CRITICAL PATH METHOD

CPM

Overview

Background & History

CPM Defined

The CPM approach

Definitions

Class Exercise

Background & History

Developed in the 1950s by the US Navy

Originally, the critical path method considered only logical dependencies between terminal elements

Since then, it has been expanded to allow for the inclusion of resources related to each activity, through processes called activity-based resource assignments and resource leveling.

Critical Path Method for the construction industry

What is CPM?

The Critical Path Method or Critical Path Analysis, is a mathematically based algorithm for scheduling a set of project activities

It is an important tool for effective project management

Commonly used with all forms of projects, including construction, software development, research projects, product development, engineering, and plant maintenance, among others

Any project with interdependent activities can apply this method of scheduling

What is CPM?

The essential technique for using CPM is to construct a model of the project that includes the following:

- A list of all activities required to complete the project (also known as Work Breakdown Structure)
- The time (duration) that each activity will take to completion
- The dependencies between the activities.

What is CPM?

- CPM calculates
  - The longest path of planned activities to the end of the project
  - The earliest and latest that each activity can start and finish without making the project longer
- Determines “critical” activities (on the longest path)
- Prioritize activities for the effective management and to shorten the planned critical path of a project by:
  - Pruning critical path activities
  - “Fast tracking" (performing more activities in parallel)
  - “Crashing the critical path" (shortening the durations of critical path activities by adding resources)

The CPM Approach

Phase I

- Break project into operations necessary for completion
- Determine sequential relationship of operations
  - Every operation must have event to mark commencement – i.e. completion of preceding operation
  - Can operations overlap?

The CPM Approach

Phase II

Create **time** estimates for each operation

Determine earliest possible start date, earliest possible finish date , latest start & finish

Determine “free float” and “total float”

Revised after completion of Phase III

The CPM Approach

Phase III

Establish **time-cost** relationship

Establish scheduling variations

Determine most favorable balance between time-cost

Normal Start – normal time, least cost

All-Crash Start – least time, higher cost

Definitions

Float (slack) - amount of time that a task can be delayed without causing a delay to:

subsequent tasks (free float)

project completion date (total float)

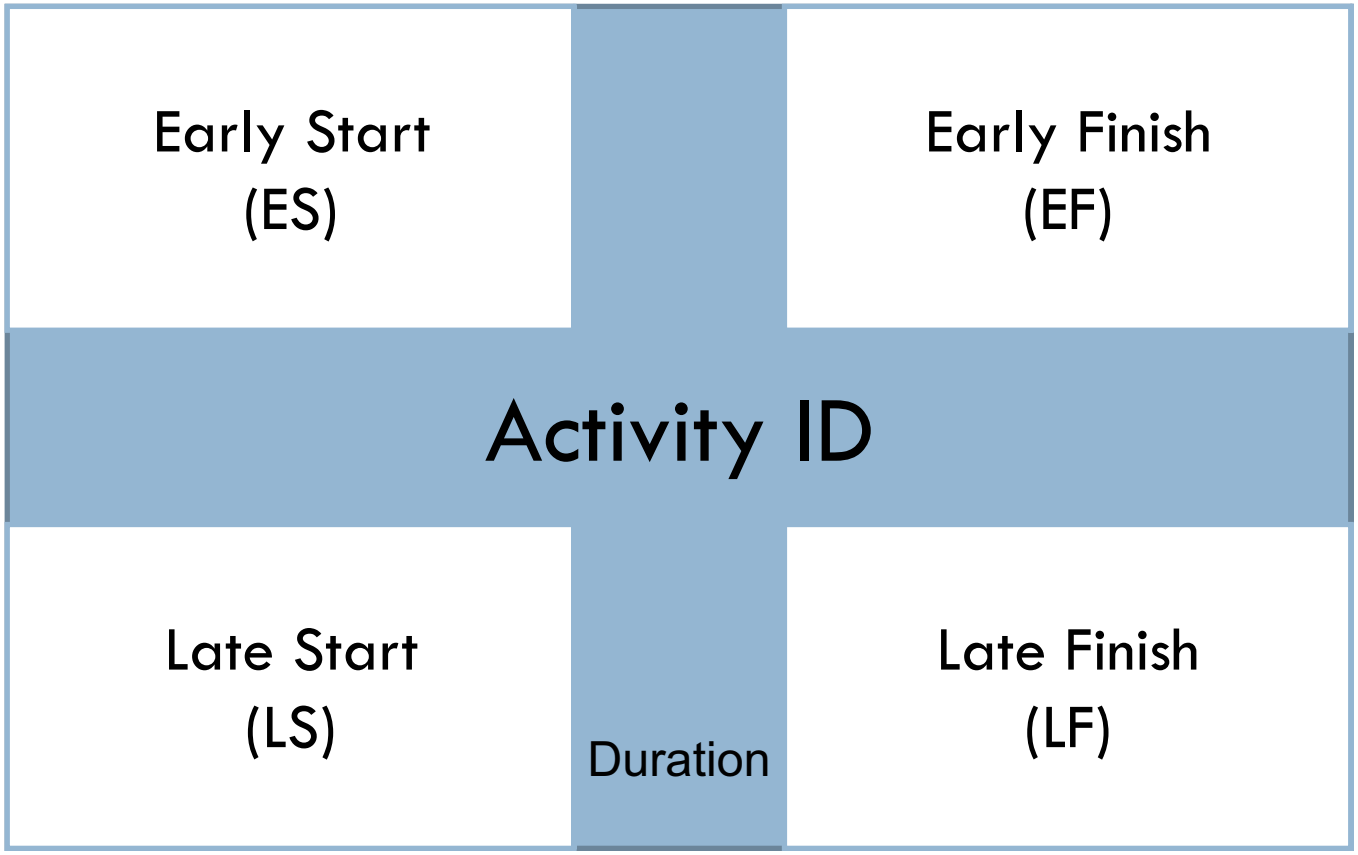
Critical path is the sequence of activities which add up to the longest overall duration. It is the shortest time possible to complete the project. Any delay of an activity on the critical path directly impacts the planned project completion date (there is no float on the critical path). A project can have several, parallel, near critical paths. An additional parallel path through the network with the total durations shorter than the critical path is called a sub-critical or non-critical path.

Critical activity – activity with zero float

Resource leveling – iterative process of assigning crews to activities in order to calculate their duration

Definitions

Activity Identity box



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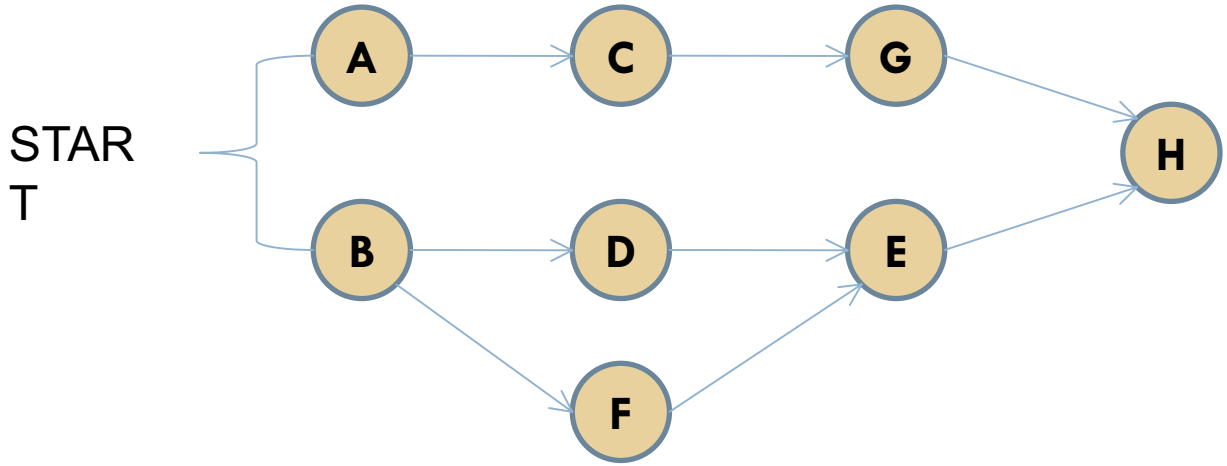
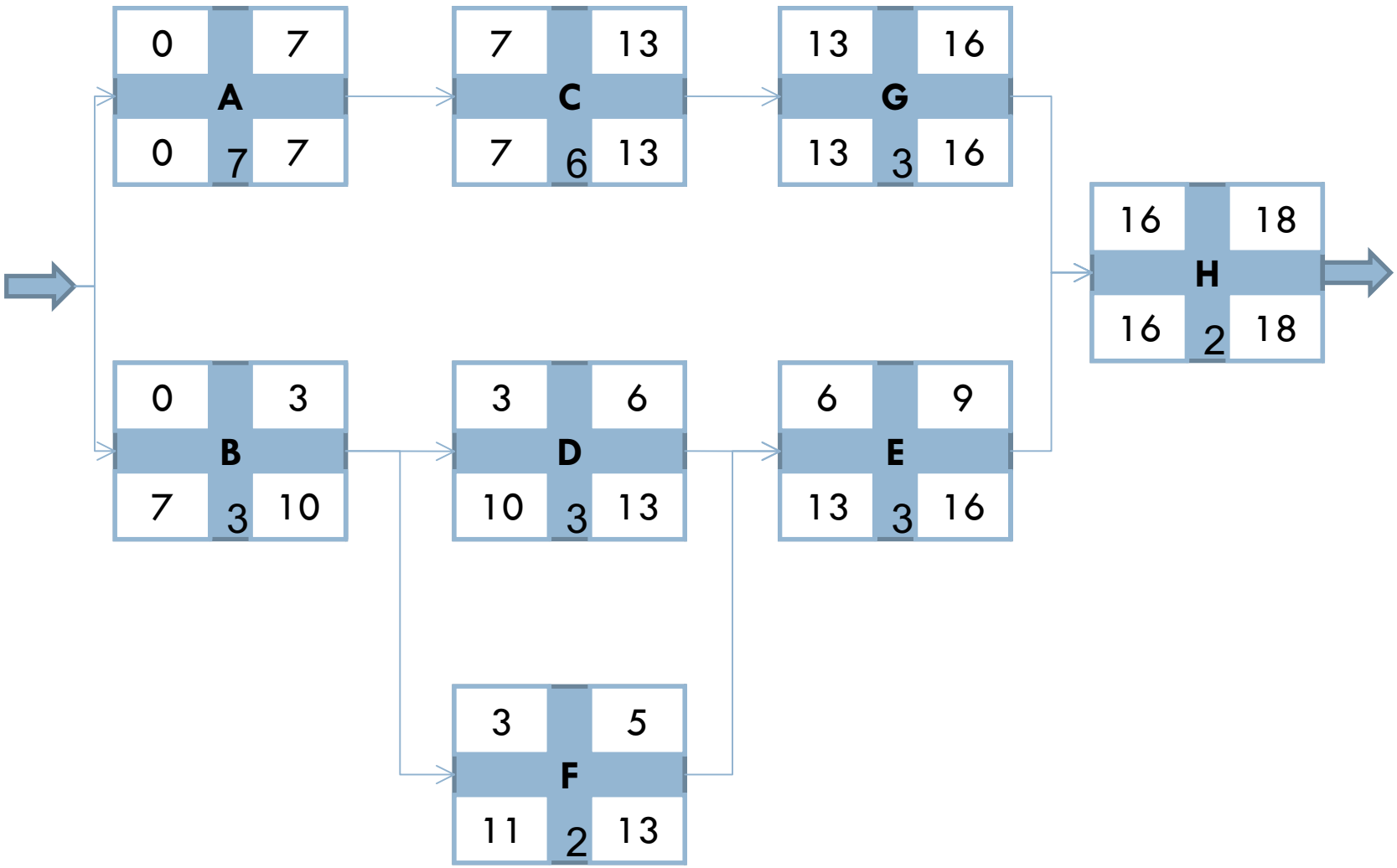
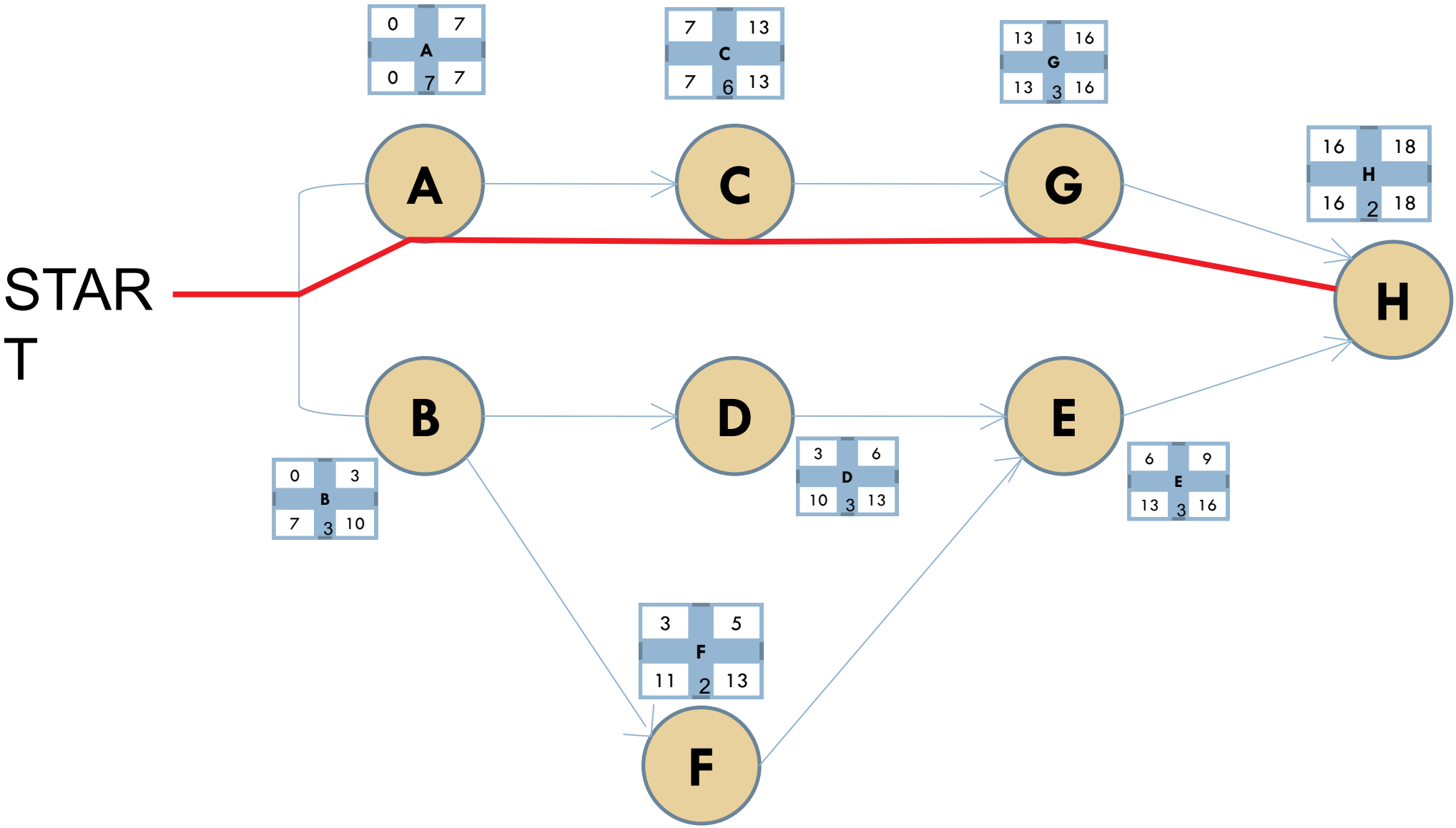


Activity ID	Duration	Dependency
A	7	
B	3	
C	6	A
D	3	B
E	3	D,F
F	2	B
G	3	C
H	2	E,G

Class Exercise

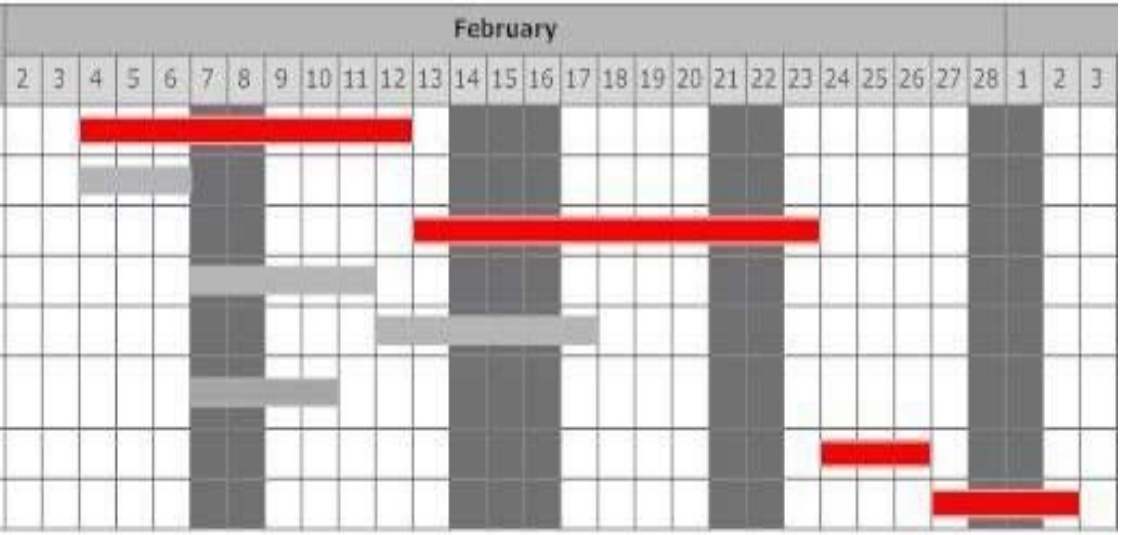



START
A
C
G
H
B
D
E
F
0 7 A 0 7 7
7 13 C 7 6 13
13 16 G 13 3 16
16 18 H 16 2 18
0 3 B 7 3 10
3 6 D 10 3 13
6 9 E 13 3 16
3 5 F 11 2 13

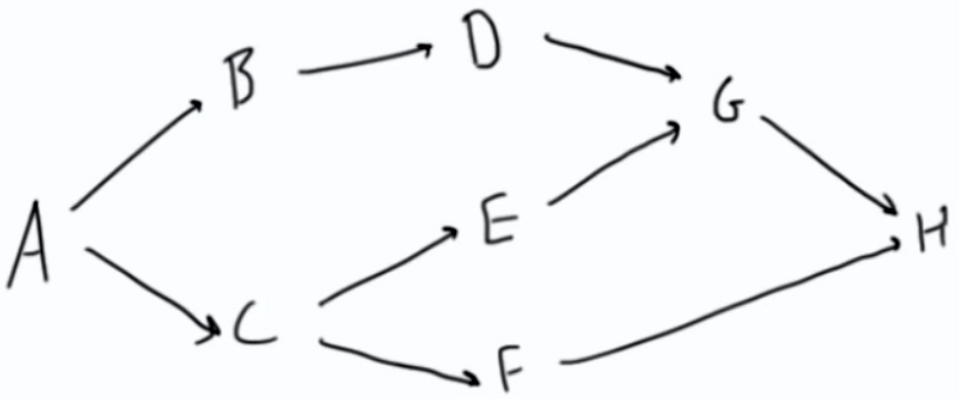
Class Exercise

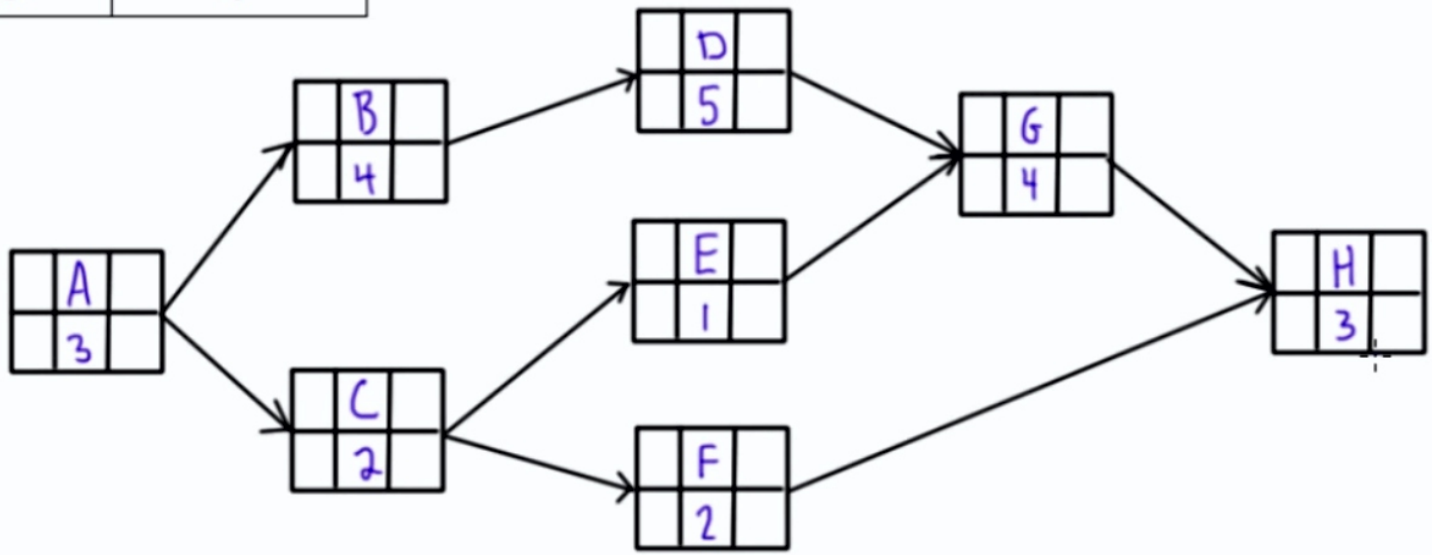
Gantt Chart

Number	Task	Start	End	Duration
1	Site Clearing	2/4/2009	2/13/2009	7
2	Removal of trees	2/4/2009	2/7/2009	3
3	General Excavation	2/13/2009	2/24/2009	6
4	Grading General Area	2/7/2009	2/12/2009	3
5	Excavation for trenches	2/12/2009	2/18/2009	3
6	Placing formwork & reinforcement	2/7/2009	2/11/2009	2
7	Install utilities	2/24/2009	2/27/2009	3
8	Place concrete	2/27/2009	3/3/2009	2



Activity	Predecessor	Duration (days)
A	-	3
B	A	4
C	A	2
D	B	5
E	C	1
F	C	2
G	D,E	4
H	F,G	3





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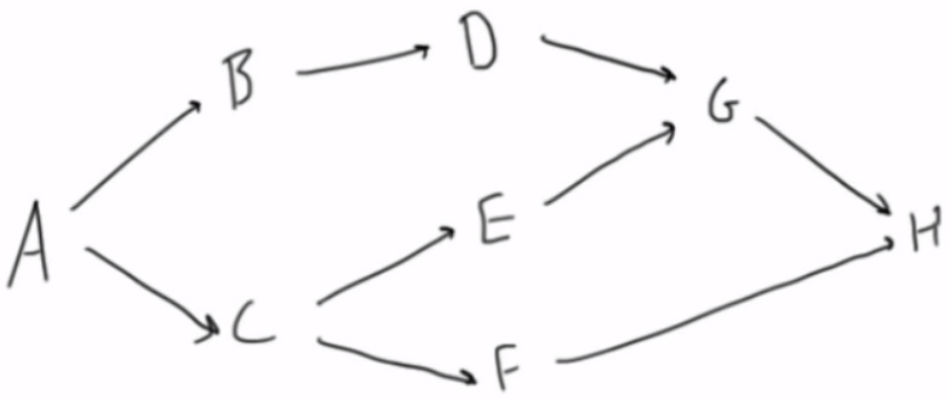
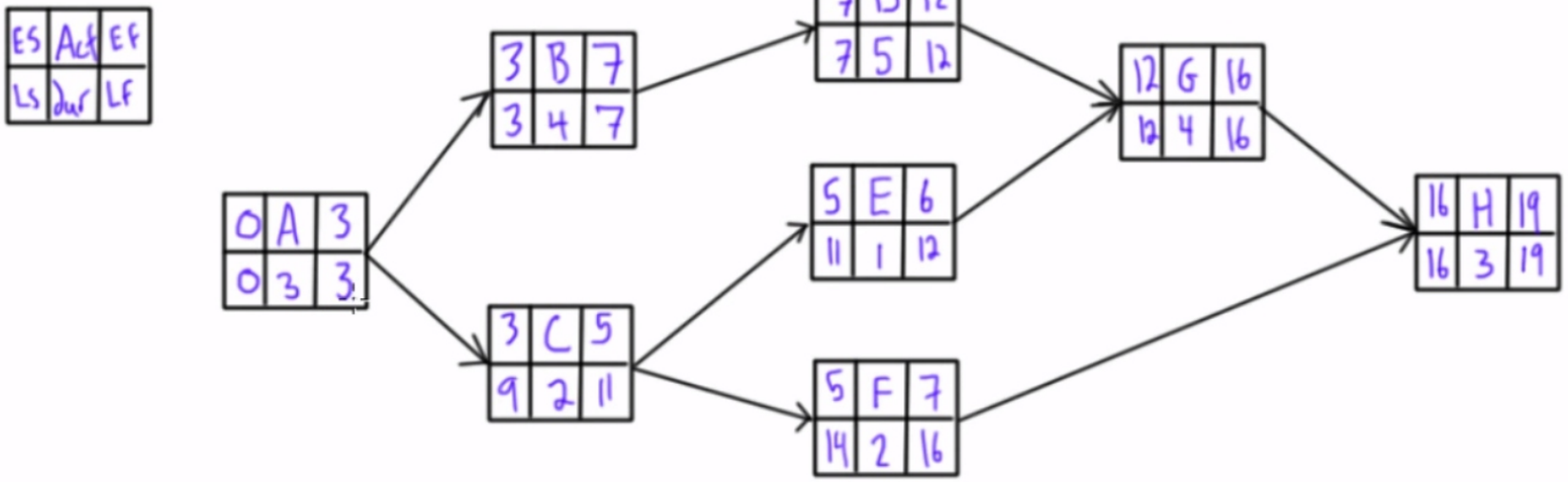
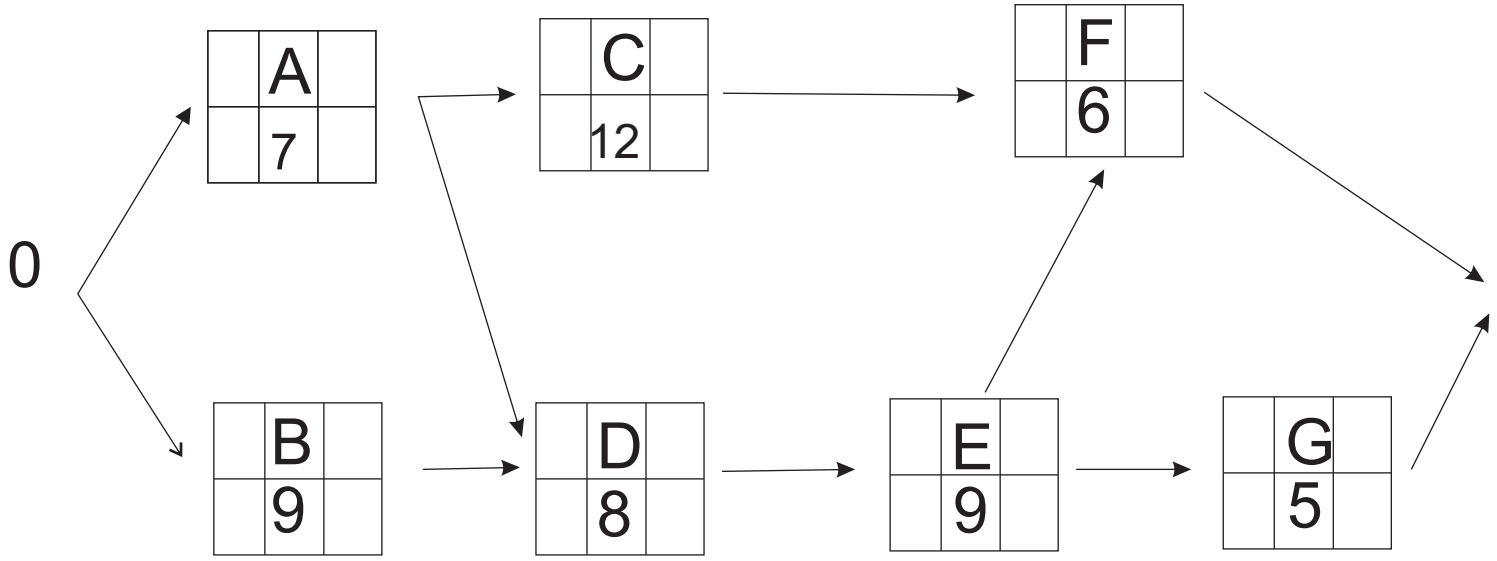




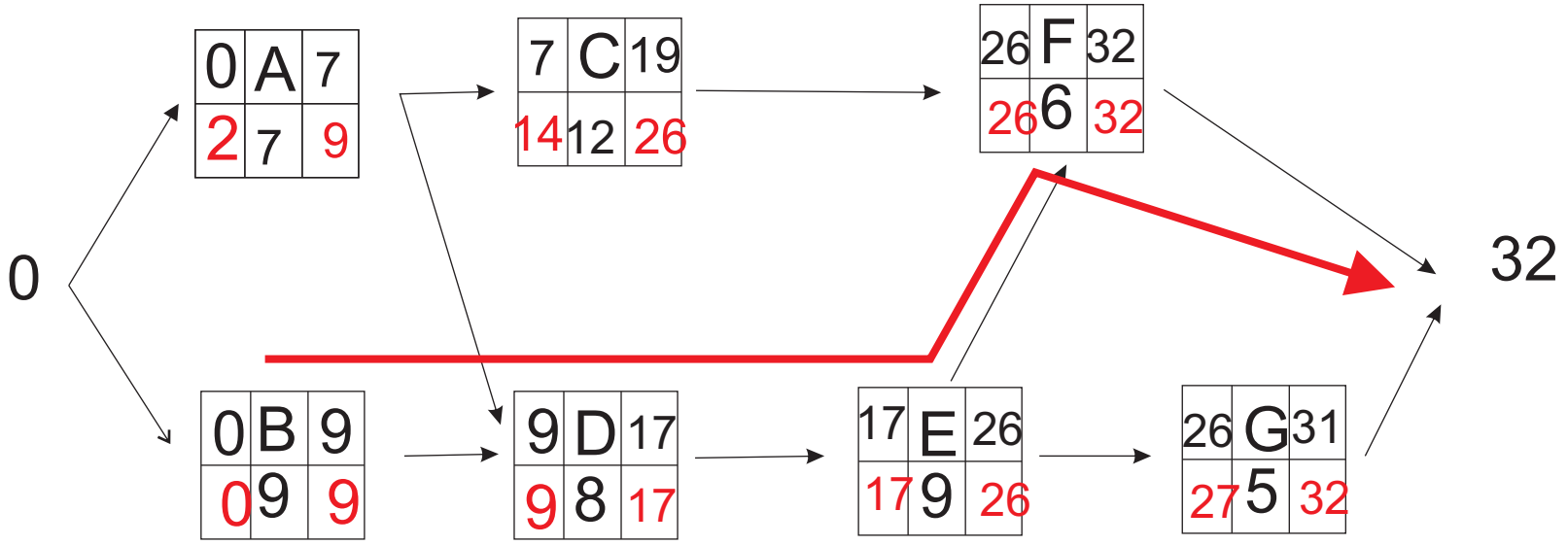
Activity	A	B	C	D	E	F	G
Immediate Predecessors	--	--	A	A, B	D	C, E	E
Expected Time (weeks)	7	9	12	8	9	6	5

- Construct a project network
- Perform forward and backward passes
- Determine project completion time
- Calculate slack values
- State the critical path

Activity	A	B	C	D	E	F	G
Immediate Predecessors	--	--	A	A, B	D	C, E	E
Expected Time (weeks)	7	9	12	8	9	6	5



Activity	A	B	C	D	E	F	G
Immediate Predecessors	--	--	A	A, B	D	C, E	E
Expected Time (weeks)	7	9	12	8	9	6	5



Activity	A	B	C	D	E	F	G
Immediate Predecessors	--	--	A	A, B	D	C, E	E
Expected Time (weeks)	7	9	12	8	9	6	5

Q- for the above schedule determine the early and late start and finish and and define according to your digram the critical work path (15 mark)