Chapter 6: Activity Planning – Part 2

NET481: Project Management

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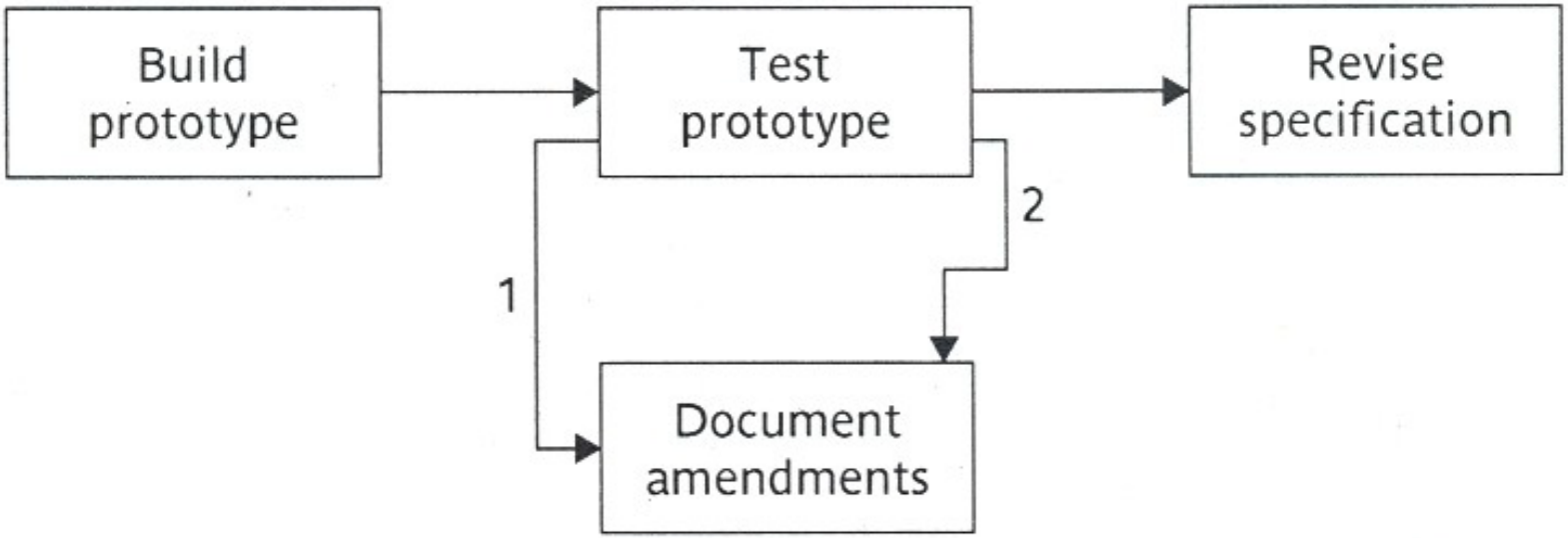
Representing Lagged Activities

- **Lag activities:** are two activities that will be undertaken in parallel but there is a lag between them.
- Here tow activities will be undertaken at the same time with some lag between them.
- "Document amendments" will start one day after "Test prototype" starts and finish two days after "Test prototype" ends.

Representing Lagged Activities



Labeling Conventions

- There are a number of labeling conventions.
- Label convention is a way of entering information on an activity-on-node network.
- One labeling convention is the British Standard 4335.

Earliest Start	Duration	Earliest Finish
Activity Label, Activity Description		
Latest Start	Float	Latest Finish

Adding the Time Dimension

- After we create the logical network model showing the activities and the interrelationships between those activities. We should think of when each activity will be undertaken.
- The critical path approach is concerned with:
  - Planning the project in a way that it will be completed as quickly as possible.
  - Identifying the activities where a delay in their execution is likely to affect
    - The overall end date of the project or
    - Later activities start dates.

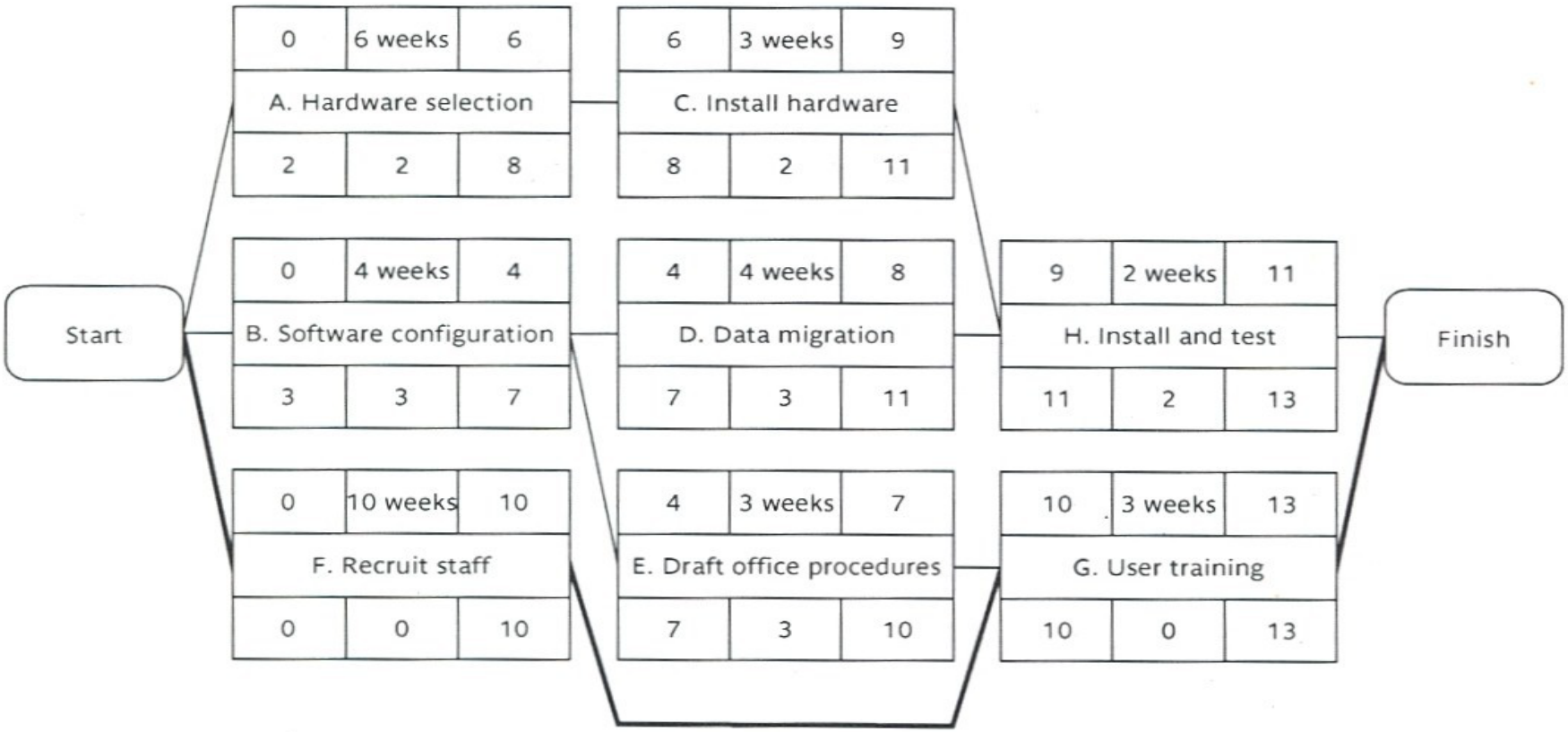
Adding the Time Dimension (cont'd)

- For each activity we will estimate its duration.
- The network is then analyzed by carrying out the forward pass and a backward pass.
- **The forward pass:**
  - Calculates the earliest dates at which activities may be started, finished
  - Project completion time.
- **The backward pass:**
  - Calculates the latest dates at which activities may be started, finished, the float and
  - The critical path.

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

Example (cont'd)



The project duration=13 weeks

The Critical Path

- There will be at least one critical path in the network.
- The critical path defines the duration of the project.
- Any delay to any of the activities on this critical path will result in a delay of the project completion.
- **Activity Float:**
  - Difference between the latest start and the earliest start or
  - Difference between the latest finish and the earliest finish.
- **Activity Span:**
  - Difference between the latest finish and the earliest start.
  - It is a measure of the maximum time allowable for the activity.

Example

- What is the Activity Spam for:
  - **Activity D:** 11-4 =7 weeks
  - **Activity G:** 13-10= 3 weeks

Critical Activities

- They are those on the critical path.
- Activities not on the critical path may become critical. **How**?
  - As the project proceeds the activities may use some of their float.
    - Periodic recalculation of the network is required.
- As soon as activities on a particular path use up their float the activities will become critical.
- Identifying critical activities is an important step in:
  - Risk analysis.
  - Resource allocation.
  - Project monitoring.

Activity Float

- • Time allowed to delay an activity start.
- **3 different types:**
  - Total float (without affecting the completion of the project) it is the float recorded in the precedence network

    = Latest start date – Earliest start date
  - Free float (without affecting the next activity)

    = Earliest start date of *next activity* – *Earliest Finish* date of activity(in question)
  - Interfering float = (total float - free float)

Example

For Activity D

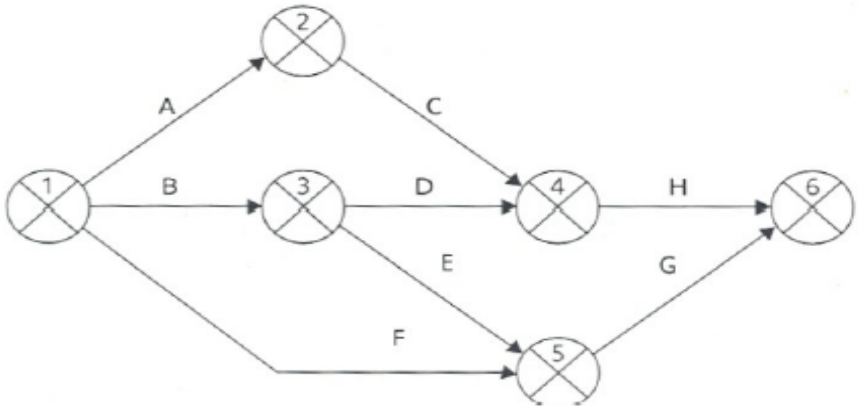
- What is the total float?
  - Total float= 3 w
- What is the free float?
  - Free float= ES(H)- EF(D)= 9 - 8=1 w
- What is the interfering float?
  - interfering float= 3 - 1=2 w

Shortening the Project Duration

- If we want to bring forward the end date of the project, which activities should we try to reduce their durations?
  - Critical activities.
- How can we reduce the time duration for an activity?
  - More resources.
  - Working overtime.
  - Additional staff
- Suppose that the duration for activity F is shortened to 8 weeks, calculate the end date of the project.

Activity-On-Arrow Network

- Links or arrows represent activities.
- Nodes represents events.



Activity-On-Arrow Network (cont'd)

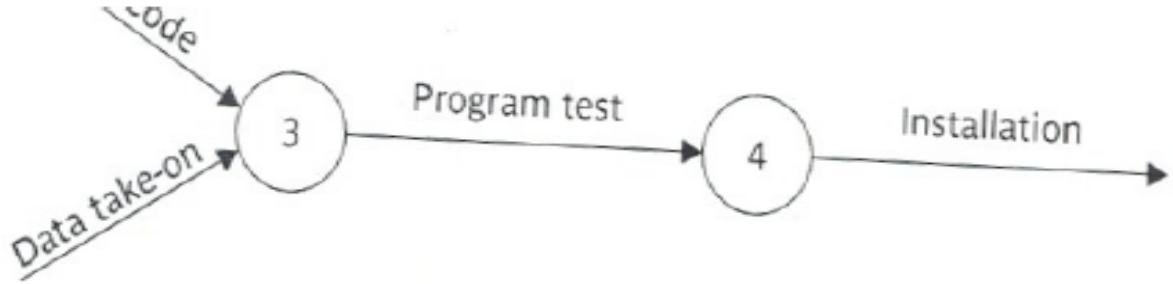
Rules and Conventions

- A project network may have one start node.
- A project network may have only one end node.
- A link has duration.
- Nodes have no duration.
  - Nodes are events.
    - The source node.
    - The sink node.
    - The intermediate nodes.

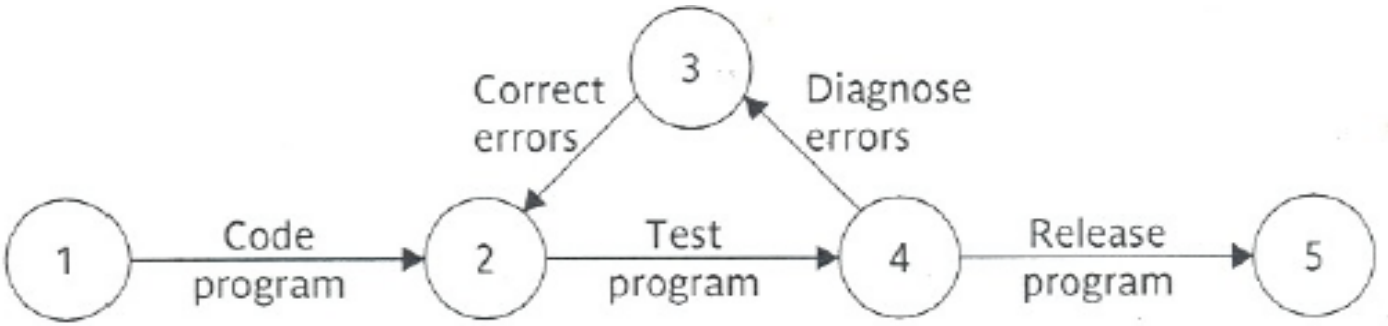
Activity-On-Arrow Network (cont'd)

- Time moves from left to right.
- Nodes are numbered sequentially.
- A network may not contain Loops.
- A network may not contain dangles.

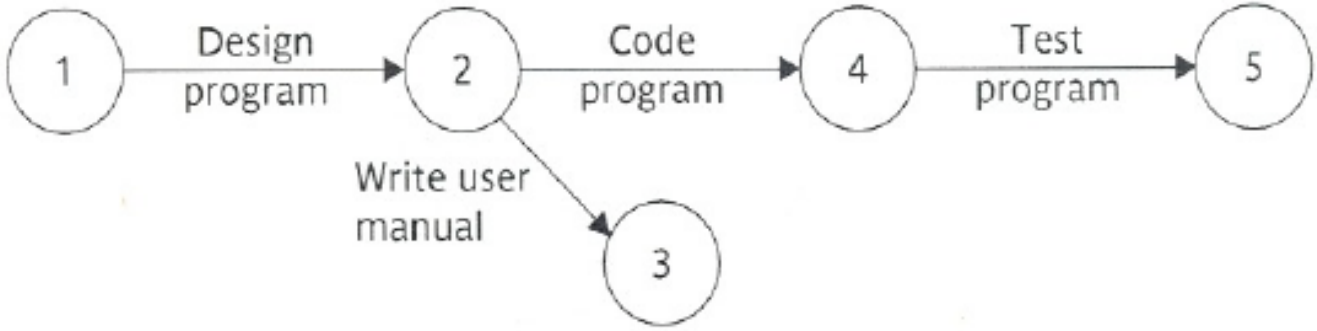
- Sequential numbering



- A loop



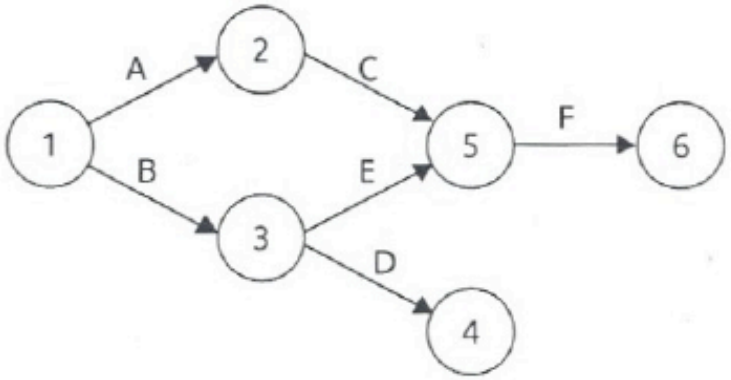
- A Dangle


1
Design program
2
Code program
4
Test program
5
Write user manual
3

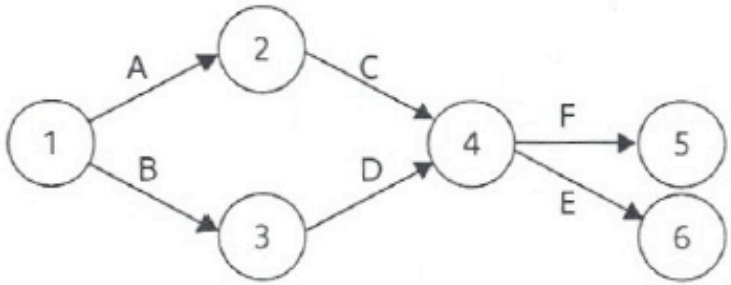
Exercise

- what is wrong with the following?

(a)



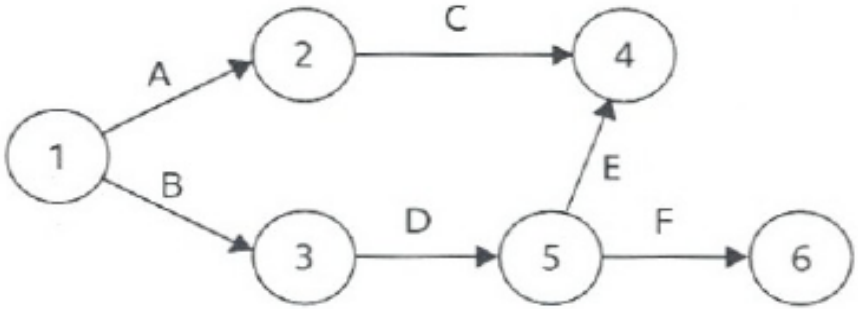
(b)



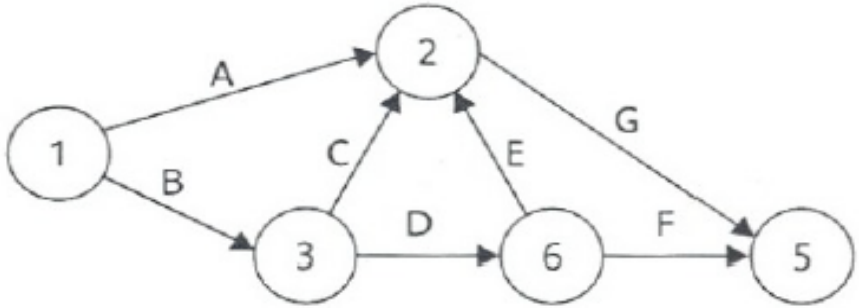
Exercise

- what is wrong with the following?

(c)

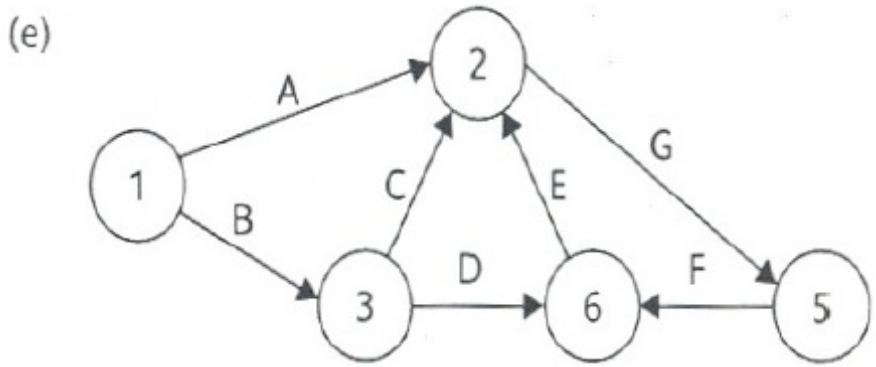


(d)



Exercise

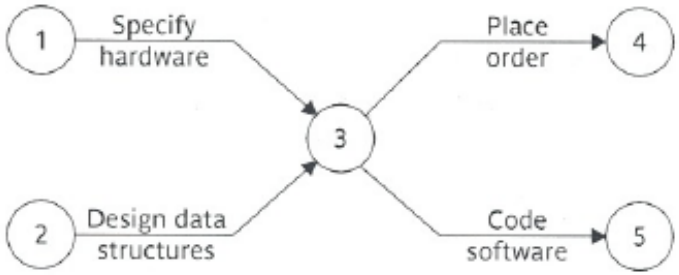
- what is wrong with the following?



Dummy Activities

Suppose that in a project,

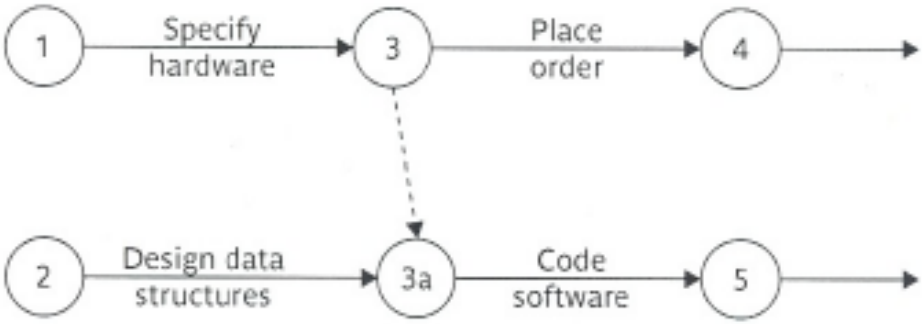
- Before you can start "coding the software" you need to:
  - "Specify the hardware"
  - "Design data structures".
- Before placing an order you only need to:
  - "Specify the hardware"



A logical error

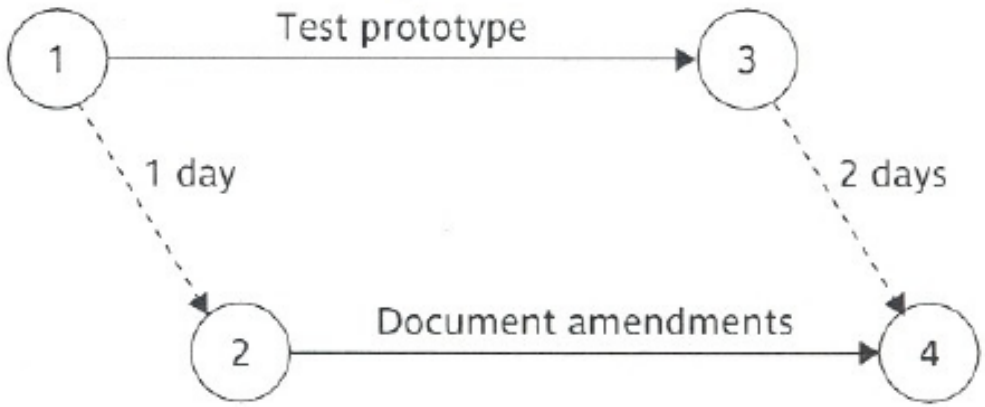
Dummy Activities

- Resolving the error using a dummy activity.
- Dummy activities:
  - Are used to aid in the layout of network drawings.



Lagged Activities

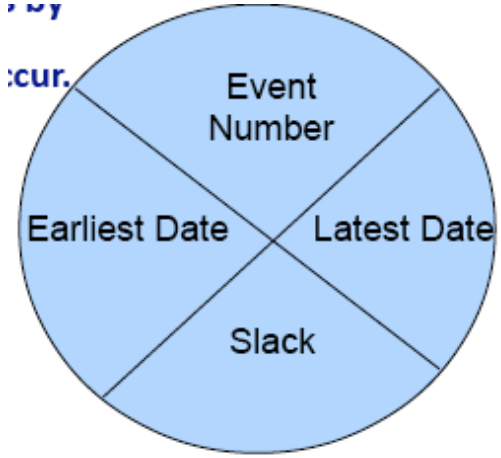
- We represent lagged activities with a pair of dummy activities.



Activity Labeling

Divide the node circle into quadrants:

- Event number
- Earliest and latest dates by which the event will occur.
- slack



Network Analysis

- The Forward Pass: it is carried out to calculate:
- the earliest date on which each event may be achieved and
- the earliest dates on which each activity may be started and completed.
- The earliest date for an event is the earliest date by which all activities upon which it depends can be completed.

Network Analysis (cont'd)

- The Backward Pass: The second stage is to carry out a backward pass to calculate:
  - the latest date at which each event may be achieved, and
  - each activity started and finished , without delaying the end date of the project.
- The latest date for an event is the latest date by which all immediately following activities must be started for the project to be completed on time.
- The Slack is the difference between the latest date and the earliest date for an event.

Network Analysis (cont'd)

- The critical path in the activity-on-arrow network is:
  - The path joining all nodes with a "zero" slack.
  - The longest path through the network.

Example

Activity		Duration (weeks)	Precedents
A	Hardware selection	6	
B	System configuration	4	
C	Install hardware	3	A
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E	Draft office procedures	3	B
F	Recruit staff	10	
G	User training	3	E, F
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Activity-on-Arrow Network. CPM Network

The project duration is: 13 weeks.