Software Engineering & Project Management

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Module 5

Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

Software Quality: Introduction, the place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.

Activity Planning

Activity planning and *scheduling* emphasis on completing the project in a minimum time and at an acceptable cost – Meeting arbitrarily set target date at minimum cost.

Need of Activity Planning:

- Ensure precise availability of appropriate resources
- Avoid multiple activities competing for same resource at the same time
- Produce detailed plan on staff allocation
- Plan to measure actual achievement
- Produce cash flow forecast
- Project replan to correct the drift from target

Objectives of Activity Planning

- **Feasibility Assessment:** Is it possible to complete the project with give timelines and resource constraints ? – Availability of Staff + Parallel Execution
- **Resource Allocation:** Effective ways of resource allocation – Investigate the relationship between timescales and availability of resources, also the need to spend additional on resource procurement
- **Detailed Costing:** Estimation of cost and timing of spend
- **Motivation:** Providing target and fostering its achievement to motivate staff
- **Coordination:** Staff allocation across activities and project

Plan – When to Plan ?

Plan is an ongoing process of refinement – Higher precision and details over iterations

Shift in Planning Purpose:

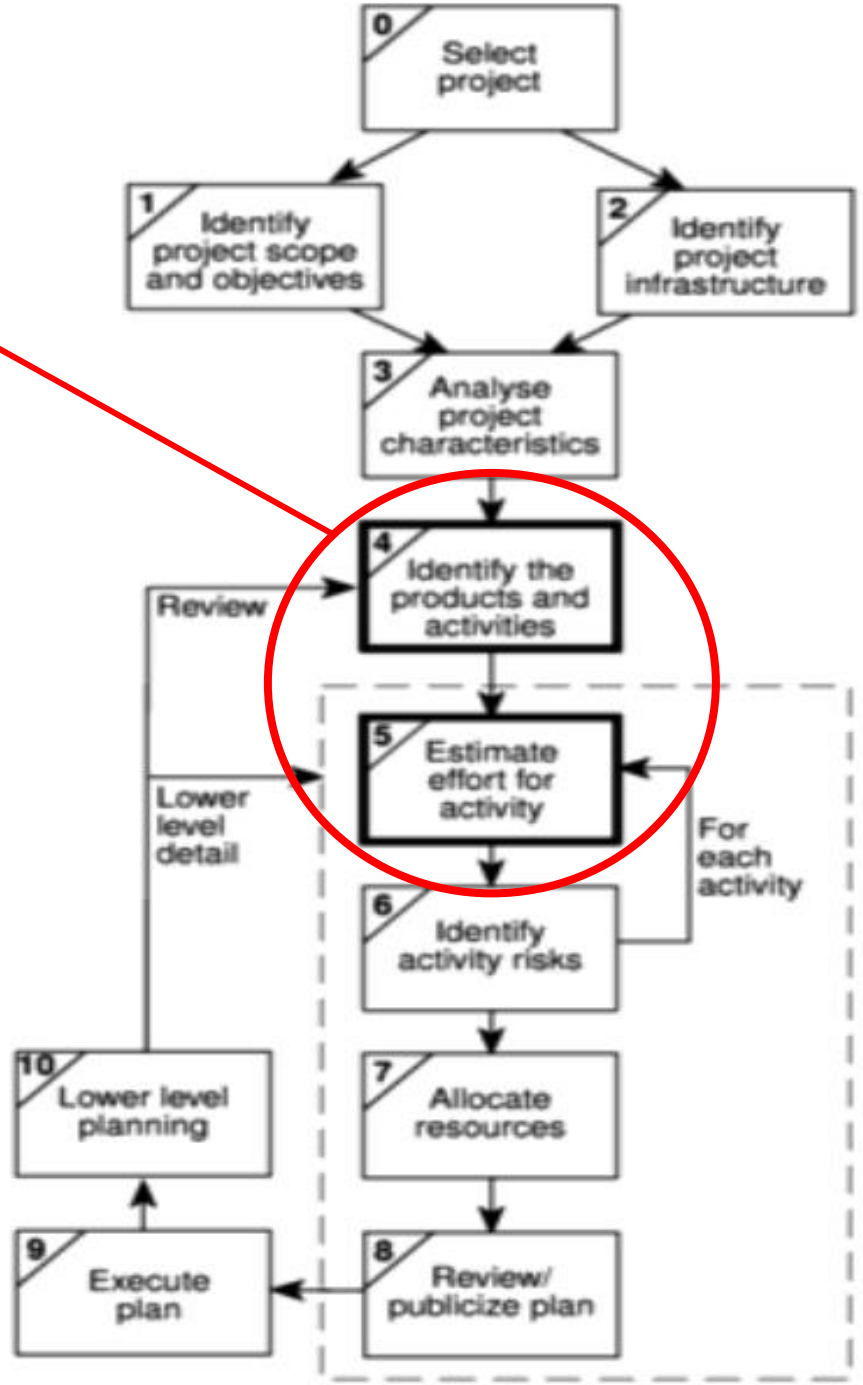
- *During Feasibility Study and Project Strat-Up:* Estimate time scales and risks of not attaining the target completion dates or falling within budget
- *Beyond Feasibility Study:* Activity plans to ensure resource availability and cash flow control

Throughout project until delivery *monitoring* and *replanning* facilitates in checking the drifts that might prevent from meeting time and cost targets.

Plan – When to Plan ?

Activity plan is carried out in Step 4 and *Step 5*

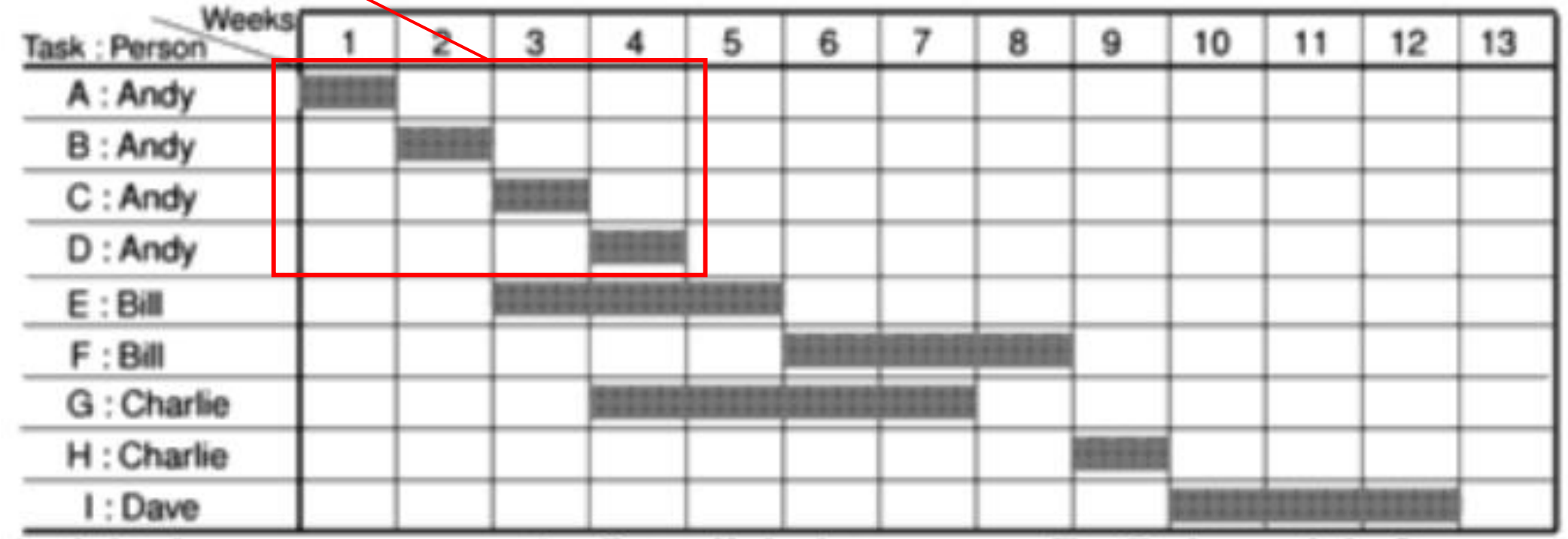
- *First Step:* What activities need to be carried on and in what order – Ideal Activity Plan (without resource constraint)
- *Activity Risk Analysis:* To identify potential problems
- Resource Allocation to foster activity as per plan
- *Final Step: Schedule Production* – Draw up and publish a project schedule with planned start and completion dates and activity wise resource allocation



Sequencing and Scheduling Activities

Sequencing: Identify dependency in development process

A Project Plan as a Bar Chart



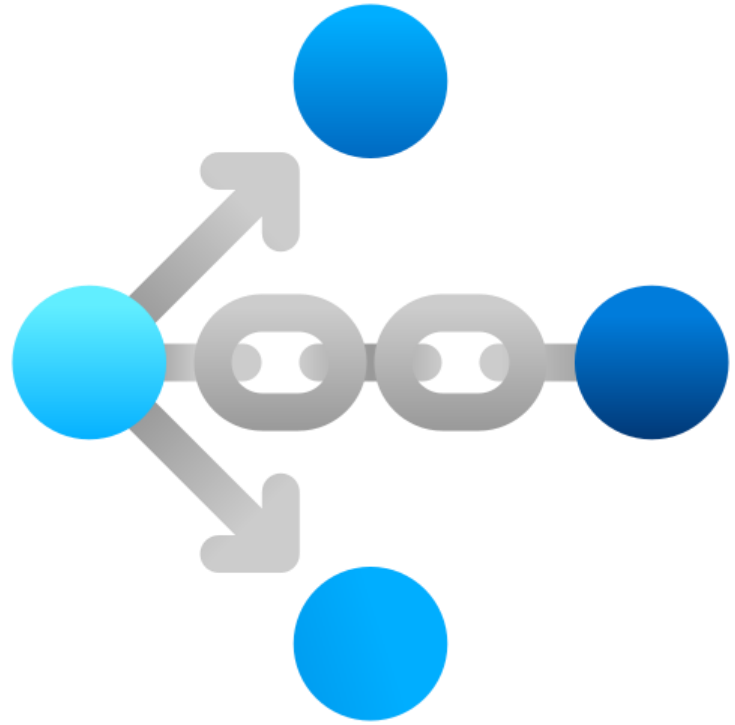
Activity key:

A: Overall design
B: Specify module 1
C: Specify module 2
D: Specify module 3
E: Code module 1
F: Code module 3
G: Code module 2
H: Integration testing
I: System testing

Network Planning Models

Project scheduling technique which models the activities and their relationship as a *Network Model*.

- *CPM* – Critical Path Method
- PERT – Program Evaluation Review Technique
- *Precedence Networks*

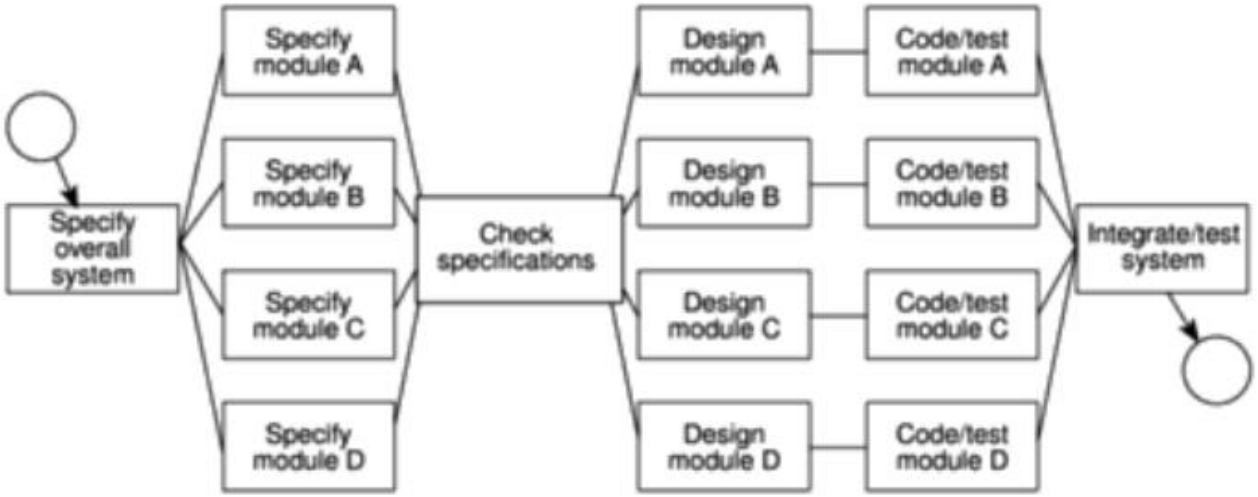


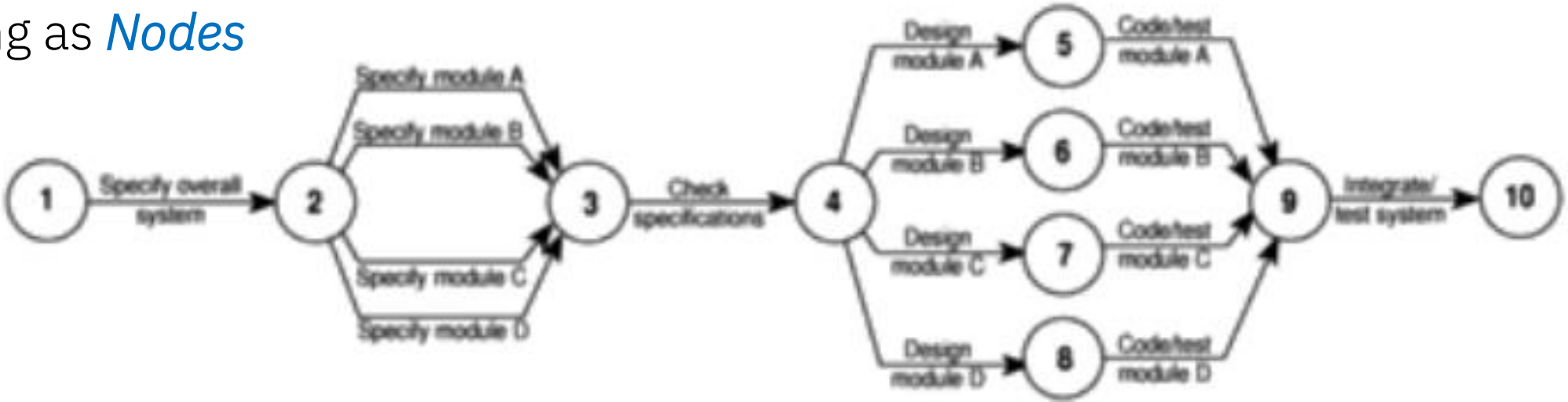
In the network time flows from left to right

Formulating a Network Model

Initial Stage: Represent activities and relationships in a graph

- *Activities* as *Links* in the Graph
- *Events* of activities stating and finishing as *Nodes*



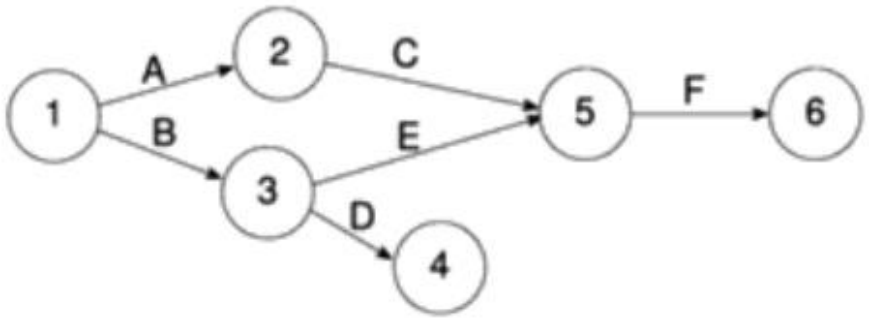


Rules for Constructing CPM Networks

- A project network may have only one start node
- A project network may have only one end node
- A link has duration
- Nodes have no duration
- Time moves from left to right
- Nodes are numbered sequentially
- A network may not contain loops
- A network may not contain dangles
- Precedents are the immediate preceding activities

State the Incorrectness in the Network Graph

(a)



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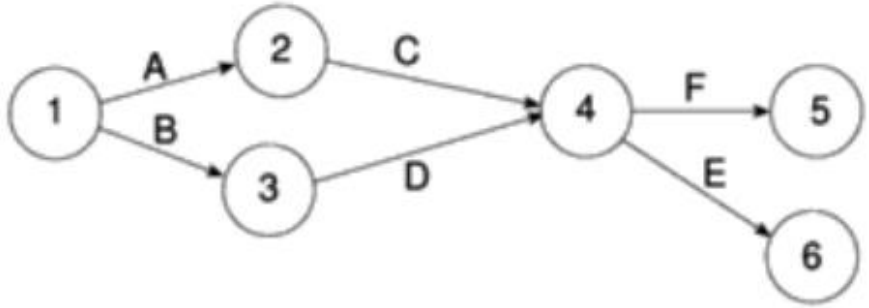

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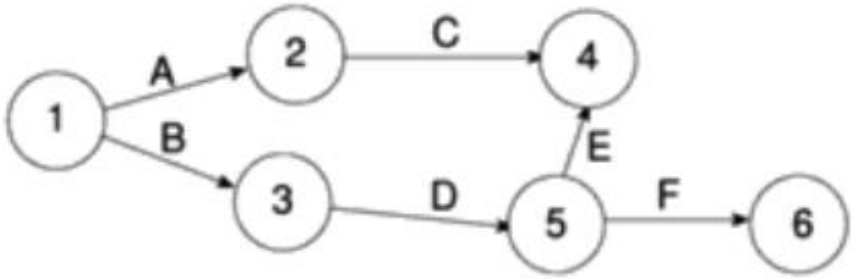

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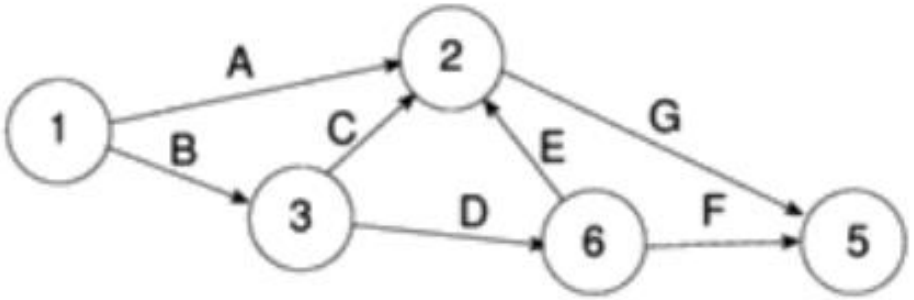

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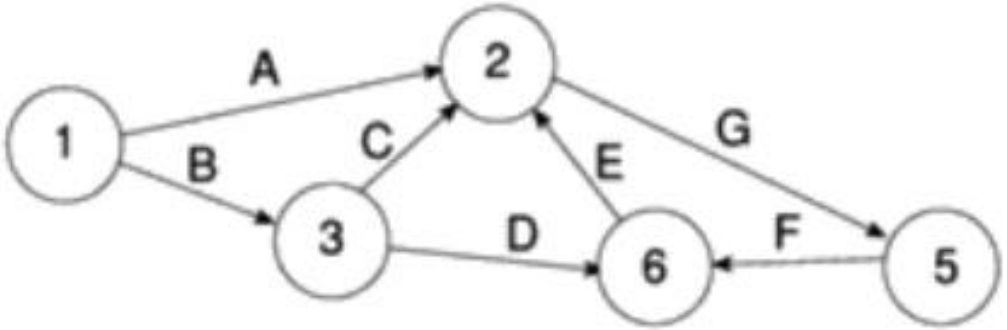
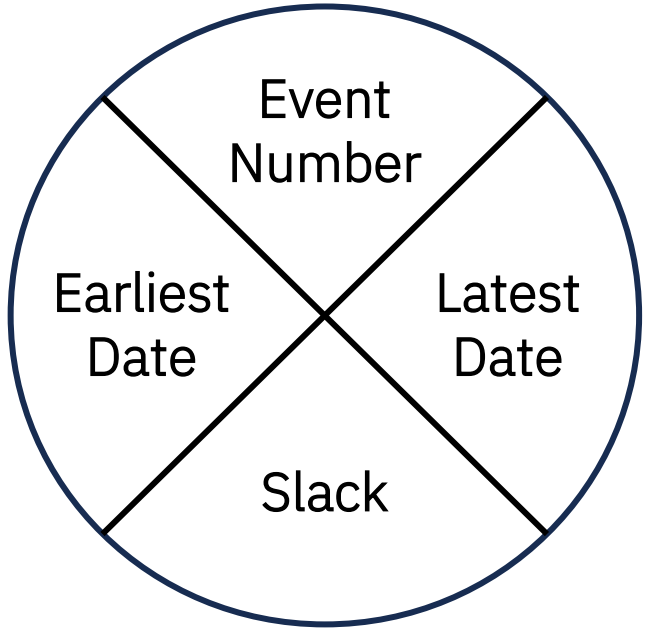


Construct the Networks Model – Activity on Arrows

An example project specification with estimated activity duration and precedence requirements

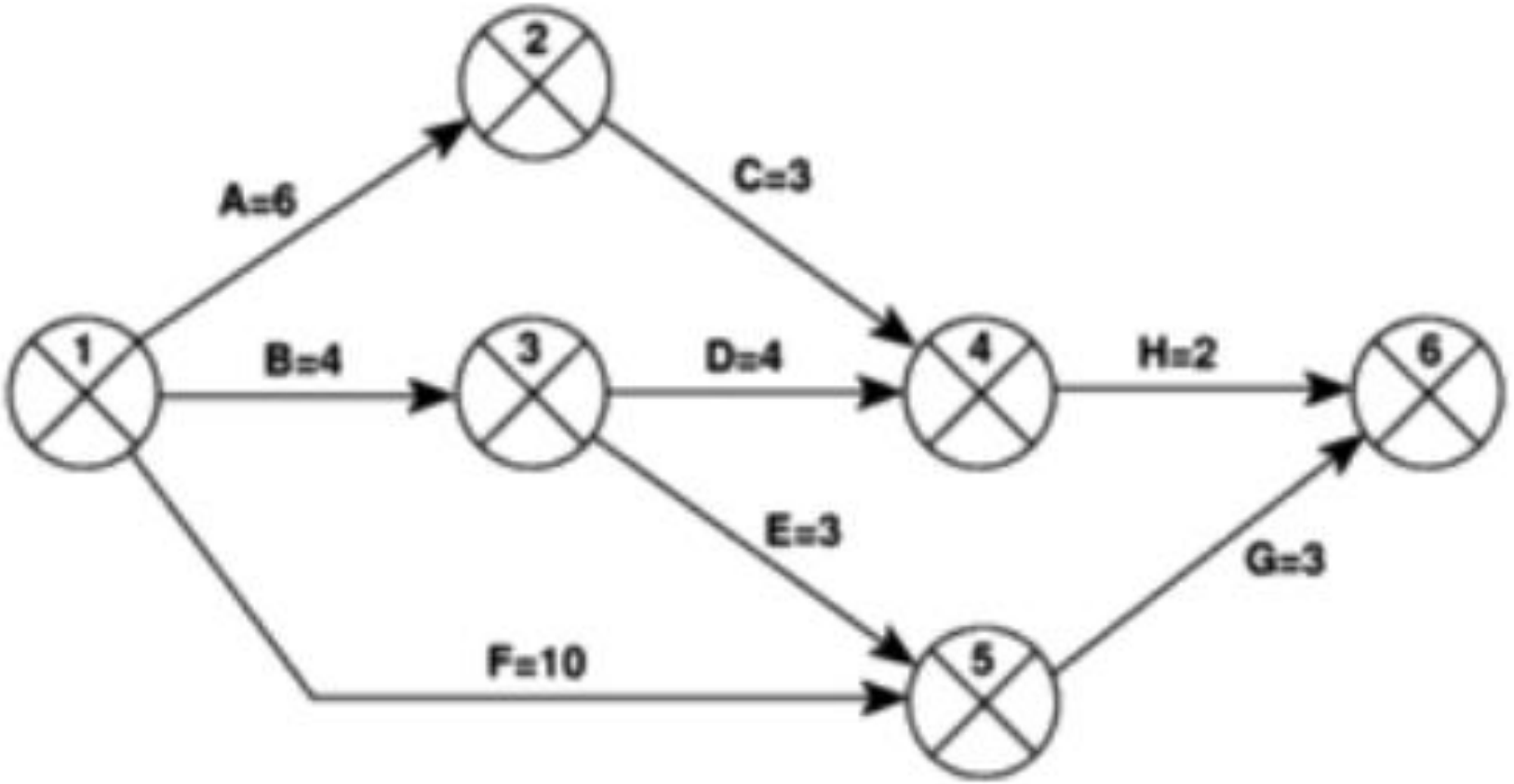
Activity		Duration (weeks)	Precedents
A	Hardware selection	6	
B	Software design	4	
C	Install hardware	3	A
D	Code & test software	4	B
E	File take-on	3	B
F	Write user manuals	10	
G	User training	3	E, F
H	Install & test system	2	C, D

CPM Convention for Node

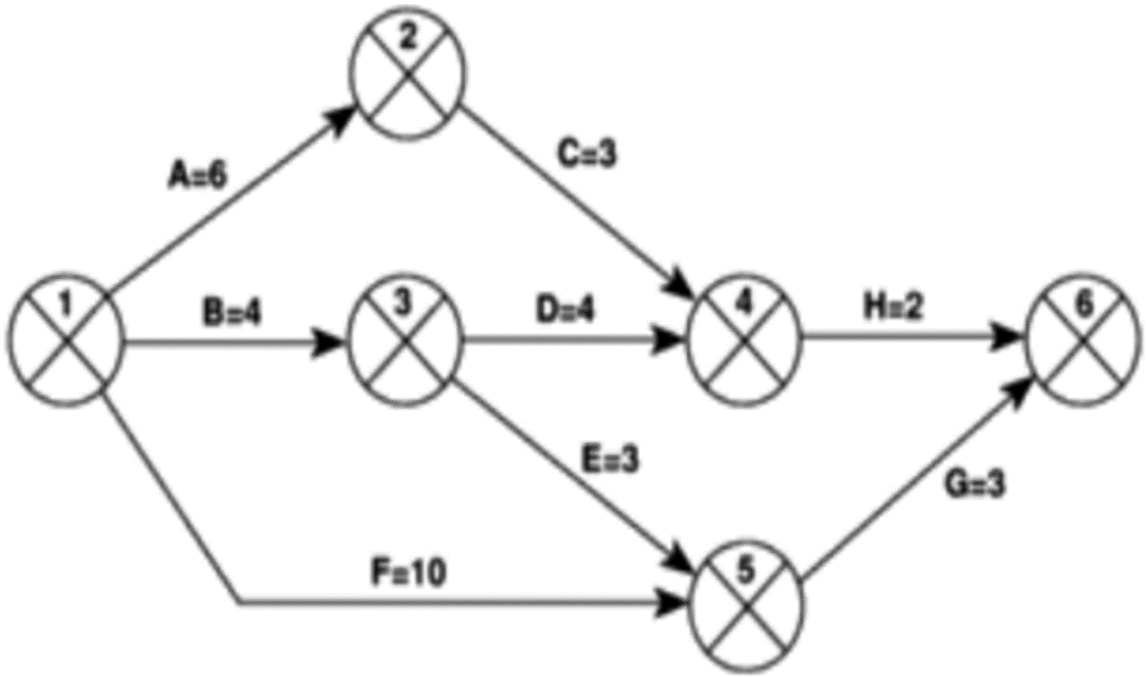


Task 1: Draw an activity network using CPM conventions for the project specified in the table

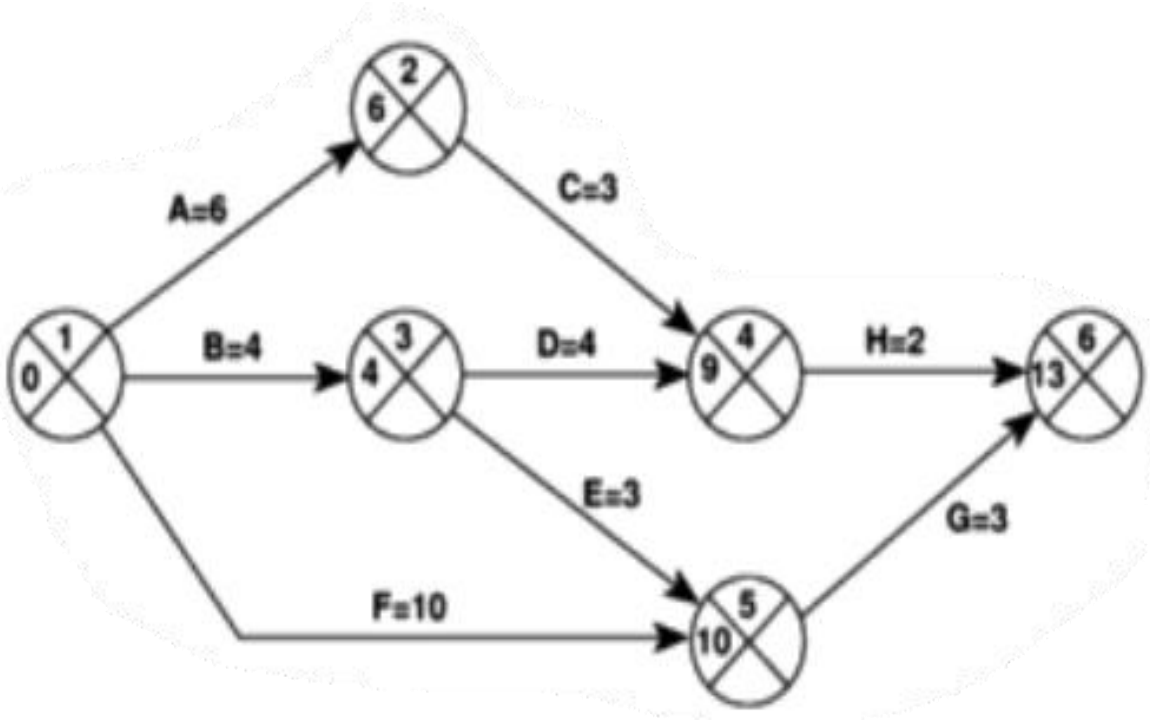
CPM Network for Task 1Problem



Forward Pass – ES & EF



CPM Network

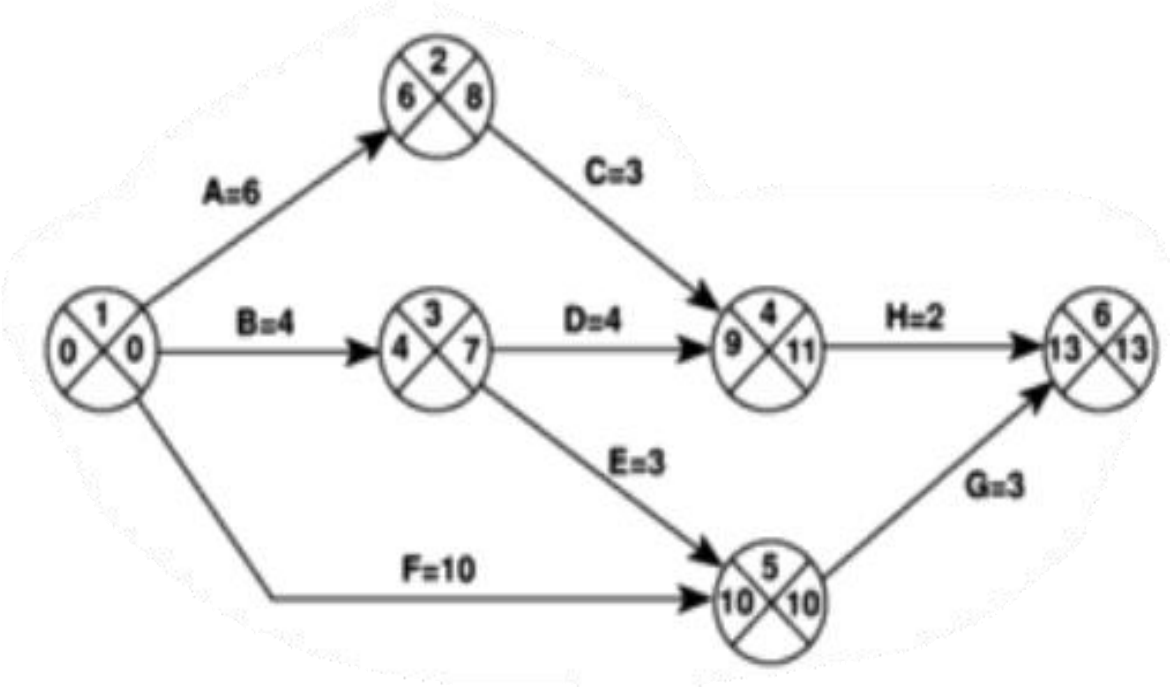


CPM Network after Forward Pass

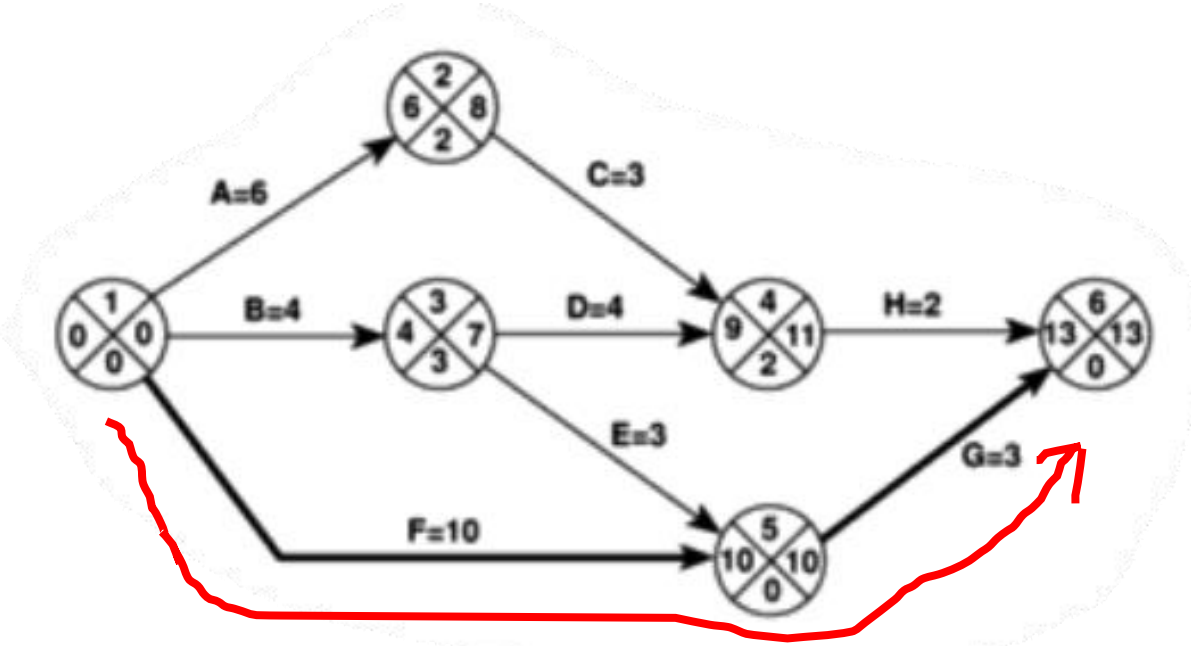
Backward Pass (LS & LF) and Slack

Critical Events: The events with zero slack (Since any delay in achieving the event would affect the project completion date)

There will always be at least one path through the network joining these critical events this path is known as the *Critical Path*



CPM Network after Backward Pass



CPM Network after Slack

The Critical Path

Specification to Activity Schedule (with Float)

Activity		Duration (weeks)	Precedents
A	Hardware selection	6	
B	Software design	4	
C	Install hardware	3	A
D	Code & test software	4	B
E	File take-on	3	B
F	Write user manuals	10	
G	User training	3	E, F
H	Install & test system	2	C, D

Specification Table

Activity	Duration (weeks)	Earliest start date	Latest start date	Earliest finish fate	Latest finish date	Total float
A	6	0	2	6	8	2
B	4	0	3	4	7	3
C	3	6	8	9	11	2
D	4	4	7	8	11	3
E	3	4	7	7	10	3
F	10	0	0	10	10	0
G	3	10	10	13	13	0
H	2	9	11	11	13	2

Activity Schedule showing total float for each activity

Shortening Project Duration

- Shortening project activity durations
- Applying more resources to the activity – Work overtime or more staff
- Reduce activity durations of activities in critical path
- Try removing bottlenecks – Altering logical sequencing of activities
- Increase parallelism

Precedence Networks - Activity on Node Networks

Notations:

<table>
<tr><td colspan="2">Activity Label</td><td>Duration</td></tr>
<tr><td>Earliest Start</td><td rowspan="2">Activity Description</td><td>Earliest Finish</td></tr>
<tr><td>Latest Start</td><td>Latest Finish</td></tr>
<tr><td colspan="2">Activity Span</td><td>Float</td></tr>
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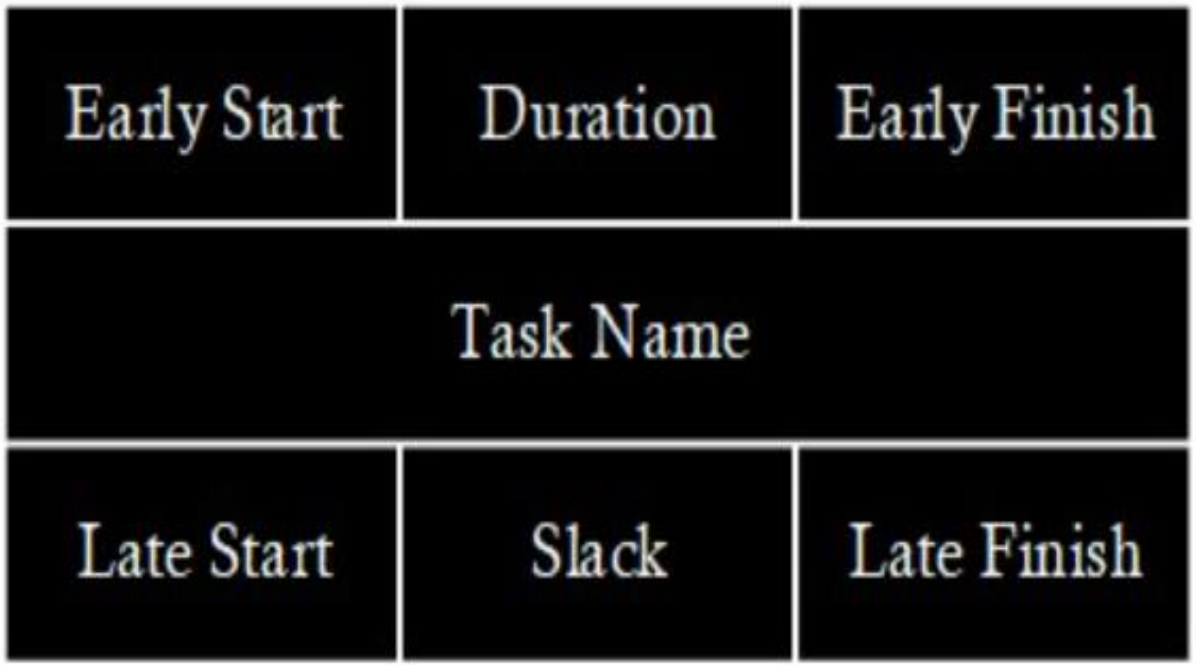


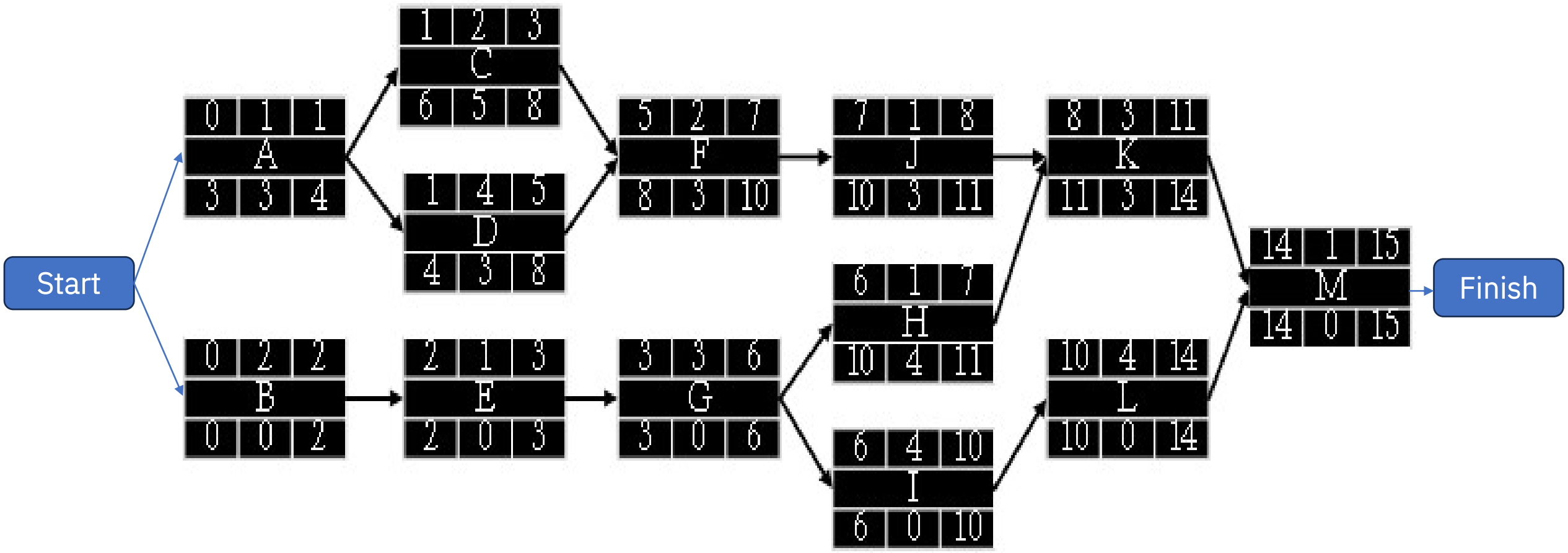
Construct the Precedence Networks Model

Activity	Duration (week)	Predecessors
A	1	–
B	2	–
C	2	A
D	4	A
E	1	B
F	2	C, D
G	3	E
H	1	G
I	4	G
J	1	F
K	3	J, H
L	4	I
M	1	K, L

Task 2: Draw an activity network using Precedence Networks conventions for the project specified in the table, also compute the critical path by illustrating the methods to construct forward pass, backward pass and the critical path

Construct the Precedence Networks Model

Task 2: Solution



Construct the Networks Model

Activity Code	Activity Description	Immediate Predecessor Activity	Estimated Duration (Weeks)
A	Finalise package design	–	2
B	Set up packaging equipment and procure raw materials	A	8
C	Produce the first batch	–	12
D	Package the first batch	B, C	4
E	Set up the sales office	–	4
F	Recruit salesmen	E	4
G	Train salesmen	F	6
H	Select retailers	E	8
I	Sell to retailers	G, H	3
J	Despatch to retailers	D, J	5
K	Select advertising agency	E	4
L	Plan advertisement campaign	K	9
M	Release pre-launch advertisements	L	1
N	Conduct advertisement campaign	J, M	4

Task 3: Draw an activity network using CPM conventions for the project specified in the table, also compute the critical path by illustrating the methods to construct forward pass, backward pass and the critical path

Construct the Networks Model

Activity	Duration	Precedence
A	1	-
B	2	-
C	4	-
D	3	A
E	1	B
F	2	C
G	5	C
H	6	E, F
I	3	G, H

Task 4: Draw an activity network using CPM conventions for the project specified in the table, also compute the critical path by illustrating the methods to construct forward pass, backward pass and the critical path

Construct the Networks Model

Task	Duration	Prerequisites
A	4	–
B	3	–
C	3	B
D	2	B
E	4	A , C
F	1	D , E

Task 5: Draw an activity network using CPM conventions for the project specified in the table, also compute the critical path by illustrating the methods to construct forward pass, backward pass and the critical path


THANK
YOU