

AIR-1 Notes

Pages: 90

PERT & CPM
Handwritten notes by



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AIR-1 ESE 2021

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PERT AND CPM

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PERT - CPM { rated as the most }
{ profitable topic }

→ Part of PTE and MCE + Also part of GATE
{ 10-12 ques/150 }

→ Helps in "Project Management" - topic of GS paper.
{ 4-5 ques/100 }

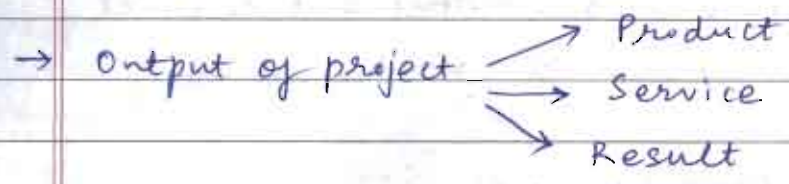
Sub-Topics

1. Project Management
2. Fundamentals of Network
3. PERT
4. CPM
5. Crashing
6. AON diagram
7. Resource Allocation
8. Updating
9. Engineering Economy
10. Construction Equipments → Pure Theory

1. Project Management

{ Initiation: Defining }
{ the objective of }
{ the project }

→ Every project has a definite start and end time { temporary }
{ nature }



→ Every project is unique in nature.

PMI (Project Management Institute)



PM BOK (Book of Knowledge) ↘

→ Project is a temporary endeavour undertaken to provide a unique product, service and result.

- A project involves series of activities that consumes resources to achieve specific objectives.

Objectives of Project

1. Project should be completed in optimum amount of time.
2. Project should use locally available manpower and resources.
3. Project should finish on time with minimum investment cost.

Project Management →

- Project Management is application of knowledge, skill, tools and techniques to meet requirements of project.

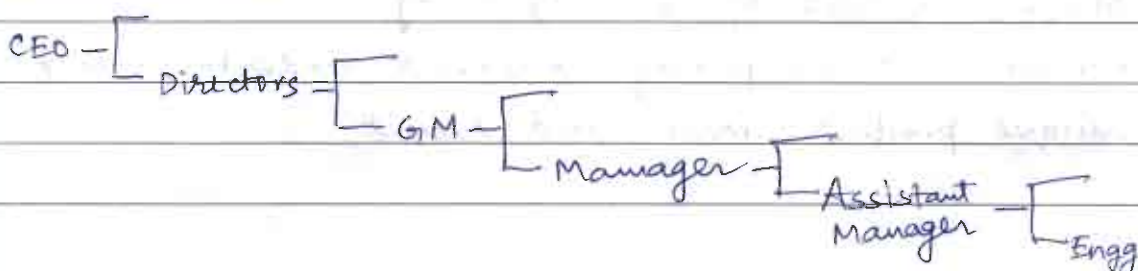
Elements of Project Management

1. Planning: Planning is one of the most important part of project management. Planning means defining objectives of project, to identify various activities and resource required for timely completion of project.

WBS - Work Breakdown Structure

- we can identify all the activities which are required for completion of the project.

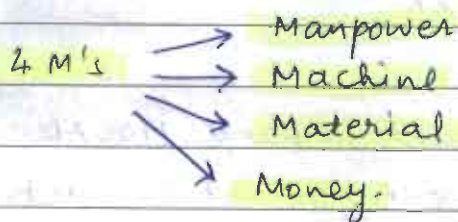
OBS - Organizational Breakdown Structure.



→ Merge the WBS and OBS in order to assign roles and responsibilities.

→ In planning phase, a plan is made along with WBS and OBS. WBS and OBS identifies group of activities that is needed to achieve the completion of project and assigning roles and responsibilities to various people in the project.

2. Scheduling → It is the process of fixing the order of all the activities and allocation of resources to these activities.



+ Time and space are the resources

3. Controlling → Controlling is the process performed to observe execution of project such that potential problems can be identified in a timely manner and necessary action can be taken.

→ During this process, project performance is regularly monitored and measured to identify deviation b/w plan & Execution.

NOTE:

Planning and Scheduling are done before execution of project whereas controlling is generally done during the execution of project.

4. Directing: It is a function of the project leader to give instruction to sub-ordinates, supervise their work and respond to reports of sub-ordinates.

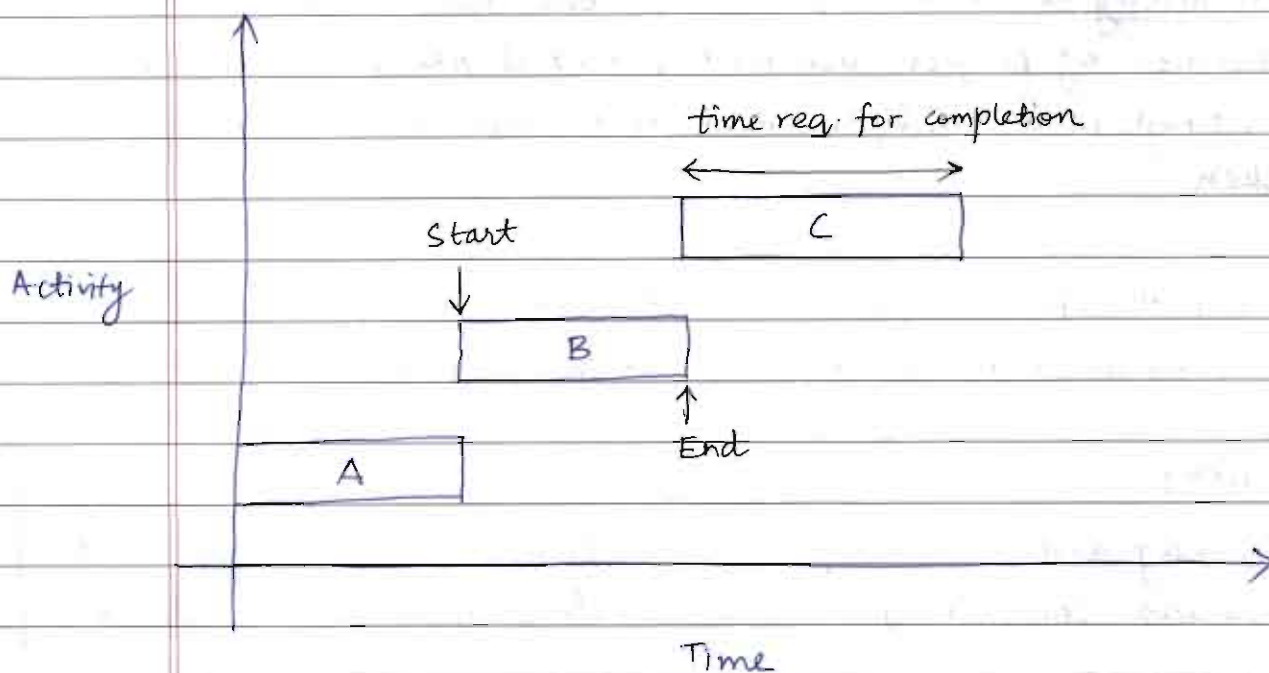
5. Coordination: Process of interaction between various departments of project.
6. Organising: It is integration of resources.

→ Methods of Project Scheduling

(1) Bar Chart (Gantt Chart)

Henry Gantt, 1900AD

- It was introduced by Henry Gantt around 1900AD.
- Bar chart is a graphical representation between activity and time.

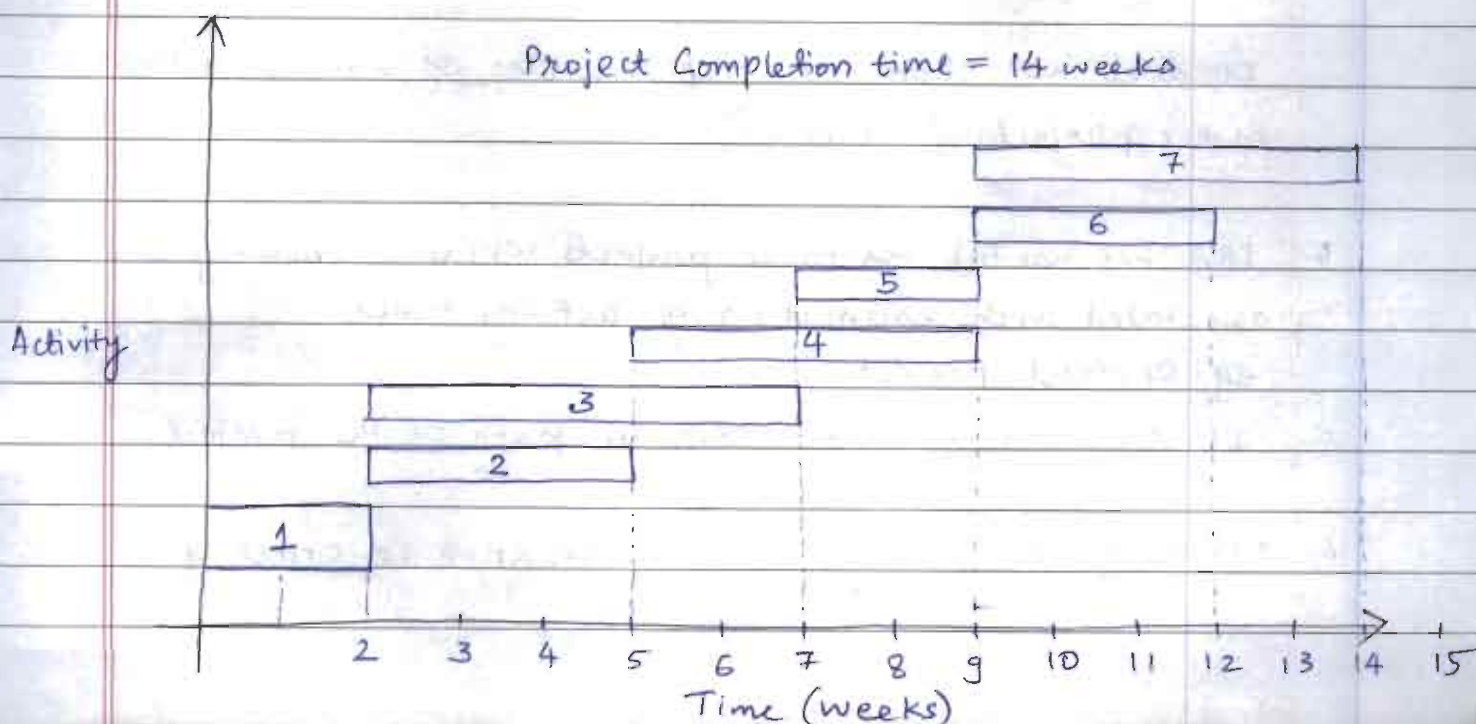


- Beginning of bar → Start of activity
- End of bar → finish of activity
- Length of bar → time required for the completion of activity.

Q- For a construction project, certain activities are to be performed, which are as given below:

Activity	Duration (weeks)
1	2
2	3
3	5
4	4
5	2
6	3
7	5

Activity 2 and 3 can be performed simultaneously and can start only when activity 1 is completed. Activity 4 can start only after activity 2 ends. Activity 5 cannot begin until activities 2 and 3 are completed. Activity 6 can start only after 4 & 5 are completed. Activity 7 is the last activity and can start only after completion of Activity 5. Draw a bar chart and determine project completion time.



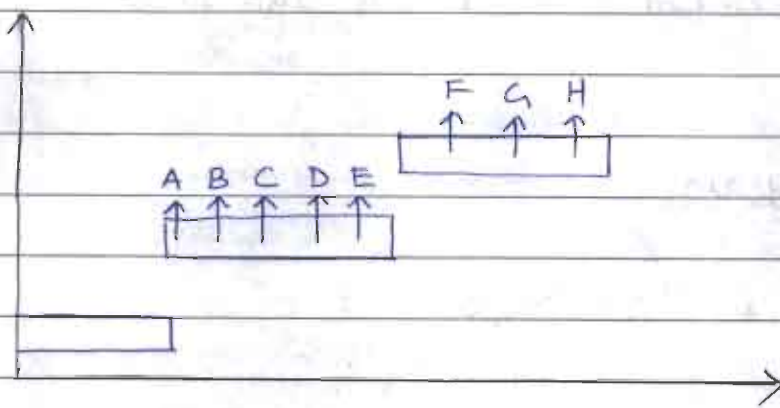
Advantages of Bar chart

1. Simple to draw and easy to understand.
2. No skilled person is required.
3. It can be used for determining resource required at any stage of project. Hence, progressive cost of project can also be determined.
4. Project progress can be expressed in terms of percentage.
↳ called a modified bar chart

Limitations of Bar chart

1. Lack of degree of detail
→ In case of big projects, only major activities can be shown otherwise it will become over crowded and clumsy.
2. Hence, bar chart is not preferred for big projects.
2. Review of project progress
A bar chart does not show progress of work. Hence, it cannot be used as a control device. As progress made at a particular instant of time is required for control of project.
3. It does not show interdependencies of various activities of the project. (not clear)
4. It is not useful for those projects where uncertainty is associated with estimation of activity times.
eg. Research project
5. It does not indicate critical path in the project.
6. It does not allow cost optimization i.e. Crashing.

② Milestone chart (Modified version of bar chart)

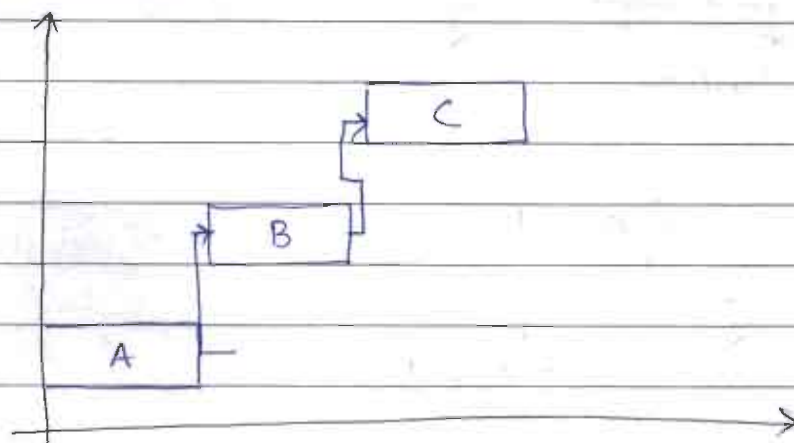


- It is an improvement over original bar chart.
- In any activity, there are certain key events which are to be carried out for the completion of activity. Such key events are called as milestones.
- Milestones can be represented by →, □ or O
- If a particular activity is very long, then details of sub-activities will be lacking. which can be shown with the help of milestones. Hence, it provides better controlling in the project.

Limitation of milestone chart

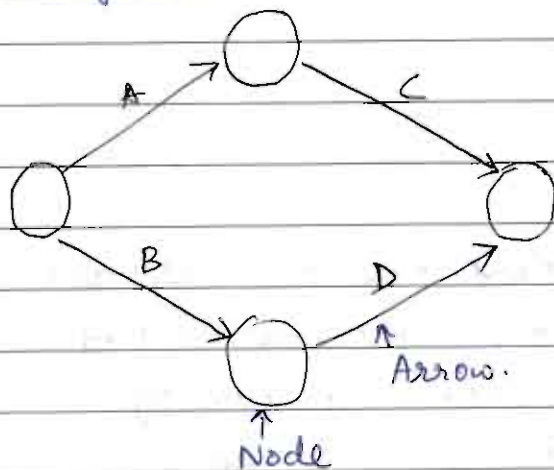
1. Relationship between sub-activities of an activity is clear but inter-relationship between various other activities is not clear.

③ Linked Bar chart



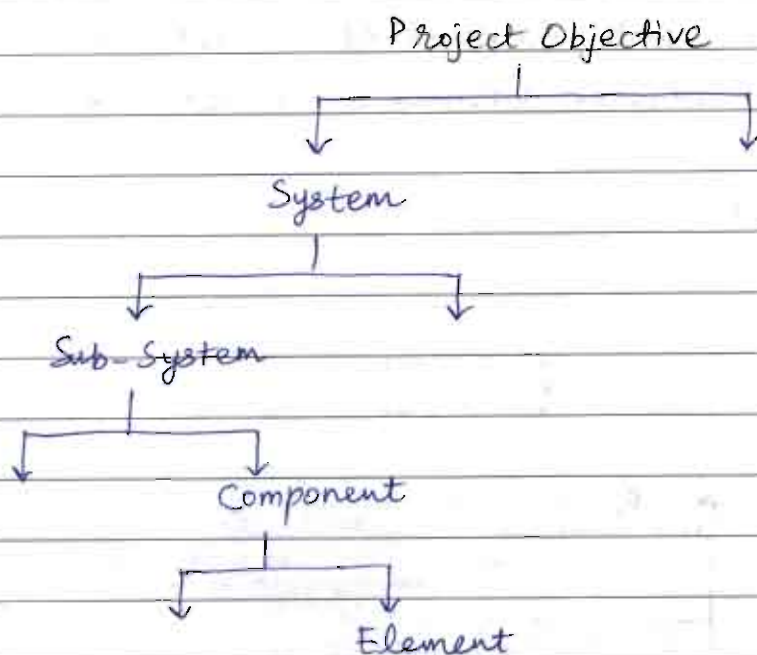
- An improvement over Bar chart and milestone chart
Activities are linked with arrows and lines.

(A) Network Diagram



- Network diagram is a graphical representation of logical sequence of activities
- It is of 2 types:
1. A-O-A: Activity over Arrow
 2. A-O-N: Activity over Node

→ Work Breakdown Structure (WBS)



- Work breakdown Structure (WBS) is a graphical representation of functional elements of entire project. It follows top to bottom approach.
- It is a process of breaking a complex project into system, sub-system, component and element.
- It helps in:
 - a) Determining what work needs to be done.
 - b) Accountability & responsibility of project team.
 - c) Ground-work for estimation of time and cost.

NOTE:

Functional Organization system of working was introduced by F.W. Taylor.

2. Fundamentals of Network

→ Definition of Network Diagram

Network diagram is a graphical representation of arrow and nodes indicating their Logical Sequence.

→ Types of Network

(a) A-O-A: Activity over Arrow / Arrow Diagram

Activities are represented by arrows and nodes represent events.

(b) A-O-N: Activity over Node / Precedence diagram.

Activities are represented by nodes and their precedence relationship (inter relationship) with arrows.

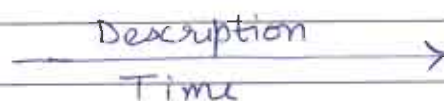
→ Basic definition

1. Activity

→ An activity is a task or job that consumes resource and time.

→ It has definite starting point and end point.

→ It is represented by:

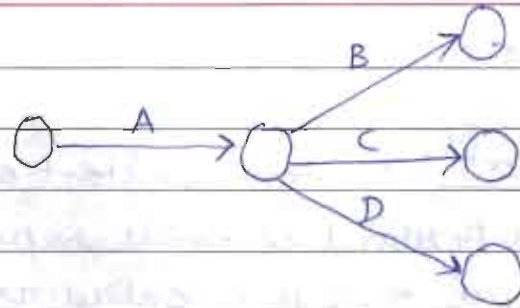


→ Length, shape and orientation of arrow has no significance.

→ Types of Activities

(a) Parallel Activities / Concurrent activities

These can be performed simultaneously and are independent of each other.



(b) Serial activities

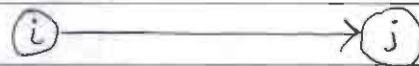
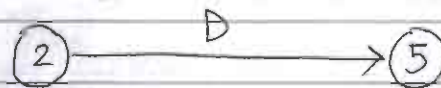


These activities can be performed one after another.

~~(b)~~

2. Event

- Event is an instant of time in the project at which something specific/significant is achieved. i.e. start of activities or completion of activities.
- Events do not consume resource and time.
- Events can be represented by nodes, shape of node can be any regular geometrical figure such as \bigcirc , \square , \triangle , \square
↓
 generally used.



NOTE:

- Events are numbered for their identification.
- Activities are also named using terminal nodes.
eg. Activity D is 25
- A general and most usual convention shown for any activity is ij.

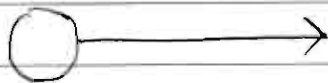
→ Types of Event

(a) Tail Event: It signifies start of an activity.

→ If a particular tail event represents start of the project, then it is called as initial event.

(b) Head Event: It signifies completion of an activity.

→ If a particular head event represents completion of the project, then it is called as final/end event.



Tail Event



Head event

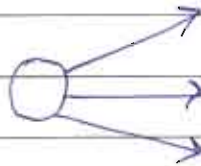
(c) Dual role events: These events are tail event for some activities and head event for other activities.

→ All the events other than initial & final events are Dual role events.



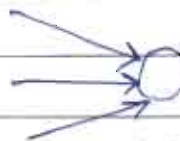
NOTE:

→ Burst Events



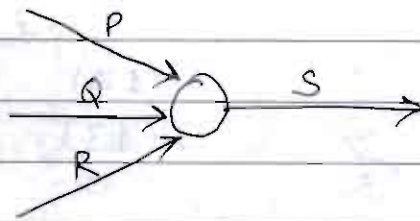
When more than 1 activity is coming out from a node.

→ Merge Events



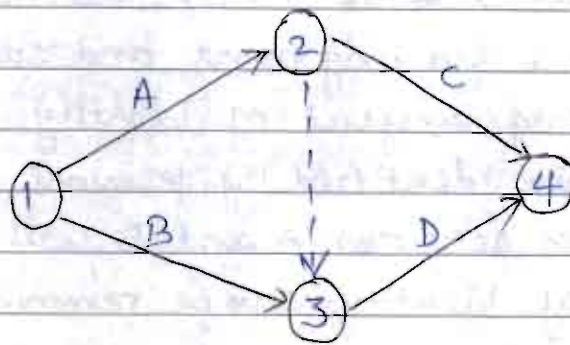
When more than one activity entering into a node.

→ Interface Event



- An interface event is a common event which shows linkage between activities performed by one or more than 1 agents/agencies.
- It may also denote linkage between 2 or more sub-projects.

3. Dummy Activity / zero time activity

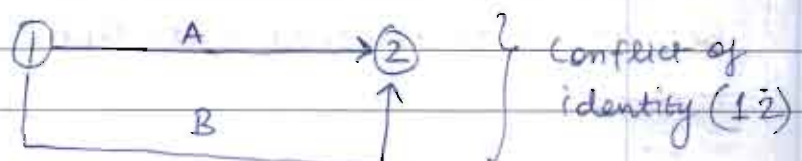


→ Here Dummy 23 represent that activity D depends on A and B.

- Dummy is an artificial activity which neither consumes any resource nor time.
- Dummy is used to show inter-relationship of activities.
- Since Dummy is not an activity, it is not represented by arrow. Rather, it is represented by dotted arrow.
- Dummy is identified by terminal nodes.
- Dummy are used to keep logical sequence and inter-relationship of activities correct.

→ Use of Dummies

(a) Grammatical purpose



Fig(a): Wrong representation