

# **CZ3002 - Advanced Software Engineering**

## **Software Project Management – Project Scheduling**

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# Lesson Objectives

At the end of the lesson, you should be able to:

- ▶ Recall the main project scheduling techniques
- ▶ Apply time-cost models in project management



# Project Scheduling



Establishing  
objectives



Estimating time,  
resources and costs  
required to complete  
each task



Assigning tasks to  
team members

**Step 1**

**Step 2**

**Step 3**

**Step 4**

**Step 5**

Breaking down project  
into tasks or work  
packages



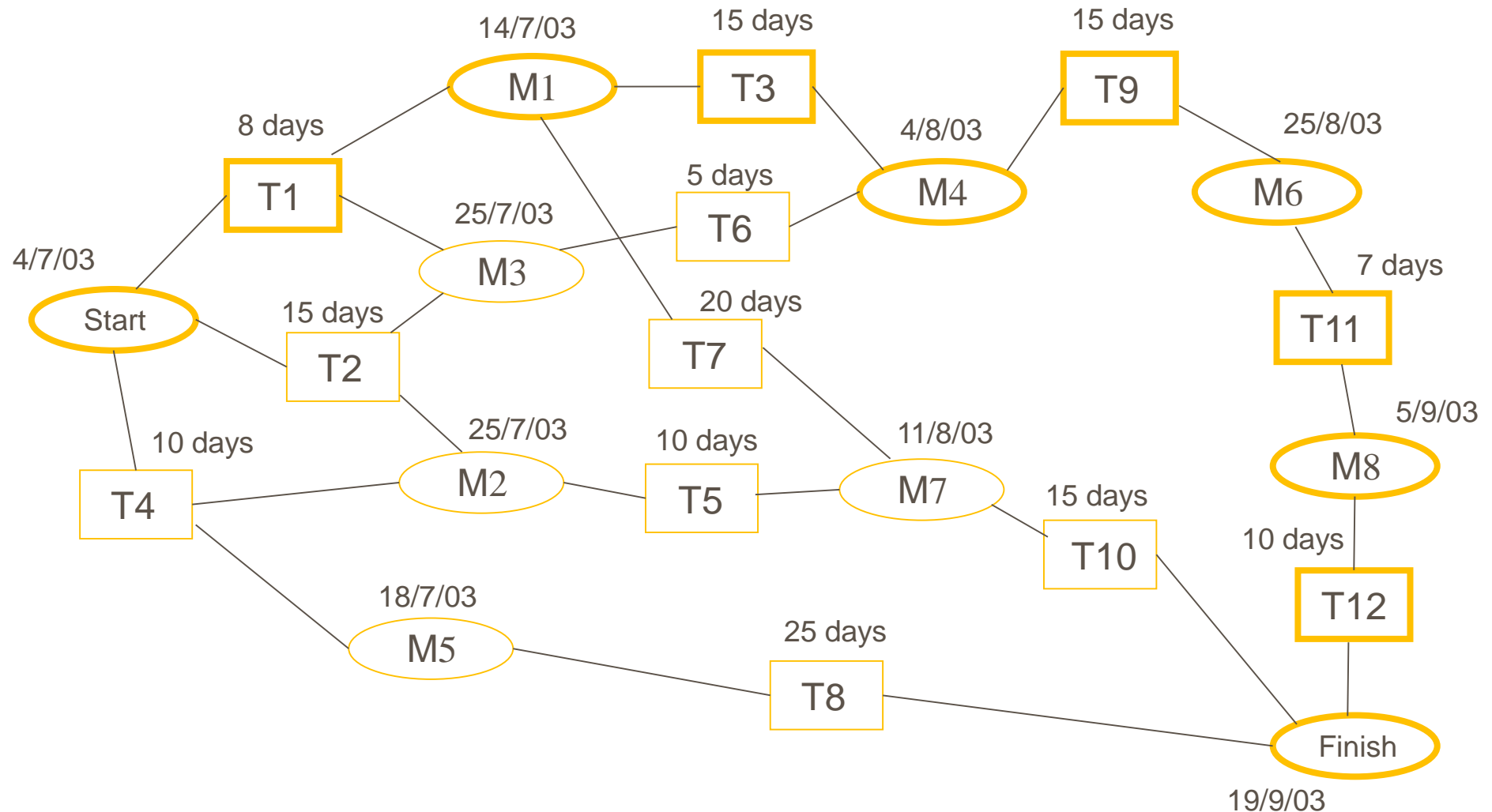
Identifying precedence  
relationships and  
sequencing activities



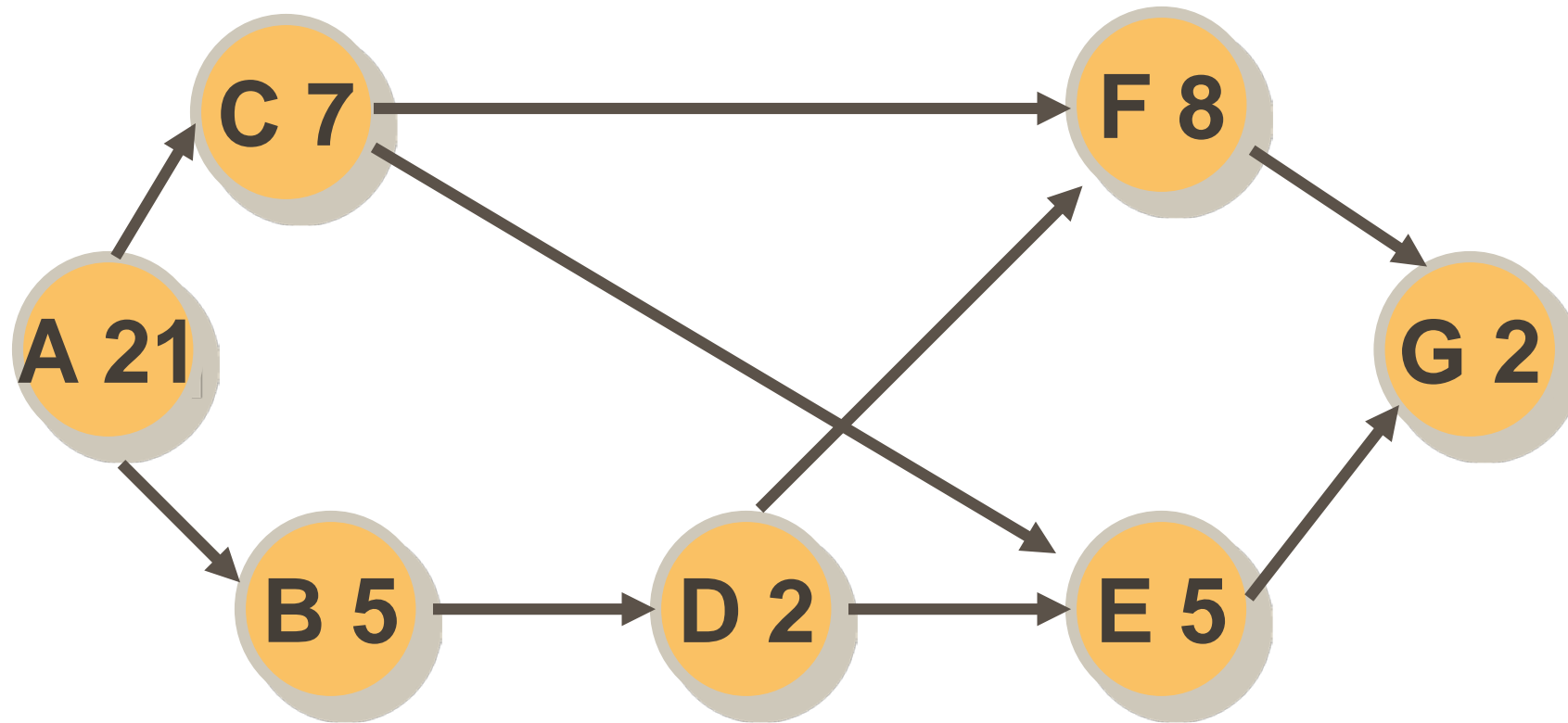
► Bar chart

Activity	Time Period						
	J	F	M	A	M	J	J
Design							
Build							
Test							

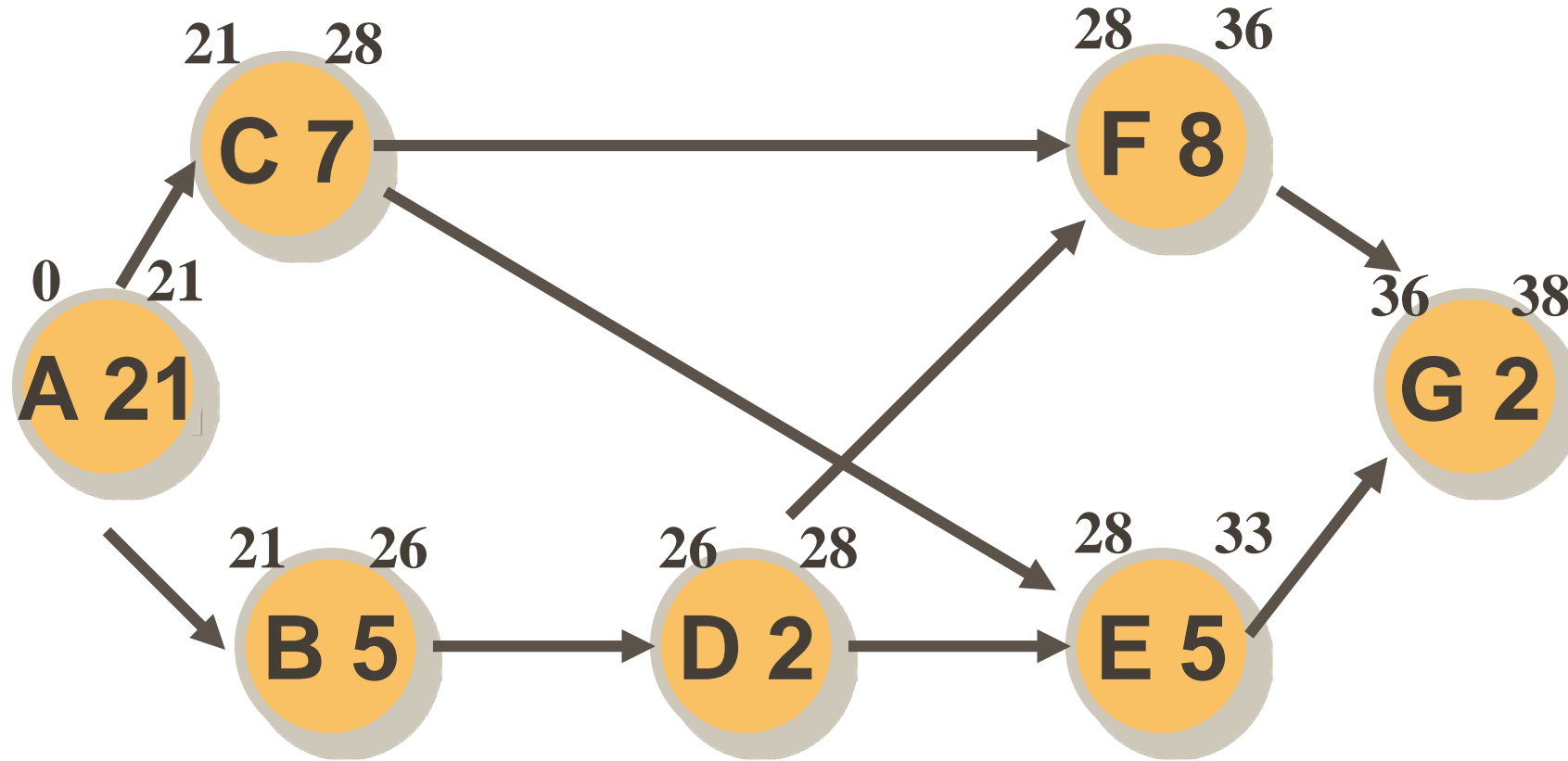
## ► Activity Network



- ▶ Critical Path Method (CPM)
  - ❖ Network techniques
  - ❖ Consider precedence relationships and interdependencies
  - ❖ Identify critical path and critical activities



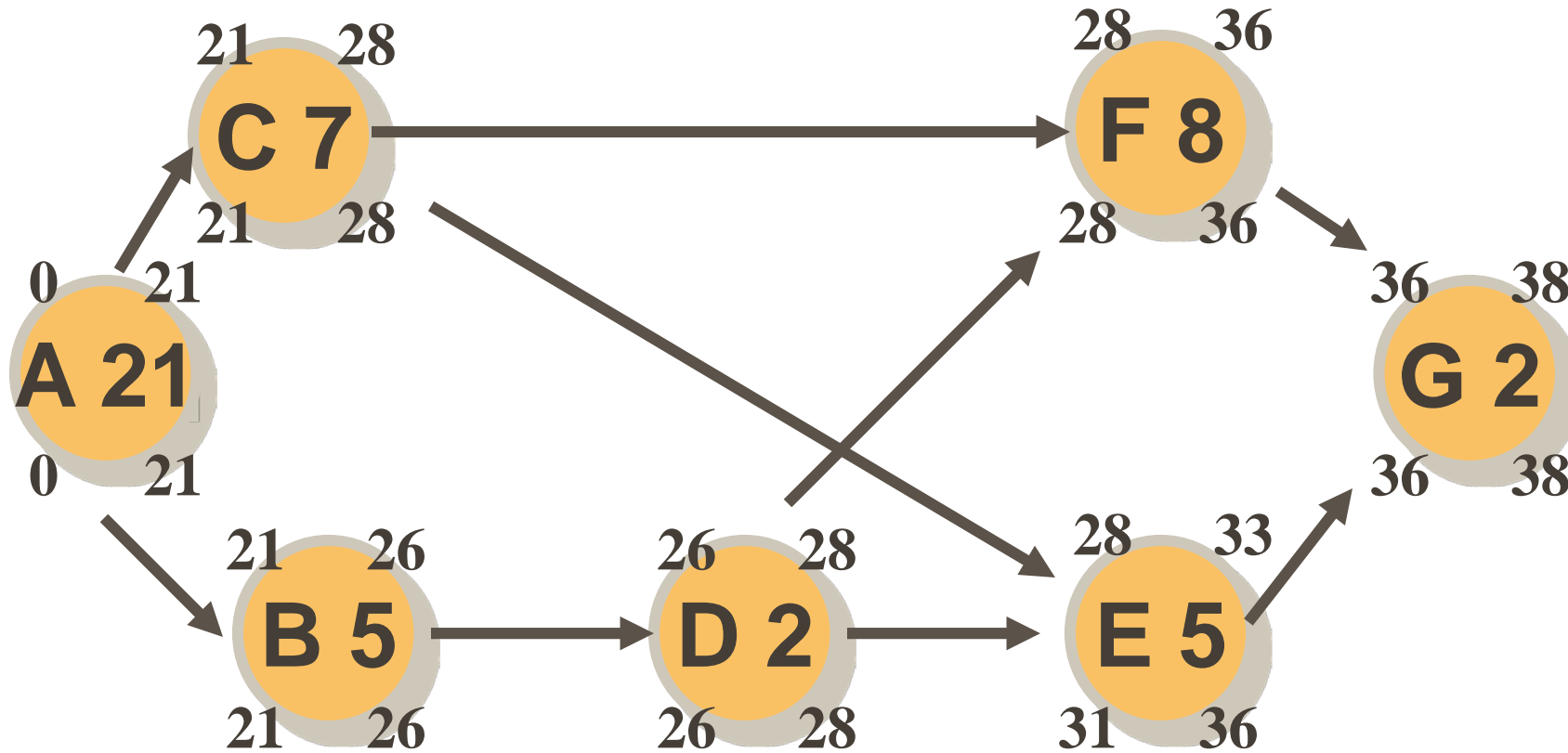
# Example



F cannot start until C and D are done.  
G cannot start until both E and F are done.

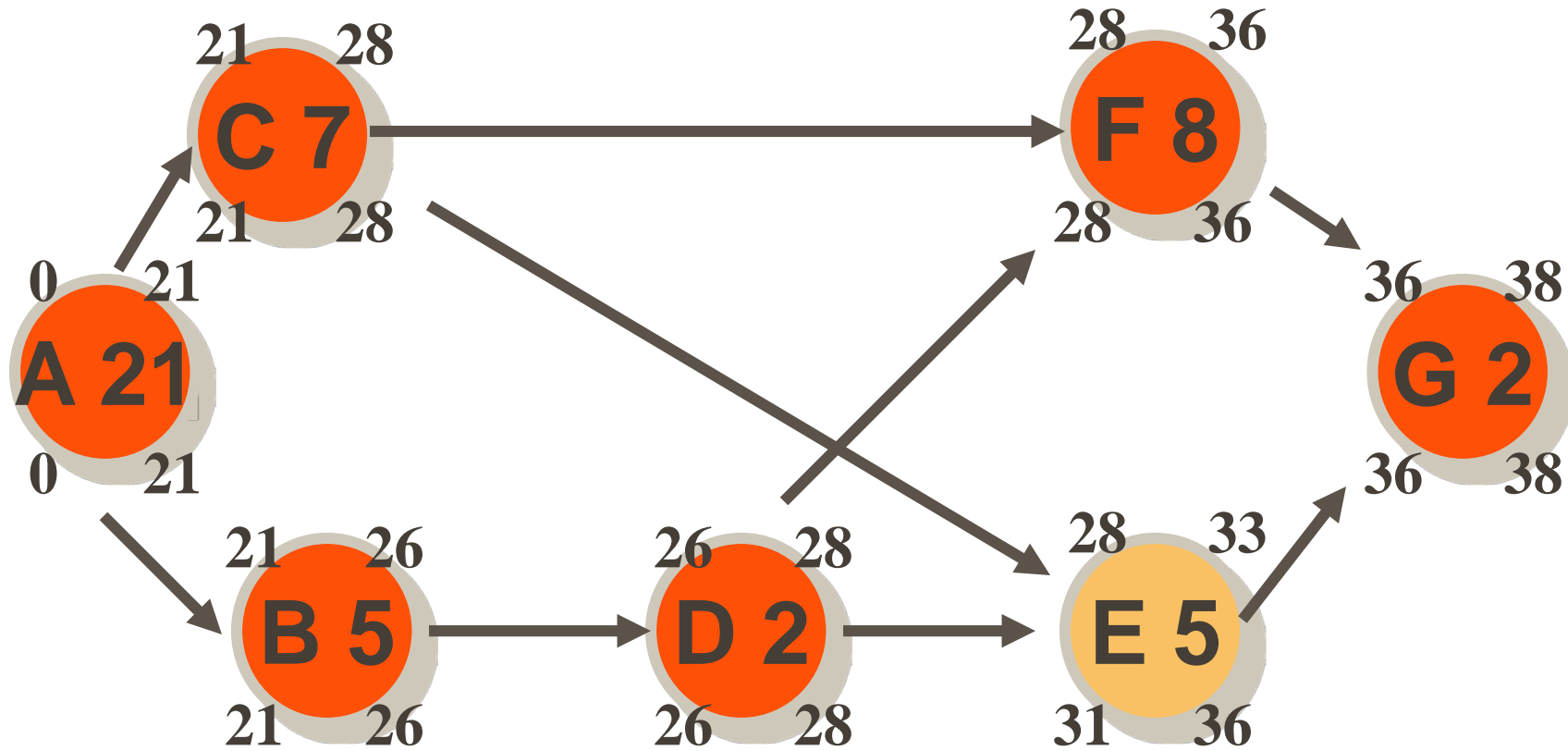


# Example

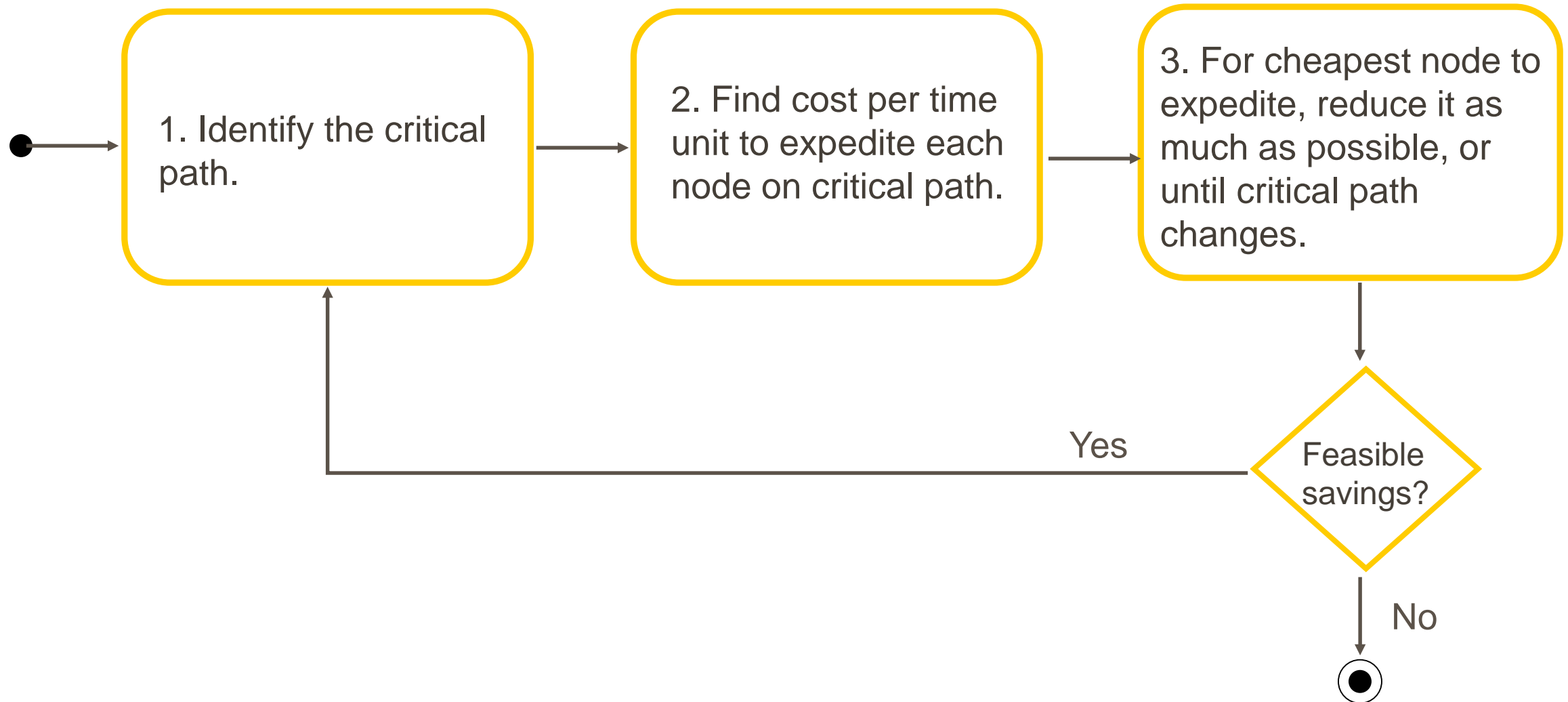


E just has to be done in time for G to start at 36, so it has slack.  
D has to be done in time for F to go at 28, so it has no slack.

# Example



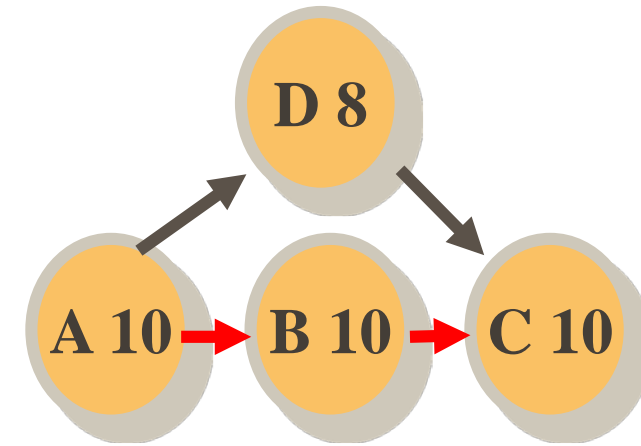
# Time-Cost Models



# Time-Cost Models

- ▶ ABC is critical path = 30

Task	Crash Cost Per Week (\$)	Crash Weeks Available
A	500	2
B	800	3
C	5,000	2
D	1,100	2

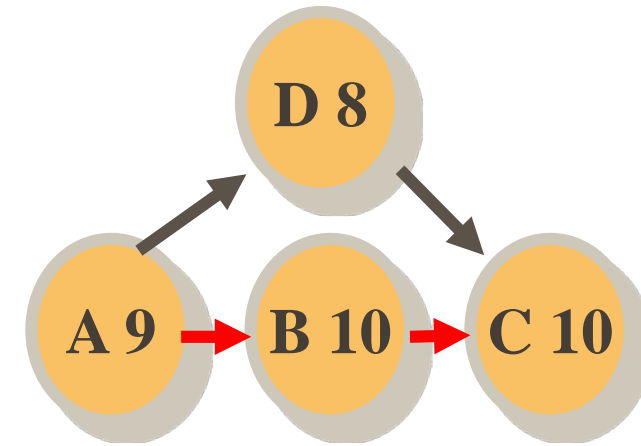


Cheapest way to gain one week is to cut A.

# Time-Cost Models

- ▶ ABC is critical path = 29

Task	Crash Cost Per Week (\$)	Crash Weeks Available
A	500	1
B	800	3
C	5,000	2
D	1,100	2



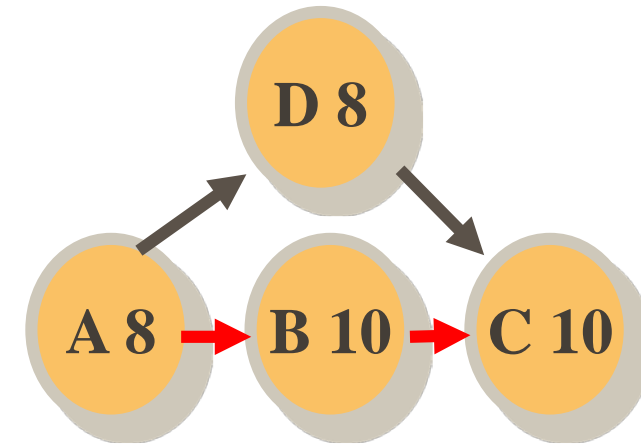
Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500

Cheapest way to gain one week still is to cut A.

# Time-Cost Models

- ▶ ABC is critical path = 28

Task	Crash Cost Per Week (\$)	Crash Weeks Available
A	500	0
B	800	3
C	5,000	2
D	1,100	2



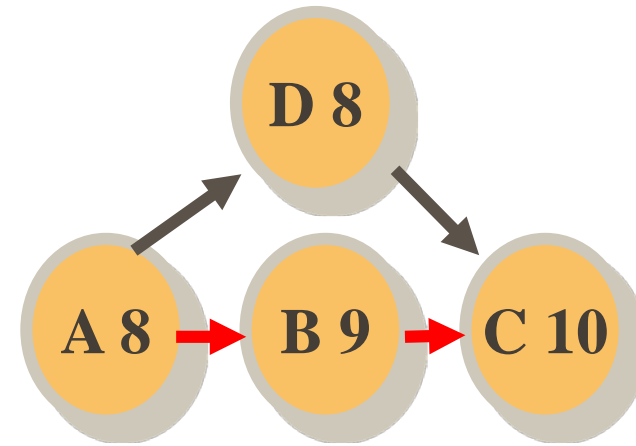
Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000

Cheapest way to gain one week is to cut B.

# Time-Cost Models

- ▶ ABC is critical path = 27

Task	Crash Cost Per Week (\$)	Crash Weeks Available
A	500	0
B	800	2
C	5,000	2
D	1,100	2



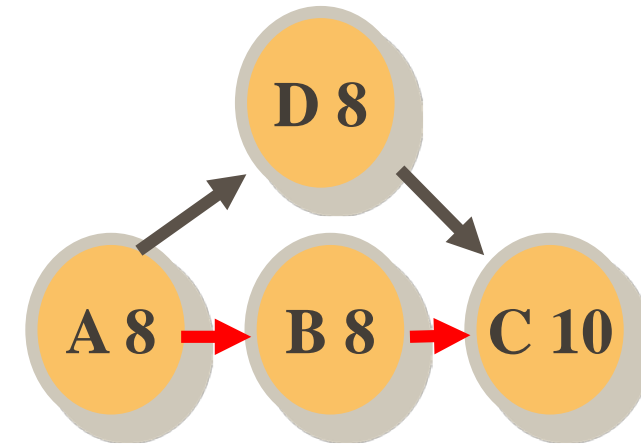
Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800

Cheapest way to gain one week  
is still to cut B.

# Time-Cost Models

- Critical paths = 26 **ADC & ABC**

Task	Crash Cost Per Week (\$)	Crash Weeks Available
A	500	0
B	800	1
C	5,000	2
D	1,100	2



Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800
4	800	2,600

How to gain one week?



# Time-Cost Example

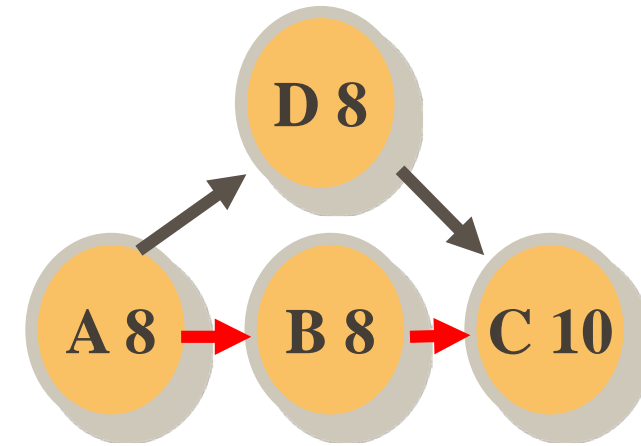
- Critical paths = 26 **ADC & ABC**

Task	Crash Cost Per Week (\$)	Crash Weeks Available
A	<del>500</del>	<del>0</del>
B	800	1
C	5,000	2
D	1,100	2

To gain one week, cut B and D, or cut C?

- Cut B and D = \$1,900
- Cut C = \$5,000

So cut B and D.



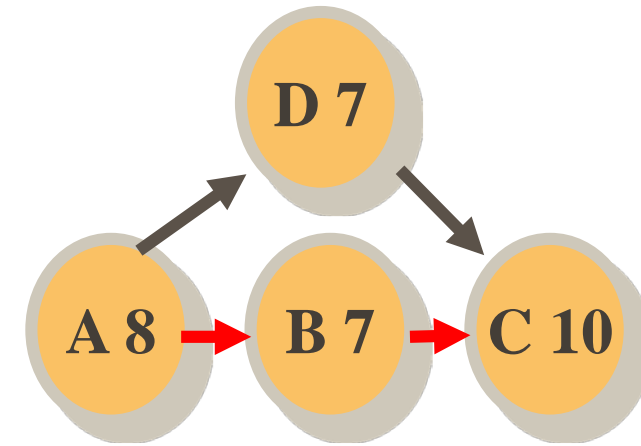
Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800
4	800	2,600

# Time-Cost Example

- Critical paths = 25 **ADC & ABC**

	Crash Cost Per Week (\$)	Crash Weeks Available
<del>A</del>	<del>500</del>	<del>0</del>
<del>B</del>	<del>800</del>	<del>0</del>
C	5,000	2
D	1,100	1

If B cannot be cut any more. The only way is to cut C.



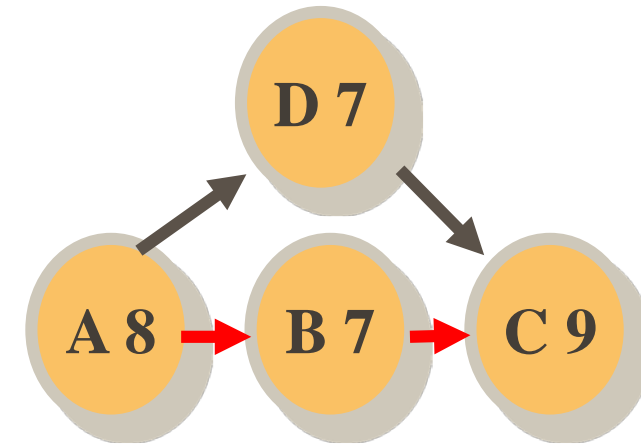
Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800
4	800	2,600
5	1900	4,500

# Time-Cost Example

- Critical paths = 24 **ADC & ABC**

	Crash Cost Per Week (\$)	Crash Weeks Available
<del>A</del>	<del>500</del>	<del>0</del>
<del>B</del>	<del>800</del>	<del>0</del>
C	5,000	1
D	1,100	1

The only way is to cut C.



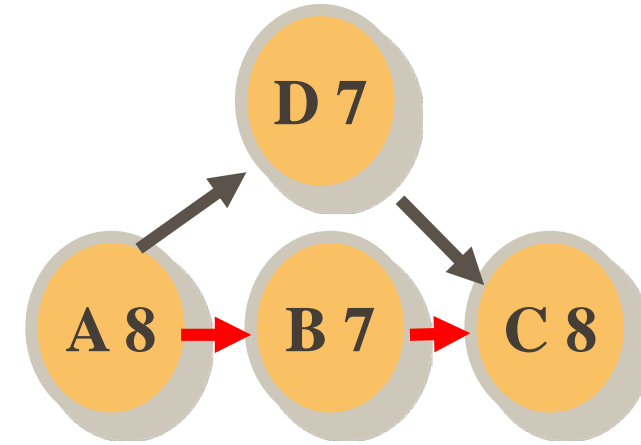
Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800
4	800	2,600
5	1900	4,500
6	5000	9,500

# Time-Cost Example

- Critical paths = 23 **ADC & ABC**

	Crash Cost Per Week (\$)	Crash Weeks Available
<del>A</del>	<del>500</del>	<del>0</del>
<del>B</del>	<del>800</del>	<del>0</del>
<del>C</del>	<del>5,000</del>	<del>0</del>
D	1,100	1

No remaining possibilities to reduce project length.

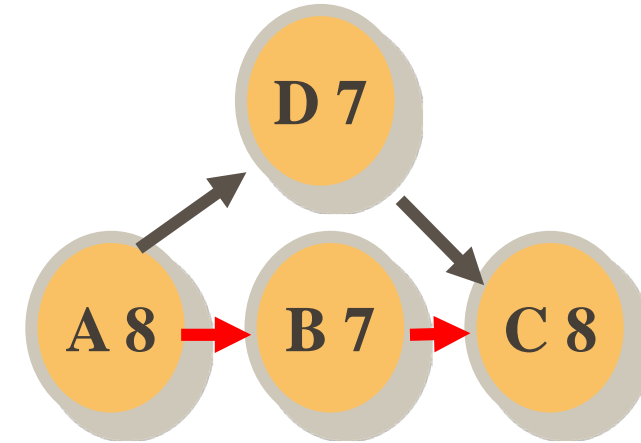


Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800
4	800	2,600
5	1900	4,500
6	5000	9,500
7	5000	14,500

# Time-Cost Example

- ▶ Now we know how much it costs us to save any number of days
- ▶ If a customer says he will pay \$2,000 per week saved
- ▶ Only need to reduce 5 weeks
- ▶ We get \$10,000 from customer, but pay \$4,500 in expediting costs
- ▶ Increased profits = \$5,500

No remaining possibilities to reduce project length.



Weeks Gained	Incremental Crash (\$)	Total Crash (\$)
1	500	500
2	500	1,000
3	800	1,800
4	800	2,600
<del>5</del>	<del>1900</del>	<del>4,500</del>
6	5000	9,500
7	5000	14,500

- ▶ Summarizing the three main project scheduling activities:
  - ❖ Bar chart
  - ❖ Critical path analysis
  - ❖ Time-Cost model

- ▶ Introduction
- ▶ Project organisation
- ▶ Hardware and software resource requirements
- ▶ Life cycle and Process definition
- ▶ Work breakdown
- ▶ Project estimation and schedule
- ▶ Monitoring and reporting mechanisms
- ▶ Risk analysis

# Summary

- ▶ Good project management is essential for project success.
- ▶ The intangible nature of software causes problems for management.
- ▶ Managers have diverse roles but their most significant activities are planning, estimating and scheduling.
- ▶ Planning and estimating are iterative processes which continue throughout the course of a project.

