PROGRAM EVALUATION AND REVIEW TECHNIQUE & CRITICAL PATH METHOD

PERT CPM

PROJECT MANAGEMENT: AN OVER VIEW

- Composed of Job, Activities and Functions (Tasks)
- One Specific purpose: Starts at some specific moment and finishes when objectives have been full filled
- For Completion: Material and manpower resources
- Role of management: deals with both
- Specific objectives:

1. Should be completed within a minimum time
2. Should use all resources as sparingly as possible
3. Should be completed with a minimum of capital investment

Phases of Project management

Three phases:

1. Project planning
2. Project Scheduling
3. Project controlling

ROLE OF DECISION IN PROJECT MANAGEMENT

If a poor decision is made and a wrong road is chosen none but luckiest survive

Steps:

- Identify : the central problem
- Develop : alternatives
- Analyse : alternatives
- Make : final decision

TECHNIQUE: OPERATION RESEARCH

A set of mathematical techniques through which a variety of organizational problems can be solved

→Net work diagrams

→Various names(PERT,CPM)

PERT: basically developed by the navy Special Project office for evaluating the feasibility of existing schedules on Polaris missile program and for reporting progress

PERT

PERT and CPM Difference?

Evaluation Technique to Estimate minimum amount of time required to complete a project

Uses **event** oriented network diagrams

An event : particular instant of time at which some specific part of a plan is to be achieved.

Does not require any resources

Preffered for

1. non repetitive projects & Task
2. précises time determination for various activities can not be made

Developed by U.S Navy in 1950 to manage Submarine missile programs

CPM

Consists of clearly recognizable job called **activities**

Activities: → take time to carry out & resources are expended

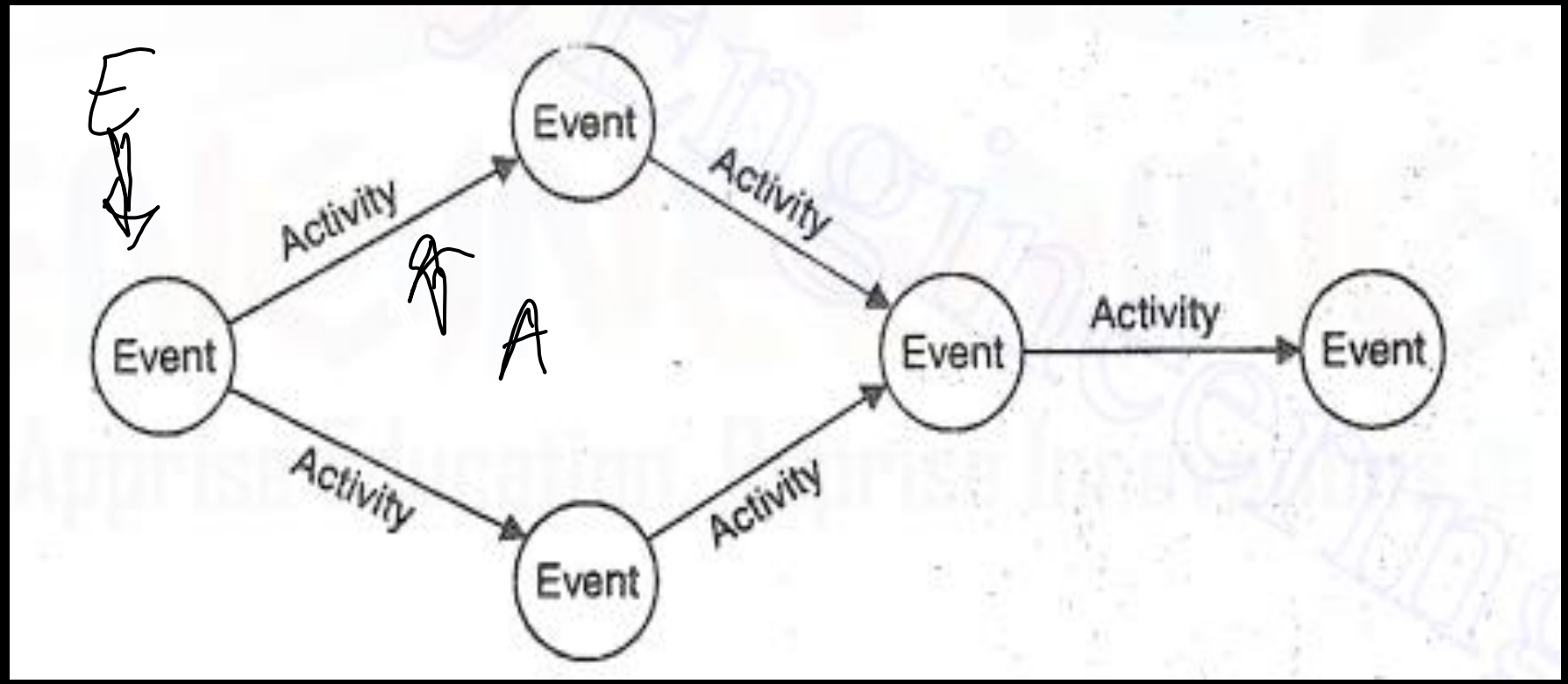
→ Junction between activities are event

→ Represented by an arrow

Generally use for repetitive projects

Fairly accurate estimate of time for completion of each activity can be made

NET WORK DIAGRAMS



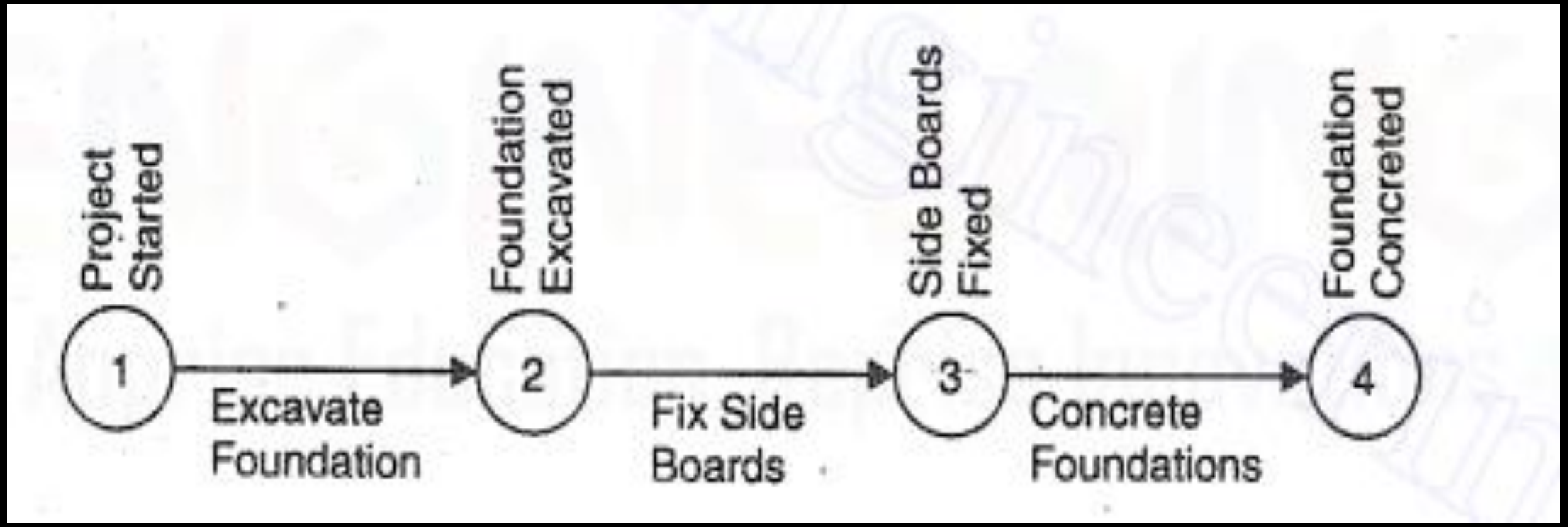
Direction of arrow indicates Sequence of task

AN EXAMPLE

Laying foundation

1. Excavation
2. Laying side boards
3. Concreting

SIMPLE NETWORK DIAGRAMS



EXAMPLE 2:

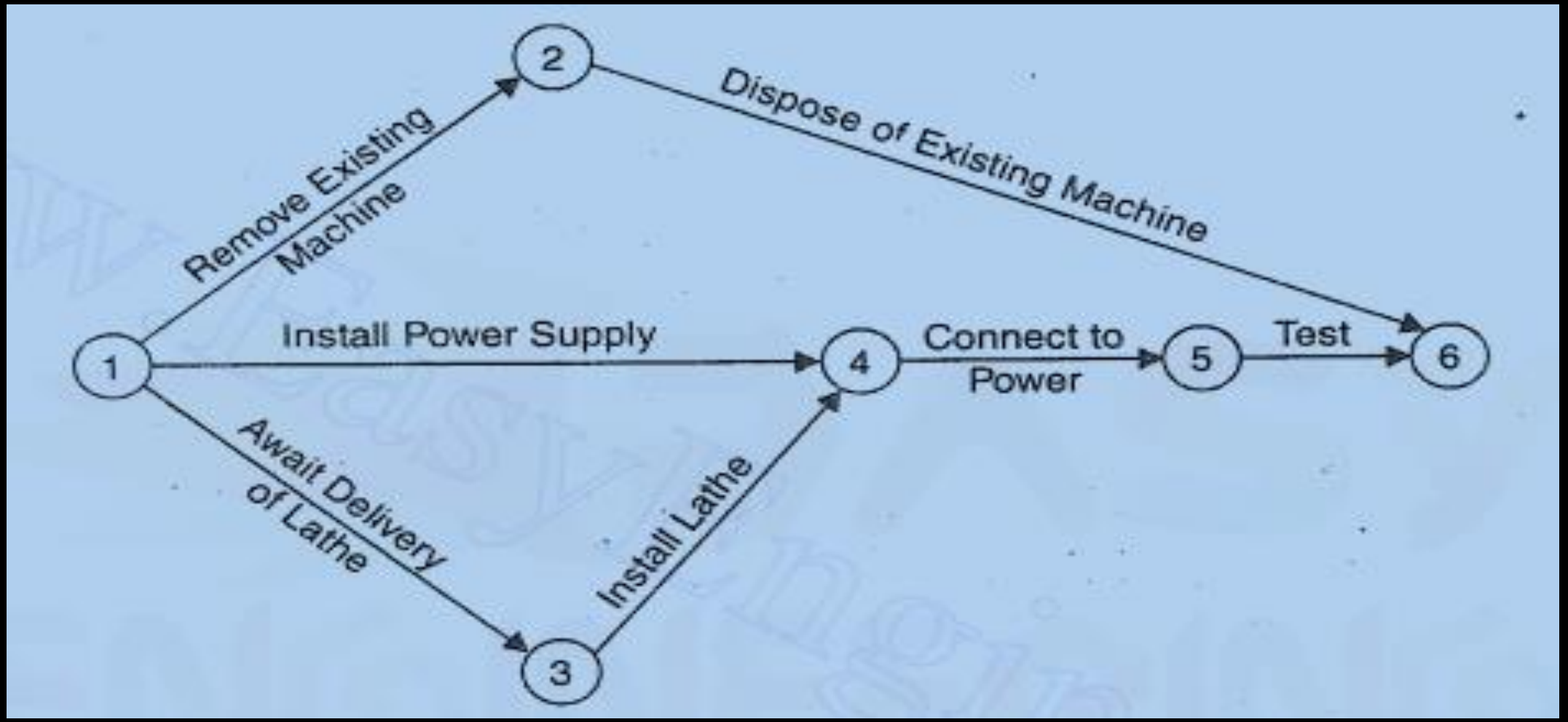
Consider a project of purchasing a new heavy duty lathe and disposing of old lathe

Activities:

1. Await delivery of lathe
2. Remove existing lathe
3. Install power supply
4. Install lathe
5. Connect to power
6. Test
7. Dispose of existing lathe

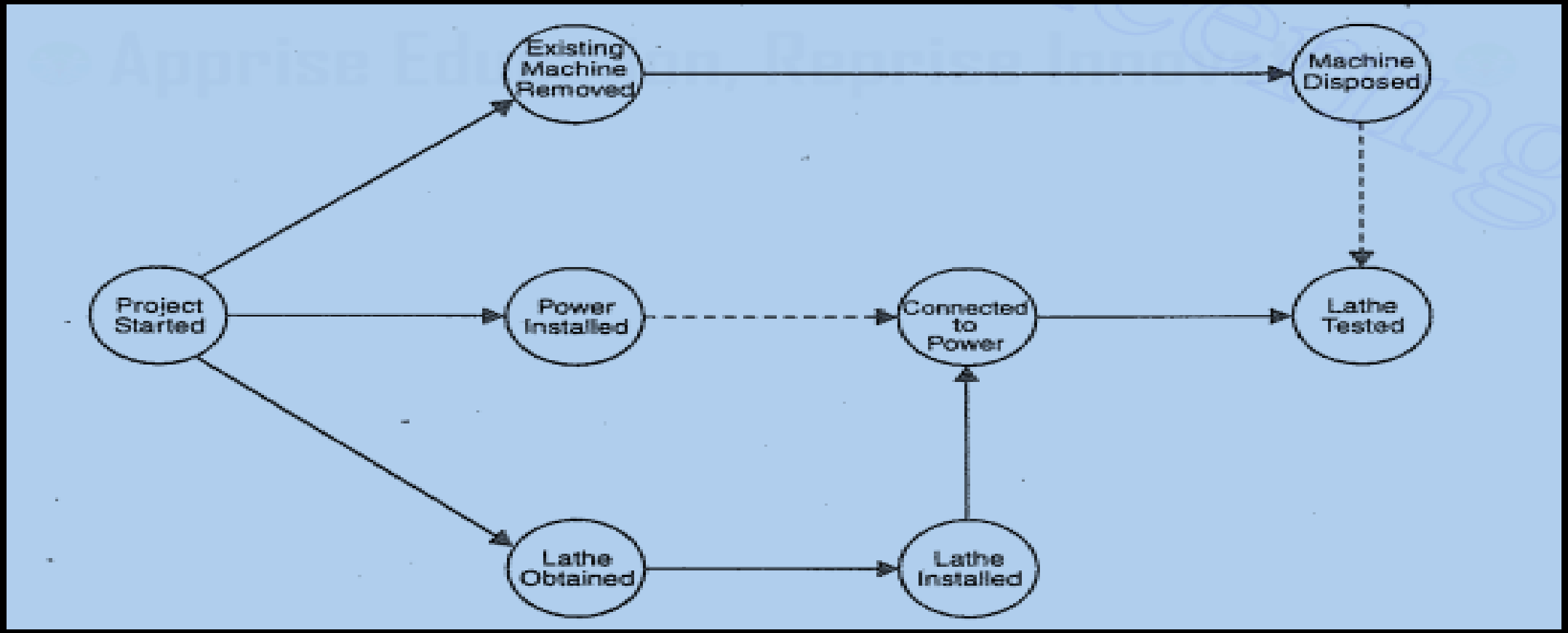
ACTIVITY ORIENTED

PERT



EVENT ORIENTED

CP M



Predecessor

An event that occurs before another event

For eg: ‘project started is an immediate predecessor for -----

Successor

An event that follows another event

Operation management techniques: PERT and CPM

The methods are essentially **network-oriented techniques**

basically time-oriented methods

In **CPM** activities are shown as a network of precedence relationships using activity-on node network construction (where each activity is represented by a *node*)

- Single estimate of activity time
- Deterministic activity times
- Control for time and costs
- **Used IN: for the jobs of repetitive in nature**

In **PERT** activities are shown as a network of precedence relationships using activity-on arrow network construction (each activity is represented by an *arc*)

Multiple time estimates

Probabilistic activity times

Used IN: for non-repetitive jobs, where the time and cost estimates tend to be quite uncertain (uses probabilistic time estimates)

BENEFITS:

Useful at many stages of project management

Mathematically simple

Give critical path and slack time

Provide project documentation

Useful in monitoring costs

STEPS

1. Define the Project and all of its significant activities or tasks. The Project (made up of several tasks) should have only a single start activity and a single finish activity.
2. Develop the relationship among the activities. Decide which activities must precede and which must follow others
3. Draw the ‘network’ connecting all the activities. Each activity should have a unique event number.
4. Assign time and/or cost estimates to each activity
5. Compute the longest time path through the network. **This is called the critical path.**
6. Use the Network to help plan, schedule, and monitor and control the project

AN EXAMPLE

The RELIABLE CONSTRUCTION COMPANY has just made the winning bid of $5.4 million to construct a new plant for a major manufacturer. The manufacturer needs the plant to go into operation within a year. Therefore, the contract incudes the following provisions:

• A penalty of $300,000 if Reliable has not completed construction by the deadline 47 weeks from now.

• To provide additional incentive for speedy construction, a *bonus* of $150,000 will be paid to Reliable if the plant is completed within 40 weeks.

ACTIVITY LIST

Activity	Activity Description	Immediate Predecessors	Estimated Duration
A	Excavate	—	2 weeks
B	Lay the foundation	*A*	4 weeks
C	Put up the rough wall	*B*	10 weeks
D	Put up the roof	*C*	6 weeks
E	Install the exterior plumbing	*C*	4 weeks
F	Install the interior plumbing	*E*	5 weeks
G	Put up the exterior siding	*D*	7 weeks
H	Do the exterior painting	*E, G*	9 weeks
I	Do the electrical work	*C*	7 weeks
J	Put up the wallboard	*F, I*	8 weeks
K	Install the flooring	*J*	4 weeks
L	Do the interior painting	*J*	5 weeks
M	Install the exterior fixtures	*H*	2 weeks
N	Install the interior fixtures	*K, L*	6 weeks

PROBABLE QUESTIONS

Immediate predecessors: Activities must be completed by no later than the starting time of the given activity. Immediate predecessors can be more than one.

1. How can the project be displayed graphically?

2. What is the total time required to complete the project if no delays occur?

3. When do the individual activities need to start and finish (at the latest) to meet this project completion time?

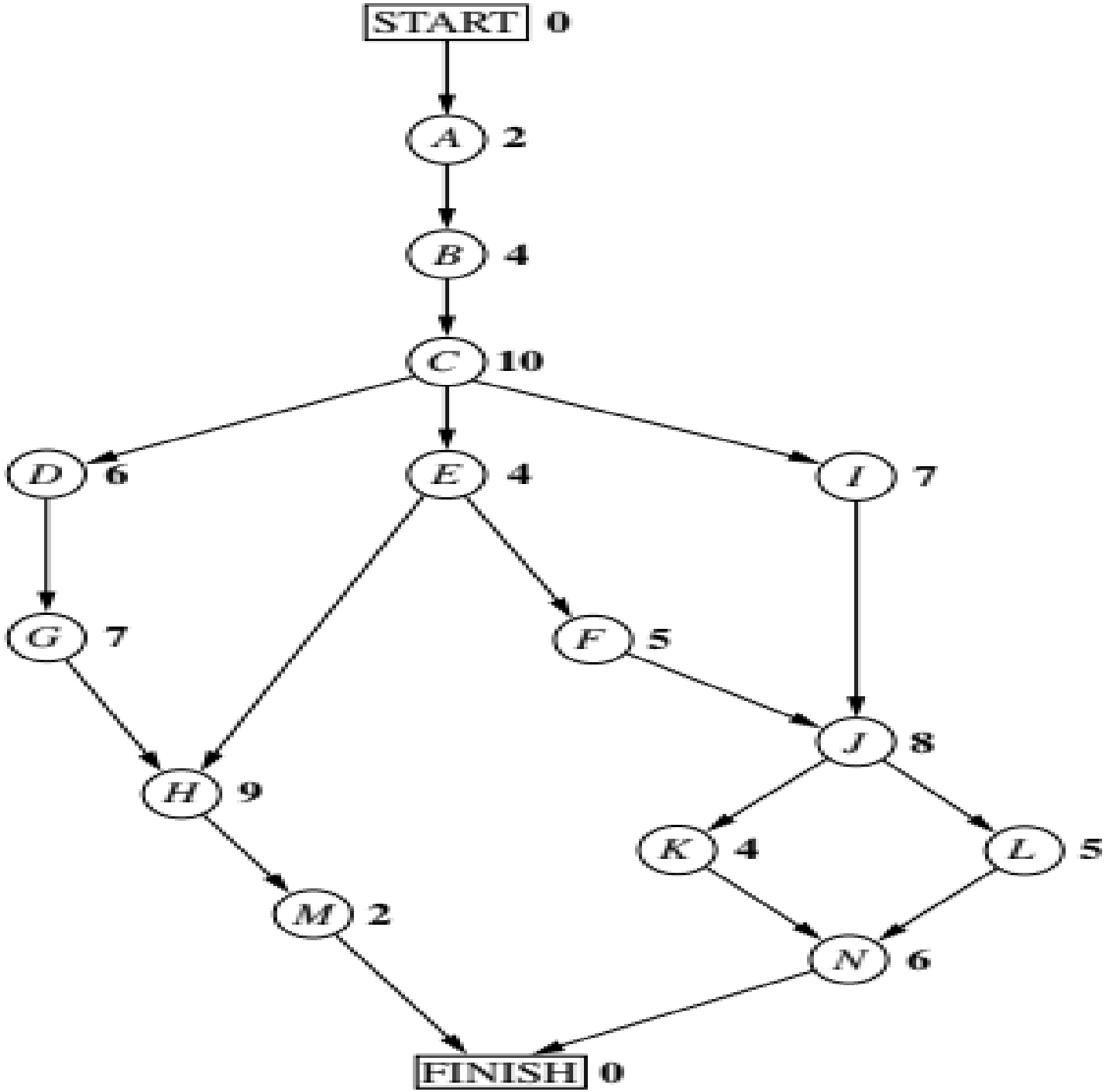
4. When can the individual activities start and finish (at the earliest) if no delays occur?

5. Which are the critical bottleneck activities?

6. For the other activities, how much delay can be tolerated without delaying project completion?

How can the project be displayed graphically?

Using project network-→ consists of a number of ***nodes*** and ***arcs***



Activity Code

A. Excavate
B. Foundation
C. Rough wall
D. Roof
E. Exterior plumbing
F. Interior plumbing
G. Exterior siding
H. Exterior painting
I. Electrical work
J. Wallboard
K. Flooring
L. Interior painting
M. Exterior fixtures
N. Interior fixtures

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CRITICAL PATH

- Sum total of duration all the activities = 79 weeks
- We have several paths with several lengths (31 to 44 weeks)
- Critical path: **the project duration will be equal to the length of the longest path.**

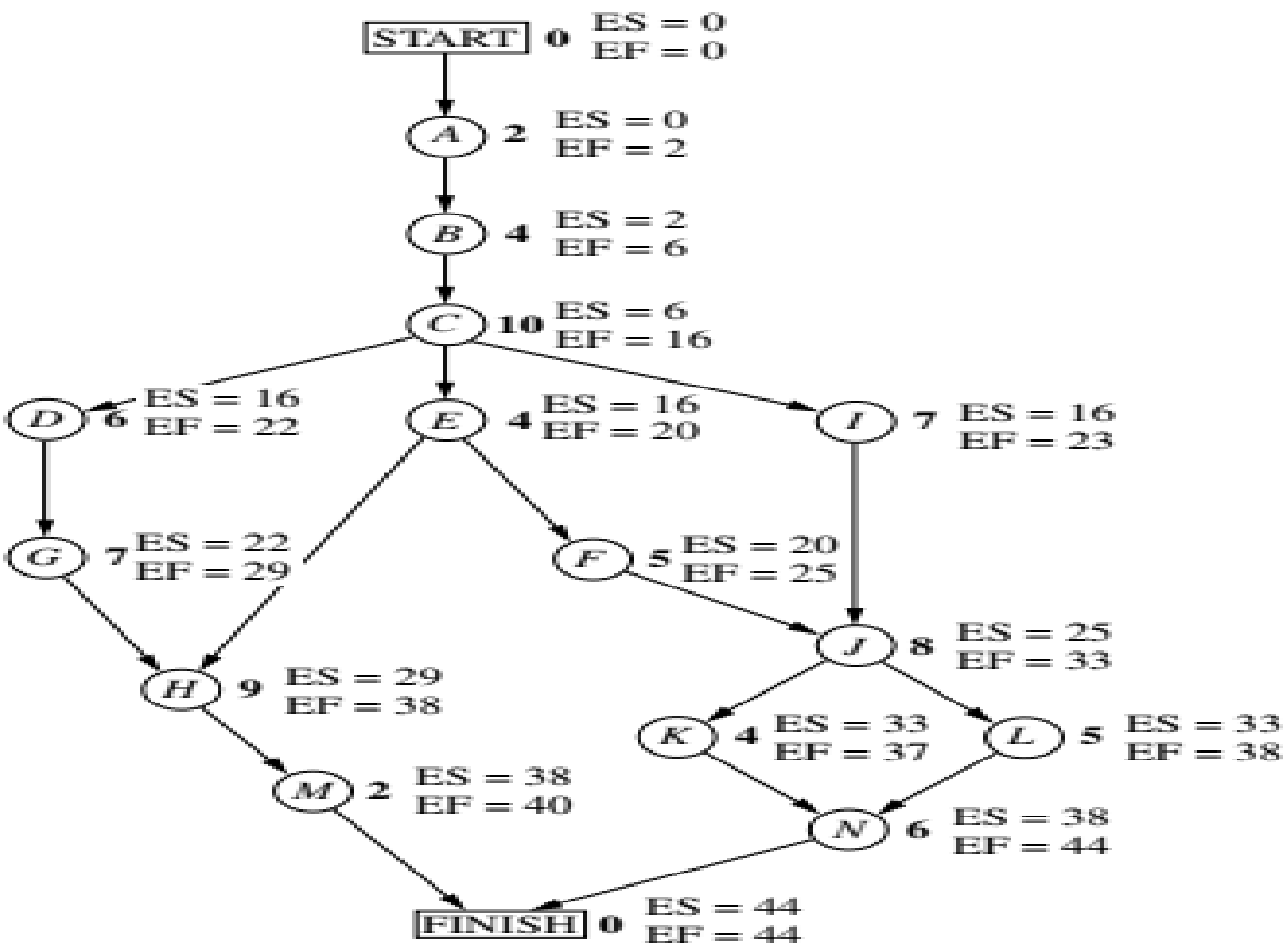
	Path	Length
1	START →A→B→C→D→G→H→M→ FINISH	2 + 4 + 10 + 6 + 7 + 9 + 2 = 40 weeks
2	START →A→B→C→E→H→M→ FINISH	2 + 4 + 10 + 4 + 9 + 2 = 31 weeks
3	START →A→B→C→E→F→J→K→N→ FINISH	2 + 4 + 10 + 4 + 5 + 8 + 4 + 6 = 43 weeks
4	START →A→B→C→E→F→J→L→N→ FINISH	2 + 4 + 10 + 4 + 5 + 8 + 5 + 6 = 44 weeks
5	START →A→B→C→I→J→K→N→ FINISH	2 + 4 + 10 + 7 + 8 + 4 + 6 = 41 weeks
6	START →A→B→C→I→J→L→N→ FINISH	2 + 4 + 10 + 7 + 8 + 5 + 6 = 42 weeks

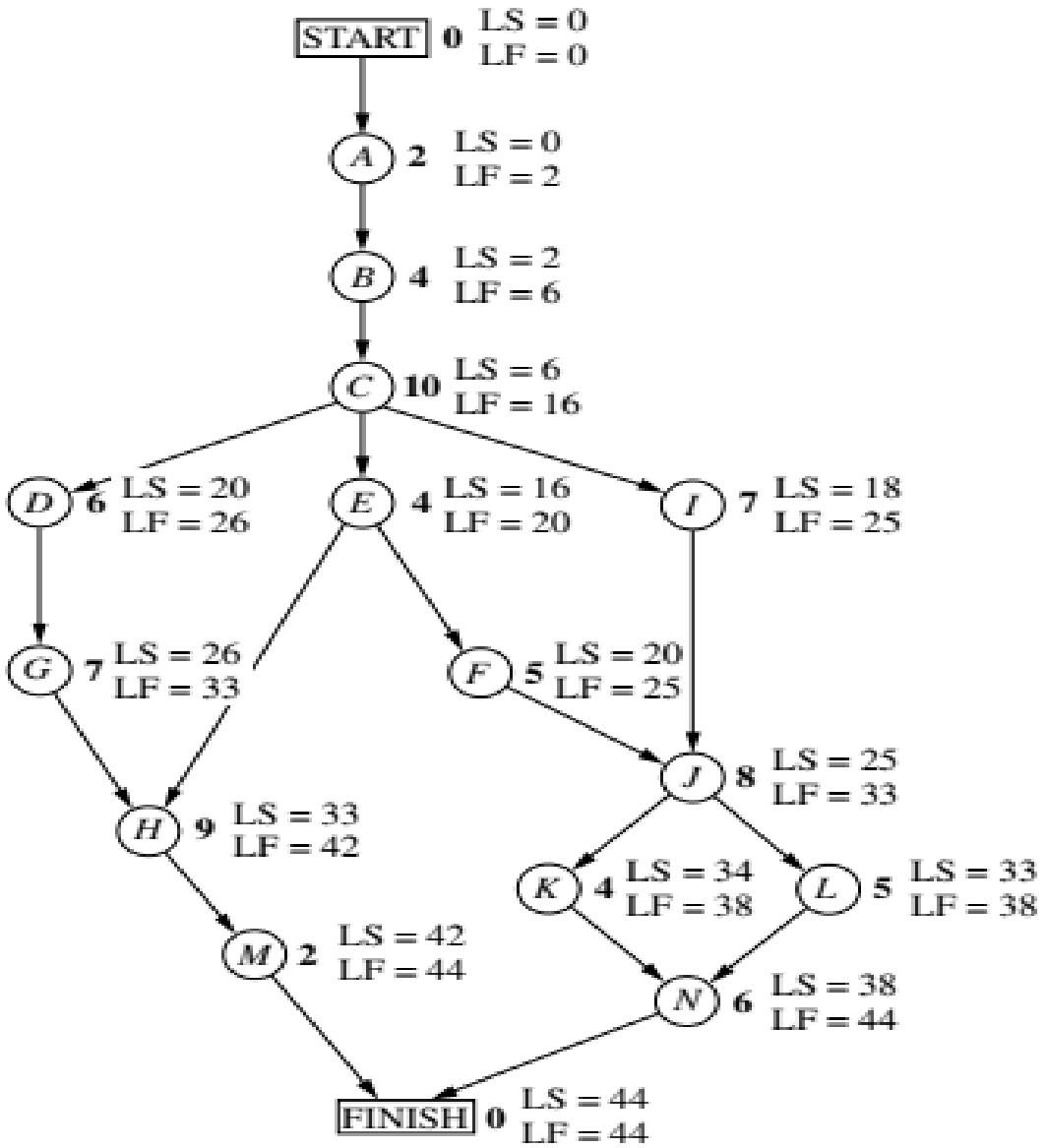
SCHEDULING INDIVIDUAL ACTIVITIES

- **By addressing question 4**
- When can the individual activities start and finish if no delays occur? (ES & EF)
- Having no delays means:
- **The actual duration of each activity= estimated duration**
- **Each activity begins as soon as all its immediate predecessors are finished**
- EF= ES+ (estimated duration of activity)
- For Activity A: ES=0
- EF= 0+ duration (2 weeks)= 2
- Activity B can start as soon as A finishes
- Activity B: ES= 2
- EF= 2 + duration= 2+4 = 6 weeks

If an activity has only a single immediate predecessor, then ES for the activity = EF for the immediate predecessor

If an activity has more than one immediate predecessors, then ES for the Activity is the **largest among them**


START 0 ES = 0 EF = 0
A 2 ES = 0 EF = 2
B 4 ES = 2 EF = 6
C 10 ES = 6 EF = 16
D 6 ES = 16 EF = 22
E 4 ES = 16 EF = 20
I 7 ES = 16 EF = 23
G 7 ES = 22 EF = 29
F 5 ES = 20 EF = 25
J 8 ES = 25 EF = 33
H 9 ES = 29 EF = 38
K 4 ES = 33 EF = 37
L 5 ES = 33 EF = 38
M 2 ES = 38 EF = 40
N 6 ES = 38 EF = 44
FINISH 0 ES = 44 EF = 44


START 0 LS = 0 LF = 0
A 2 LS = 0 LF = 2
B 4 LS = 2 LF = 6
C 10 LS = 6 LF = 16
D 6 LS = 20 LF = 26
E 4 LS = 16 LF = 20
I 7 LS = 18 LF = 25
G 7 LS = 26 LF = 33
F 5 LS = 20 LF = 25
J 8 LS = 25 LF = 33
H 9 LS = 33 LF = 42
K 4 LS = 34 LF = 38
L 5 LS = 33 LF = 38
M 2 LS = 42 LF = 44
N 6 LS = 38 LF = 44
FINISH 0 LS = 44 LF = 44

IDENTIFYING SLACK IN THE SCHEDULE

Slack: it indicates how long an activity can be delayed beyond the earliest time schedule without delaying the completion of the project

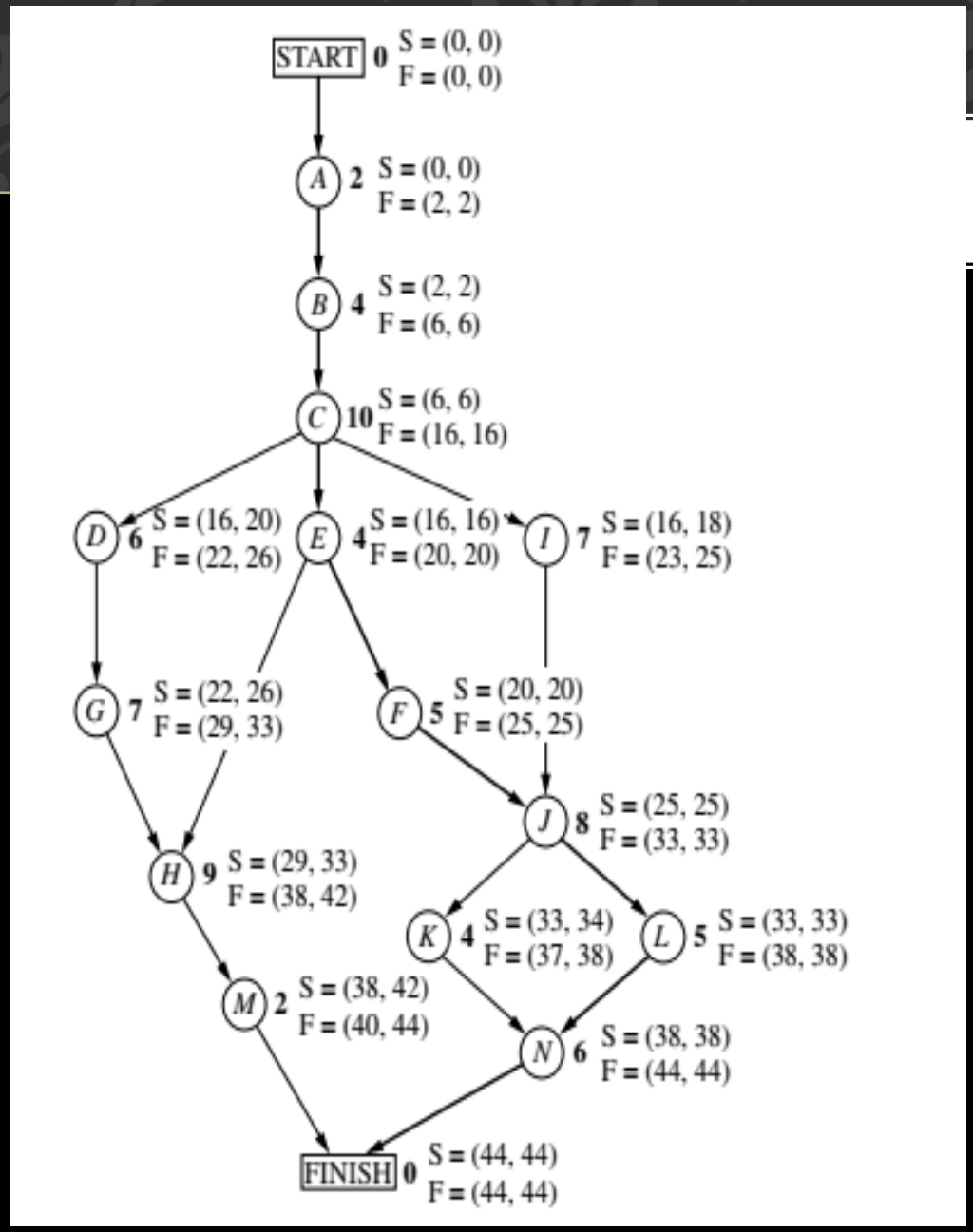
M

S(38,42)

F(40,44)

Slack= LF-EF= 44-40=4

Zero slack indicate any delays in this activity delays the project completion


START 0 S = (0, 0) F = (0, 0)
A 2 S = (0, 0) F = (2, 2)
B 4 S = (2, 2) F = (6, 6)
C 10 S = (6, 6) F = (16, 16)
D 6 S = (16, 20) F = (22, 26)
E 4 S = (16, 16) F = (20, 20)
I 7 S = (16, 18) F = (23, 25)
G 7 S = (22, 26) F = (29, 33)
F 5 S = (20, 20) F = (25, 25)
J 8 S = (25, 25) F = (33, 33)
H 9 S = (29, 33) F = (38, 42)
K 4 S = (33, 34) F = (37, 38)
L 5 S = (33, 33) F = (38, 38)
M 2 S = (38, 42) F = (40, 44)
N 6 S = (38, 38) F = (44, 44)
FINISH 0 S = (44, 44) F = (44, 44)

Best Wishes