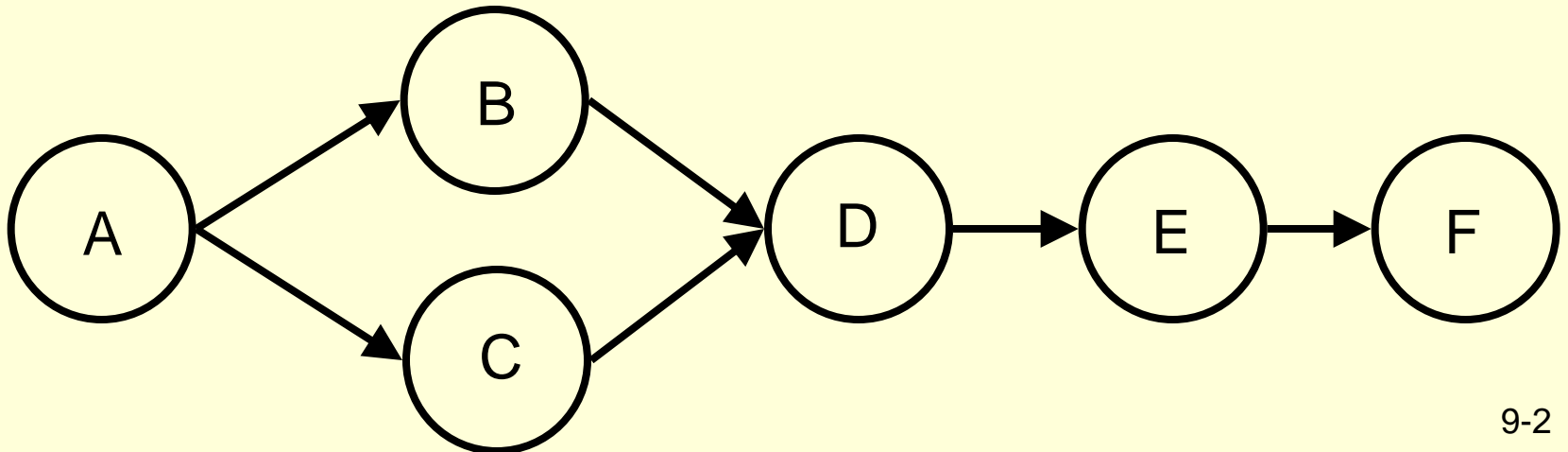


Project Scheduling: Networks, Duration Estimation, and Critical Path

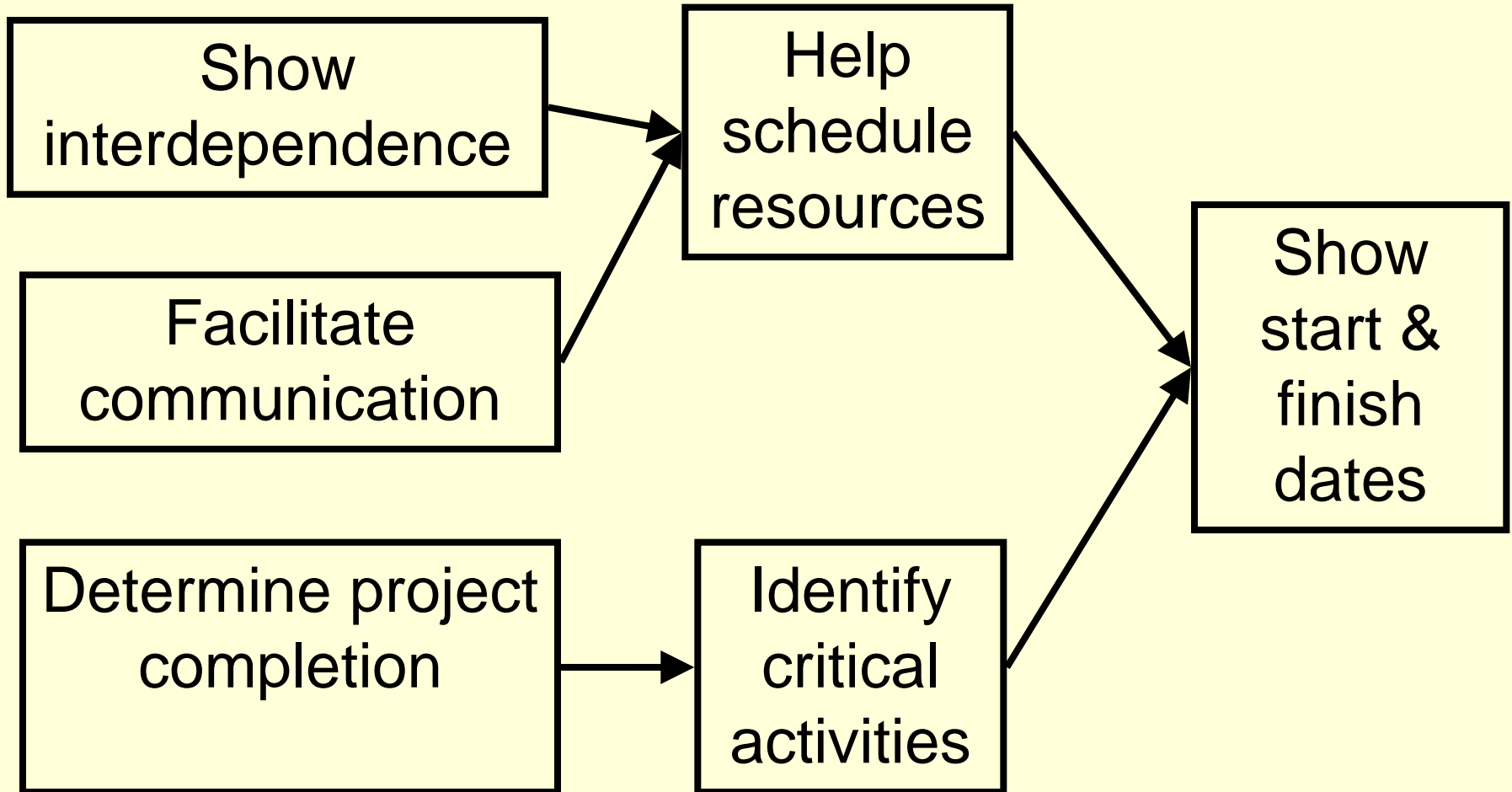
Chapter 9

Project Scheduling Terms

- Successors
- Predecessors
- Network diagram
- Serial activities
- Concurrent activities
- Merge activities
- Burst activities
- Node
- Path
- Critical Path

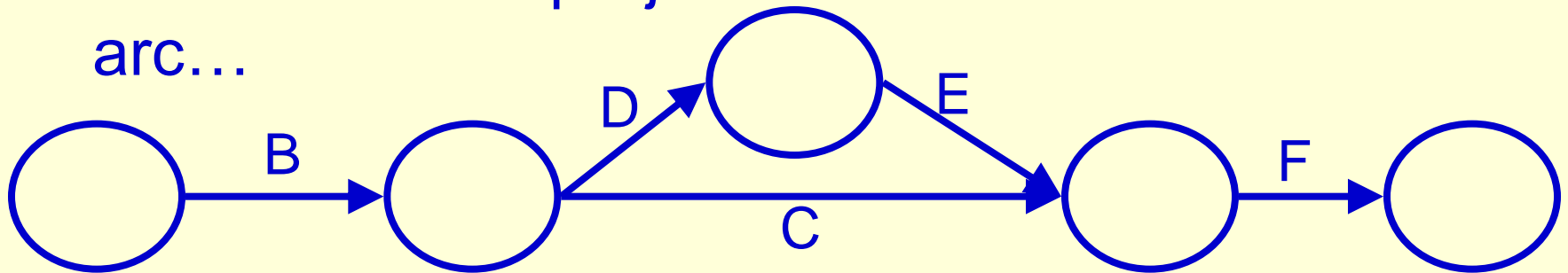


Network Diagrams

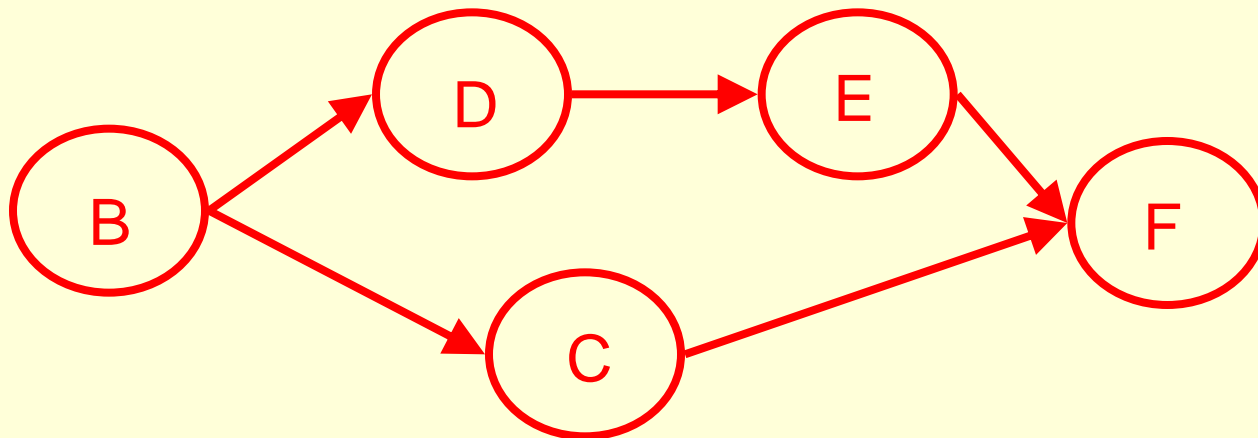


AOA Vs. AON

The same mini-project is shown with activities on arc...



...and activities on node.



Node Labels

Early Start	ID Number	Early Finish
Activity Float	Activity Descriptor	
Late Start	Activity Duration	Late Finish

Duration Estimation Methods

- Past experience
- Expert opinion
- Mathematical derivation – Beta distribution
 - Most likely (m)
 - Most pessimistic (b)
 - Most optimistic (a)

$$\text{Activity Variance} = \sigma^2 = \left(\frac{b - a}{6} \right)^2$$

$$\text{Activity Duration} = \text{TE} = \frac{a + 4m + b}{6}$$

1. Sketch the network described in the table.
2. Determine the expected duration and variance of each activity.

Task	Predecessor	a	b	c
Z	--	7	8	15
Y	Z	13	16	19
X	Z	14	18	22
W	Y, X	12	14	16
V	W	1	4	13
T	W	6	10	14
S	T, V	11	14	19

Constructing the Critical Path

- Forward pass – an ***additive move*** through the network from ***start to finish***
- Backward pass – a ***subtractive move*** through the network from ***finish to start***
- Critical path – the ***longest path*** from end to end which determines the ***shortest project length***

Rules for Forward/Backward Pass

Forward Pass Rules (ES & EF)

- $ES + \text{Duration} = EF$
- $EF \text{ of predecessor} = ES \text{ of successor}$
- Largest preceding EF at a merge point becomes EF for successor

Backward Pass Rules (LS & LF)

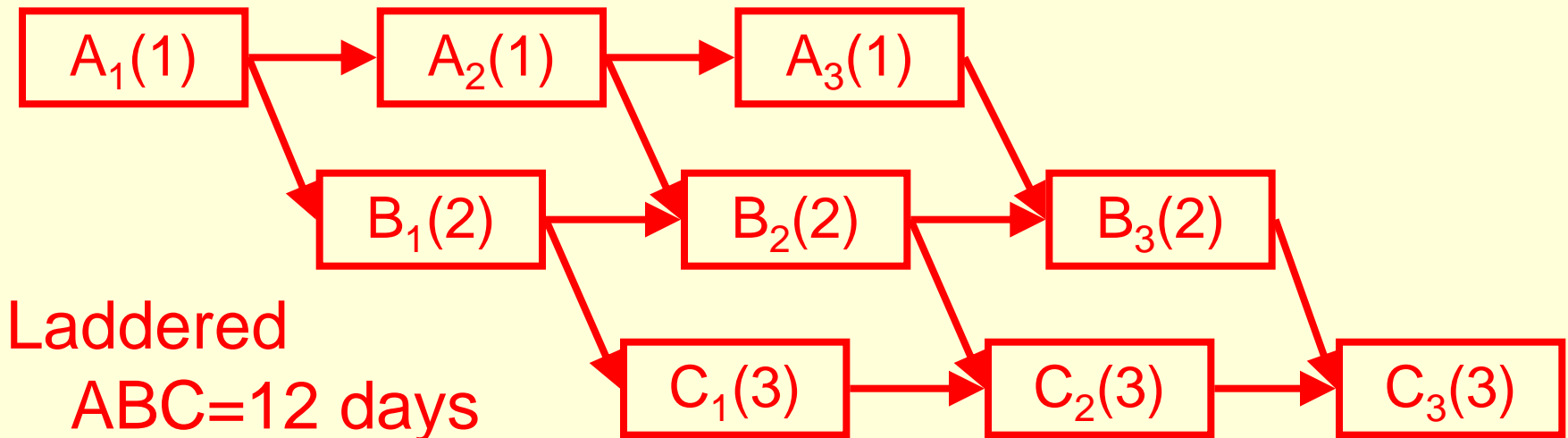
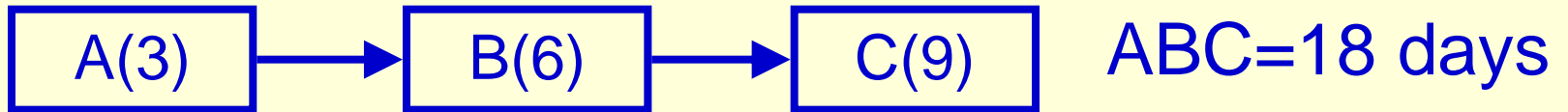
- $LF - \text{Duration} = LS$
- $LS \text{ of successor} = LF \text{ of predecessor}$
- Smallest succeeding LS at a burst point becomes LF for predecessor

Task	Predecessor	Time
A	--	4
B	A	9
C	A	11
D	B	5
E	B	3
F	C	7
G	D, F	3
H	E, G	2
K	H	1

1. Sketch the network described in the table.
2. Determine the ES, LS, EF, LF, and slack of each activity

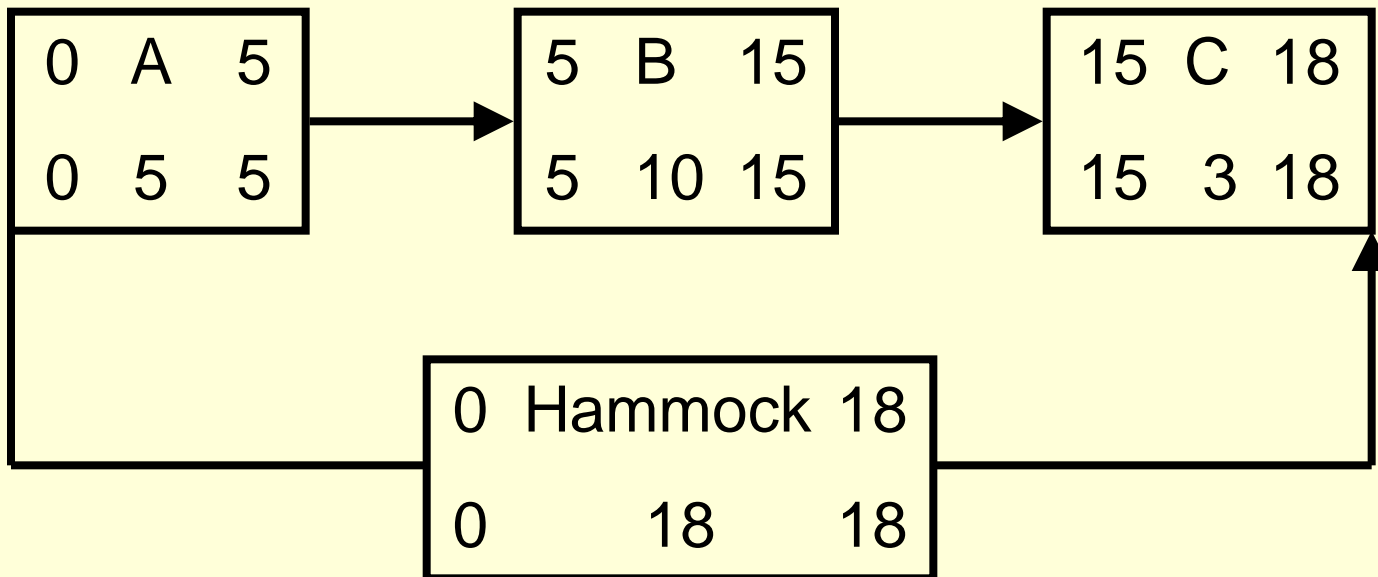
Laddering Activities

Project ABC can be completed more efficiently if subtasks are used



Hammock Activities

Used as summaries for subsets of activities



Useful with a complex project or one that has a shared budget

Reducing the Critical Path

- Eliminate tasks on the CP
- Convert serial paths to parallel when possible
- Overlap sequential tasks
- Shorten the duration on critical path tasks
- Shorten
 - early tasks
 - longest tasks
 - easiest tasks
 - tasks that cost the least to speed up