SOFTWARE PROJECT MANAGEMENT

Module-3: ACTIVITY PLANNING AND RISK MANAGEMENT

CSE4016

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ACTIVITY PLANNING

- As a project progresses it is unlikely that everything will go according to plan.
- Much of the job of project management concerns recognizing when something has gone wrong, identifying its causes and revising the plan to mitigate its effects.
- The 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.
- The activity plan may well also offer guidance as to which components of a project should be most closely monitored.

Objectives of activity planning

In addition to providing project and resource schedules, activity planning aims to achieve a number of other objectives which may be summarized as follows.

1-Feasibility assessment- Is the project possible within required timescales and resource constraints? The fact that a project may have been estimated as requiring two work-years effort might not mean that it would be feasible to complete it within, say. three months were eight people to work on it - that will depend upon the availability of staff and the degree to which activities may be undertaken in parallel.

2-Resource allocation -

- What are the most effective ways of allocating resources to the project and when should they be available?
- The project plan allows us to investigate the relationship between timescales and resource availability .

3-Detailed costing- How much will the project cost and when is that expenditure likely to take place? After producing an activity plan and allocating specific resources, we can obtain more detailed estimates of costs and their timing.

4-Motivation- Providing targets and being seen to monitor achievement against targets is an effective way of motivating staff, particularly where they have been involved in setting those targets in the first place.

5-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?

The project plan, particularly with large projects involving more than a single project team, provides an effective vehicle for communication and coordination among teams. In situations where stuff may need to be transferred between project teams a set of integrated project schedules should ensure that such staff are available when required and do not suffer periods of enforced idleness

- Activity planning and scheduling techniques place an emphasis on completing the project in a minimum time at an acceptable cost or, alternatively, meeting an arbitrarily set target date at minimum cost.
- One effective way of shortening project durations is to carry out activities in parallel. Clearly we cannot undertake all the activities at the same time - some require the completion of others before they can start.

When to plan ?

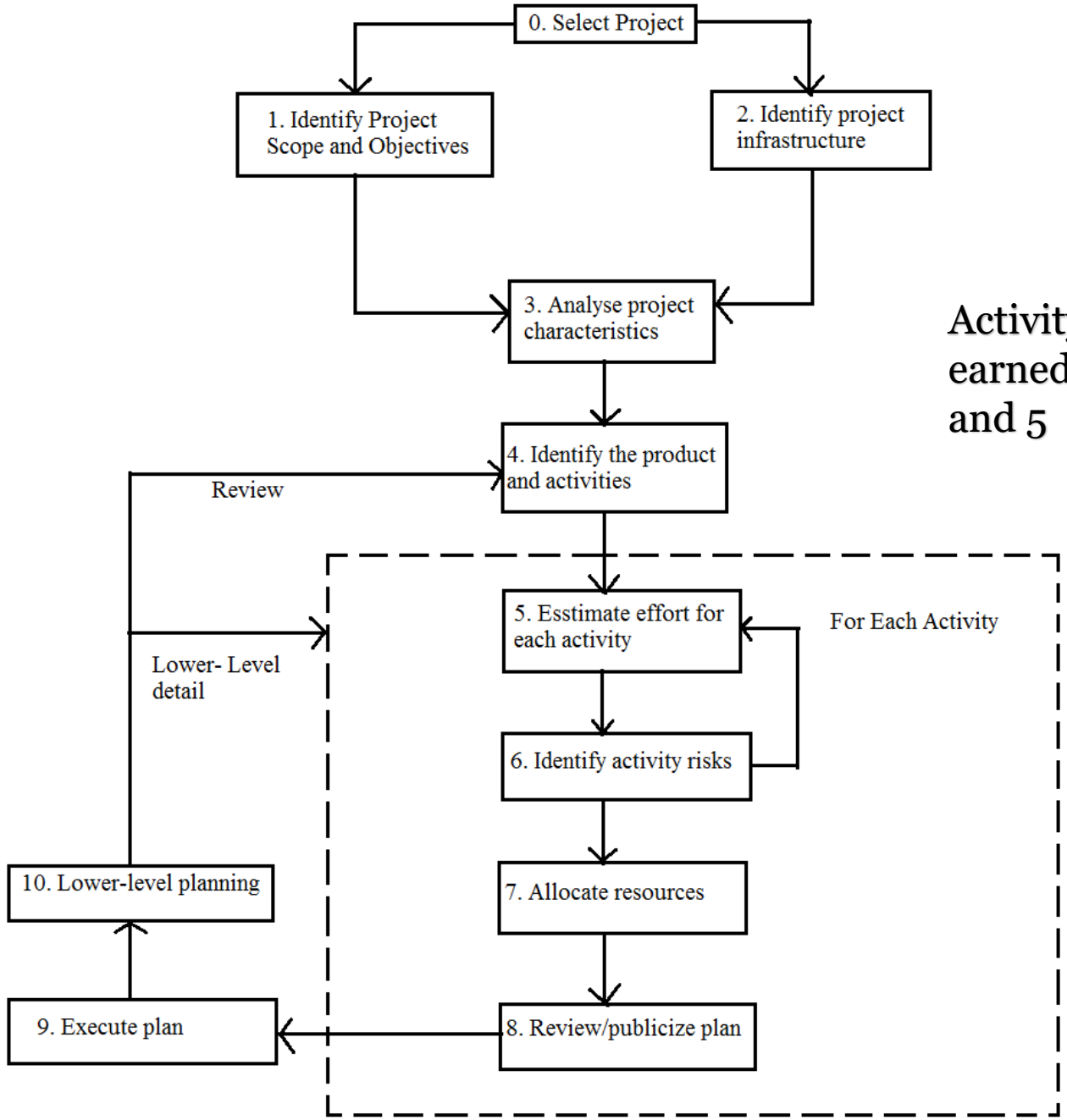
- Planning is an ongoing process of refinement, each iteration becoming more detailed and more accurate than the last.
- Over successive iterations, the emphasis and purpose of planning will shift.
- Throughout the project, until the final deliverable has reached the customer, monitoring and replanning must continue to correct any drift that might prevent meeting the targets.

Project schedules

- 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. Once the plan has been refined to this level of detail we call it a *project schedule*.

Creating a project schedule comprises four main stages.

1-The first step in producing the plan is *to decide what activities need to be carried out and in what order they are to be done*. From this we can construct *an ideal activity plan* - that is, a plan of when each activity would ideally be undertaken were resource is not a constraint.



Activity planning is earned out in Steps 4 and 5

2- The ideal activity plan will *then be the subject of an activity risk analysis, aimed at identifying potential problem*. This, might suggest alterations to the ideal activity plan and will almost certainly have implication for resource allocation.

3- The third step is *resource allocation*. The expected availability of resources might place constraints on when certain activities can be carried out, and our ideal plan might need to be adapted to take account of this.

4- 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 requirements statement for each activity.

Projects and 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 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 requirement.).

Identifying activities

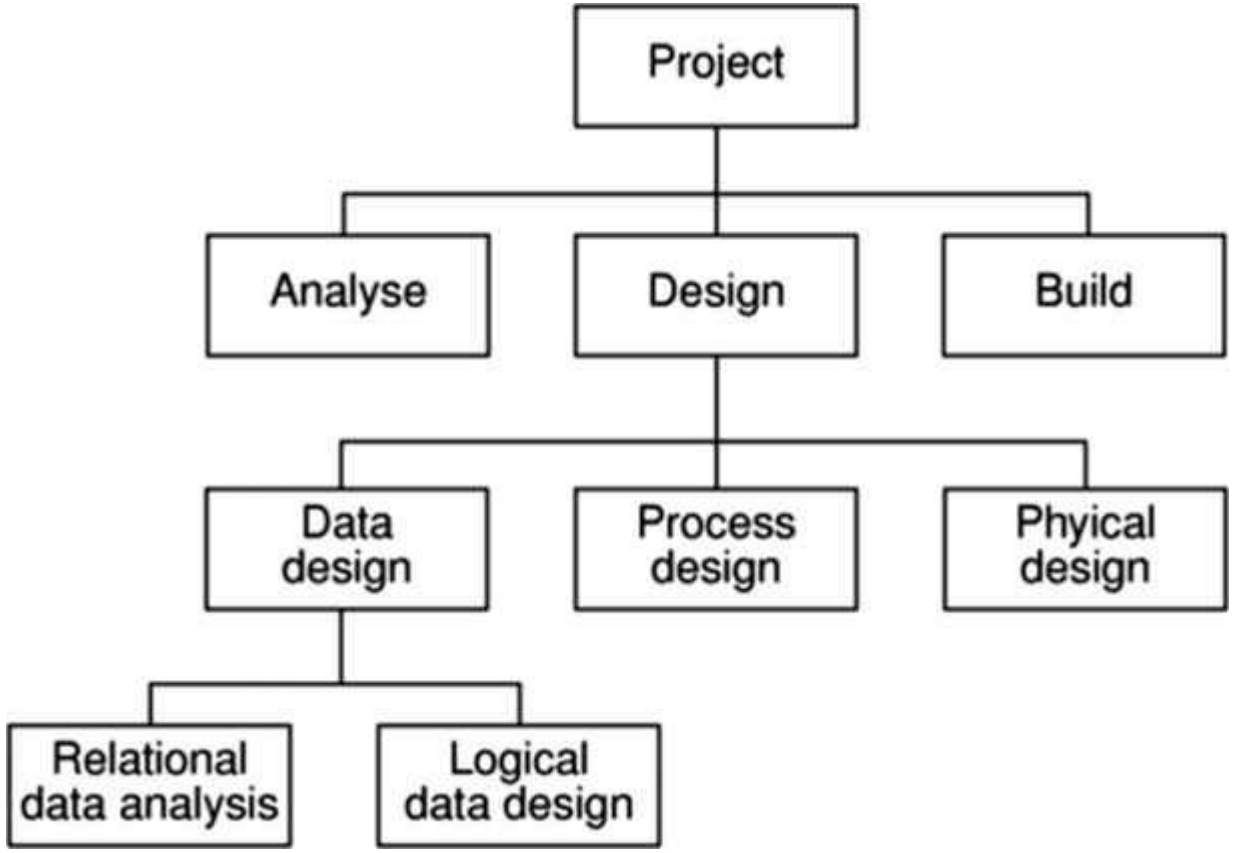
Essentially there are three approaches to identifying the activities or tasks that make up a project -

1. Activity-based approach
2. Product-based approach and
3. Hybrid approach

Activity-based approach

- The activity-bascd approach consists of creating a list of all the activities that the project is thought to involve.
- This might involve a brainstorming session involving the whole project team or it might stem from an analysis of similar past projects.
- When listing activities, particularly for a large project, it might be helpful to subdivide the project into the main life style stages and consider each of thcsc separately.
- Rather than doing this in an ad hoc manner, with the Obvious risks of omitting or double-counting tasks, a much favored way of generating a task list is to create a "Work Breakdown Structure (WBS).
- This involves identifying the main (or high- level) tasks required to complete a project and then breaking each of these down into a set of lower-level tasks.

A fragment of an activity-based Work Breakdown Structure.



- Activities are added to a branch in the structure if they directly contribute to the task immediately above - if they do not contribute to the parent task, then they should not be added to that branch.
- The tasks at each level in any branch should include everything that is required to complete the task at the higher level - if they are not a comprehensive definition of the parent task, then something is missing.
- When preparing a WBS, consideration must he given to the final level of detail or depth of the structure. Too great a depth will result in a large number of small tasks that will be difficult to manage, whereas 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.

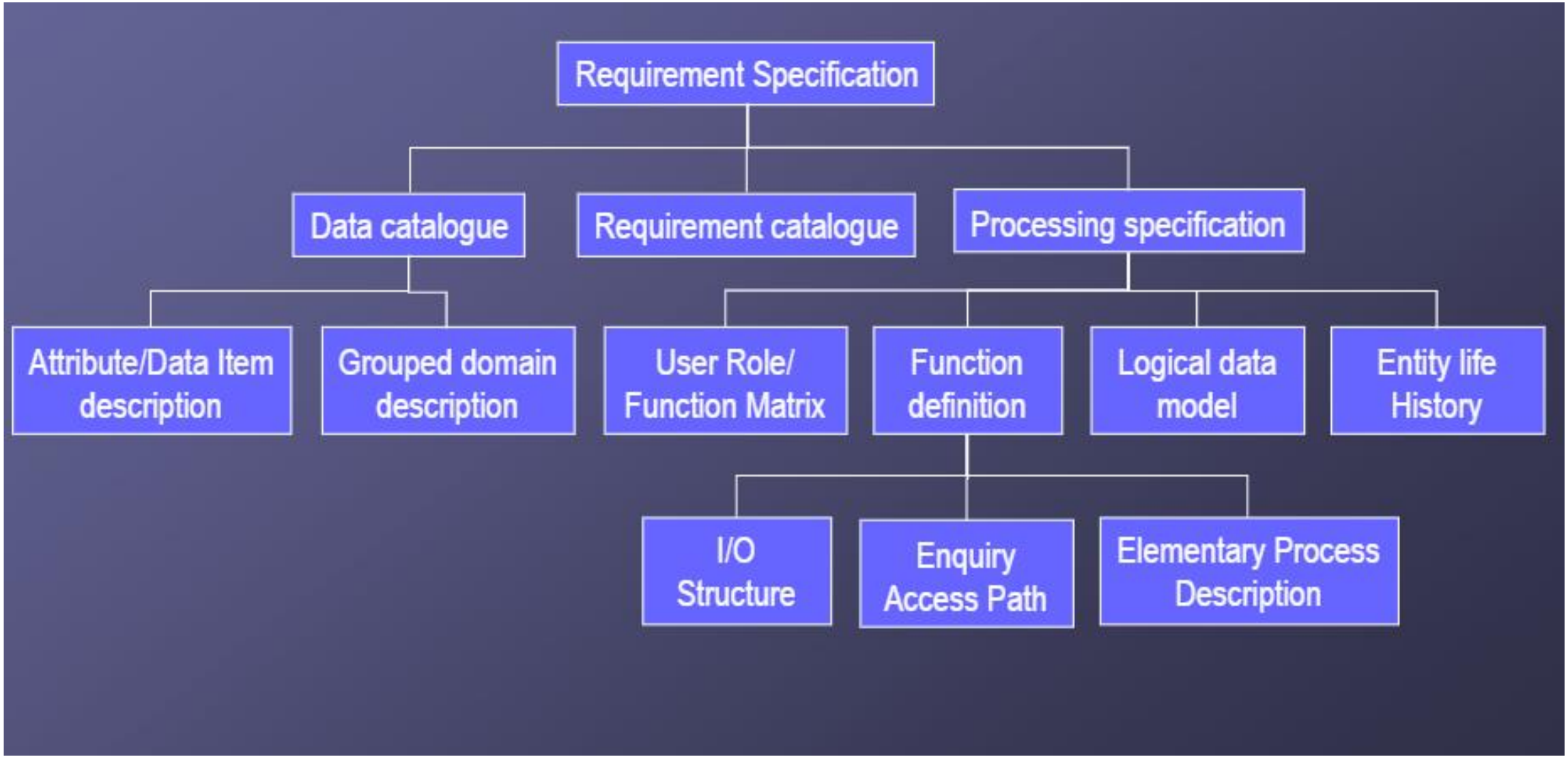
- Advantages claimed for the WBS approach include the belief that it is much more likely to result in a task catalogue that is complete and is composed of non-overlapping activities.
- The WBS also represents a structure that may be refined as the project proceeds.
- Once the project's activities have been identified (whether or not by using a WBS) they need to be sequenced in the sense of deciding which activities need to be completed before others can start.

The product-based approach

- It consists of producing 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 therefore be easily transformed into an ordered list of activities by identifying the transformations that turn some products into others.
- Proponents of this approach claim that it is less likely that a product will be left out of a PBS than that an activity might be omitted from an unstructured activity list.

- The Product Flow Diagram shows which products must be complete before the next can be produced
  - Most items in the diagram are things the customer needs,
    - eg. design documentation, software, manuals
    - indicated by boxes
  - Some items are intermediate products, needed only to help produce other products,
    - eg. first cut database design
    - indicated by boxes
  - Some items will exist already,
    - eg. feasibility study report, terms of reference
    - indicated by ellipses (ovals)
  - Arrows indicate that one product is required in order to produce the next

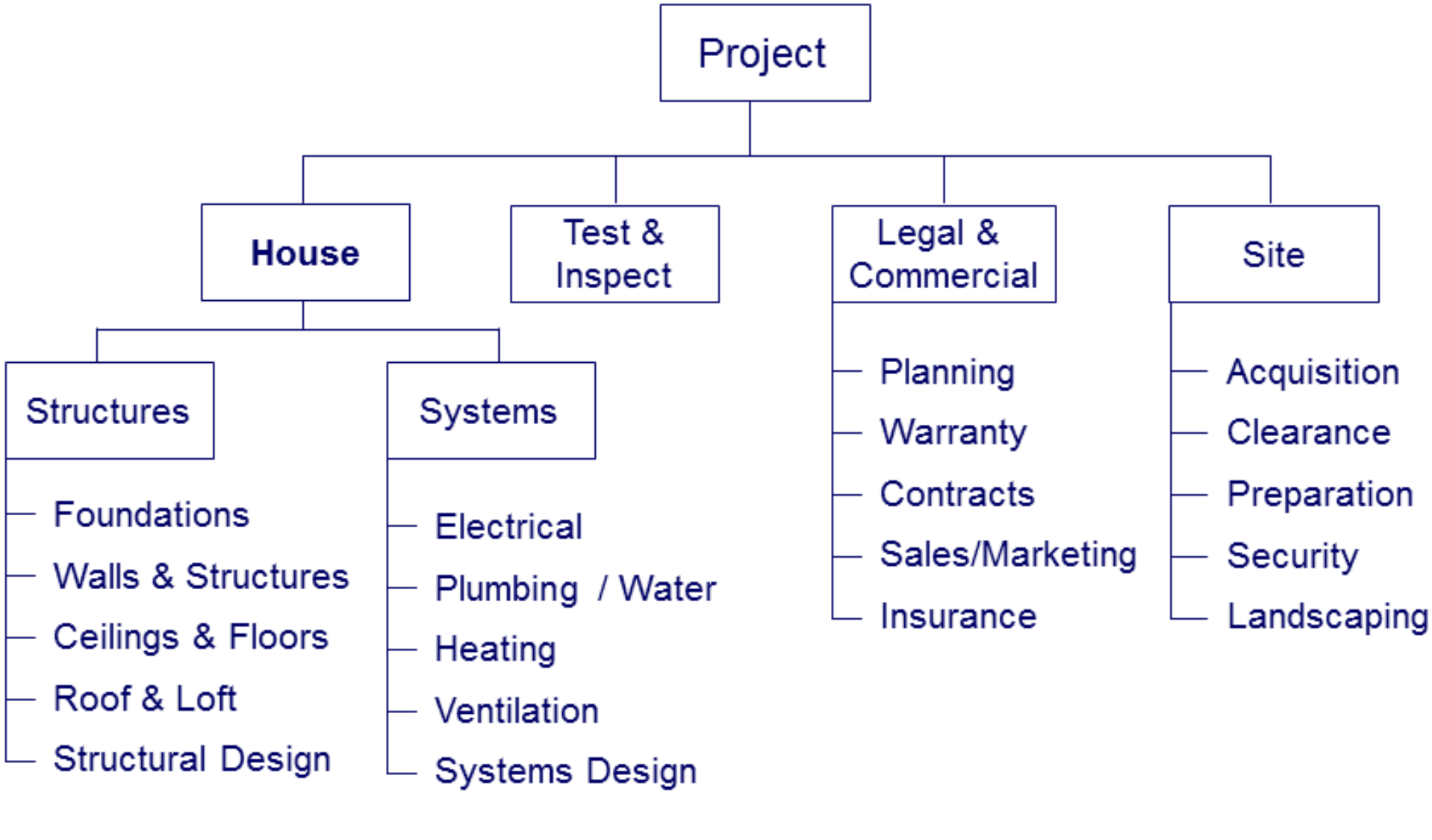
SSADM Product Breakdown Structure for Requirements Specification



- This approach is particularly appropriate if using a methodology such as SSADM (Structured Systems Analysis and Design Method), which clearly specifies, for each step or task, each of the products required and the activities required to produce it.
- The SSADM Reference Manual also supplies generic activity networks and, using the project-specific PBS and derived PFD, these may be used as a basis for developing a project-specific activity network.

The hybrid approach

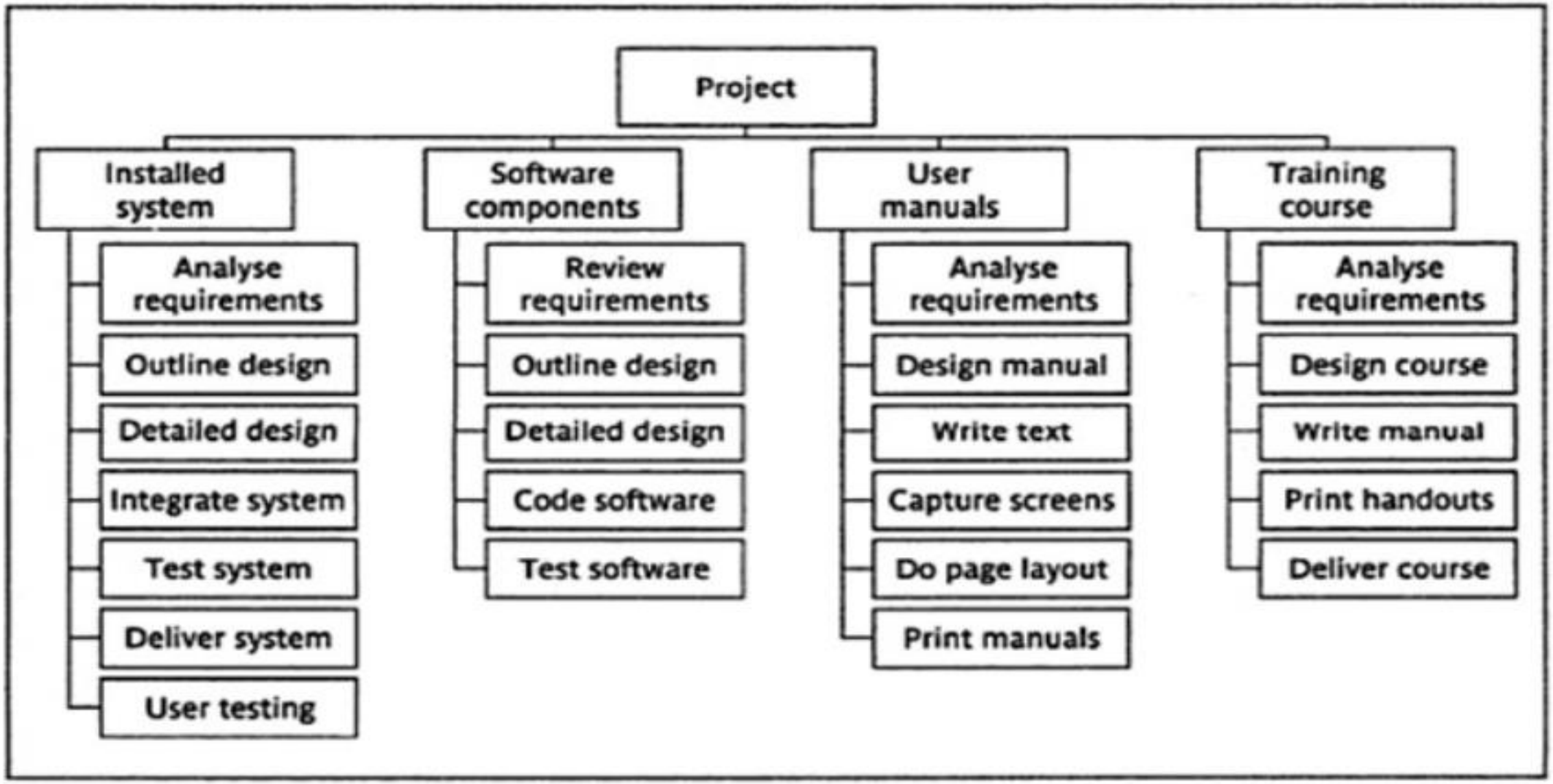
- For each deliverable, a set of activities required to produce that product can be added.
- In a project of any size, it would be beneficial to introduce additional levels - structuring both products and activities.
- The degree to which the structuring is product-based or activity-based might be influenced by the nature of the project and the particular development method adopted.
- As with a purely activity-based WBS, having identified the activities wc are then left with the task of sequencing them.

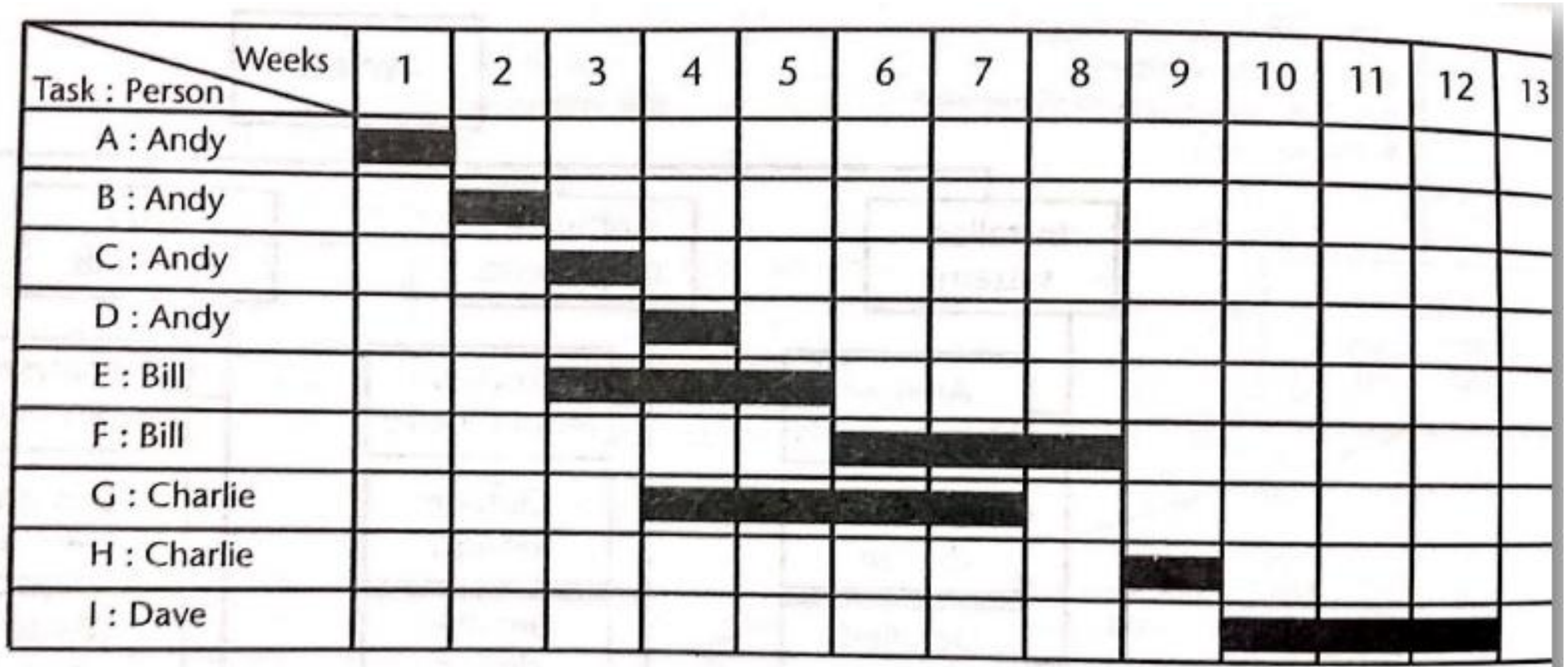

Project
House
Test & Inspect
Legal & Commercial
Site
Structures
Systems
Foundations
Walls & Structures
Ceilings & Floors
Roof & Loft
Structural Design
Electrical
Plumbing / Water
Heating
Ventilation
Systems Design
Planning
Warranty
Contracts
Sales/Marketing
Insurance
Acquisition
Clearance
Preparation
Security
Landscaping

A framework dictating the number of levels and the nature of each level in the structure may be imposed on a WBS. For example, in their MOT (moment of truth) methodology, IBM recommend that the following five levels should be used in a 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 work 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.





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 : Sytem tesing

- In drawing up the chart, we have done two things:-
  - Sequencing the tasks(i.e., identified the dependencies among activities dictated by the development process)
  - Scheduled them(i.e., specified when they should take place)

- The scheduling has had to take account of availability of staff and the way in which the activities have been allocated to them.

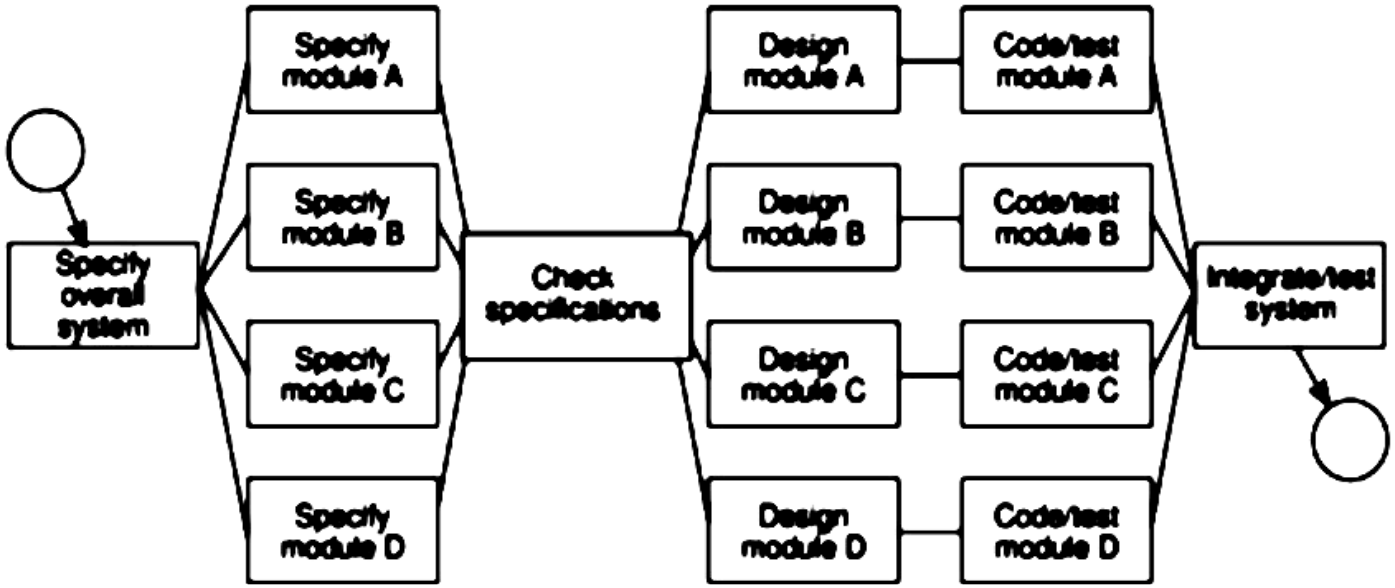
NETWORK PLANNING MODEL

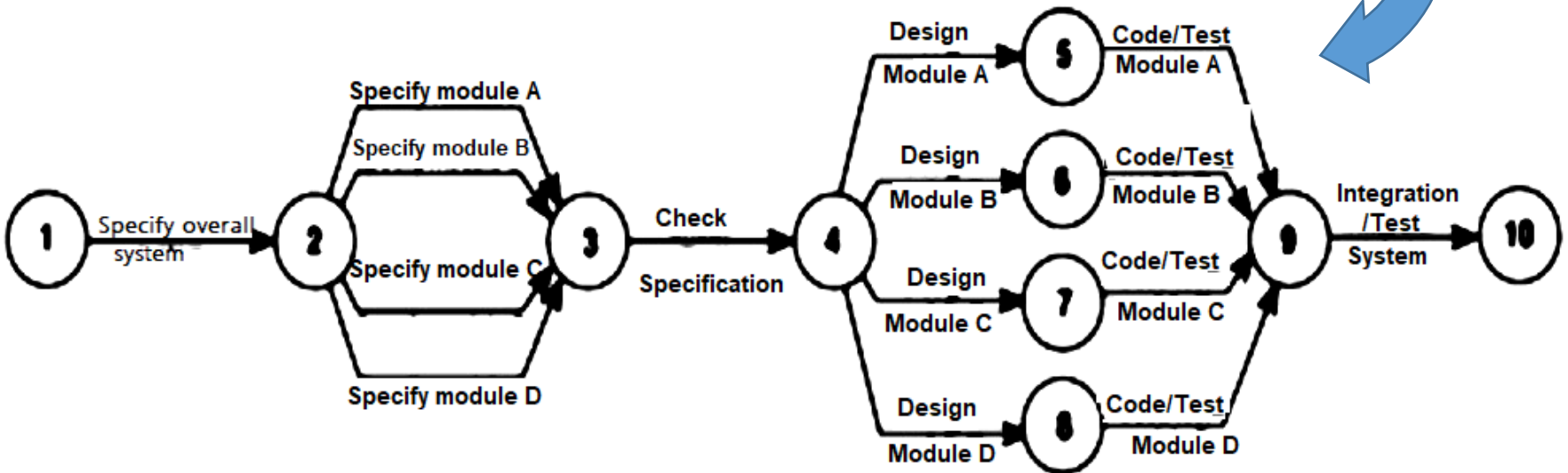
- These project scheduling techniques model the project's activities and their relationships as a network.
- In network, time flows from left to right.
- These technologies were originally developed in the 1950s- the two best known being CPM(critical path method) and PERT (program evaluation review technique).
- Both of these techniques used an activity-on-arrow approach to visualizing the project as a network where activities are drawn as arrows joining circles or nodes, which represent the possible start and/or completion of an activity or set of activities.
- Now, precedence networks has become popular which use activity-on-node networks where activities are represented as nodes and the links between nodes represents precedence (or sequencing) requirements.

Formulating a network model

- The first stage in creating a network model is to represent the activities and their inter-relationships as a graph.
- In CPM we do this by representing activities as links (arrowed lines) in the graph - the nodes (circles) representing the events of activities starting and finishing.

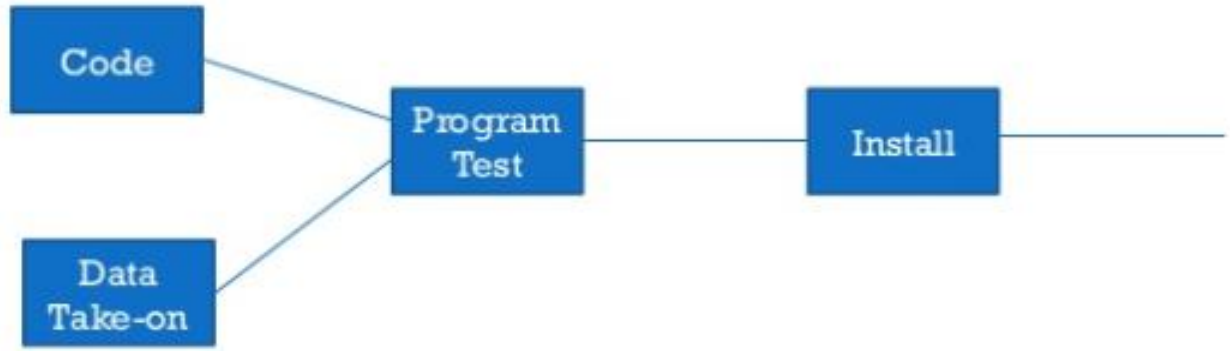
Project activity network fragment to CPM example





Constructing CPM networks

- **A project network should have only one start node**-The start node designates the point at which the project may start. All activities coming from this node may start immediately resources are available - that is, they do not have to wait for any other activities to be completed.
- **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.

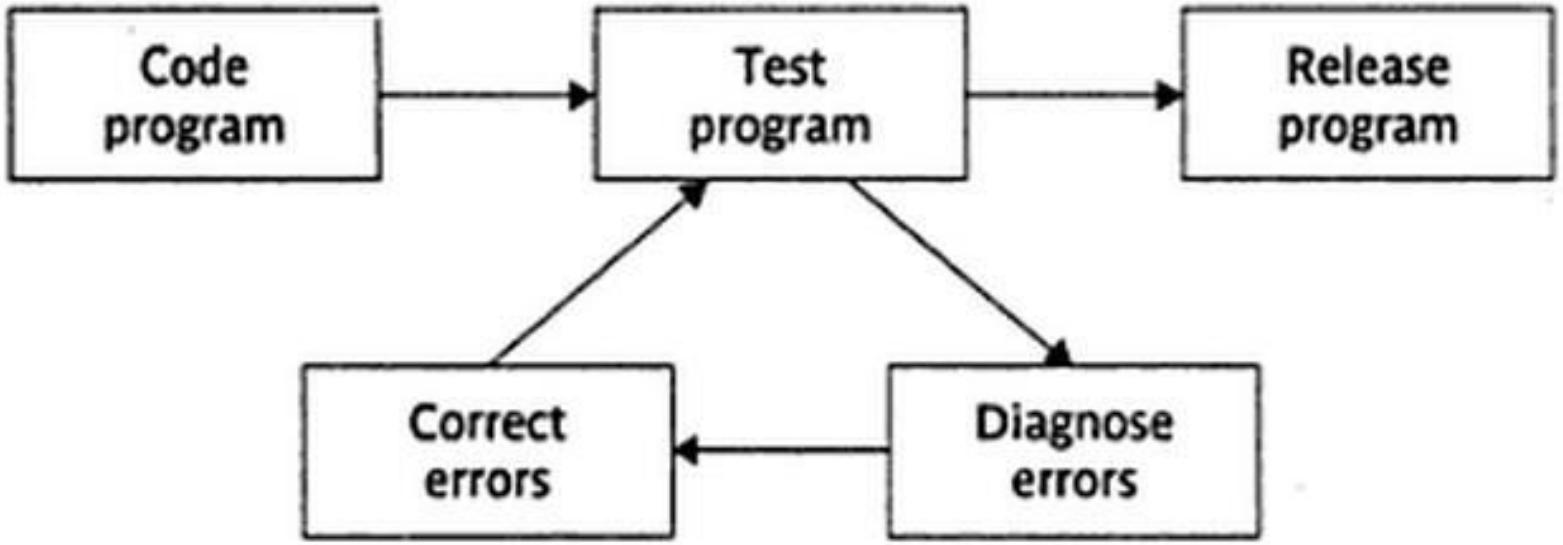


- **Nodes have no duration**- Nodes are events and, as such, are instantaneous points in time. The source node is the event of the project becoming ready to start and the sink node is the event of the project becoming completed.
- Intermediate nodes represent two simultaneous events - the event of all activities leading in to a node have been completed and the event of all activities leading out of that node being in a position to be started.
- **A link has duration**- A link represents an activity and, in general, activities take time to execute.

- **Precedents are the immediate preceding activities- T**he activity Program test cannot start until both Code and Data take-on have been completed and activity Install cannot start until Program test has finished. Code and Data take-on can therefore be said to be precedents of Program test, and Program test is a precedent of Install.

- **Time moves from left to right-**If at all possible, networks are drawn so that time moves from left to right.

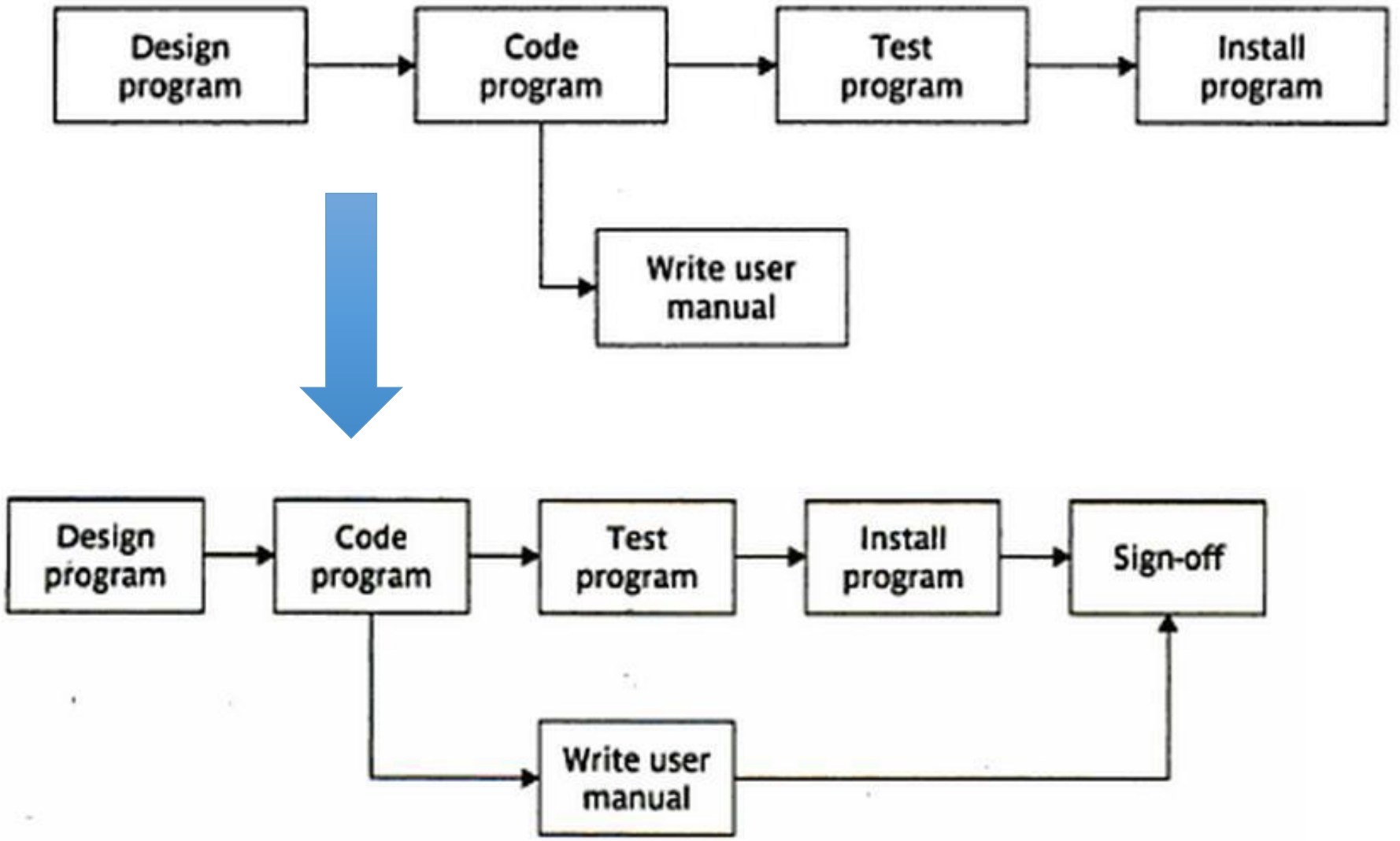
- **A network may not contain loops-** A loop is an error in that it represents a situation that cannot occur in practice. While loops, in the sense of iteration, may occur in practice, they cannot be directly represented in a project network.



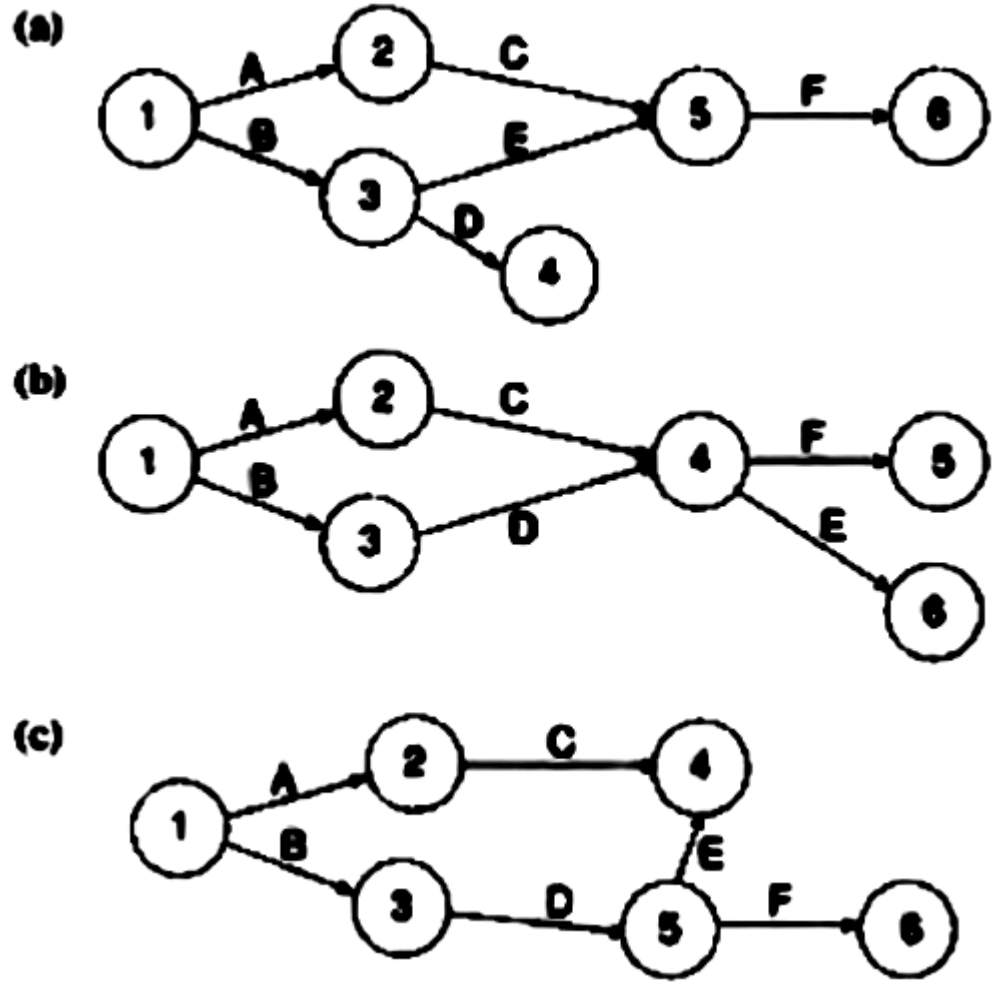
- **Nodes are numbered sequentially-** There are no precise rules about node numbering but nodes should be numbered so that head nodes always have a higher number than tail events.

- **A network should not contain dangles.-**A dangling activity such as Write user manual in Figure cannot exist, as it would suggest there are two completion points for the project. In other words, all events, except the first and the last, must have at least one activity entering them and at least one activity leaving them and all activities must start and end with an event.

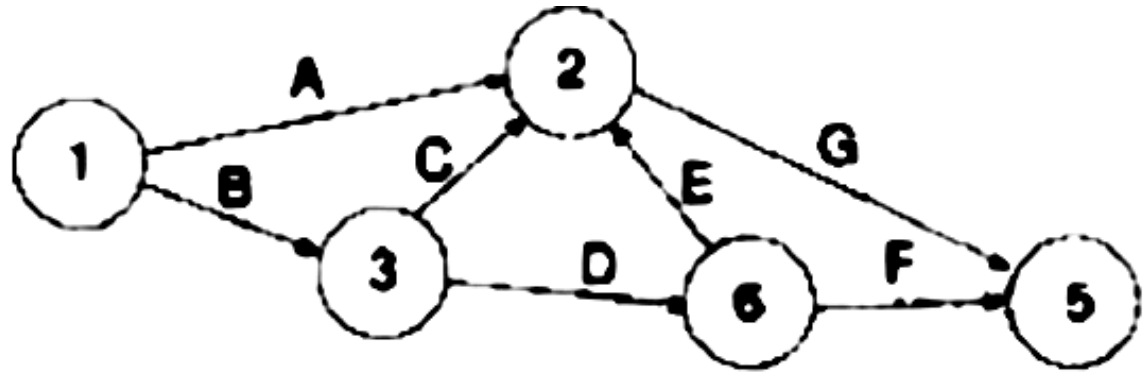
RESOLVING THE DANGLE



Take a look at network and state what is wrong with each of them and where possible redraw them correctly.



(d)



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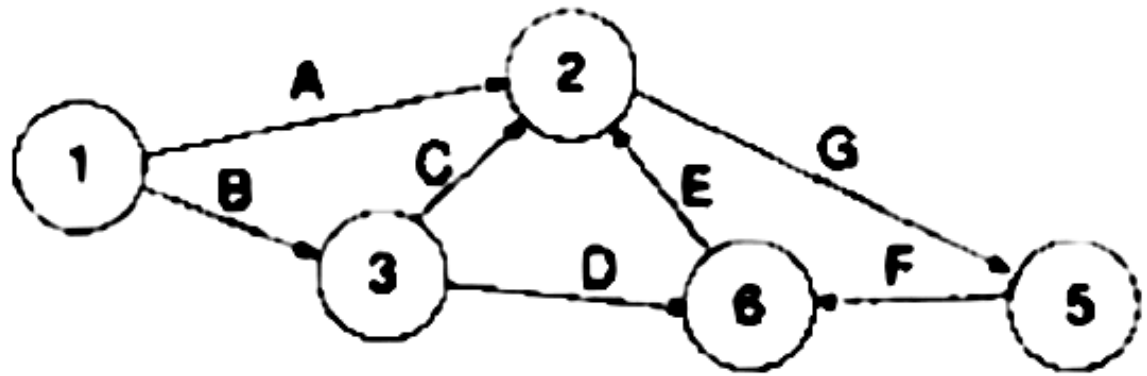
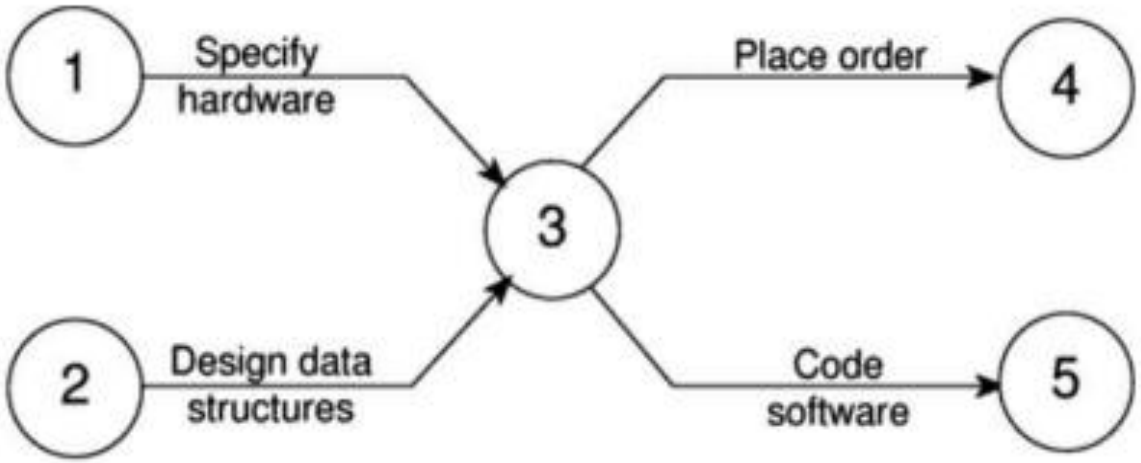


Using dummy activities

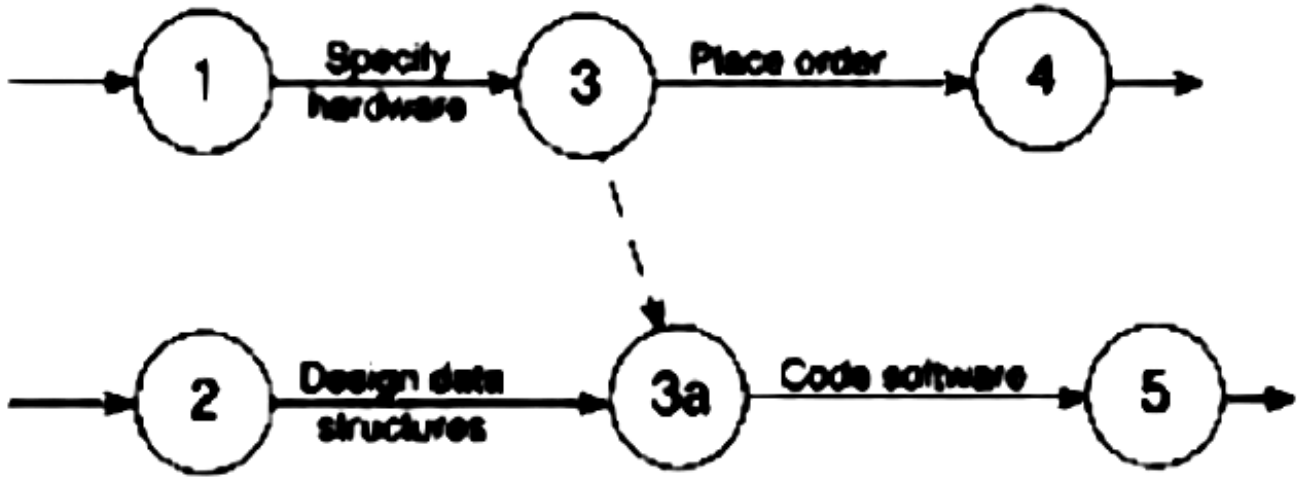
- When two paths within a network have a common event although they are, in other respects independent, a logical error might occur.
- Suppose that, in a particular project, it is necessary to specify a certain piece of hardware before placing an order for it and before coding the software. Before coding the software it is also necessary to specify the appropriate data structures, although clearly we do not need to wait for this to be done before the hardware is ordered.

- Figure is an attempt to model the situation described, although it is incorrect in that it requires both hardware specification and data structure design to be completed before either an order may be placed or software coding may commence.



Two paths with a common node

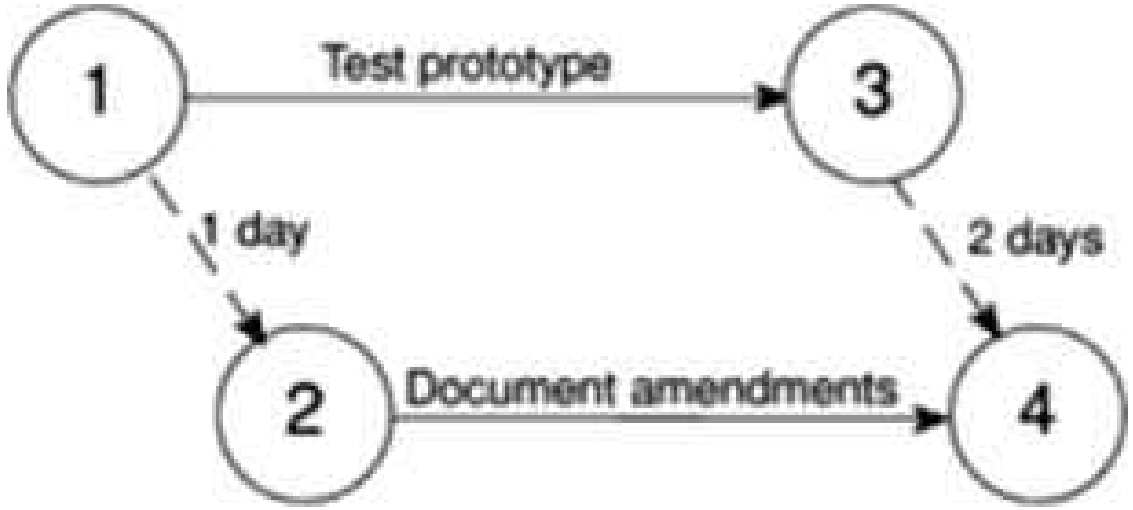
We can resolve this problem by separating the two (more or less) independent paths and introducing a dummy activity to link the completion of data structure design to the start of the activity placing an order. This effectively breaks the link between data structure design and placing the order. Dummy activities shown as dotted lines an the network diagram, have a zero duration and use no resources.



Representing lagged activities

- We might come across situations where we wished to undertake two activities in parallel so long as there is a lag between the two. We might wish to document amendments to a program as it was being tested - particularly if evaluating a prototype.
- In such a case we could designate an activity 'test and document amendments. This would, however, make it impossible to show amendment recording starting after testing had begun and finishing a little after the completion of testing.

- Where parallel activities have a time lag we may show this as a **ladder of activities**. In this case documentation may proceed alongside prototype testing so long as it starts at least a day later. It will finish two days after the completion of prototype testing.



Adding the time dimension

- Having created the logical network model indicating what needs to be done and the interrelationships between those activities, we are now ready to start thinking about when each activity should be undertaken.
- The critical path method is concerned with two primary objectives:
  - planning the project in such a way that it is completed as quickly as possible;
  - identifying those activities where a delay in their execution is likely to affect the overall end date of the project or later activities' start dates.

- The method requires that for each activity we have an estimate of its duration. The network is then analyzed by carrying out a forward pass, to calculate the earliest dates at which activities may commence and the project be completed, and a backward pass, to calculate the latest start dates for activities and the critical path.
- In practice we would use a software application to carry out these calculations for anything but the smallest of projects. It is important, though, that we understand how the calculations are carried out in order to interpret the results correctly and understand the limitations of the method.

CPM conventions

- There are a number of differing conventions that have been adopted for entering information on a CPM network. Typically the diagram is used to record information about the events rather than the activities
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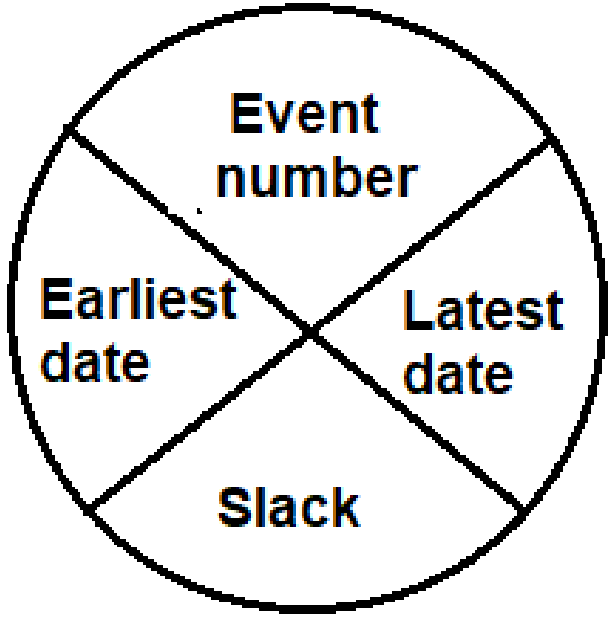

- One of the more common conventions for labelling nodes, and the one adopted here, is to divide the node circle into quadrants and use those quadrants to show the event number, the latest and earliest dates by which the event should occur, and the event slack.

An example project specification with estimated activity durations and precedence requirements

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

Activity		Duration (weeks)	Precedents
A	Hardware selection	6	
B	System configuration	4	
C	Install hardware	3	A
D	Data migration	4	B
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F	Recruit staff	10	
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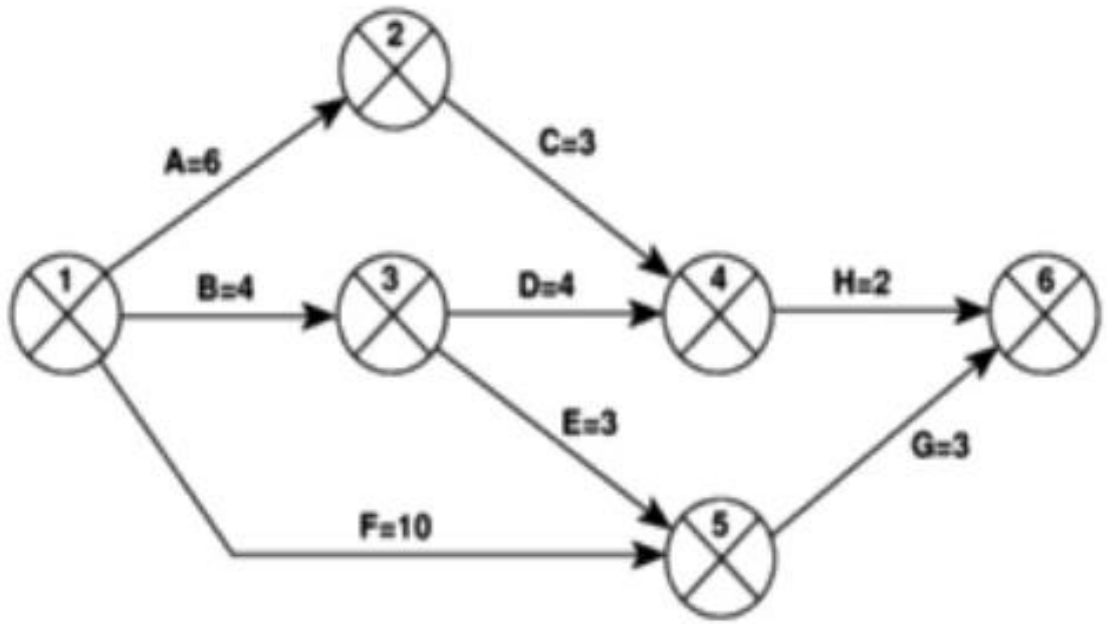
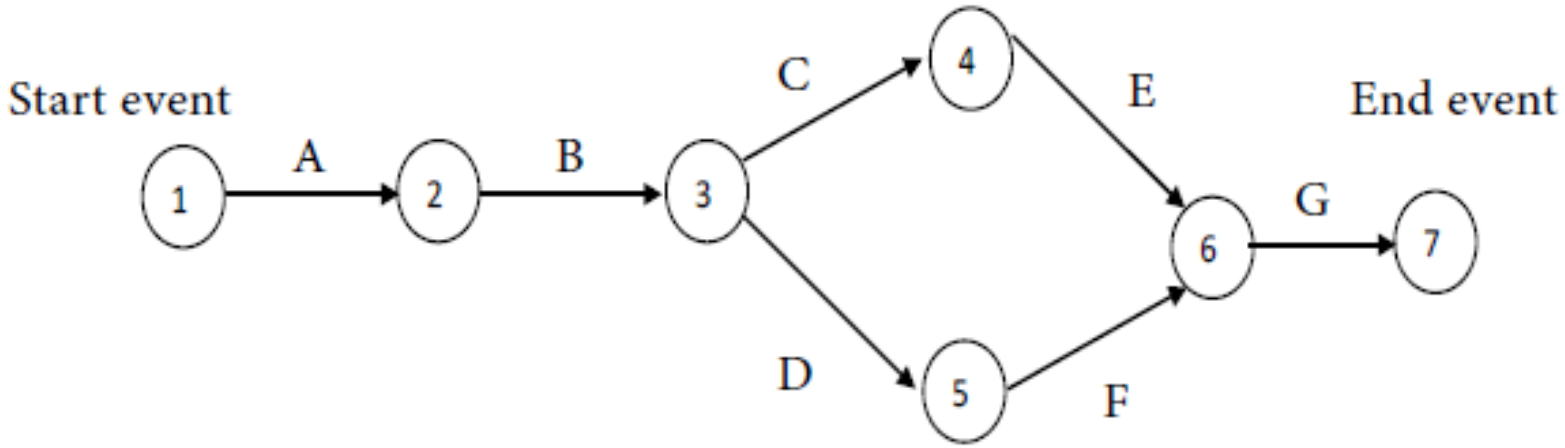


Develop a network diagram for the project specified below

Activity	Immediate Predecessor Activity
A	-
B	A
C, D	B
E	C
F	D
G	E, F

Solution



Construct the network diagram for the following project

Activity	Immediate Predecessor Activity
A	-
B	-
C	A
D	B
E	A
F	C, D
G	E
H	E
I	F, G
J	H, I

Practice questions

Name of Activity	Predecessor Activity	Duration (Weeks)
A	-	8
B	A	13
C	A	9
D	A	12
E	B	14
F	B	8
G	D	7
H	C, F, G	12
I	C, F, G	9
J	E, H	10
K	I, J	7

Activity	Predecessor Activity	Duration (Weeks)
A	-	12
B	A	7
C	A	11
D	A	8
E	A	6
F	B	10
G	C	9
H	D, F	14
I	E, G	13
J	H, I	16

Activity	Predecessor Activity
A	-
B	A
C	A
D	B
E	C
F	C
G	D,F
H	E
I	G,H

Activity	Predecessor Activity
A	-
B	A
C	A
D	A
E	B
F	C
G	D, E, F