MASTER OF COMPUTER SCIENCE/
MASTER OF SCIENCE IN COMPUTER SCIENCE

MCS 4204 –
Software Project Management and Quality Assurance

Project Schedule Management

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

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Project Schedule

- To ensure timely completion of a project
- Will be derived from the WBS
  - Calculate the start or end point of each activity
  - Calculate the project completion date
- Explains how and when the project will deliver the products, services, and results
- Serves as a tool for communication, managing stakeholders' expectations, and as a basis for performance reporting
- Remain flexible throughout the project to adjust for knowledge gained, understanding of the risk, and value-added activities

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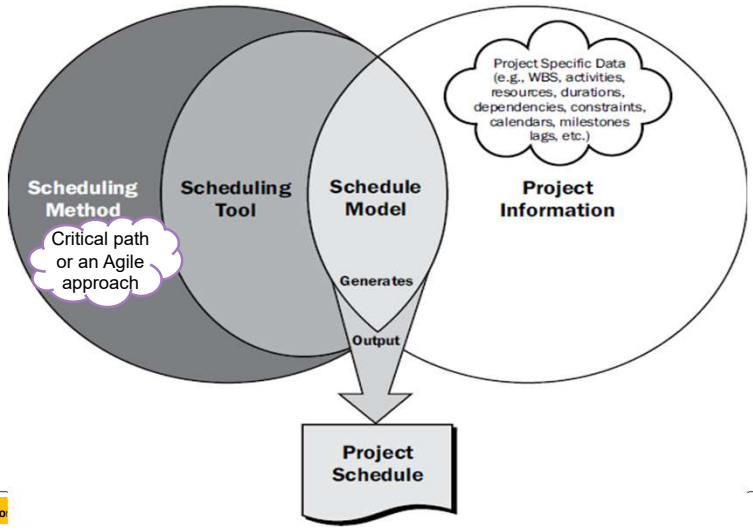
Project Scheduling



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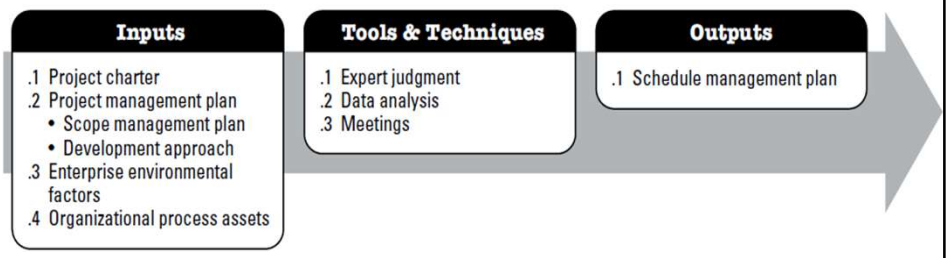
Schedule Management Processes

1. Plan Schedule Management
2. Define Activities
3. Sequence Activities
4. Estimate Activity Durations
5. Develop Schedule
6. Control Schedule

4

Plan Schedule Management

- The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.



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Schedule Management Plan

- Based on the needs of the project it can be informal and broad or formal and detailed.
- It includes information about
  - Project schedule model development
  - Level of accuracy and units of measure
  - Control thresholds for monitoring schedule performance
  - Rules of performance measurement
  - Reporting formats
  - Process descriptions

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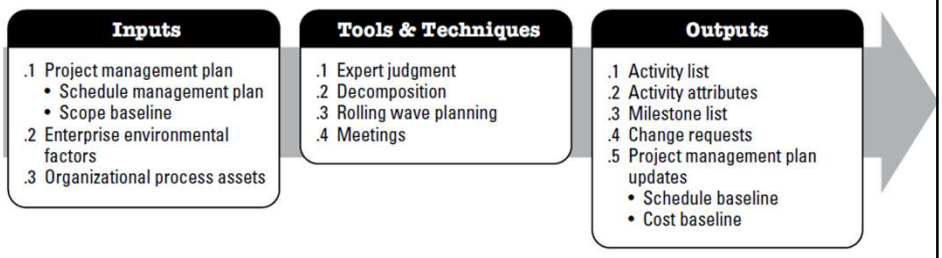
Define Activities

- The process of identifying and documenting the specific actions to be performed to produce the project deliverables.



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Define Activities: Tools and Techniques

Decomposition

- Subdividing the project work packages into smaller more manageable components called ACTIVITIES.

Rolling Wave Planning

- Rolling wave planning is an iterative planning technique in which the work to be accomplished in the near term is planned in detail, while the work in the future is planned at a higher level.
- This helps to accommodate expected project changes into the project plan.

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Define Activities: Outputs

Activity List

- A comprehensive list that includes all project activities with the activity identifier and a scope of work description.

Activity Attributes

- Activity attributes extend the description of the activity by identifying the multiple components associated with each activity.
- During the initial stages of the project, they include the activity identifier (ID), WBS ID, and activity label or name, and when completed, may include activity codes, activity description, predecessor activities, successor activities, logical relationships, leads and lags.

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Define Activities: Outputs > Milestone List

A milestone is a significant point or event in a project. A milestone list is a list identifying all project milestones and indicates whether the milestone is mandatory, such as those required by contract, or optional, such as those based upon historical information. Milestones are similar to regular schedule activities, with the same structure and attributes, but they have zero duration because milestones represent a moment in time.

MILESTONE LIST

PROJECT No:	MA-015-02	FULL PROJECT NAME:	Project Orion
DATE:		PROJECT MANAGER:	A Smith

MILESTONE ID	MILESTONE TITLE	MILESTONE DESCRIPTION	MILESTONE TYPE	DATE IF APPLICABLE
M-001	Project Kick off	Completion of the project kick off meeting with key customer stakeholders.	Mandatory	
M-002	Design sign-off	Sign-off of the design documentation	Mandatory (SOW payment milestone)	
M-003	Demo show case	Demonstration of the build so far at quartely business review.	Optional	30 June

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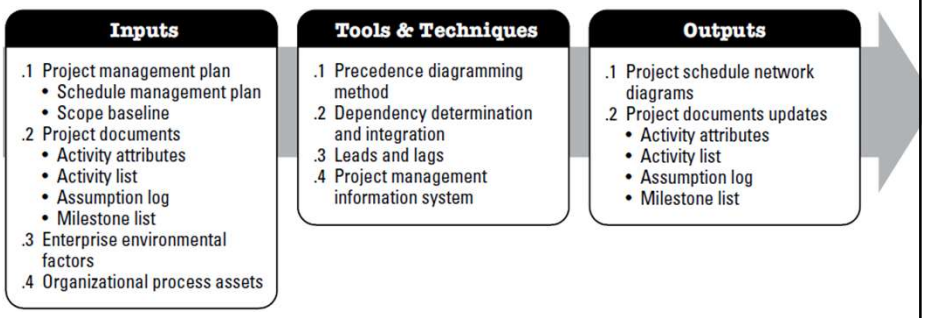
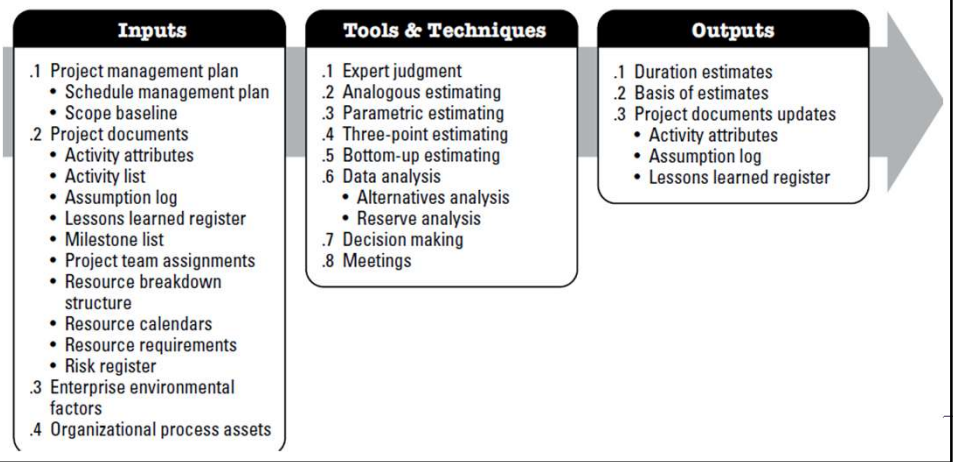
Sequence Activities

- The process of identifying and documenting relationships among the project activities.



Estimate Activity Durations

The process of estimating the number of work periods needed to complete individual activities with the estimated resources.

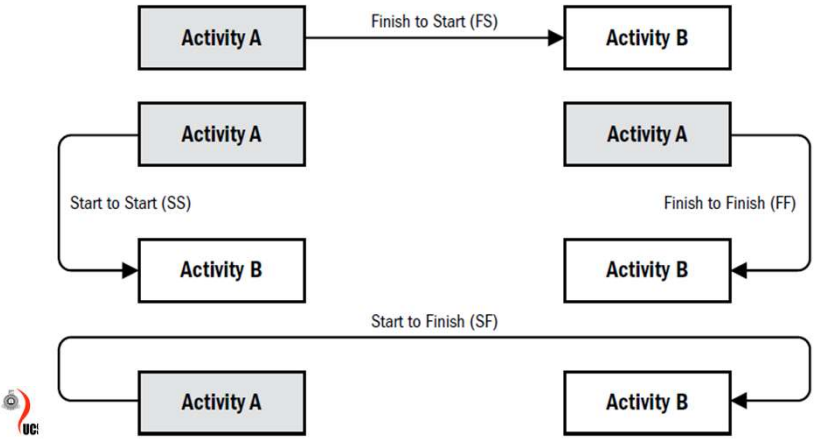


Assumptions

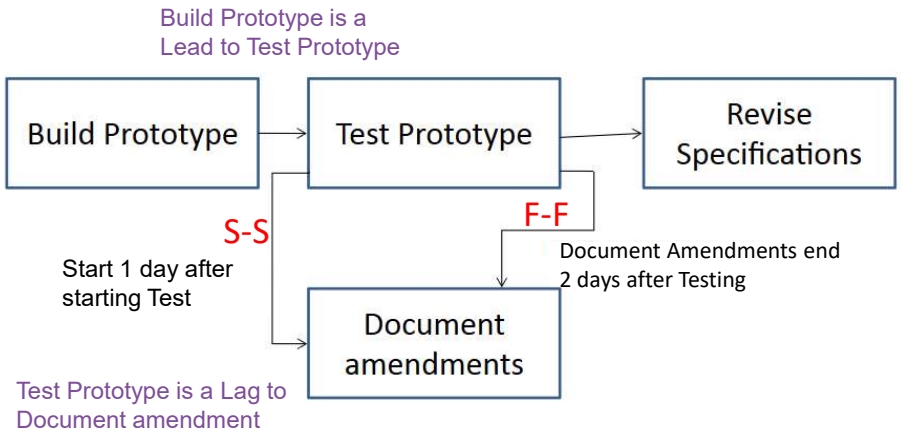
Assumption #	Description	Reason for Assumption	Impact if Incorrect	Comments
[A-1]	The Project will be completed within 7 months	Vendor is contractually obligated	Impact on the schedule, and vendor will incur penalties for the delay	
[A-2]	All the data required from various locations will be made available readily by the client	Data is needed to create a real time warehouse application	Impact on the quality of the system	
[A-3]	System maintenance will not be taken care by the vendor	Scope of the contract is limited to system development only	Project cost will increase	
[A-4]	Will have to migrate from Windows 2000 and XP to deliver real-time inventory data, automation, and auction functionalities	Microsoft stopped providing security updates and support in 2010	System will be vulnerable to attacks and functionalities will have to be ignored due to incompatibility	
[A-5]	Project is fully supported by project sponsor	Ms. Dorothy Deal wants to expand revenue and market share with this project	Major functionalities will not be funded. Project may be cut short. Integration compromises won't be made	
[A-6]	Customers will find	New features	Customers will	

Sequence Activities: Tools and Techniques

Precedence Diagramming Method (PDM)



Representing Leads and Lags



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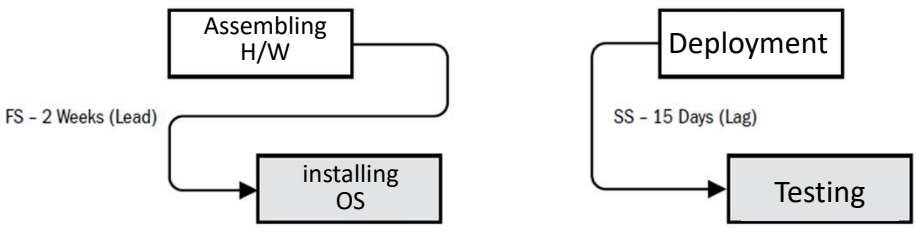
Leads and Lags



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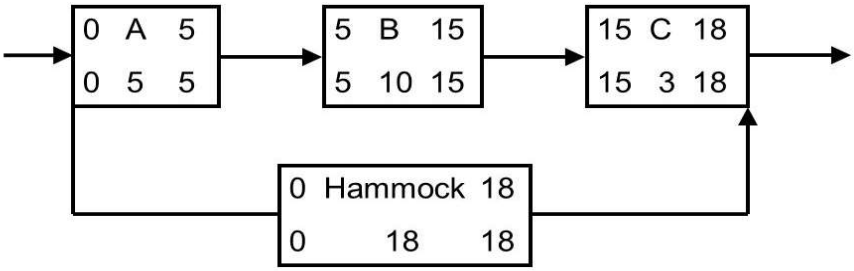
Hammock Activities

Activities that have zero duration
Used as a summary for subsets of activities



Useful with a complex project or one that has a shared budget

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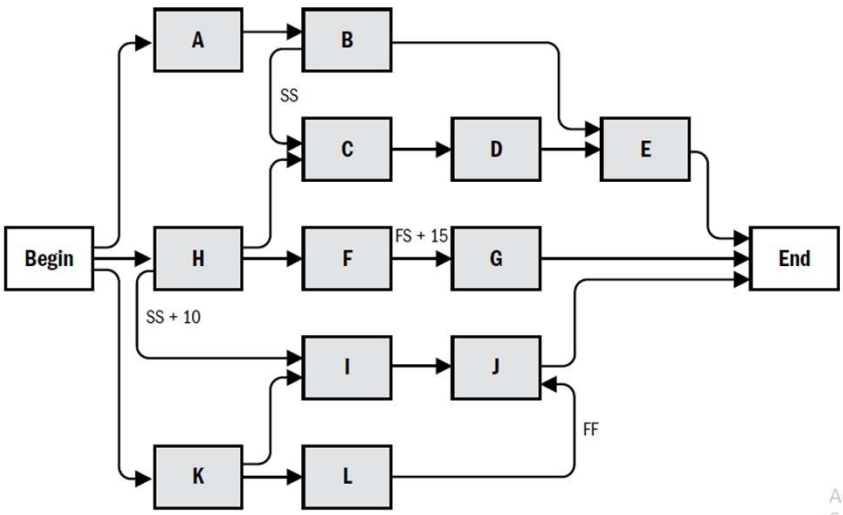
Project Schedule Network Diagram



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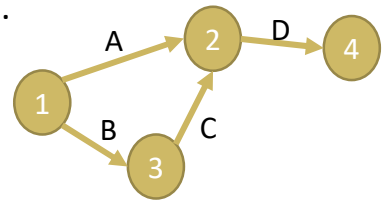
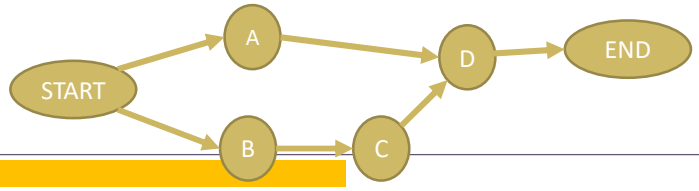
Network Planning Models

- Project scheduling techniques that model the project activities and their relationships.
- Time flows from left to right
- **Activity-on-arrow technique**
  - CPM (Critical Path Method)
- **Activity-on-node technique**
  - PDM (Precedence Diagramming Method)





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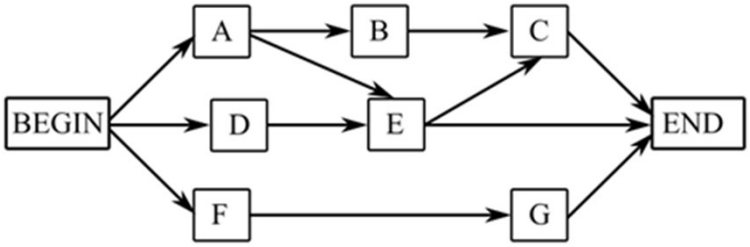
Activity on Node (Precedence) Network



- Node is drawn for each activity.
- Arrows are used to show the dependencies.
- The activities are executed according to the chronological order.

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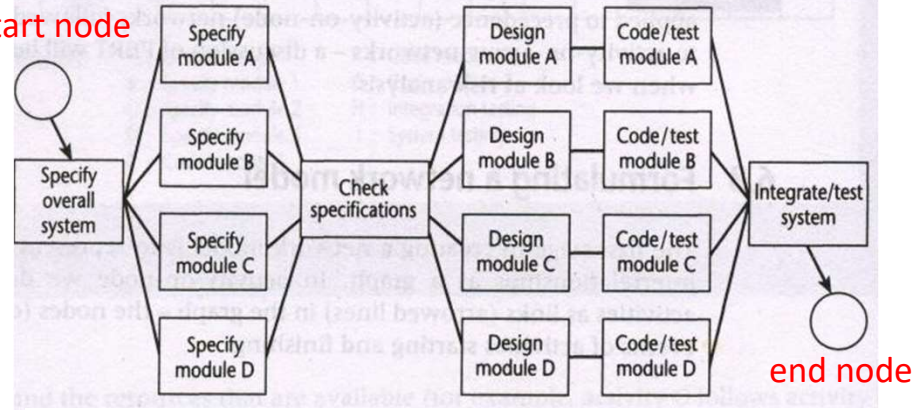
Example: Activity-on-node network

A node has duration, but links normally have no duration

start node



end node

Precedents are the immediately preceding activities
Network may contain loops or dangles

Labelling Conventions

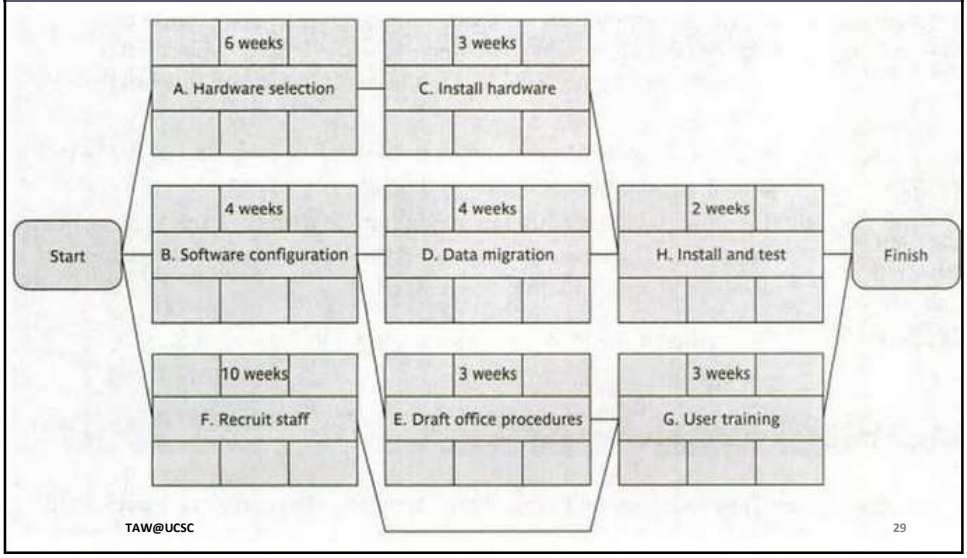
- There are a number of different conventions that have been adopted.
- E.g. entering information on an activity-on-node network

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

An Example: Project specification

Activity		Duration (weeks)	Precedents
A	Hardware selection	6	
B	System configuration	4	
C	Install hardware	3	A
D	Data migration	4	B
E	Draft office procedures	3	B
F	Recruit staff	10	
G	User training	3	E, F
H	Install and test system	2	C, D

Precedence Network for the example project



Forward pass and Backward pass

- Forward pass:
  - The earliest dates on which each activity may be started and completed
- Backward pass:
  - The latest date at which each activity may be started and finished without delaying the end date of the project
  - In calculating latest dates, we assume, the latest finish date for the project is the same as the earliest finish date- to complete project as early as possible

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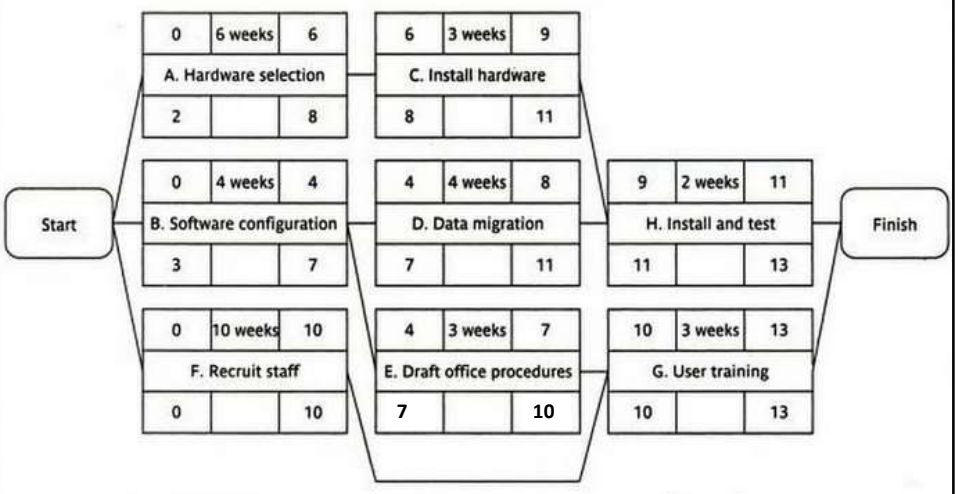
The network after forward pass and backward pass



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Activity's float and critical activity

- Float - The difference between an activity's earliest start date and its latest start date

  Total Float= LS - ES

- Critical Activity- An activity with a float of '0 –any delay of activity will delay the completion date of the project .
- Free float - the amount of time that a schedule activity can be delayed without delaying the early start date of any successor or violating a schedule constraint.

  FF = ES of the successor activity – EF of the current activity

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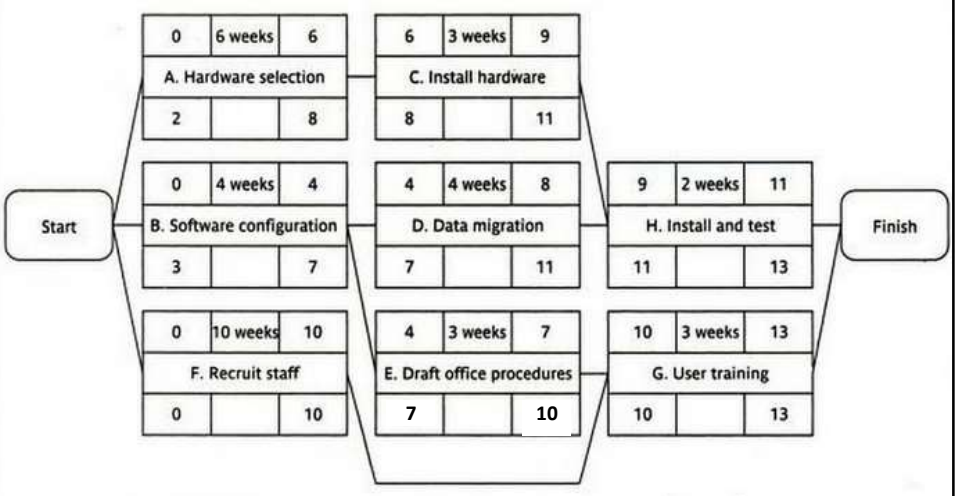
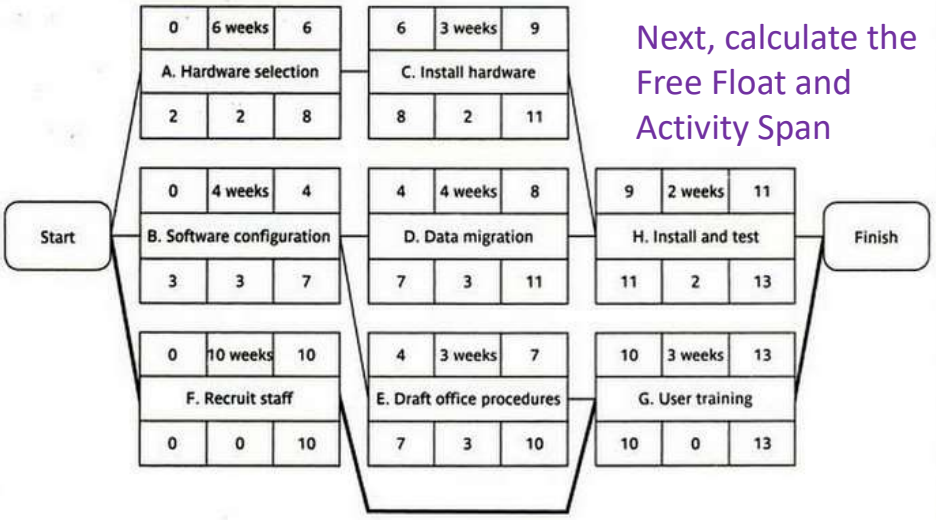
Activity: Calculate the total float



Answer: Calculating total float



Next, calculate the Free Float and Activity Span

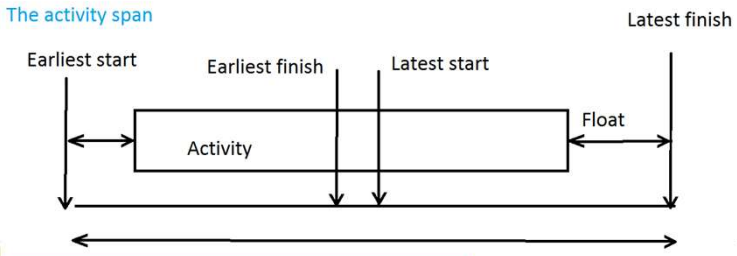
Activity: Draw the AON network and find the Total and Free floats

Activity	Predecessor	Duration (Weeks)
A	-	5
B	A	4
C	A	5
D	B	6
E	C	3
F	D, E	4

Activity Span

- The total duration within which the activity can be floated without delaying subsequent tasks or project completion date

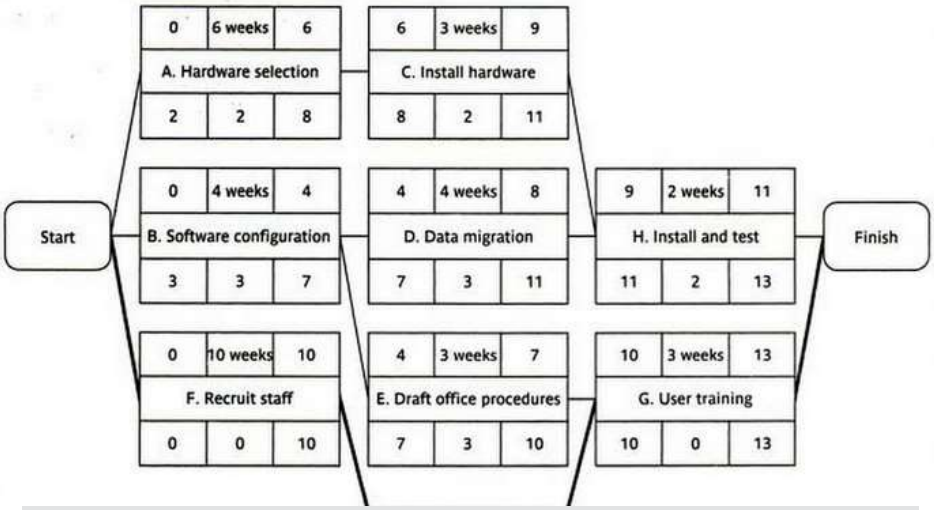
Activity Span = LF – ES



Critical Path

- The longest sequence of activities in a project plan which must be completed on time for the project to complete on due date
- The path through the network joining the critical activities.
- In managing the project;
  - Effects of delays of critical activities should be identified and corrected.
  - Critical path must be shortened to reduce the overall duration of the project.

Exercise: Find the critical path



Consider total floats and free floats.

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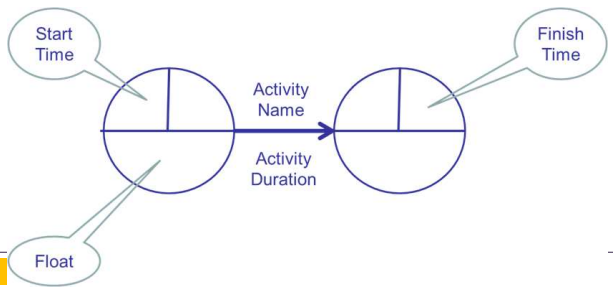
Activity-on-Arrow Diagrams

- Activities are represented by links
- Nodes represent events of activities (or groups of activities)



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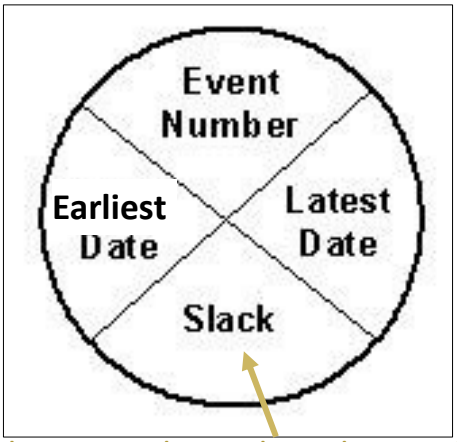
Rules and Conventions

- 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 or Dangles

Labeling Convention



Slack=LD - ED

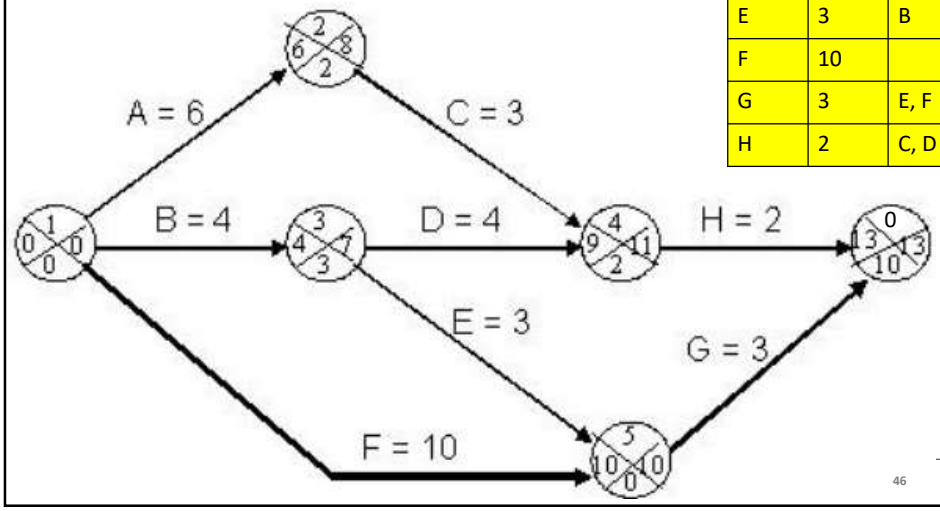
The difference between the earliest date and the latest date for an event

Activity-on-Arrow Network *Example*

Activity		Duration (weeks)	Precedents
A	Hardware selection	6	
B	System configuration	4	
C	Install hardware	3	A
D	Data migration	4	B
E	Draft office procedures	3	B
F	Recruit staff	10	
G	User training	3	E, F
H	Install and test system	2	C, D

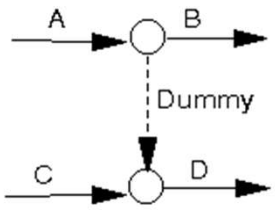
AOA Network *Example*

A	6	
B	4	
C	3	A
D	4	B
E	3	B
F	10	
G	3	E, F
H	2	C, D



Dummy Activities

- Shown as dotted arcs/lines
- Often have a zero-completion time
- Used to represent precedence relationships which cannot be easily represented using the actual **activities**



A must finish before B can start

both A and C must finish before D can start

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Exercise 01

Activity	Preceding Activity
A	None
B	None
C	None
D	A, B
E	B
F	B, C

Draw the Activity-on-Arrow network diagram

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Exercise 02

Activity	Prior Activity
A	None
B	None
C	A
D	A, B
E	B

Draw the Activity-on-Arrow network diagram

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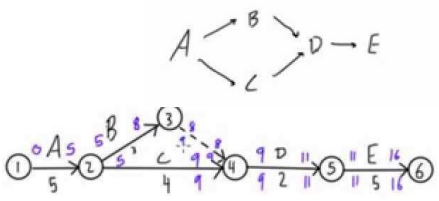
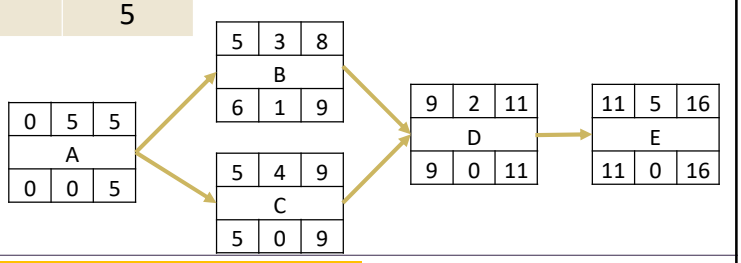
Draw AON and AOA networks

Activity	Predecessor	Duration
A	-	5
B	A	3
C	A	4
D	B, C	2
E	D	5





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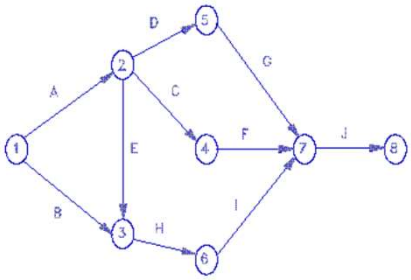
What is the difference between AOA networks and AON networks?

- AOA networks use **links** to represent activities and **nodes** to represent events, AON networks use **boxes** (nodes) to represent activities and **links** to represent dependencies.
- AOA networks may need dummies to represent precedence relationships, but no dummies are necessary in AON networks.
- AOA network diagrams use only finish-to-start dependencies, but AON can show different dependencies among tasks.

ACTIVITY TIME

Exercise 3: Draw AOA network diagram. Find slack and critical path

Activity Code	Dependency	Duration
A	(None)	5
B	(None)	1
C	A	2
D	A	3
E	A	2
F	C	3
G	D	4
H	B, E	2
I	H	1
J	F, G, I	1



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Exercise 4: Draw AON network diagram. Find, FF, TF and critical path

Activity Code	Dependency	Duration
A	-	5
B	A	8
C	A	6
D	C	8
E	B	12
F	B	7
G	D, F	10
H	E, G	8

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Schedule Management Processes

1. Plan Schedule Management
2. Define Activities
3. Sequence Activities
4. Estimate Activity Durations
5. Develop Schedule
6. Control Schedule

Develop Schedule

- The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model for project

Inputs	Tools & Techniques	Outputs
.1 Project management plan • Schedule management plan • Scope baseline .2 Project documents • Activity attributes • Activity list • Assumption log • Basis of estimates • Duration estimates • Lessons learned register • Milestone list • Project schedule network diagrams • Project team assignments • Resource calendars • Resource requirements • Risk register .3 Agreements .4 Enterprise environmental factors .5 Organizational process assets	.1 Schedule network analysis .2 Critical path method .3 Resource optimization .4 Data analysis • What-if scenario analysis • Simulation .5 Leads and lags .6 Schedule compression .7 Project management information system .8 Agile release planning	.1 Schedule baseline .2 Project schedule .3 Schedule data .4 Project calendars .5 Change requests .6 Project management plan updates • Schedule management plan • Cost baseline .7 Project documents updates • Activity attributes • Assumption log • Duration estimates • Lessons learned register • Resource requirements • Risk register

Control Schedule

- The process of monitoring the status of the project to update the schedule and manage changes to the schedule baseline.