

Unit 5

Part 2

Critical Path Method Charts



Planning and Scheduling the Activities

- **Once we have a project plan (or, project schedule), we need to schedule the activities in a project taking into account the resource constraints**

Scheduling Techniques

- **Simple sequencing**
 - **Suitable for small projects**
- **Critical Path Method (CPM)**
 - **Suitable for large software projects**
 - **The most commonly used “networking” technique**

Simple sequencing

- A simple sequencing of the tasks and the responsible personnel taken into account of the resources
- Easily presented in a simple bar chart
- Suitable for allocating individuals to particular tasks at an early stage

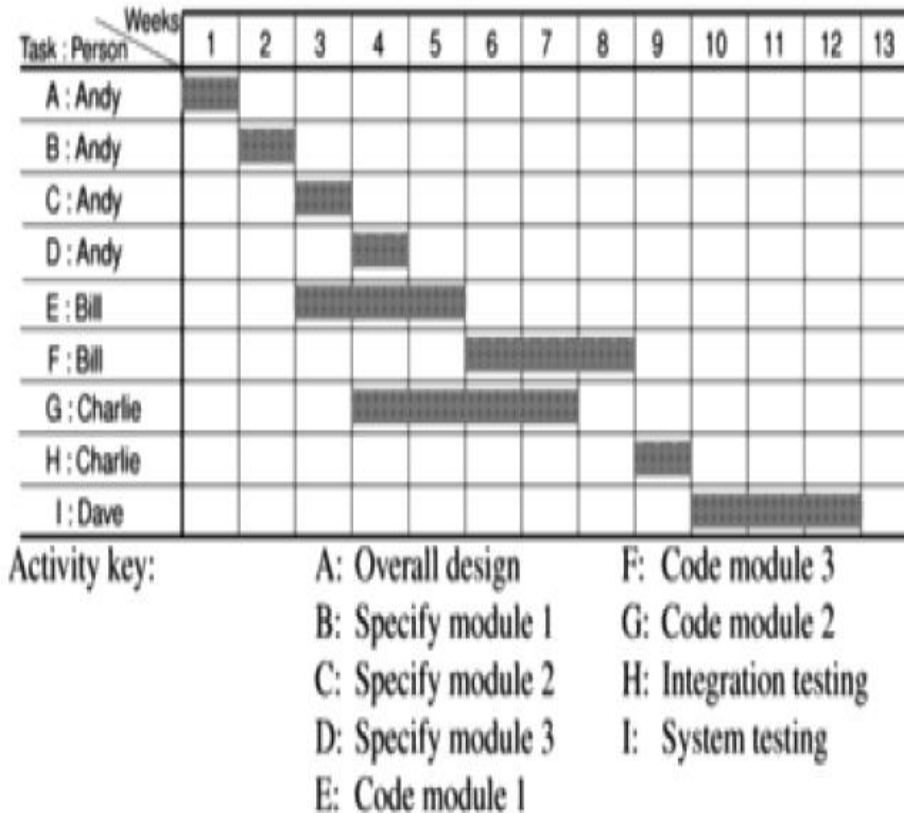


Figure 6.6 A project plan as a bar chart.

Critical Path Method

- o Definition: In **CPM** activities are shown as a network of precedence relationships using activity-on-node network construction
 - o Single estimate of activity time
 - o Deterministic activity times
- o **Critical Path:**
 - o Is that the sequence of activities and events where there is no “slack” i.e.. **Zero slack**
 - o Longest path through a network
 - o minimum project completion time

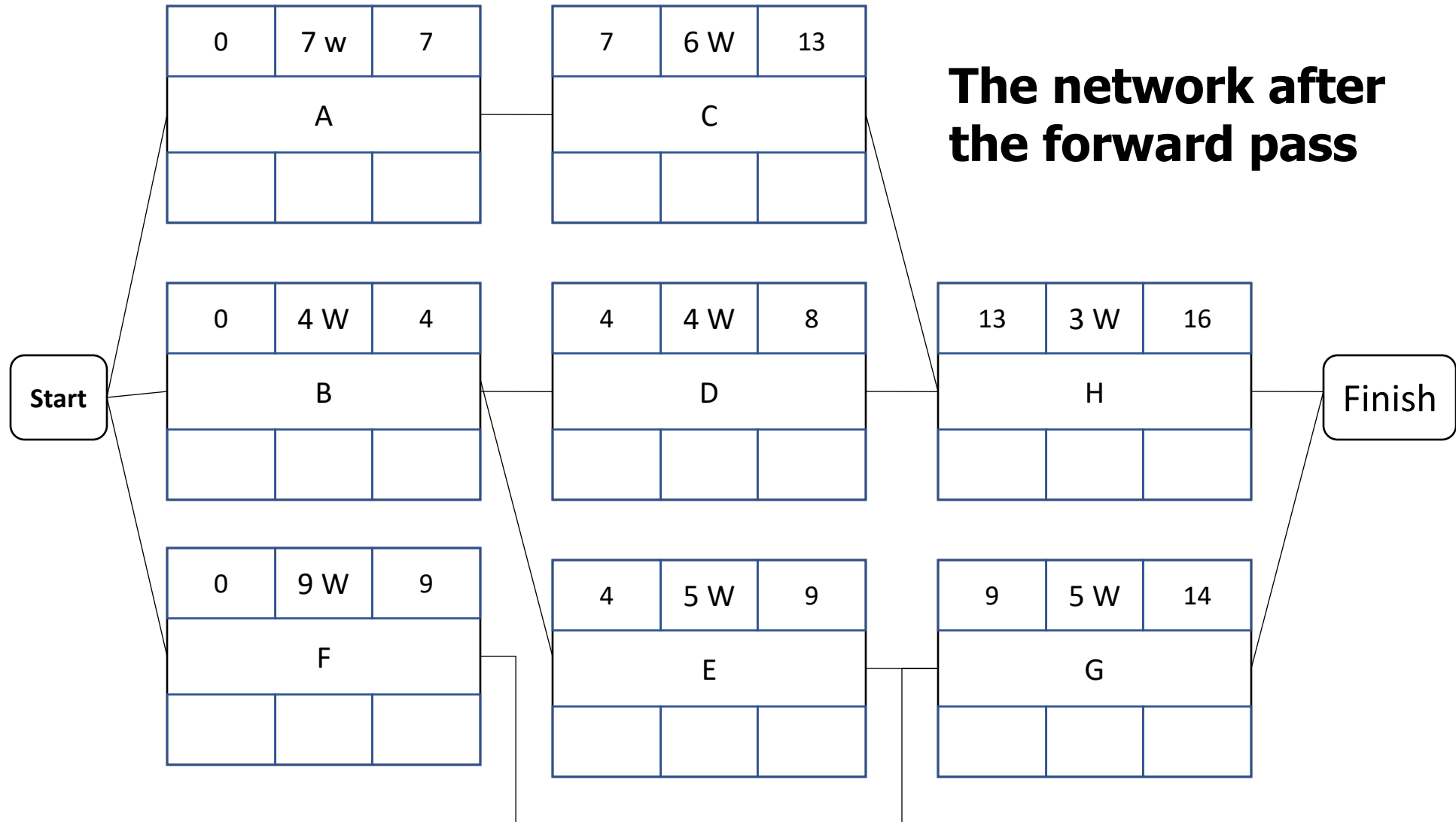
Activity on Node

Earliest start	Duration	Earliest finish
Activity label, activity description		
Latest start	Float/slack	Latest finish

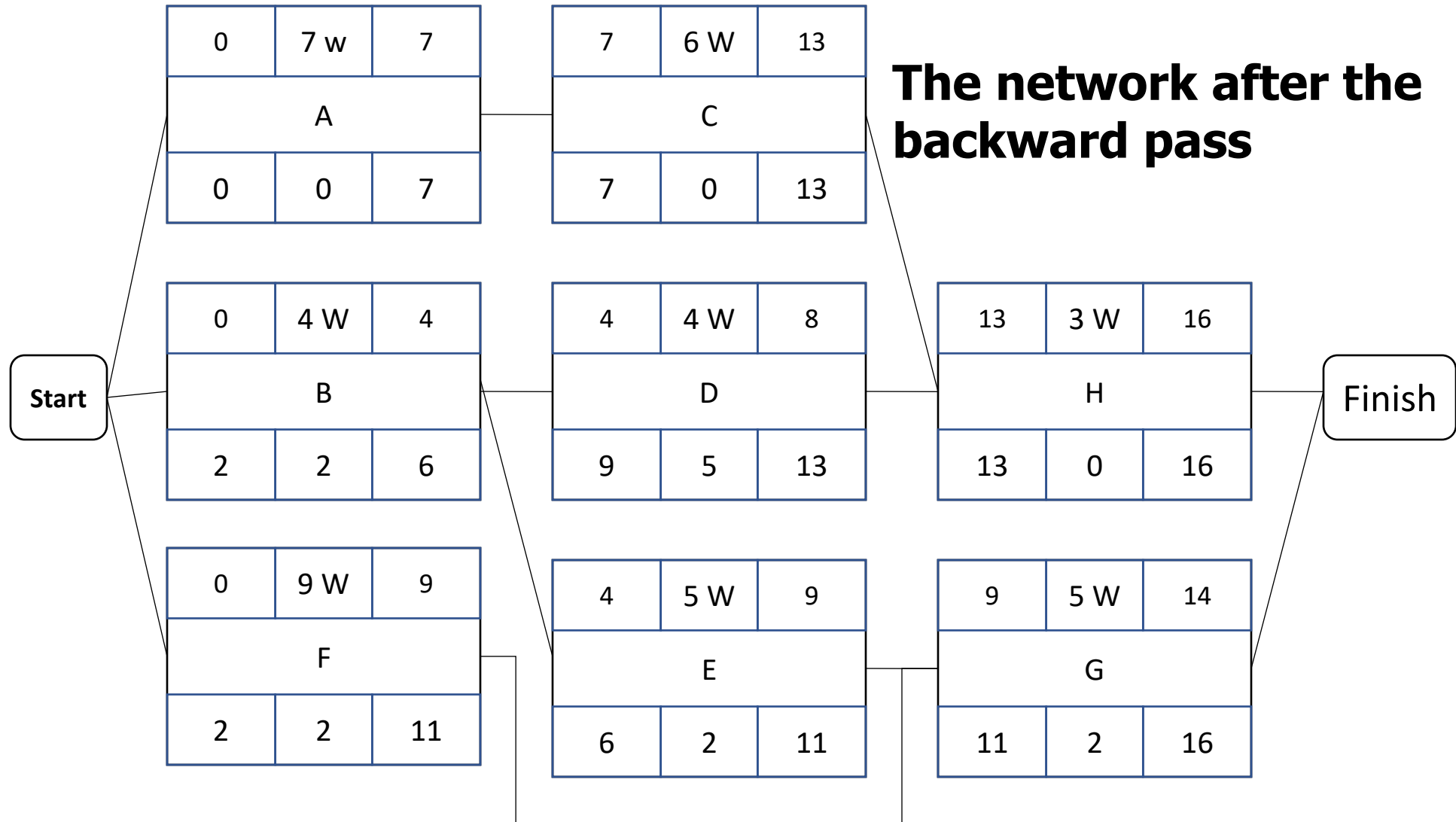
Example to construct a CPM

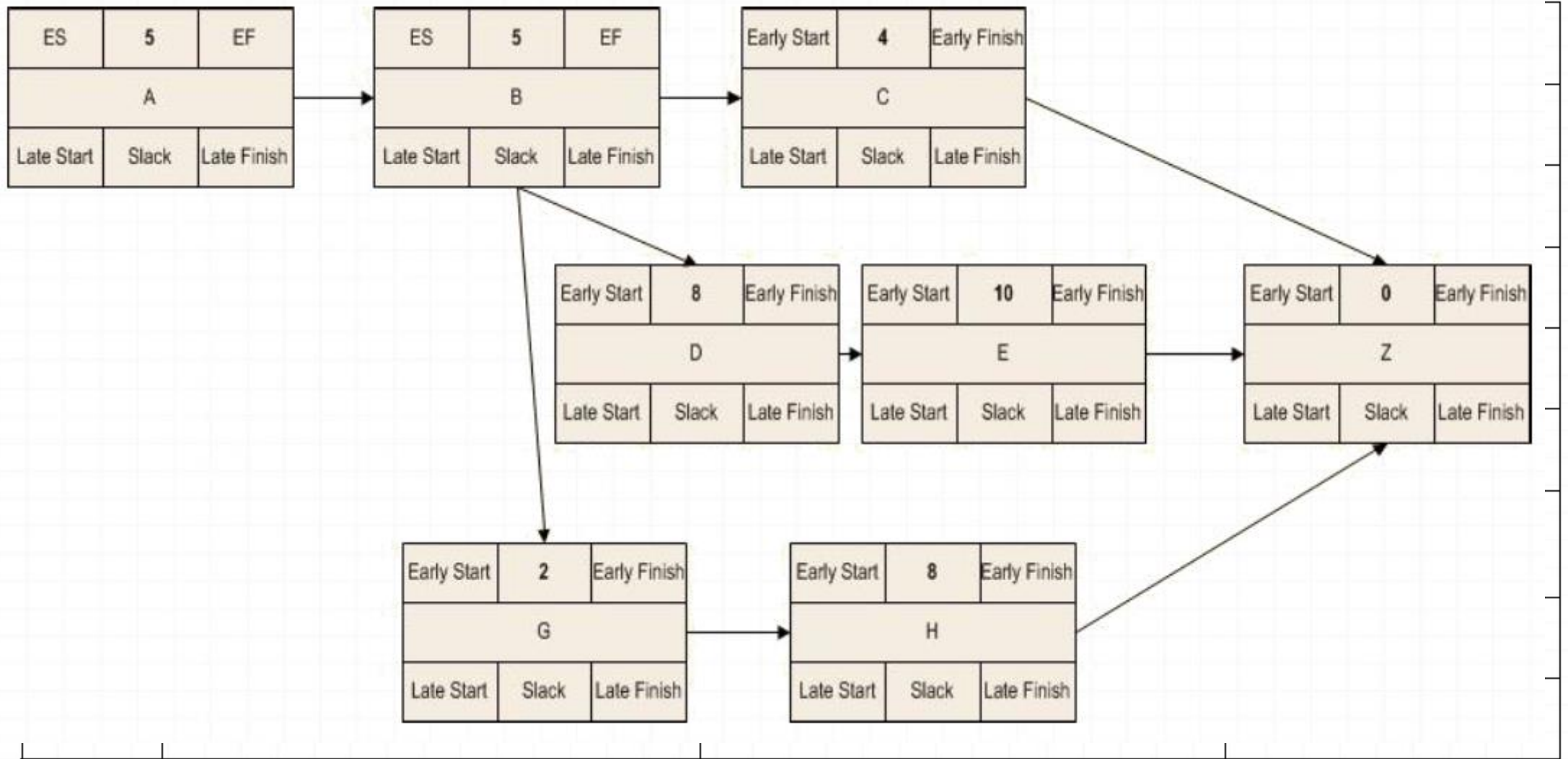
Id.	Activity Name	Duration (weeks)	Precedents
A	Hardware selection	7	
B	Software design	4	
C	Hardware Installation	6	A
D	Coding	4	B
E	Data Preparation	5	B
F	User Documentation	9	
G	User Training	5	E,F
H	System Installation	3	C,D

6.10 The forward Pass

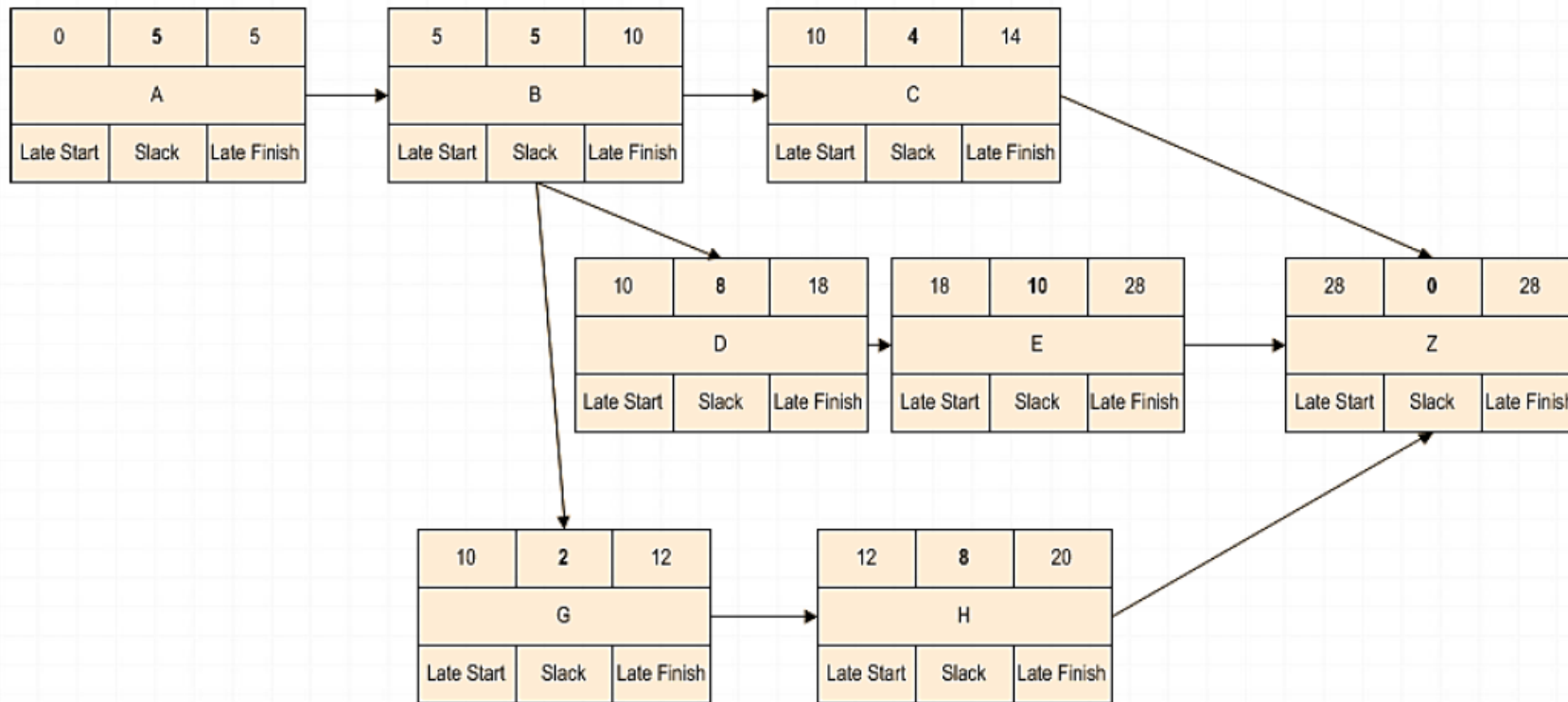


6.11 The backward Pass

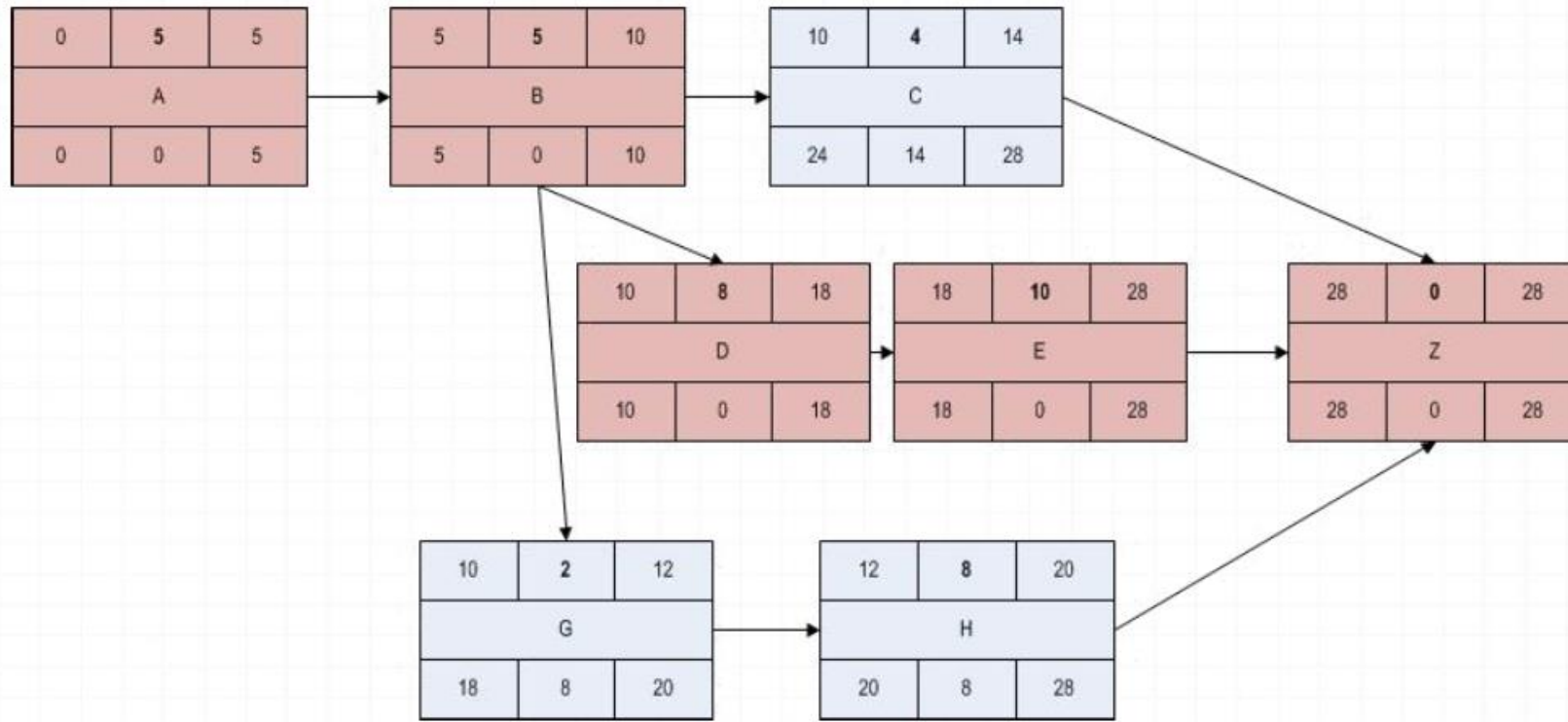




Forward pass calculations



A,B,D,E and Z forms the critical path



Activity	Duration (Days)	Immediate Predecessor Activities
A	3	-
B	6	A
C	7	A
D	5	A
E	13	B & C
F	8	C & D
G	11	D & F
H	6	G & E

- CRITICAL PATH IS:

- A,C, F, G, H

6.16 Activity-on-arrow network

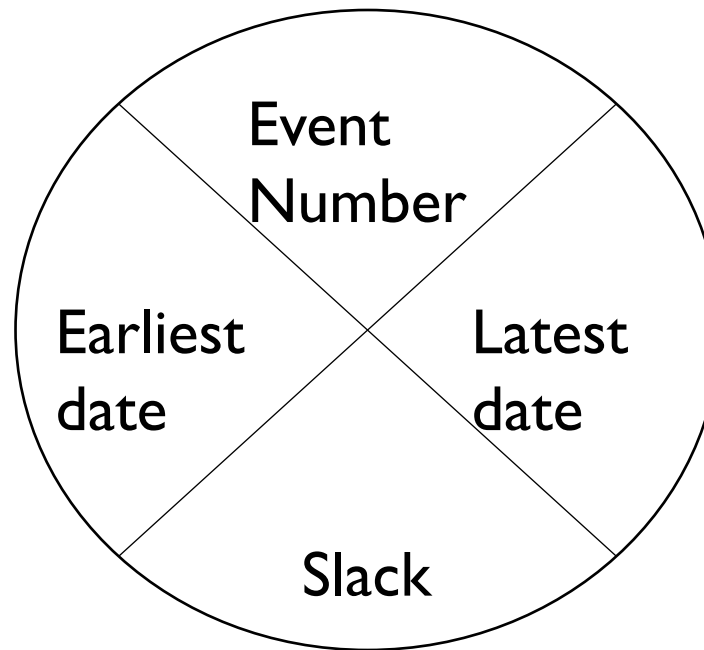
Rules:

- A Project network should have only one start node
- A Project network should have only one end node
- A node has no duration
- Links have duration
- Precedents are the immediate preceding activities
- Time moves from left to right
- A network may not contain loops
- A network should not contain dangles

An example project specification with estimated activity durations and precedence requirements

<i>Activity</i>		<i>Duration (weeks)</i>	<i>Precedents</i>
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 (AOA)

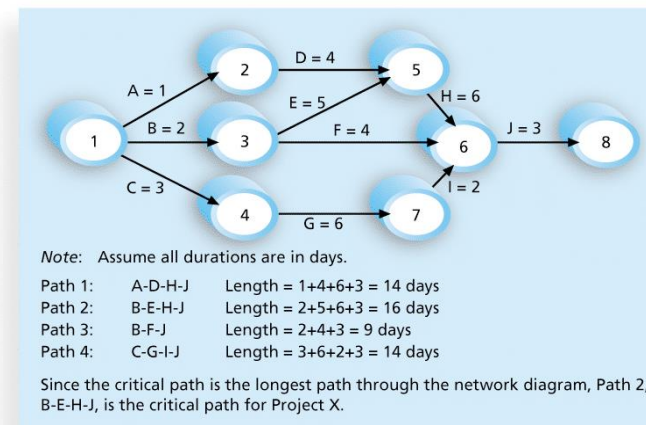


FIND CRITICAL PATH

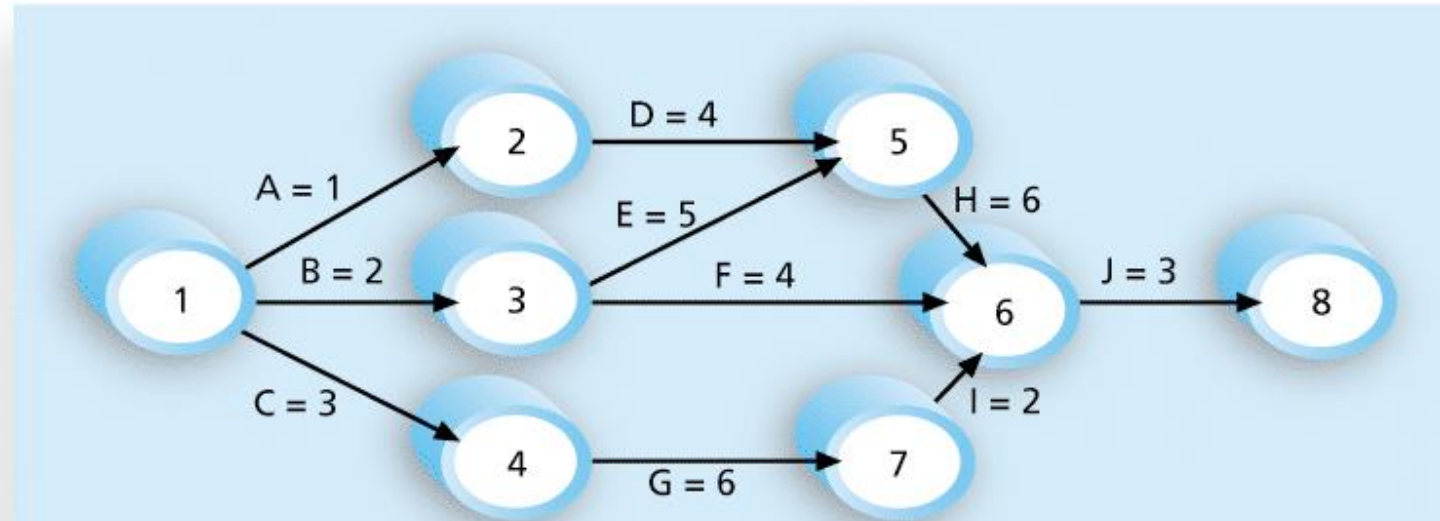
TASK	DURATION	PRECEDENTS
A	1	--
B	2	--
C	3	--
D	4	A
E	5	B
F	4	B
G	6	C
H	6	D,E
I	2	G
J	3	F,H,I

Critical Path Method (CPM)

- **CPM** is a network diagramming technique used to predict total project duration
 - A **critical path** for a project is the series of activities that determines the *earliest time* by which the project can be completed
 - **Slack/float**



Determining the Critical Path



Note: Assume all durations are in days.

Path 1:	A-D-H-J	Length = $1+4+6+3 = 14$ days
Path 2:	B-E-H-J	Length = $2+5+6+3 = 16$ days
Path 3:	B-F-J	Length = $2+4+3 = 9$ days
Path 4:	C-G-I-J	Length = $3+6+2+3 = 14$ days

Since the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.



Critical Path

- Any delay in critical path delays the project
- Slack= difference between earliest and latest dates
- Any event with slack 0 is critical.
 - Path joining these events is critical path
- Activity float
 - Float=difference in earliest finish and it's latest start



Adding the time dimension

- Critical path approach is concerned with:
 - Project completed as quickly as possible
 - Identifying activities leads to delay project or later activities start date, if delayed.
- Forward pass
 - Earliest dates of activities
- Backward pass
 - Latest start dates and the critical path

Activity Float

- Time allowed for an activity to delay
- 3 different types:
 - **Total float** (no delay in project end date)
$$= |\text{latest start date} - \text{earliest start date}|$$
 - **Free float** (delay without affecting subsequent activity)
$$= |\text{earliest completion date of activity} - \text{earliest start date of succeeding activity}|$$
 - **Interfering float** $= |\text{total float} - \text{free float}|$

