Unit 4: Activity Planning

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Includes…

1. Objectives of activity planning, project schedule, projects and activities
2. Sequencing and scheduling activities, network planning model, representation of lagged activities
3. Adding the time dimension, backward and forward pass, identifying critical path
4. Activity float, shortening project, precedence networks

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Activity planning.

- An activity plan should provide a means of **evaluating the consequences of not meeting any of the activity target dates** and **guidance as to how the plan might most effectively be modified to bring the project back to target.**

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Objectives of activity planning.

- **Feasibility assessment >>>**
  - Is the project possible within required timescales and resource constraints?
- **Resource Allocation>>>**
  - What are the most effective ways of allocating resources to the project and when should they be available?
  - Timescale vs resource availability
- **Detailed costing>>>**
  - How much will the project cost and when is that expenditure like to take place?
- **Motivation>>>**
  - Providing targets and monitoring achievement against targets is an effective way of motivating staff, particularly where they have been involved in setting those targets in the first place.
- **Co-ordination>>>**
  - When do the staff in different departments need to be available to work on a particular project and when do staff need to be transferred between projects?

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When to plan

- Planning is **an ongoing process of refinement**, each iteration becoming more detailed and more accurate than the last.
- During feasibility study and project start up>>>
  - the main purpose of planning will be **to estimate timescales and the risks of not achieving target** completion dates or keeping within budget
- As the project proceeds beyond the feasibility study, the emphasis will be placed upon the production of activity plans for e**nsuring resource availability and cash flow control.**
- Throughout the project, until the final deliverable has reached the customer, monitoring and re-planning must continue to correct any drift that might prevent meeting time or cost targets.

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Project Schedule

- Before work commences on a project, the project plan must be developed to the level of **showing dates when each activity should start and finish** and **when and how much of each resource will be required.**
- One the plan has been refined to this level of detail, we call it a ***project schedule***.
- Creating a project schedule ***comprises four main stages***.
  - The first step in producing the plan is **to decide what activities need to carried out** and in what **order** they are to be done. ----- ***creating an activity plan***
  - The ideal activity plan will then be the subject of an ***activity risk analysis***, aimed at identifying potential problems.
  - The third step is ***resource allocation***.
  - The final step is ***schedule production***. Once resources have been allocated to each activity, we will be in a position to draw up and publish a project schedule, which indicates planned start and completion dates and a resource requirement statement for each activity.

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Projects and activities: Defining Activities

- a project is composed of a number of inter-related activities;
- a project may start when at least one of its activities is ready to start;
- a project will be completed when all of the activities it encompasses have been completed;
- an activity must have a clearly defined start and a clearly defined end-point, normally marked by the production of a tangible deliverable;
- if an activity requires a resource (as most do) then that resource requirement must be forecastable and is assumed to be required at a constant level throughout the duration of the activity;
- the duration of an activity must be forecastable – assuming normal circumstances, and the reasonable availability of resources;
- some activities might require that others are completed before they can begin (these are known as *precedence requirements*).

- **Activities must be defined so that they meet these criteria. Any activity that does not meet these criteria must be redefined.**

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Projects and activities: Identifying Activities

- Essentially there are three approaches to identifying activities that make up a project.
  - **Activity based Approach**
  - **Product based Approach**
  - **Hybrid approach**.

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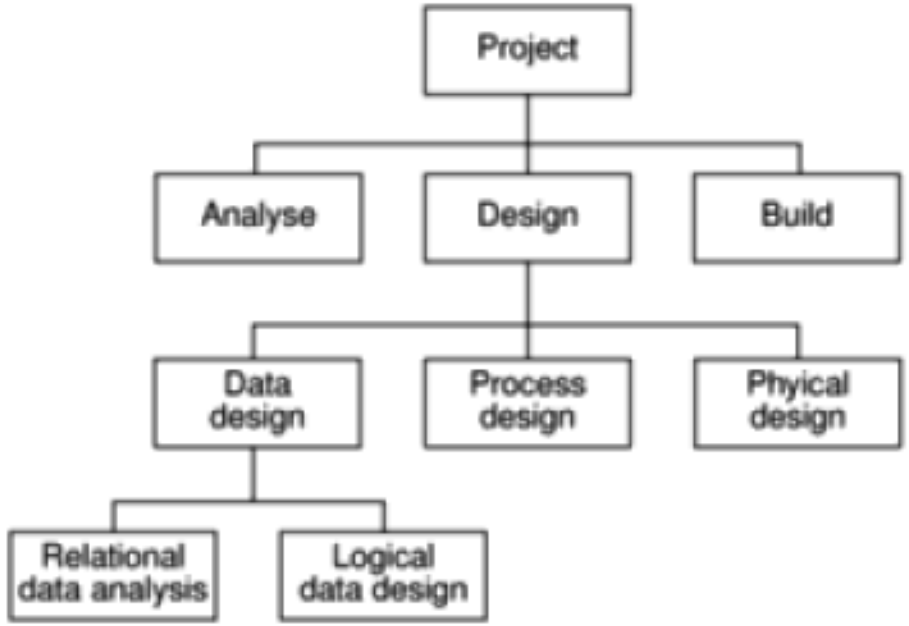
The Activity Based Approach

- Consists of **creating a list of all the activities that the project is thought to involve**.
- Might involve a **brainstorming session involving the whole project team**
- While listing activities for a large project, it might be helpful to **subdivide the project into subtasks** using a Work Breakdown Structure (WBS)



A fragment of an activity-based Work Breakdown Structure.

The Activity Based Approach

- When preparing a WBS, **consideration must be given to the final level** of detail or **depth of the structure**.
- **Too great depth will result in a large number of small tasks** that will be difficult to manage.
- **Too shallow structure will provide insufficient detail** for project control.
- Each branch should, however, be broken down at least to a level where each leaf may be assigned to an individual or responsible section within the organization.

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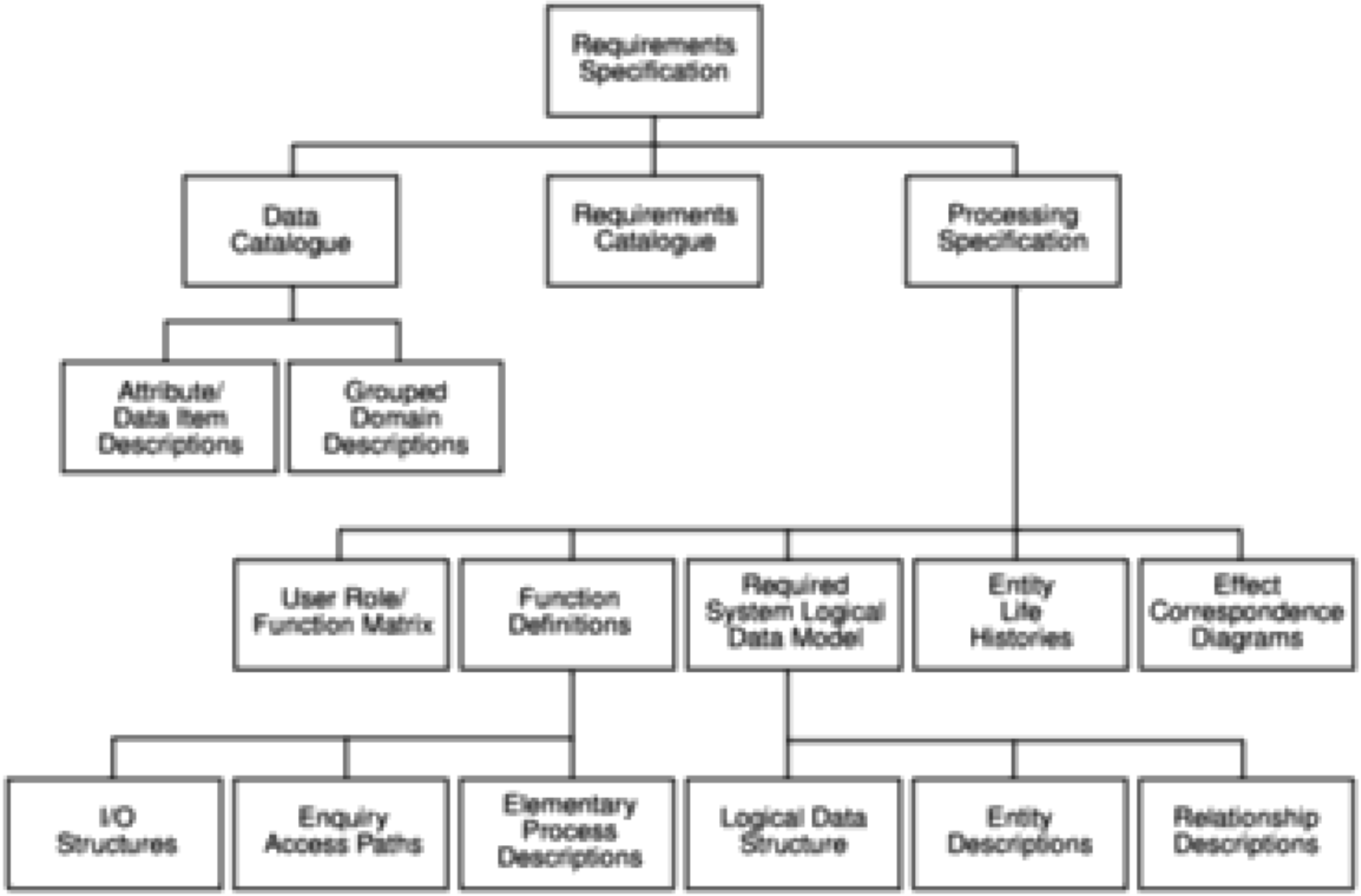
The Product Based Approach

- Consists of a Product Breakdown Structure (PBS) and a Product Flow Diagram (PFD).
- The PFD indicates, for each product, **which other products are required as inputs**
- The PFD can easily be transformed into an ordered list of activities.
- Is particularly appropriate for SSADM which clearly specifies, **for each step, each of the products required and the activities required to produce it.**



SSADM Product Breakdown Structure for Requirements Specification (adapted from Goodland and Slater).

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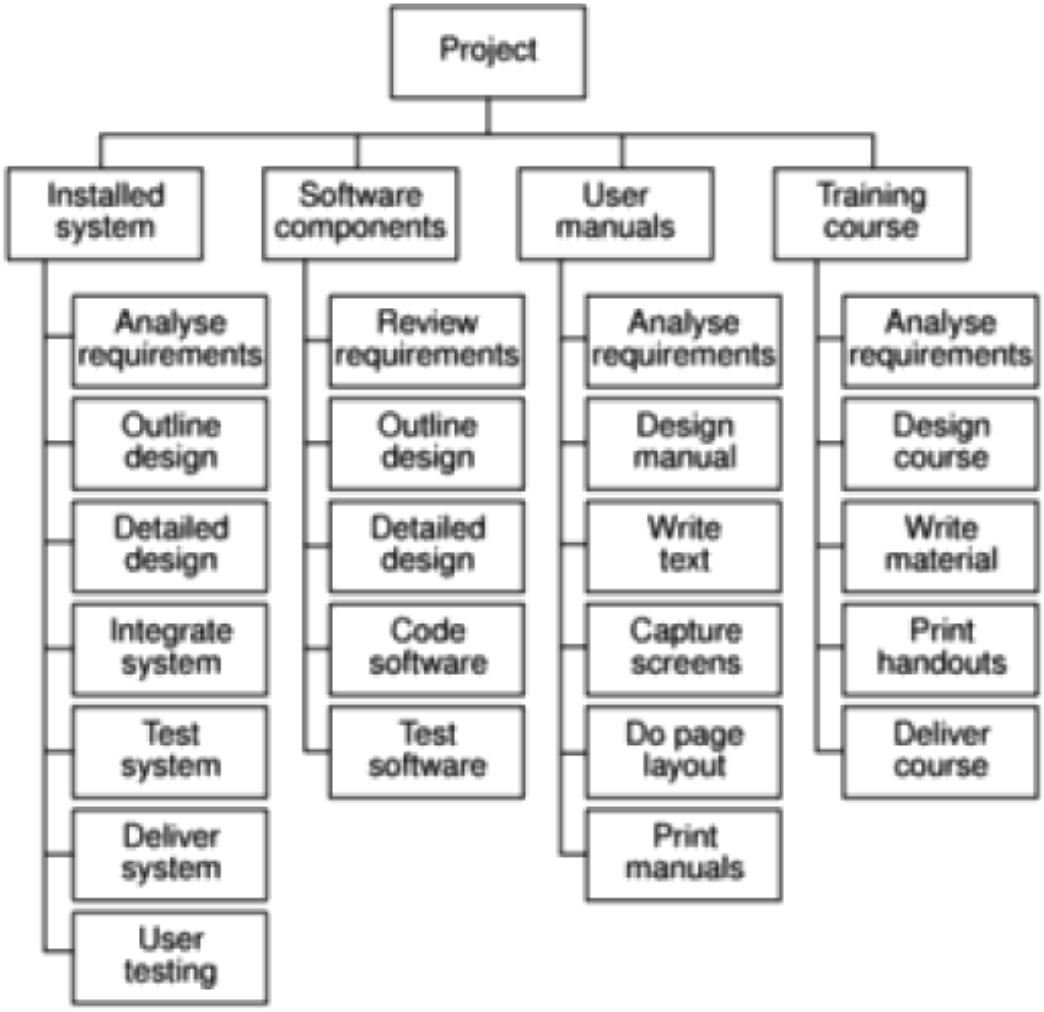
The Hybrid Approach

- IBM recommended 5 levels in WBS
- **Level 1:** Project
- **Level 2:** Deliverables such as software, manuals and training courses
- **Level 3:** Components which are the key work items needed to produce deliverables such as the modules and tests required to produce the system software
- **Level 4:** Work packages which are major items, or collections of related tasks, required to produce a component
- **Level 5:** Tasks which are tasks that will normally be the responsibility of a single person



A Work Breakdown Structure based on deliverables.

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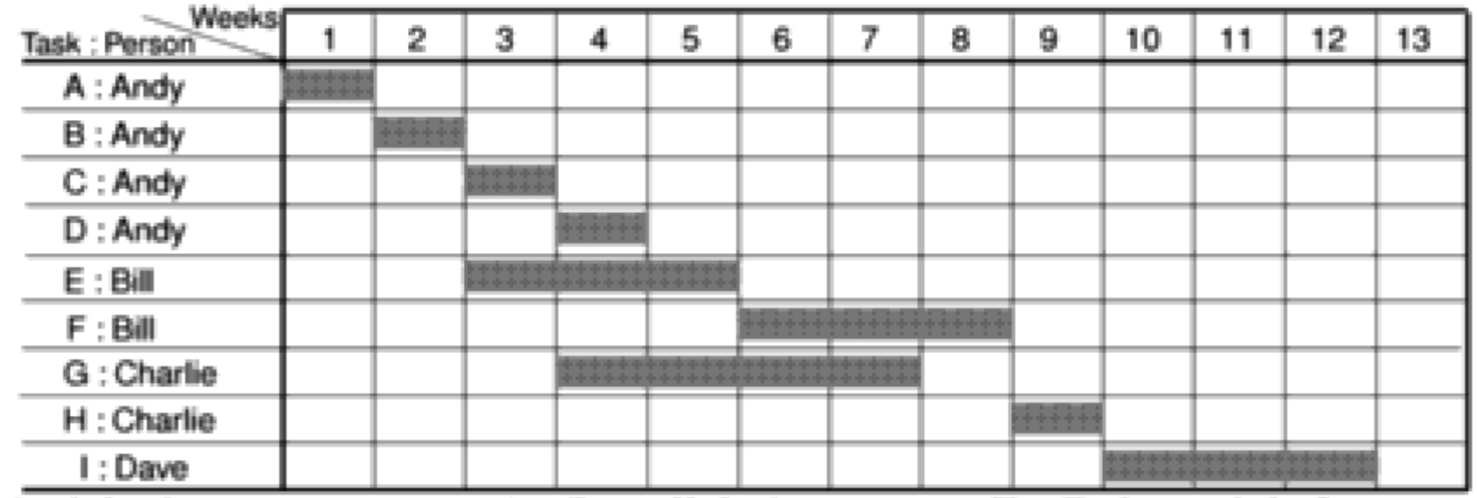
Sequencing and Scheduling Activities

- Through out a project, we will require a schedule that clearly indicates when each of the project's activities is planned to occur and what resources it will need.
- On way of presenting such a plan is to use 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

Figure *A project plan as a bar chart.*

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Network Planning Models

- CPM – Critical Path Method
- PERT – Program Evaluation and Review Technique
- **Both CPM and PERT (Program Evaluation and Review Technique) provide the user with project management tools to plan, monitor, and update their project as it progresses.**

Similarities between PERT and CPM

- Both follow the same steps and use network diagrams
- Both are used to plan the scheduling of individual activities that make up a project
- They can be used to determine the earliest/latest start and finish times for each activity

Differences between PERT and CPM

- PERT is probabilistic whereas CPM is deterministic
- In CPM, estimates of activity duration are based on historical data
- In PERT, estimates are uncertain and we talk of ranges of duration and the probability that an activity duration will fall into that range
- In routine projects where estimated time for each activity is known, CPM is a better tool to control both time and cost.

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Formulating a Network Model

- The first stage in creating a network model is to represent the activities and their interrelationships as a graph.
- **Activity Network Rules and Conventions (Constructing Precedence Network)**

- **A project network should have only one start node:**
  - Although it is logically possible to draw a network with more than one starting node, it is undesirable to do so as it is **a potential source of confusion**.

- **A project network should have only one end node:**
  - The end node designates the completion of the project and a **project may only finish once.**

- **A node has duration:**
  - A node represents an activity and in general, **activities take time to execute.**

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Formulating a Network Model

- **Activity Network Rules and Conventions (Constructing Precedence Network)**

- **Links normally have no duration:**
  - Links represent the relationships between activities.
  - In the figure below, neither installation cannot start until program testing is complete.
  - Program testing cannot start until both coding and data take on have been completed.

- **Precedents are the immediate preceding activities:**
  - Program Test cannot start until both Code and Data Take-on have been completed
  - Install cannot start unit program test has finished.
  - Code and Data Take-on can therefore be said to be precedents of Program Test and Program Test is precedent of Install

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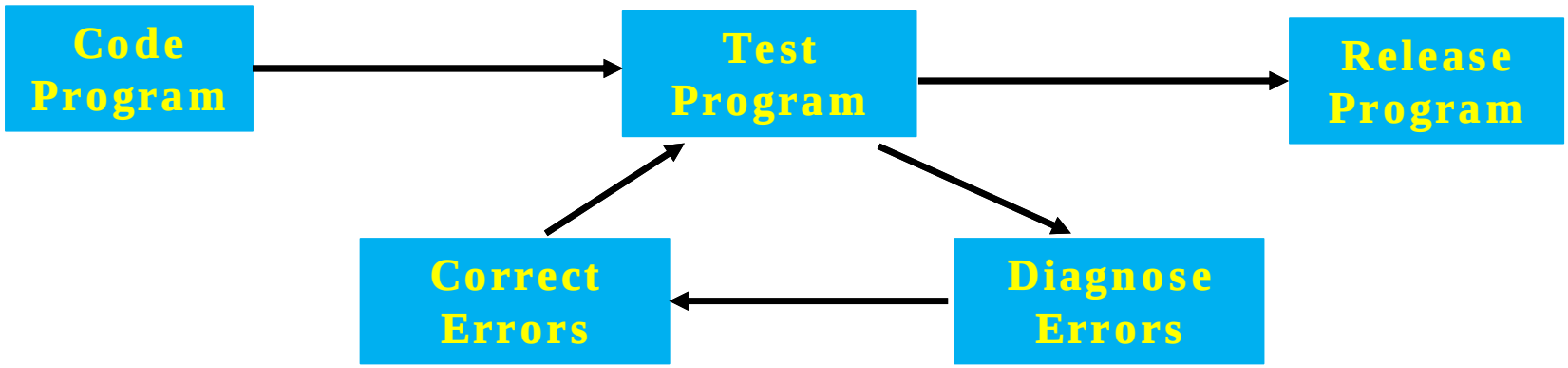
Formulating a Network Model

- **Activity Network Rules and Conventions (Constructing Precedence Network)**
- **Time moves from left to right**
  - Networks are drawn so that time moves from left to right.
  - ***It is rare that this convention is flouted.***
  - People add arrow heads to the lines to give stronger visual indication of time flow
- **A network may not contain loops**
  - A loop is an error in that it represents a situation that cannot occur in practice



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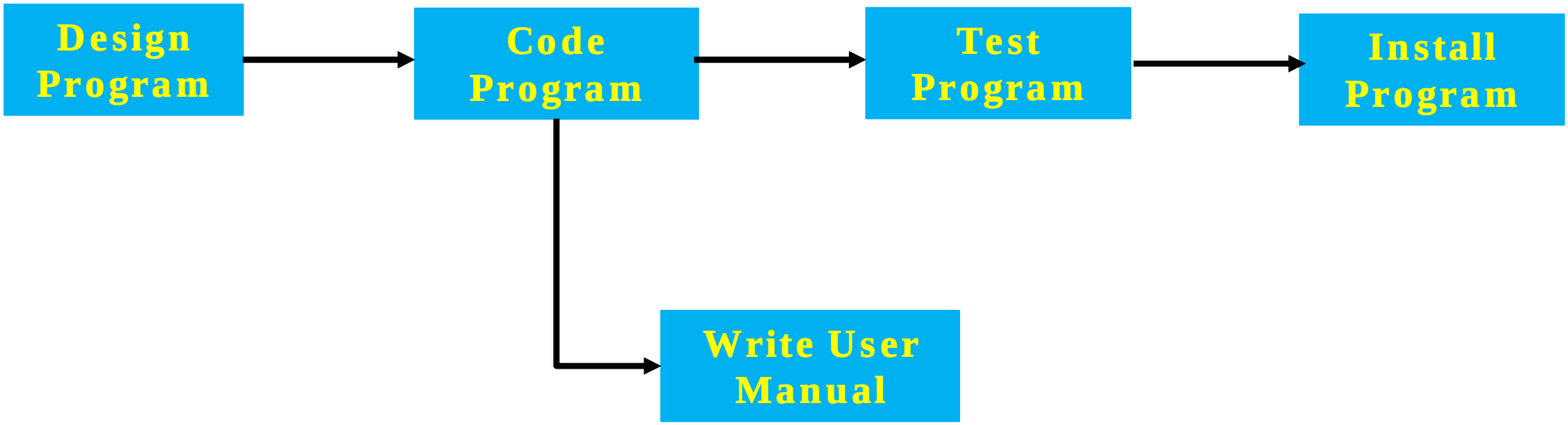
Formulating a Network Model

- **Activity Network Rules and Conventions (Constructing Precedence Network)**
- **A network should not contain dangles:**
  - A dangling activity write user manual in the figure below should not exist as it is likely to lead to errors in subsequent analysis
  - In many cases dangling activities indicate errors in logic when activities are added as an afterthought.



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Formulating a Network Model

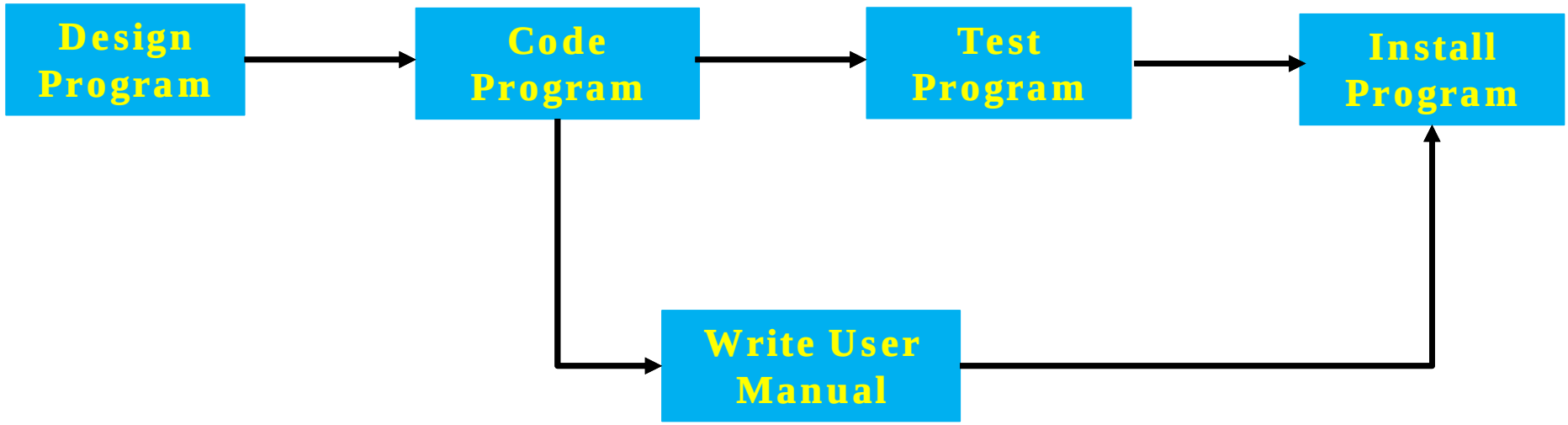

Fig. Resolving a dangle

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Formulating a Network Model

- **Activity Network Rules and Conventions (Constructing Precedence Network)**

- **Representing Lagged Activities:**
  - We might come across situations where we wish to undertake two activities in parallel so long as there is a lag between the two.
  - Eg. We would designate an activity "test and document amendments which would make it impossible to show that amendment recording could start say 1 day after testing has begun and finishing a little after the completion of testing.
  - The figure indicates that the document amendments can start one day after the start of prototype testing and will be completed two days after prototype testing us completed.

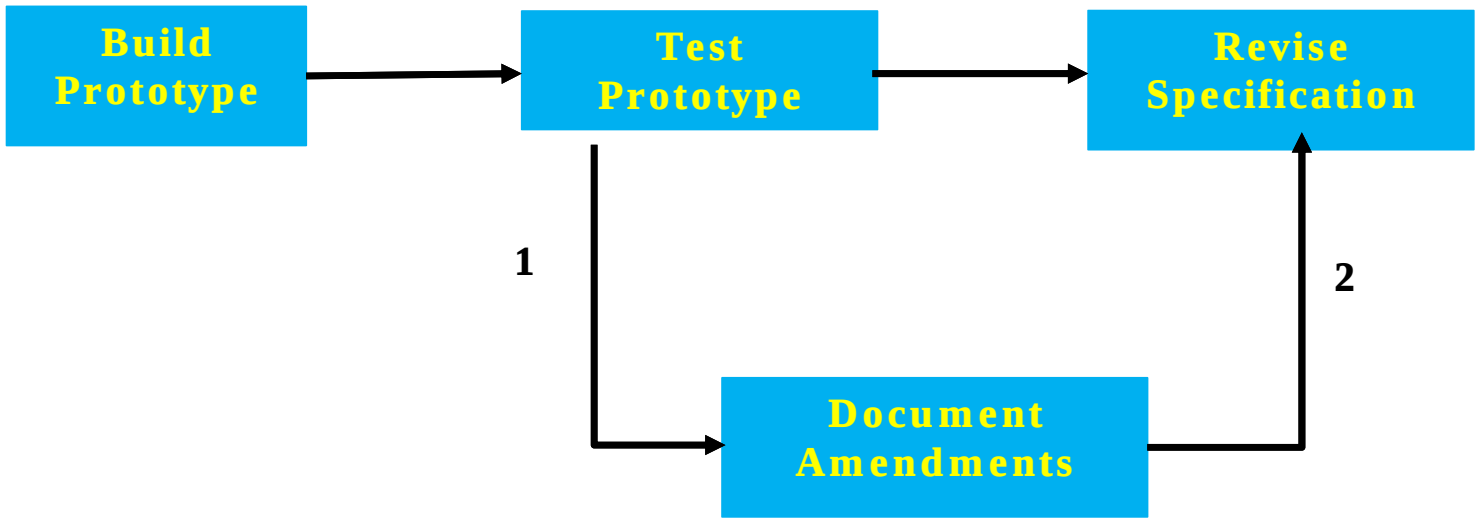

Fig. Indicating Lags

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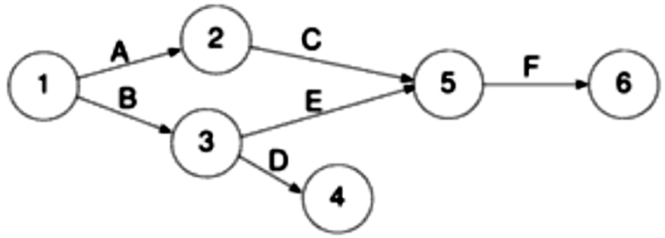
Formulating a Network Model

Concept Check

State what is wrong with each of them and redraw where possible.

Answer

(a)



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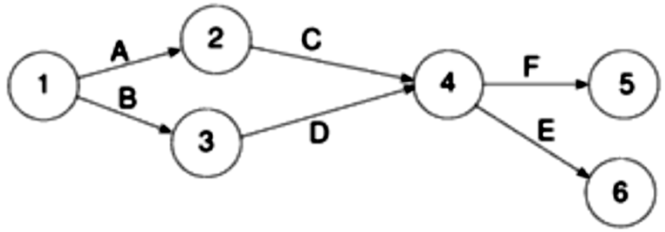

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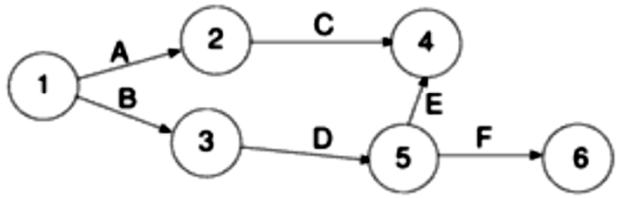

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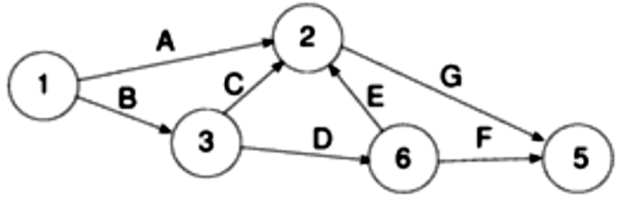

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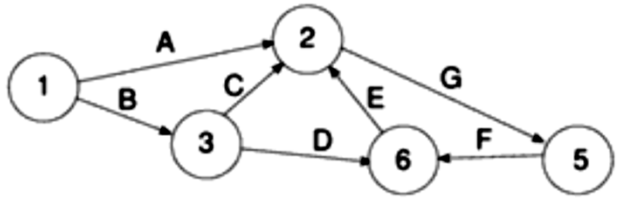

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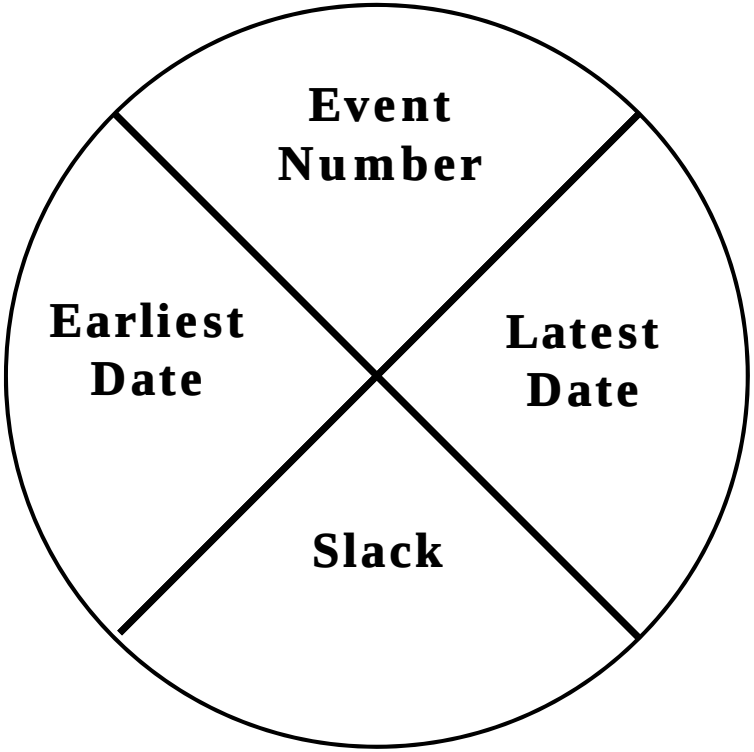
Activity Labelling



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The Forward Pass Rule

- The earliest date for an event is the earliest finish date for all the activities terminating at the event.
- Where more than one activity terminates at a common event we take the latest of the earliest finish dates for those activities.

The Backward Pass Rule

- The latest date for an event is the latest start date for all the activities that may commence from that event.
- Where more than one activity commences at a common event, we take the earliest of the latest start dates for those activities.

Question!!!

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An example project specification with estimated activity durations 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

Solution!!!

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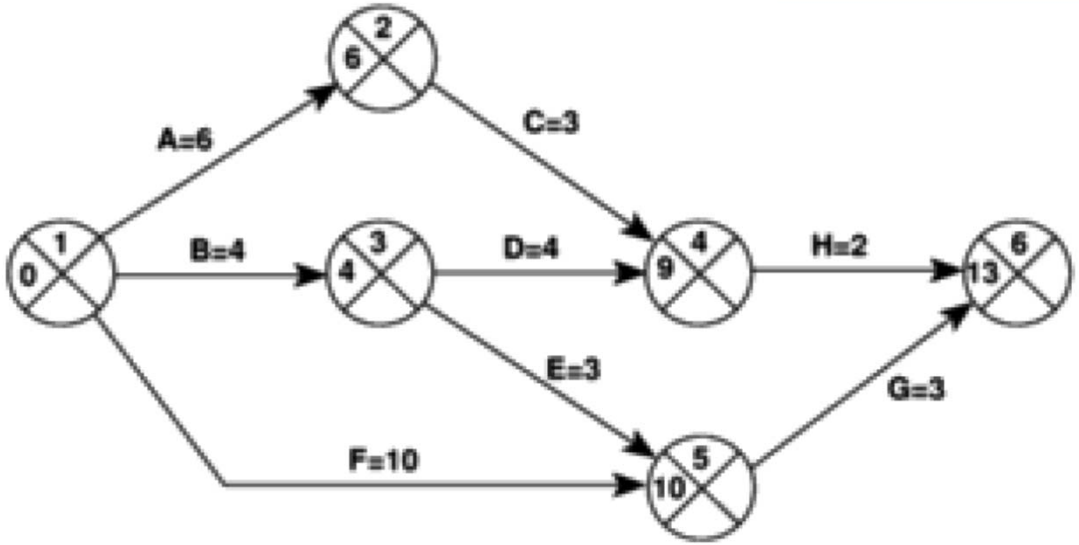
A CPM network after forward pass



The activity table after the forward pass

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

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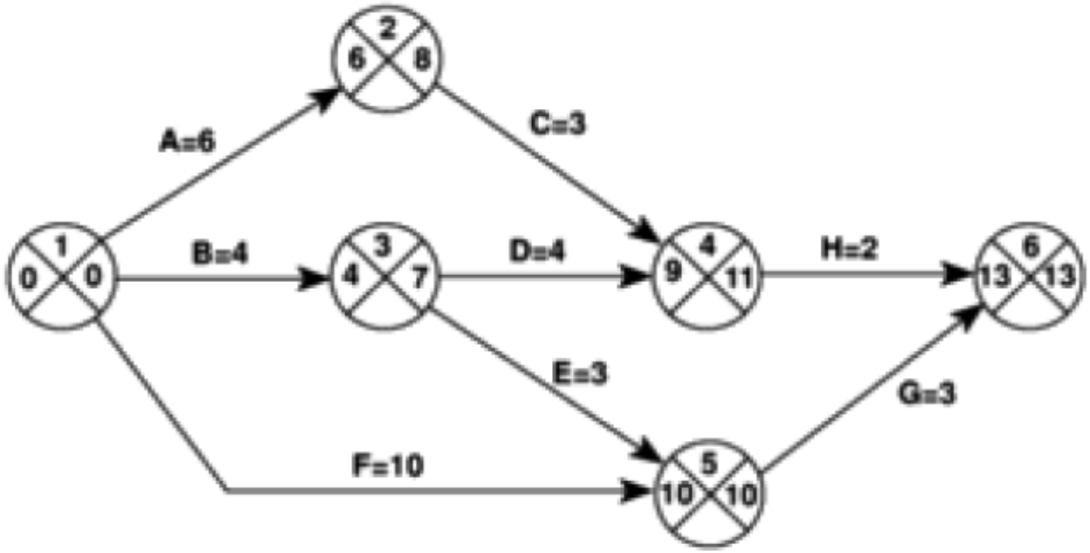
Solution!!!

A CPM network after backward pass



The activity table following the backward pass

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

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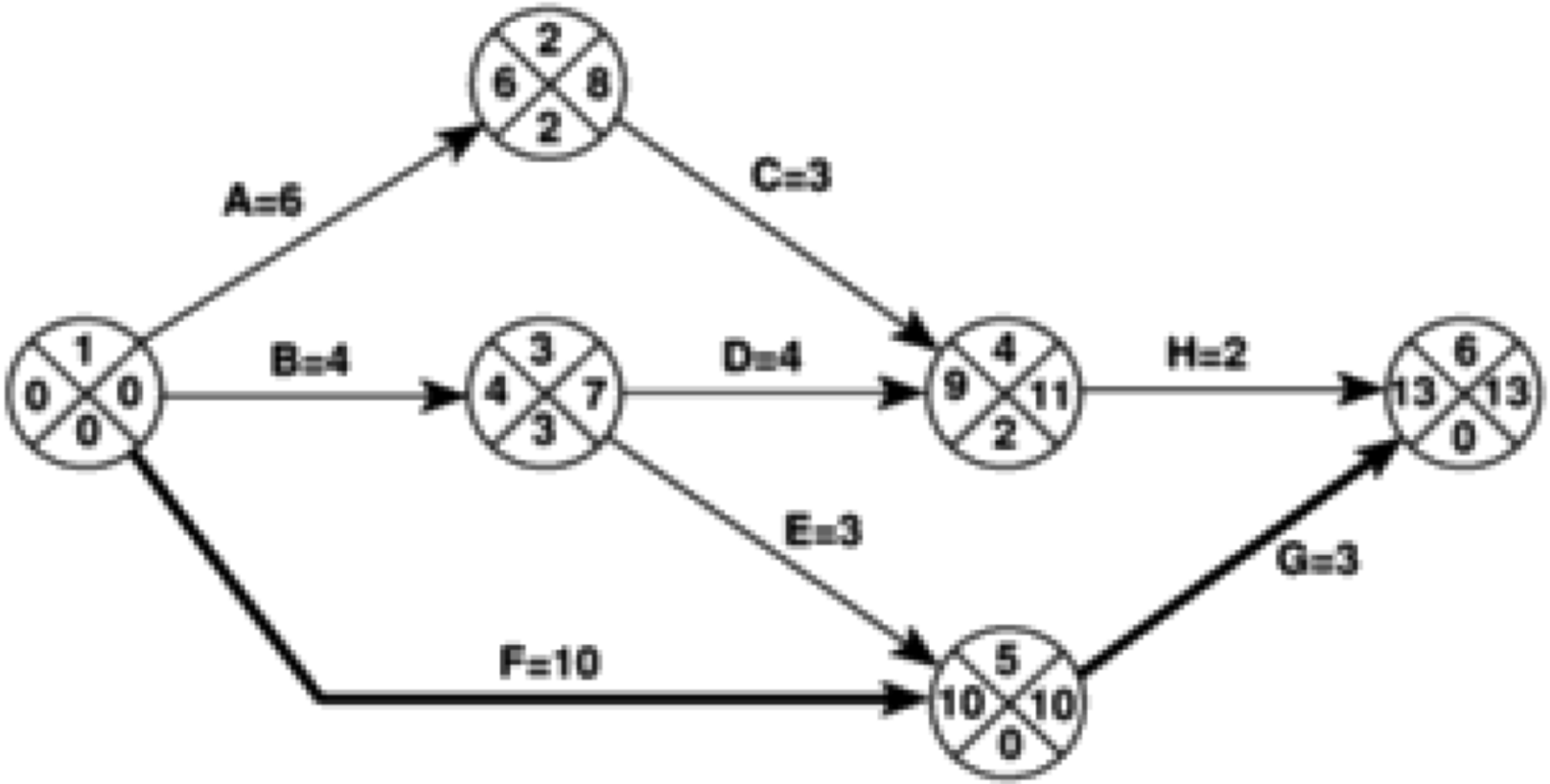
Identifying the critical path

- **Slack :** it is the **difference between the earliest date and the latest date for an event** – it is a measure of how late an event may be without affecting the end date of the project.
- The critical path is the path joining all nodes with a zero slack.



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Identifying the critical path

The activity schedule showing total float for each activity

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

1	**2**	**3>>(5-1)**	**4>>(2+1)**	**5**	**(5-4)**

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Any Queries?