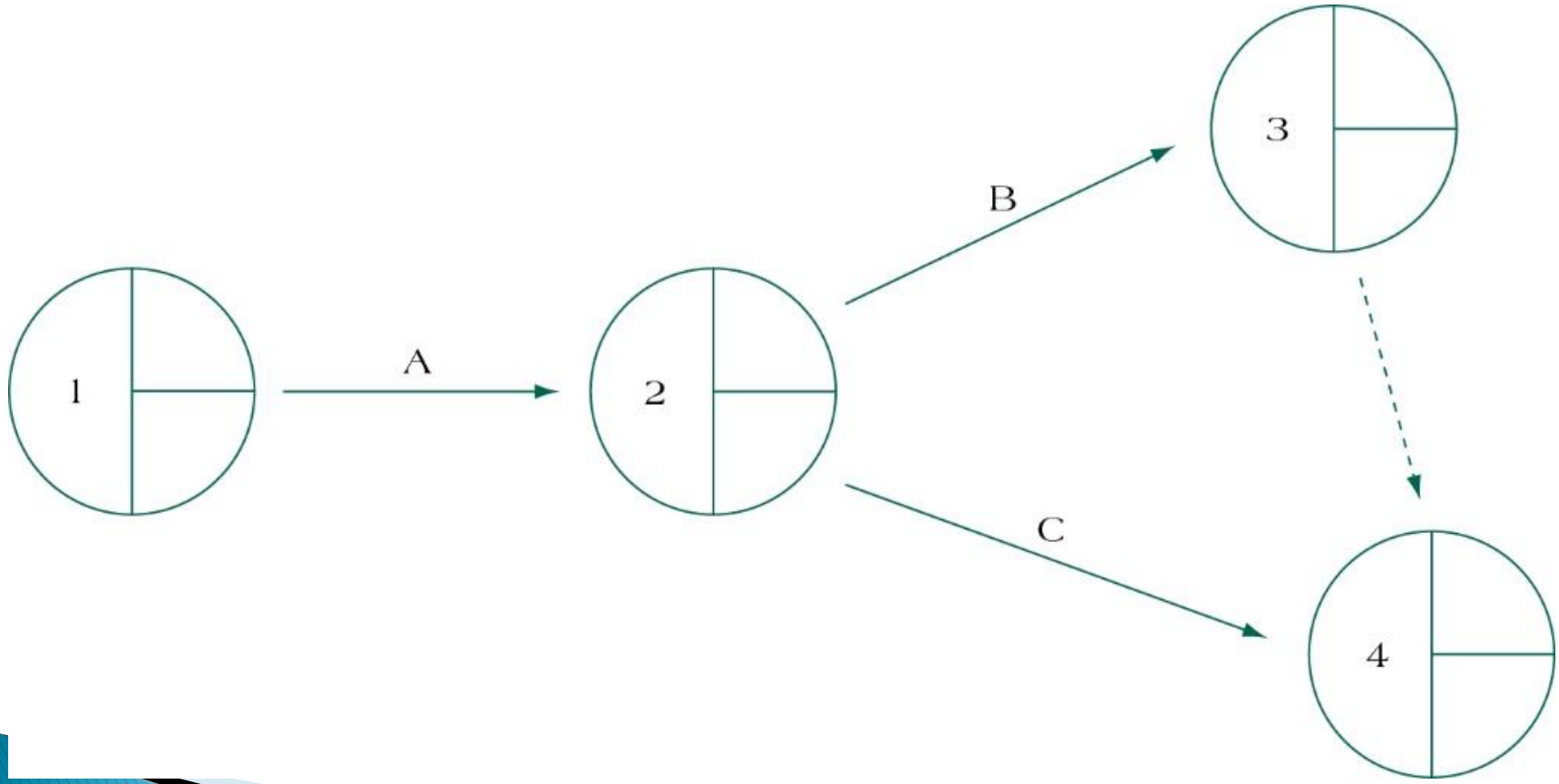
Alternative Way to Represent Activities with Two or More Immediate Successors (Wrong)



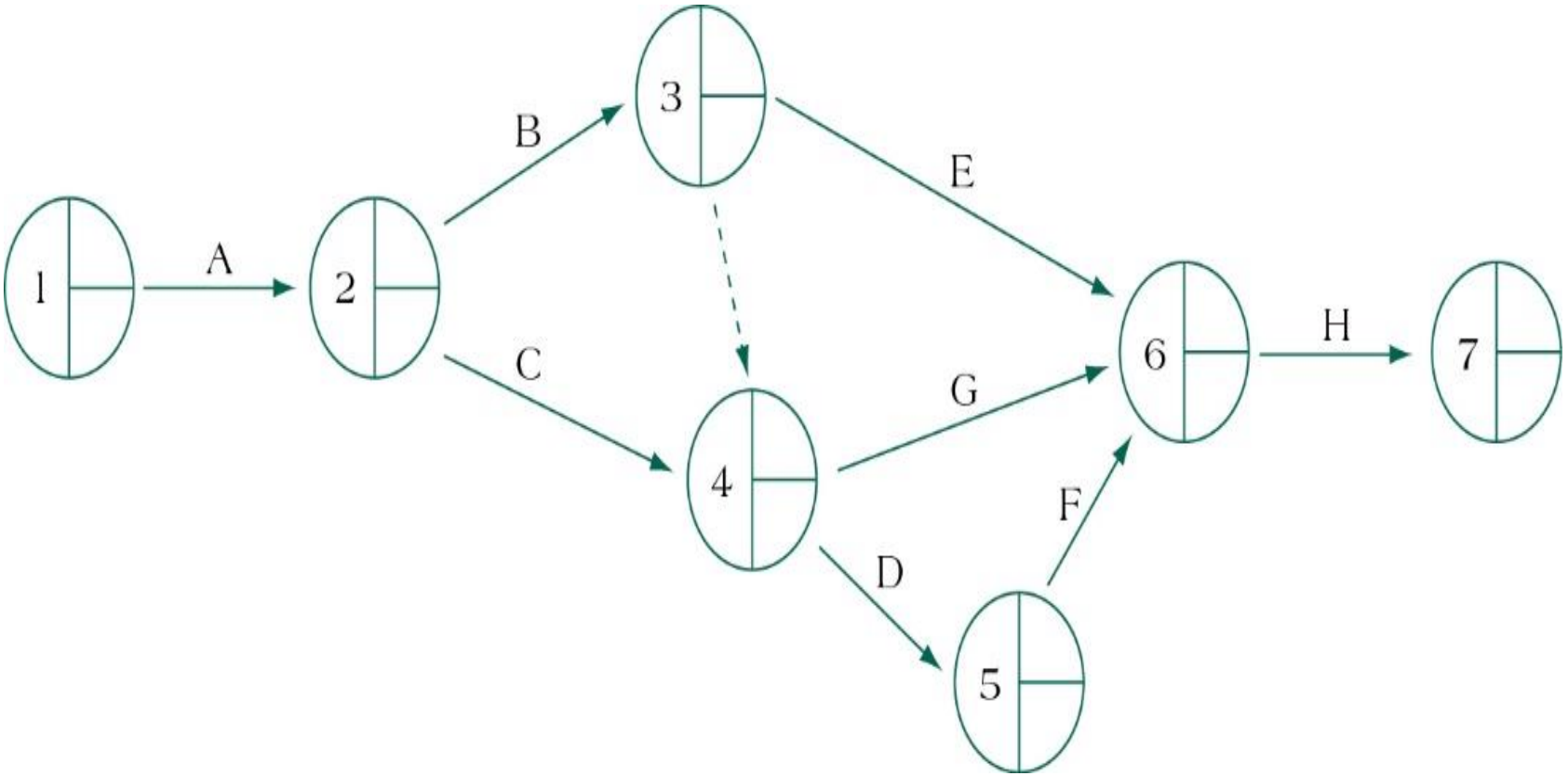
Representing Activities with Two or More Immediate Successors Using Dummy Activities (Better)



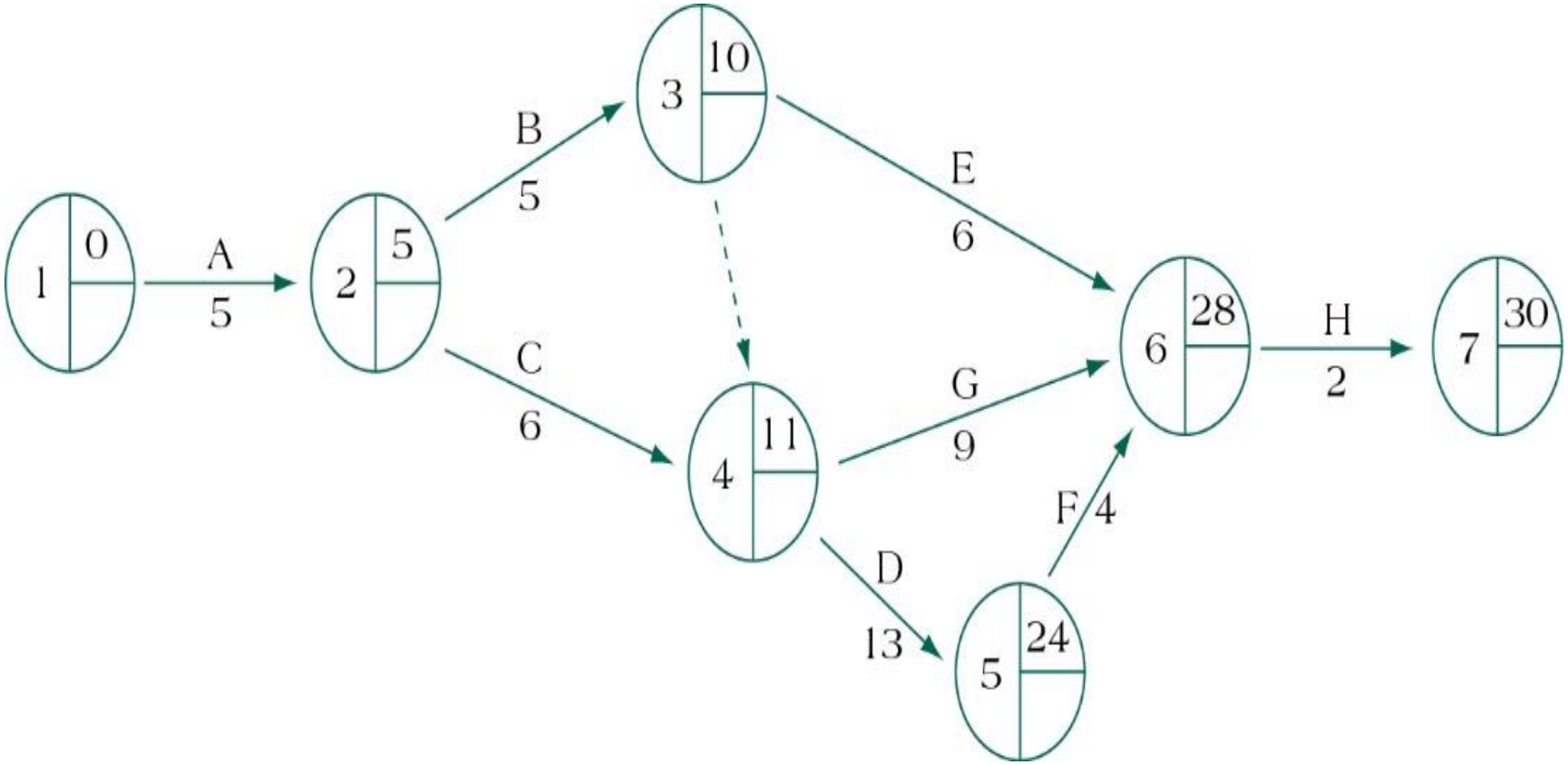
Partial Project Delta Network Using AOA Notation



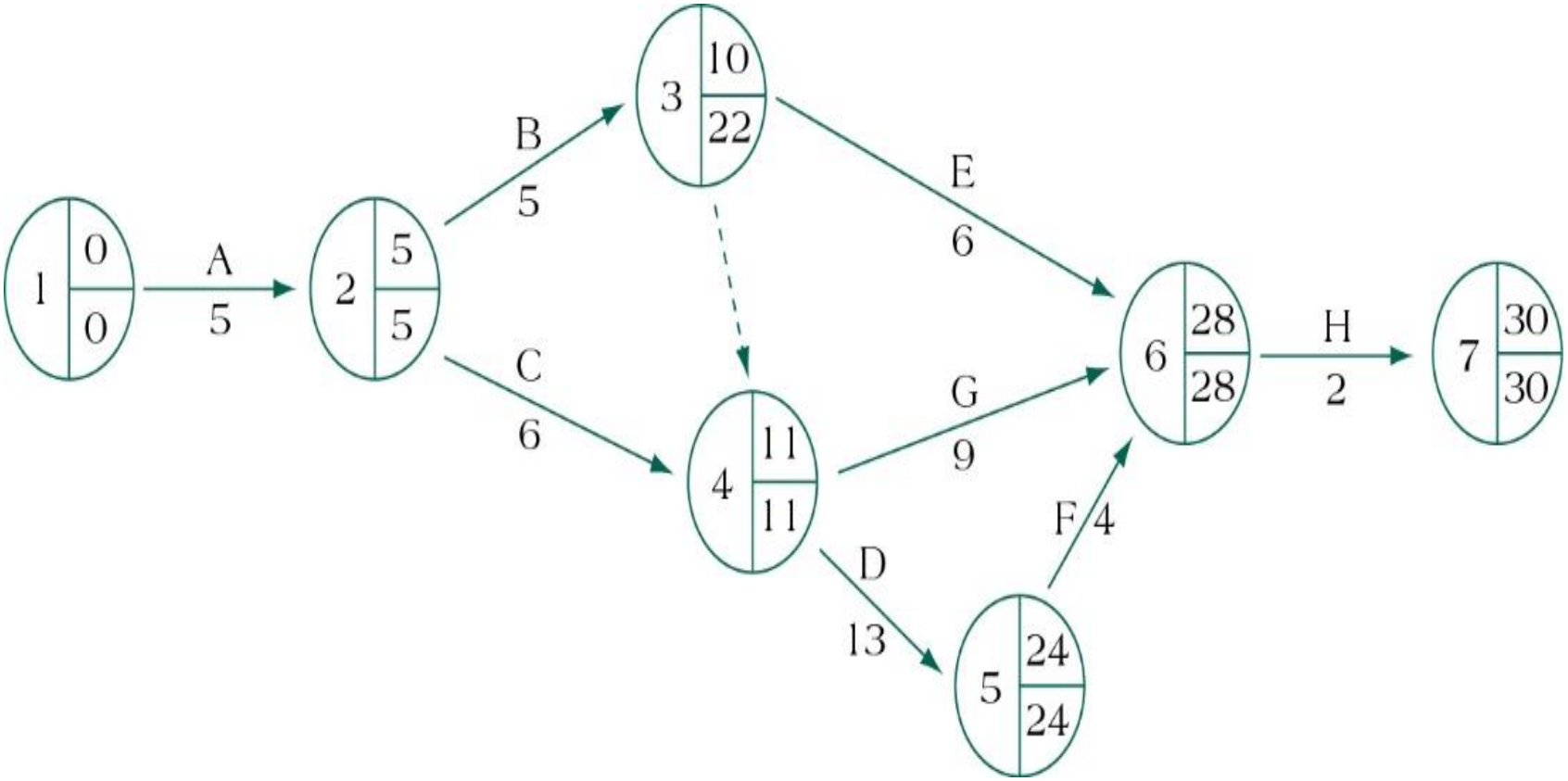
Completed Project Delta AOA Network



Project Delta Forward Pass Using AOA Network



Project Delta Backward Pass Using AOA Network



Controversies in the Use of Networks

1. Networks can be *too complex*.
2. Poor *network construction* creates problems.
3. Networks may be used *inappropriately*.
4. Networks pose *special dangers* because contractors may create their own networks.
5. *Positive bias* exists in PERT networks.