The Key Things to know about CPM Network Analysis:

1.   How to construct the Activity-on-node diagram – Forward pass, Backward pass, Critical Path, accounting for Lead and Lag Times

2.   Floats: Total Float, Free Float and Independent Float.

    → Total Float = Late Finish – Early Finish

    → Free Float = Early Start of successor – Early Finish of Activity

    → Independent Float = Early Start of successor – Late Finish of predecessor – Duration of Activity

Key # 1 Constructing the Critical Path

- Forward pass – an *additive move* through the network from *start to finish*
    - *Determines ES and EF using ES+DUR = EF*
    - *If 2 (or more) EF from proceeding uses largest*

- Backward pass – a *subtractive move* through the network from *finish to start*
    - *Determines LS and LF using LF- DUR = LS*
    - *If 2 (or more) LS from succeeding use smallest*
    - *Determine AF using LS-ES = AF*

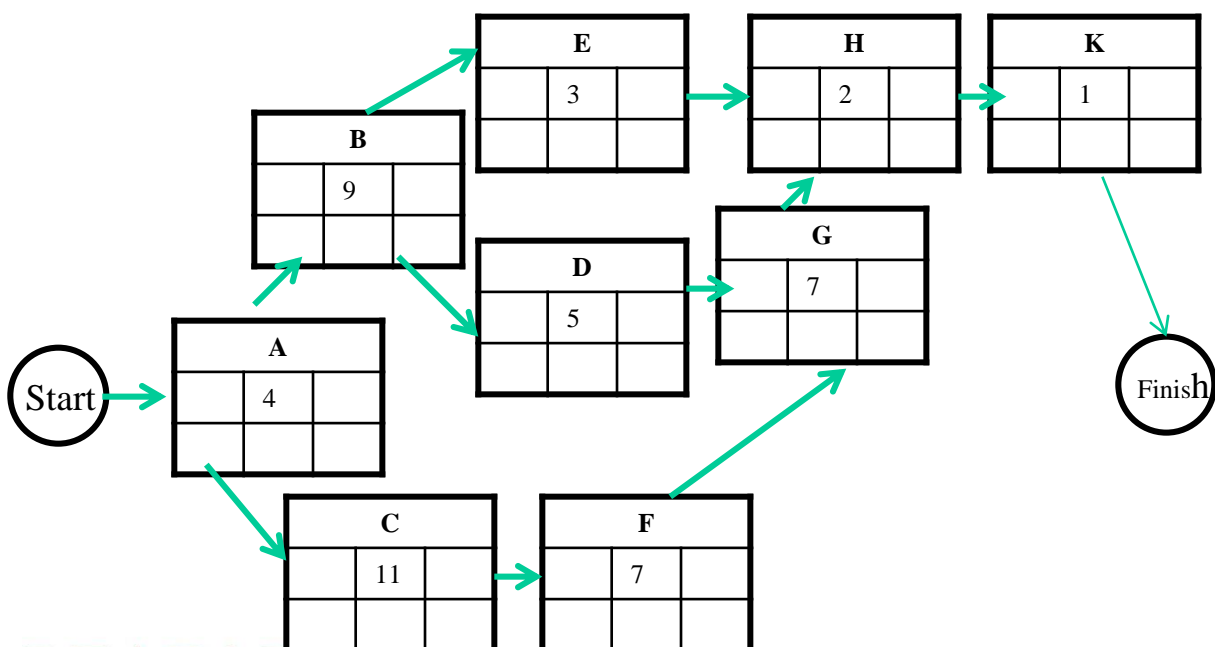- Critical path – the *longest path* from end to end which determines the *shortest project length*

Using the example from the previous section:

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

Activity		
Early Start	Duration	Late Start
Early Finish	Resource Used	Late Finish

Step 1: Setup the diagram in the correct order.
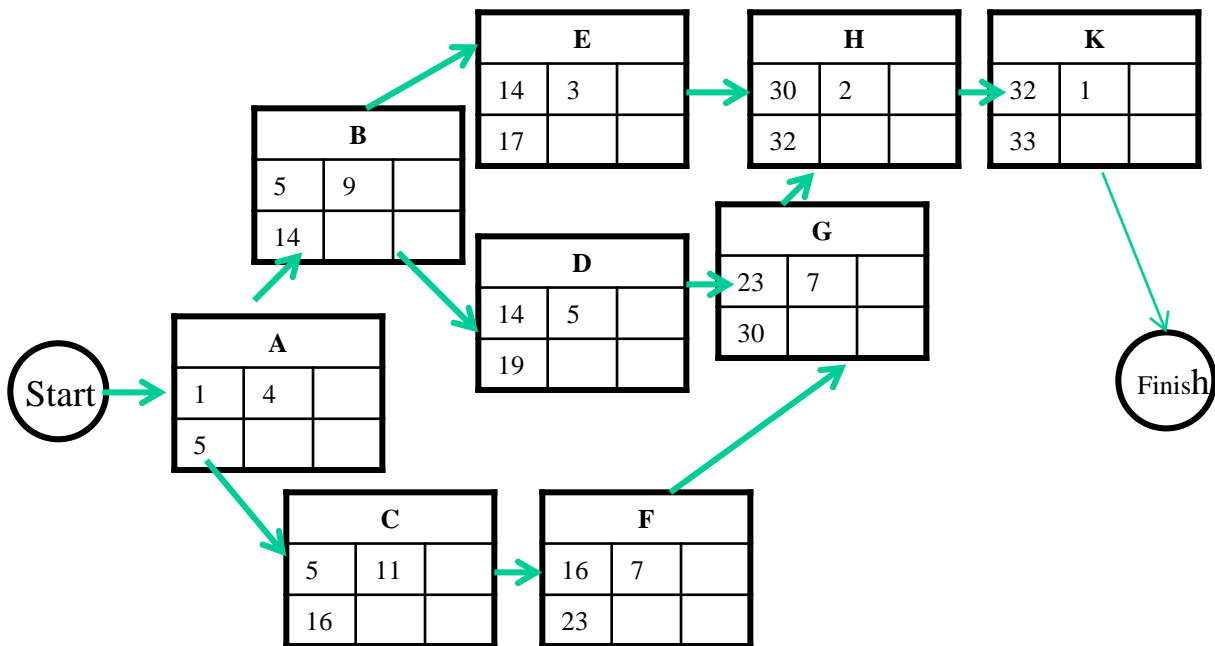
Step 2: Do the forward pass.

Determines ES and EF using ES+DUR = EF
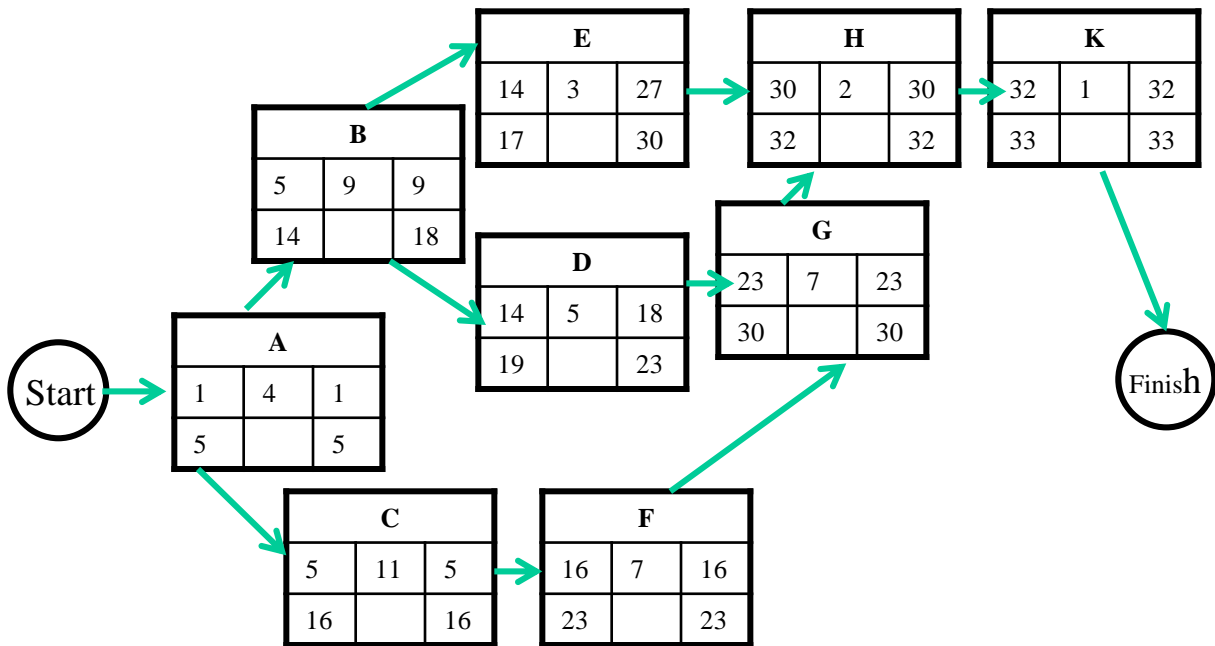*If 2 (or more) EF from proceeding uses largest*

Step 3: Do the backward pass.

Determines LS and LF using LF- DUR = LS
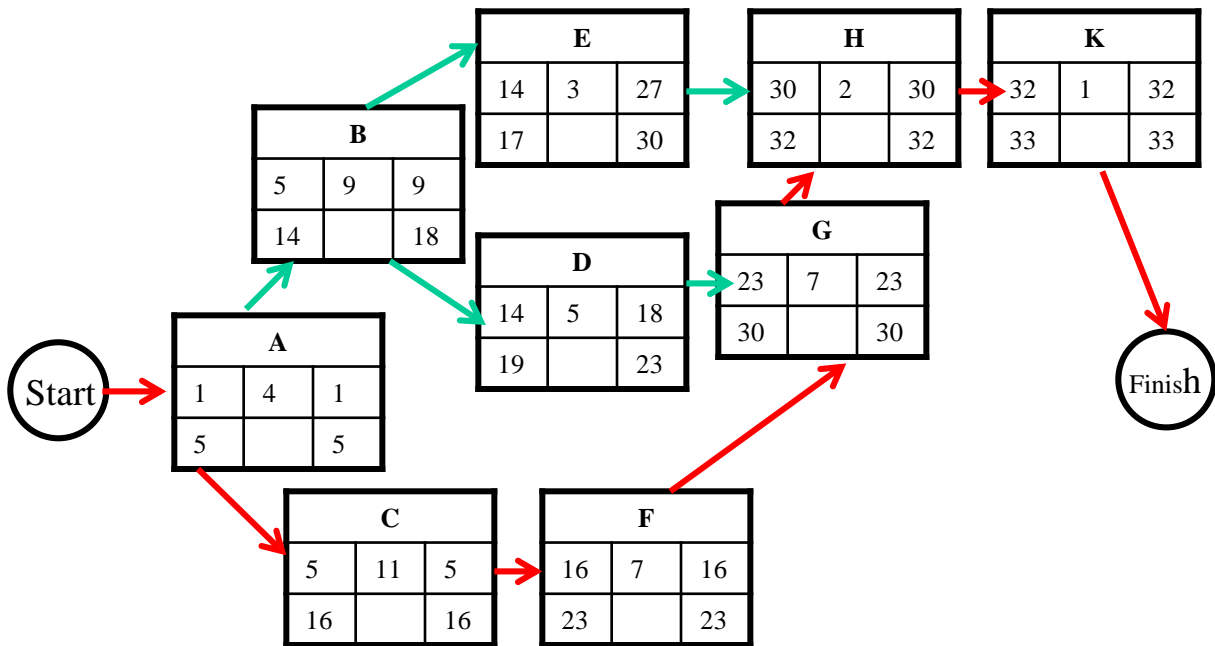*If 2 (or more) LS from succeeding use smallest*
Determine AF using LS-ES = AF

Step 4: Find Critical Path

Critical path – the ***longest path*** from end to end which determines the ***shortest project length***

	E	
14	3	27
17		30

	H	
30	2	30
32		32

	K	
32	1	32
33		33

	B	
5	9	9
14		18

	D	
14	5	18
19		23

	G	
23	7	23
30		30

	A	
1	4	1
5		5

Start

Finish

	C	
5	11	5
16		16

	F	
16	7	16
23		23

→ = Critical Path

LEARN
CIVIL ENGINEERING
.COM

→ Lead and Lag times

- Lead (or negative Lag) is starting the next task before the first task is complete
  - Example: Begin erecting the steel 3 days before all the steel is delivered

- Lag (or negative lead) is the adding of a buffer of time before the next task begins
  - Example: Once the walls have been painted, wait one day before laying the carpet so that the walls have had a chance to dry

→ Example: Activity D has a lag of 4 days from Activity B, and Activity F has a 6 day lead from Activity C

** See how the critical path changed and some of the float changed

LEARN
CIVIL ENGINEERING
.COM