DRAWING A PRECEDENCE NETWORK DIAGRAM
(ACTIVITY-ON-NODE)

EXAMPLE 1:

Consider the following activities:

Task	Precedents	Duration (weeks)
A	None	6
B	None	7
C	None	28
D	B	7
E	A	6
F	A	9
G	D, E	5
H	F, G	8

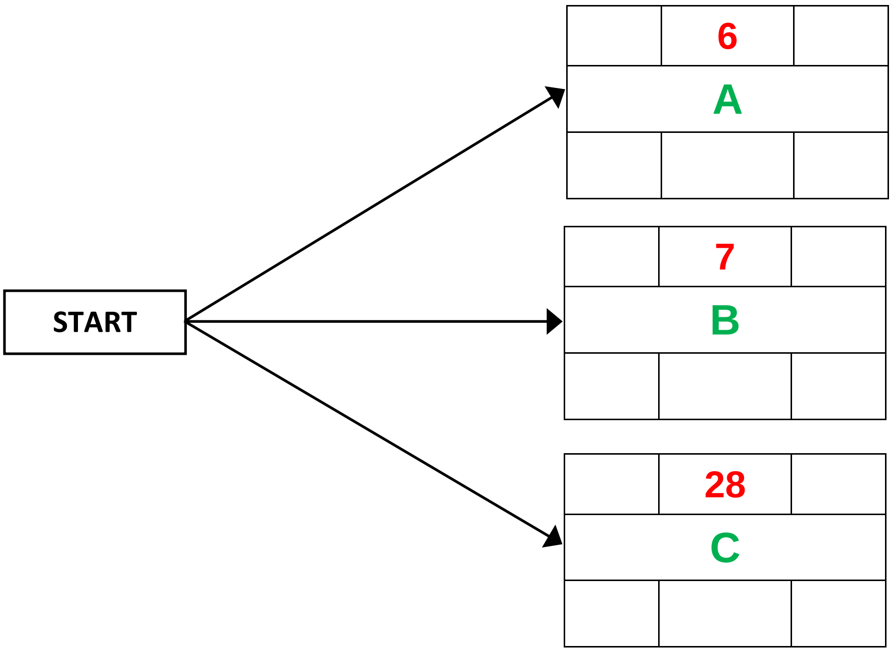
The **ACTIVITY-ON-NODE STRUCTURE** is based on the **British Standard BS 4335**

EARLIEST START	DURATION	EARLIEST FINISH
ACTIVITY LABEL, ACTIVITY DESCRIPTION		
LATEST START	FLOAT	LATEST FINISH

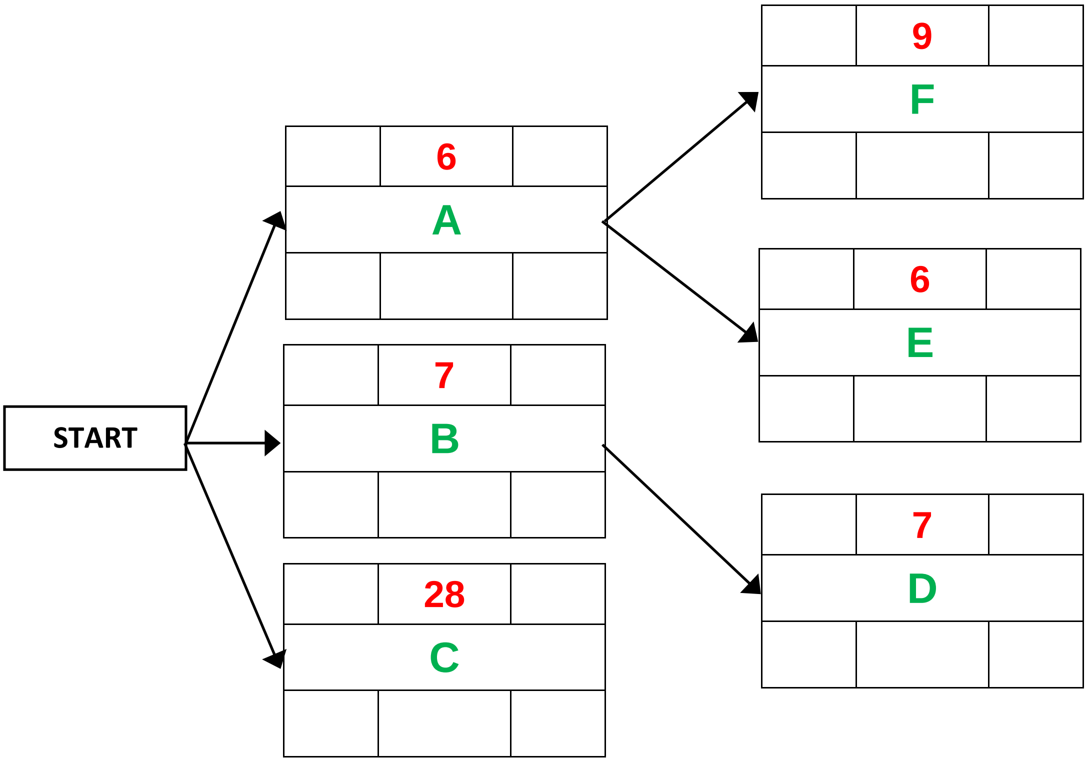
STEP 1:

DRAW THE DIAGRAM

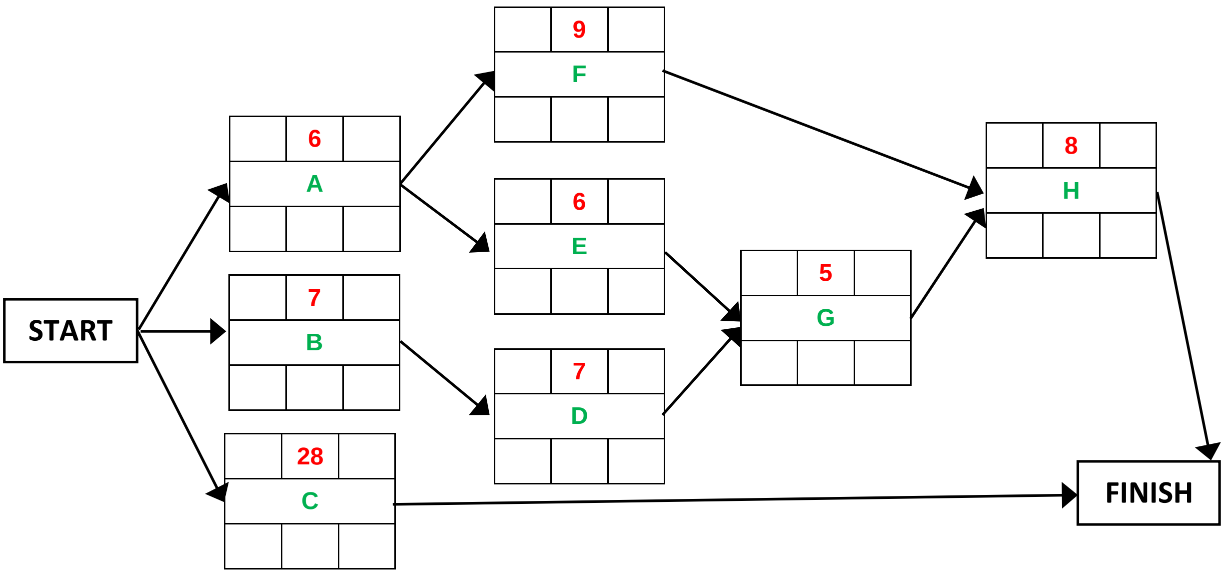
- You start by finding all activities that have no precedents, in other words, the tasks that can start immediately.
- In this case it is activities **A, B and C.**
- Also indicate the activity duration which is given in above table.



- Next find all activities which are dependent on A, B or C and draw them on your diagram.
- In this case D is dependent on B and both E and F are dependent on A.



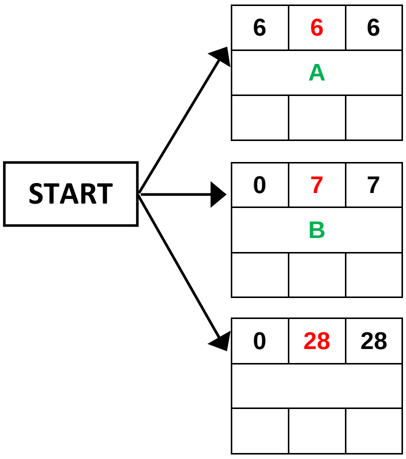
- Repeat this process for the rest of the activities.
- Up to this point all the information indicated on the diagram has been given to you - that is the activity name and duration.
- Now you are ready to do the forward pass



STEP 2:

CALCULATE THE FORWARD PASS

- A, B and C can start as soon as the project kicks-off, so their earliest start is week **0**.
- Fill this on your diagram.
- The earliest finish is then simply the earliest start + activity duration.
  A = 0+6 = **6**
  B = 0+7 = **7**
  C = 0+28 = **28**



- Now activities E and F can only start once activity A is completed, so the earliest start for both E and F is 6

- Once again you find their earliest finish by adding their earliest start to their duration.
  E = 6+6 = **12**
  F = 9+6 = **15**

6	**6**	**12**
	E	

6	**9**	**15**
	F	

- After completing the same exercise for D (which is dependent on B) D will look as

7	**7**	**14**
	D	

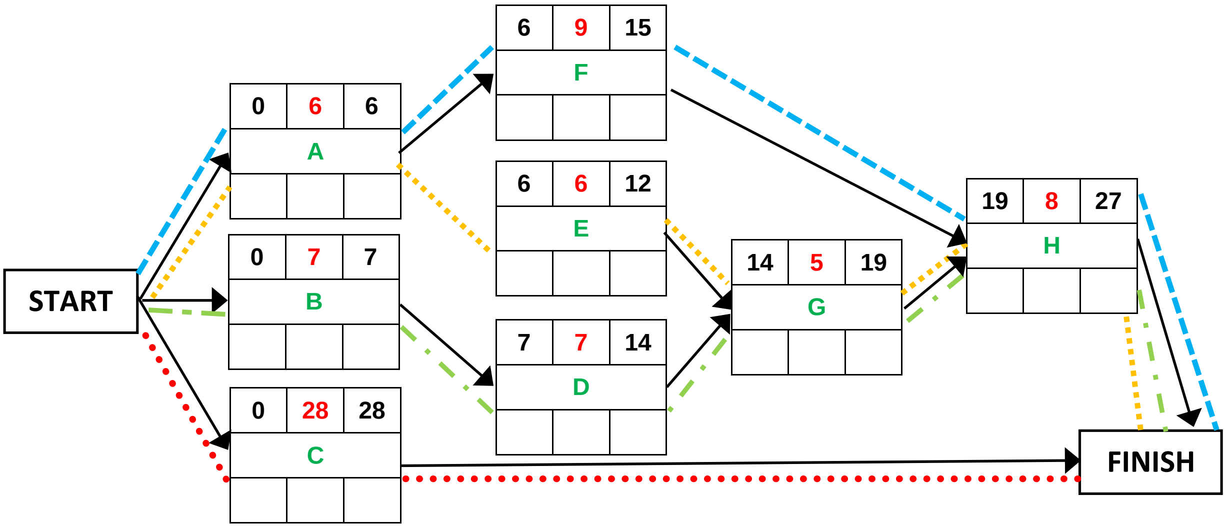
- G is dependent on both D and E, so G cannot start until **both** D and E have been completed.
- From the information thus far on the diagram, you can see that the earliest completion date for E is week 12 and for D it is week 14.
- Activity G will therefore have to wait until week 14 (when both E and D is completed) before it can start.

14	**5**	**19**
	G	

- Repeat this process for the rest of the activities.
- Before you do backward pass, you first need to identify the critical path(s)

STEP 3:

Identify the <u>CRITICAL PATH</u>



- First you determine all possible paths. You do this by starting at the START node and following the links to the FINISH node without moving backwards in the diagram at anytime.

    1. Path 1: A-F-H
    2. Path 2: A-E-G-H
    3. Path 3: B-D-G-H
    4. Path 4: C

- You then add the individual activities' durations to calculate the total path duration.
    1. A-F-H = 6+9+8 = 23
    2. A-E-G-H = 6+6+5+8 = 25
    3. B-D-G-H = 7+7+5+8 = 27
    4. **C = 28**

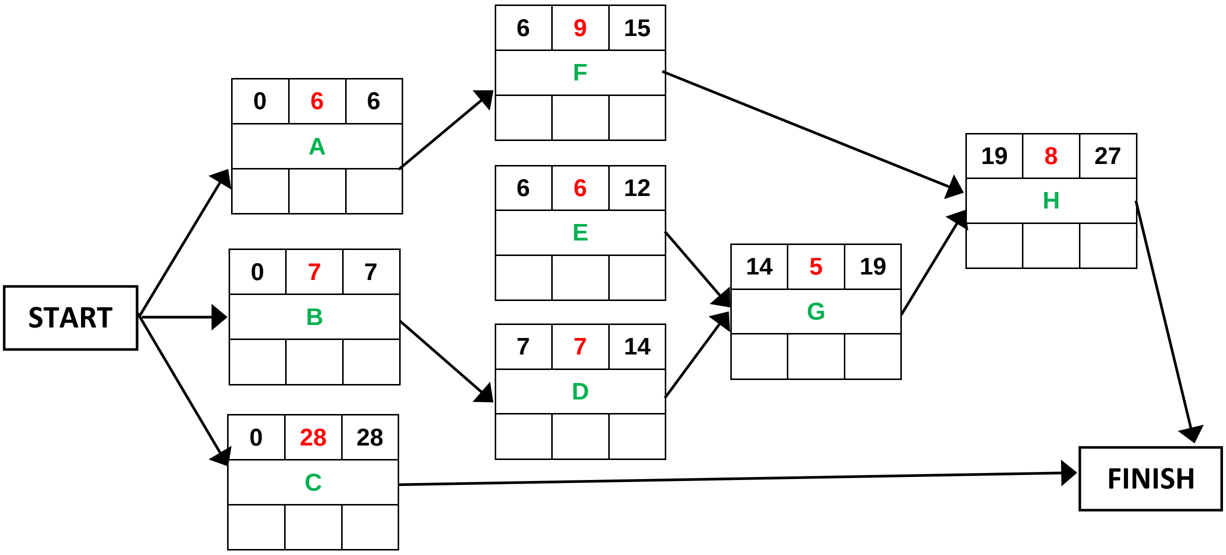
- The critical path is the path with the longest duration, in this case path 4 which consists of only 1 activity – C

- Now you are ready for the **backward pass**.

STEP 4:

CALCULATE THE BACKWARD PASS

- Having completed the forward pass, your diagram should now look like this:



- We have also established that C is our critical path and has a duration of 28 weeks
- This means the latest finish date of all nodes linked directly to the finish node should be 28 in order not to delay completion of the project
- Fill in 28 as the latest finish for nodes C and H so that it looks like this:

0	28	28
	C	
		28

19	8	27
	H	
		28

- From this point it is quite simple to calculate the latest start for an activity by simply subtracting the activity's duration from the activity's latest finish.
  For C: 28 – 28 = **0**
  For H: 28 – 8 = **20**

0	28	28
	C	
0		28

19	8	27
	H	
20		28

- You have now calculated the latest start date for activity H as week 20.
- Since H is dependent on activities F and G it means that both F and G must be completed at the latest in week 20.
- Fill in 20 as the latest finish date for F and G as follows:

6	9	15
	F	
		20

14	5	19
	G	
		20

- Then calculate the latest start date for these activities by subtracting their duration from their latest finish date.
  F = 20 – 9 = **11**
  G = 20 – 5 = **15**

6	9	15
	F	
11		20

14	5	19
	G	
15		20

- Repeat this process for the other activities.

STEP 5:

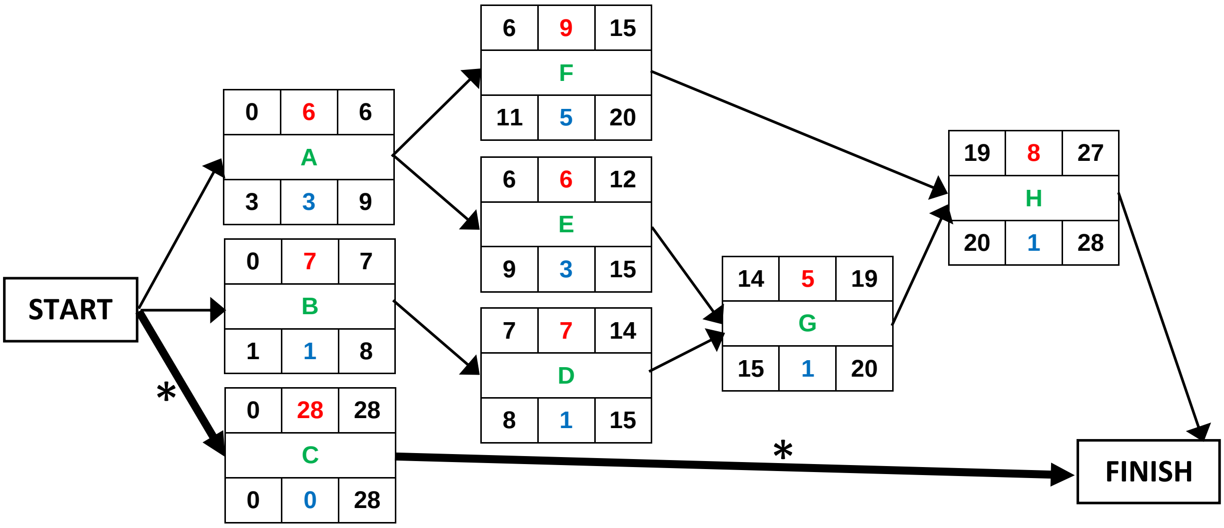
CALCULATE THE ACTIVITY SLACK / FLOAT

- Slack = Latest finish – Earliest finish
  - e.g. for F it would be 20 – 15 = 5

- Slack can also be calculated Latest start – Earliest start:
  - e.g. for F it would be 11 – 6 = 5

- Repeat for all nodes

Complete DIAGRAM!!



EXAMPLE 2:

1. Consider the following list of tasks with dependencies and estimated durations reflected in table 2. Draw the activity-on-node network (precedence network) diagram for the tasks as given in table 2. Indicate all the values on the nodes. Indicate the critical path with an ***** on each task in the path.

Task	Precedents	Duration (weeks)
A	None	5
B	A	9
C	None	4
D	A	2
E	C	5
F	B	6

2. Calculate the earliest start time, earliest finish, latest start time, latest finish and total float of the tasks for the activity-on-node network (precedence network diagram drawn in Question 1.3. Give your answer in table format.

EXAMPLE 3:

Consider the following activities with their precedents and durations.

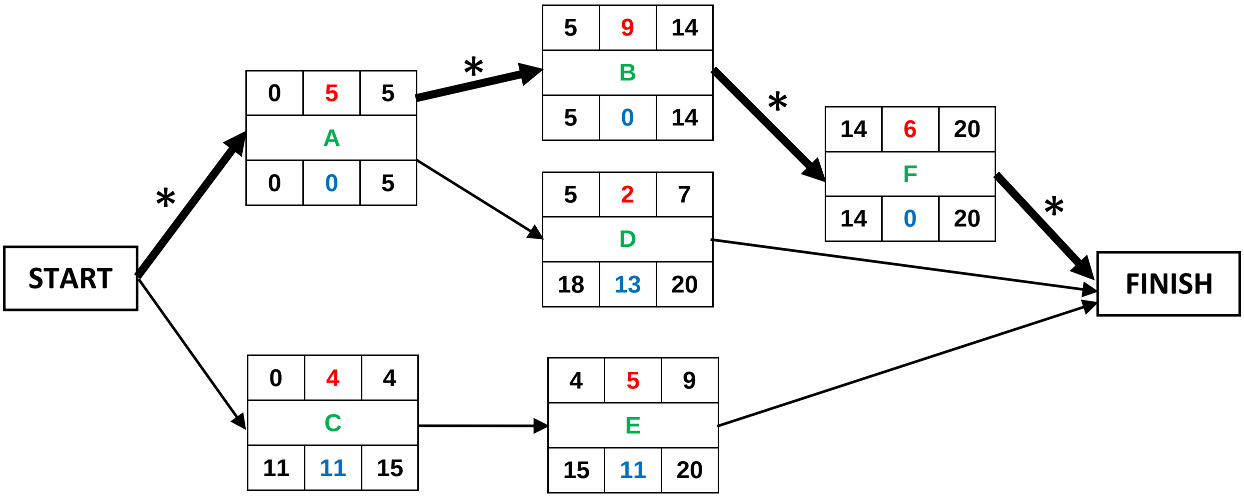
Task	Precedents	Duration (weeks)
A	None	6
B	None	4
C	A	3
D	B	4
E	B	3
F	None	10
G	E, F	3
H	C, D	2

1. Draw a complete Precedence network (Activity-on-node) diagram. Use the naming convention for nodes as used in Hughes & Cotterel, which is based on the **British Standard BS 4335**. (see figure below) Complete both a forward and backward pass to determine the total duration and critical path.
2. Indicate the critical path with an ***** on each task in the path.

<table>
<tr><td>EARLIEST START</td><td>DURATION</td><td>EARLIEST FINISH</td></tr>
<tr><td colspan="3">ACTIVITY LABEL, ACTIVITY DESCRIPTION</td></tr>
<tr><td>LATEST START</td><td>FLOAT</td><td>LATEST FINISH</td></tr>
</table>

SOLUTION of EXAMPLE 2:

1.



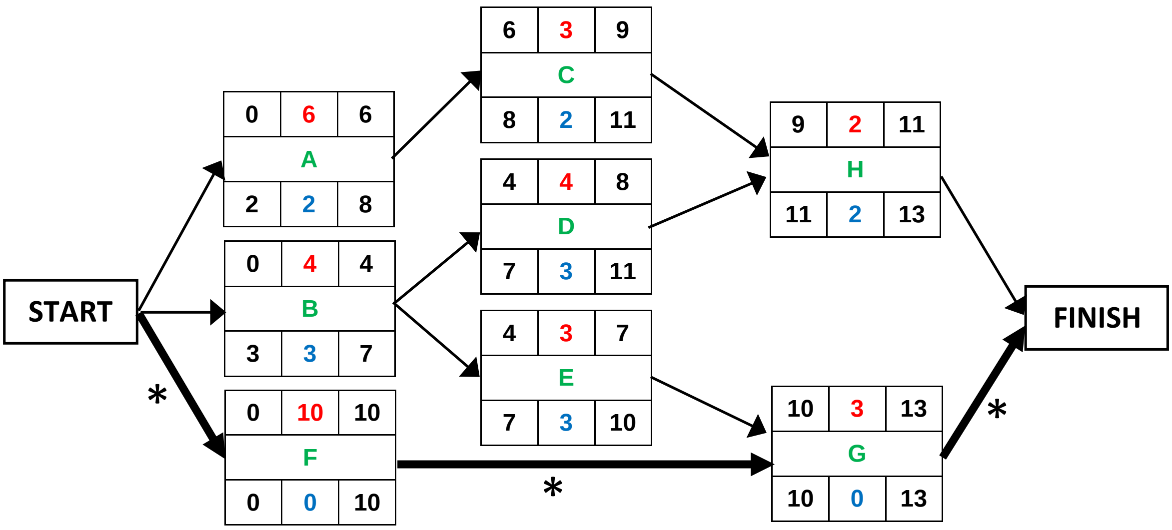
* **CRITICAL PATH: A-B-F = 20**

2.

TASK	Duration (weeks)	Earliest Start	Earliest Finish	Latest Start	Latest Finish	Float
A	5	0	5	0	5	0
B	9	5	14	5	14	0
C	4	0	4	11	15	11
D	2	5	7	18	20	13
E	5	4	9	15	20	11
F	6	14	20	14	20	0

SOLUTION of EXAMPLE 3:

1.



* **CRITICAL PATH: F-G = 13**