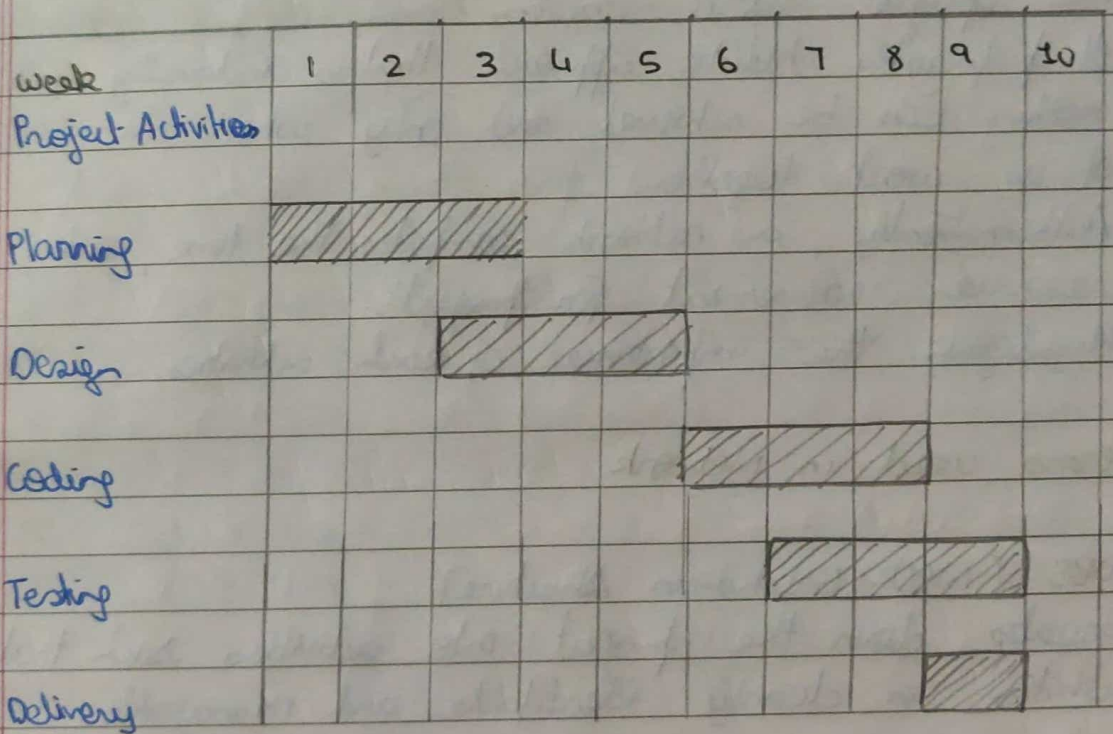
unit3- Gantt Chart

Gantt chart is a pictorial representation showing the various jobs or activities to be done.

Bar chart involves following
1 Activities involved in project
2 Concurrent activities
3 Start and end time of activity
4 Activities will have to be completed before others can begin



Advantages
1 Simple to understand
2 Easy to change
3 Simple and least complex means of portraying progress
4 Easy to identify specific elements that can either be behind or ahead of schedule.

Limitations

1. Cannot indicate interdependencies of the activities. Some activities are dependent on the other activites and some are independent.
2. Cannot show the progress of work
3. Cannot reflect uncertainity and tolerances in the duration estimated for various activities

Network Techniques

- Network is a graphical model depicting the inter-relationship between the various elements of the project work system
- It propagates holistic approach that is individually and nothing can be achieved and only when all of us work together.
- Arithematically, a network computes the time, cost, resource requirement for project.
- Highlights the importance of each activities.

Terms used in Network

WBS [Work Breakdown Structure]
Breaks down the project into activities such that activities is clearly identifable and manageable.

Activity
Physically identifable part of the project that consumes time and the resources.
Represented by an arrow.

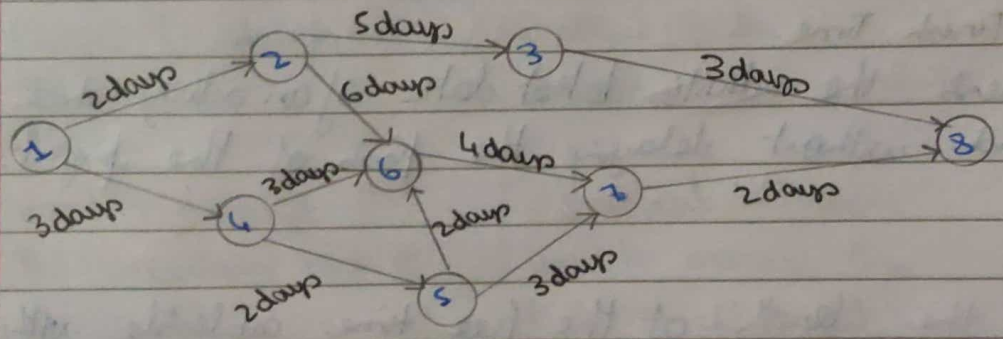
Events (Node)
Beginning and Ending of an activity

Path
Continous chain of activities from the beginning to the end of project.

Activity on Activity Diagram
Network with activities represented on arrows, events on the nodes.

Activity on Node Diagram
Network with activities represented on nodes.

Activity	Activity	Duration (days)
A	1-2	2
B	1-4	3
C	2-3	5
D	2-6	6
E	4-5	2
F	4-6	3
G	5-6	2
H	5-7	3
I	3-8	3
J	7-8	2



Network Constructions.

Activities progress from left to right
Each activity is represented by one straight and solid arrow.
If two activities having same start and end nodes, show one of them separately with dummy activity with dashed line.
An activity which shows the logical relationship between it's immediate predecessor and successor activities.
Arrow should not cross each other as far as possible.
Avoid curved arrows, dangling and looping of network.

Critical Path
This is the longest path time-wise connecting the start & end events.
The events laying along this path are critical in the sense that their occurences cannot be delayed if the scheduled time is to be met.

Earliest Start Time
Early start of an activity in a project is the earliest possible time that the activity can start

Late Finish Time
Represents the activities latest date of an activity which can finish without delaying the finish of the project.

Float
It is the length of the free time available within the estimated times of critical path.

Total Float

Amount of time by which an activity can be delayed without affecting the project duration time.

Free Float

It is how much an activity's completion may be delayed without causing any delay in it's immediate successor's activity

Independent Float

Amount of time an activity can be delayed for start without affecting the completion of preceeding activity.

Types of Network

Critical Path method does not incorporate uncertainties in jobs time, suitable for project activities having single time estimates.
Determine the critical path, minimum project duration, floats available with each activity.

Project Evaluation Review Technique is suitable for non repitative projects where jobs times are not estimable with certainity, so it as ~~a~~ probabilistic in nature.

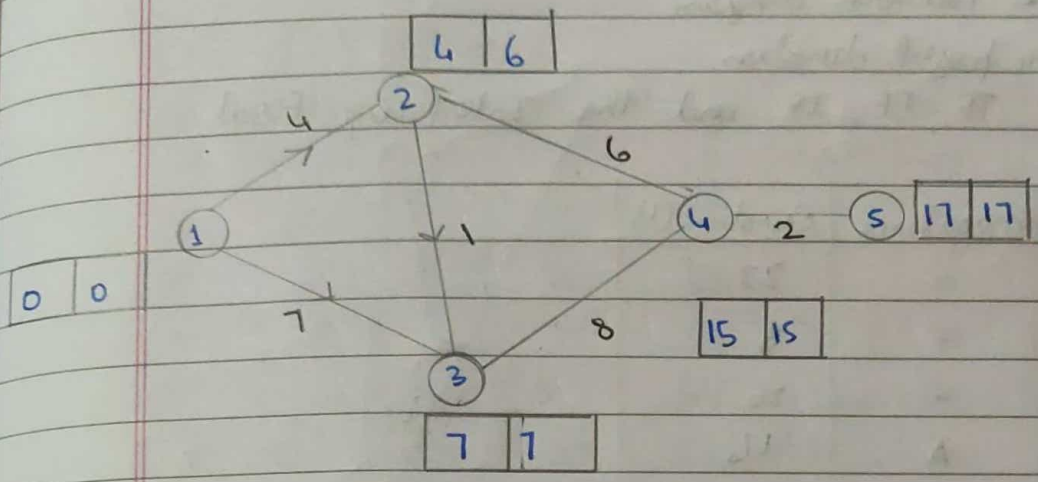
Criteria	PERT	CPM
Abbreviation	Project Evaluation Review Technique	Critical path method
Purpose	used to manage the uncertain task of the project	statistical technique used to manage the tasks of a project
Use	To control time	To control cost & time

Suitable for wild projects	Research and development projects	Construction Projects
Management	Unpredictable activities	Predictable activities
model	Probabilistic model	deterministic model
Crashing Concept	Not applicable	Applicable
Nature of the jobs	Non - repetitive nature.	Repetitive nature.
Estimate	Three time	One time
Orientation	Event oriented	Activity Oriented
Focuses on	Time	Time - cost trade off.

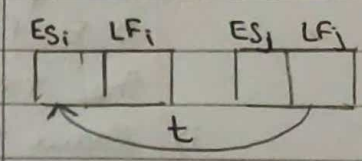
1. A project consists of following activities with their duration in days.

a) Draw a network for the above project.
b) Identify the critical path and duration of the project
c) Calculate ES, EF, LS, LF, TF, FF and IF for each activity.

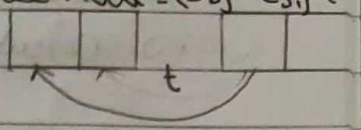
Activity	Duration in days
1-2	4
1-3	7
2-3	1
2-4	6
3-6	8
4-5	2



Total Float = $LF_j - ES_i - t$

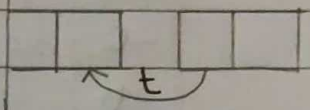


Free Float = $(ES_j - ES_i - t$



Interfering Float =

$(ES_j - LF_i) - t$



$EF = ES + t$

$LS = LF - t$

Critical Path

1-3-4-5 = 7+8+2 = 17 days

Activity	t	ES	LF	EF	LS	TF	FF	IF
1-2	4	0	6	4	2	2	0	0
1-3	7	0	7	7	0	0	0	0
2-3	1	4	7	5	6	2	2	0
2-4	6	4	15	10	9	5	5	3
3-4	8	7	15	15	7	0	0	0
4-5	2	15	17	17	15	0	0	0

Time Estimates

1. Optimistic Time Estimate (t_o)
This is the estimate of the shortest possible time in which an activity can be completed under the ideal conditions.

2. Pessimistic Time Estimate (t_p)
This is the maximum possible time it could take to accomplish the given job.
If every thing went wrong and abnormal situations prevailed, this would be the time estimate for the activity.

3. Most Likely Time Estimates (t_m).
This is the time estimates which lies between the optimistic and pessimistic time estimates.
It assumes that things go in the normal way with a few setbacks, usual lapses in delivers, no dramatic breakthroughs and so on.

4. R&D Activities for which the 3 estimates are given below along with precedence activities.

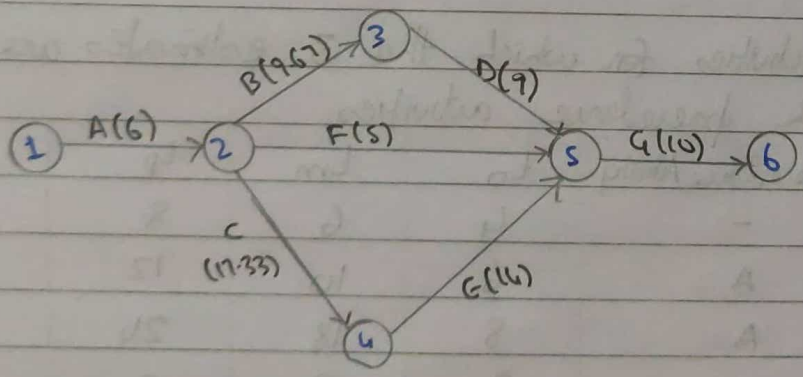
Activity	Precedence Activity	t_o	t_m	t_p
A	-	4	6	8
B	A	6	10	12
C	A	8	18	24
D	B	9	9	9
E	C	10	14	18
F	A	5	5	5
G	D, E, F	8	10	12

i) Draw PERT network
ii) Find CP
iii) If scheduled time is 35 weeks, find the probability of completing the work.

Answer $t_e = \frac{t_o + 4t_m + t_p}{6}$

$\sigma^2 = \left[\frac{t_p - t_o}{6}\right]^2$

Activity	Precedence Activity	Expected Time	Variance (σ^2)
A	-	6	.44
B	A	9.67	1
C	A	17.33	7.11
D	B	9	1.77
E	C	14	1.77
F	A	5	0
G	D, E, F	10	.44



Critical Path : $6 + 17.33 + 14 + 10 = 34.66$ weeks

variance also critical path $= \sqrt{.44 + 7.11 + 1.77 + .44}$

$= \sqrt{9.76} = 3.12$ weeks

$Z = \frac{T_s - T_e}{C_p} = \frac{35 - 34.66}{3.12} = .1089$

Prob of completion of project within 35 weeks = .56336
= 56.336%

Crashing of Project

In many situations it becomes necessary to cut down the project duration.

Activities that are critical needs to be crashed in order to reduce project durations as it these activities that determine project duration.

But this has got it's own cost implications.

Reduction in project duration calls for more resources to be pumped in, hence direct costs increases.

Indirect costs such as equipment, rent, supervision charges decreases; thus it becomes necessary to identify a project duration up to which the project can be crashed so that the overall project costs are minimum.

$$\text{Cost slope} = \frac{C_c - N_c}{N_t - C_t}$$

C_c - Crash cost
N_c - normal cost
N_t - normal time
C_t - crash time

Resource Allocation

Every organisation in any industry has the own resources which consists of equipement, materials, people, time and knowledge.
Most organization have very limited resources.
These limited resources are utilized by the project management team based on the priority.
This is a tough task to deal with but with the help of an effective allocation plan, it becomes easier to effectively manage resource project resources By doing this planned resource allocation, most of the companies is saved important resources by utilizing it more effitively & efficiently

Resource Leveling
Technique of using limited resources at a constant level and resources are optimized by extending the schedule, ~~and resources which are optim~~ so. the project duration may change.

Resource Leveling is used when
i) demand for a resource exceeds the supply
ii) share resources
iii) critical resources may not be available for the certain duration.

Resource smoothing
Resource allocation method without extending the schedule of the project.
Time is the main constant in this type of leveling.
Project completion time date and critical path will stay the same.

Difference between Resource Leveling & Resource Smoothing

In Resource leveling resources are the main constraints while in resource Smoothing project due date is a constraint.

In leveling the project due date may change while in Smoothening it doesn't change.

In leveling the critical path changes (generally) increases while in Smoothening it does and the activities can be delayed within their float

Resource leveling is used when resources are under or over allocated whereas Smoothening is used when the resources are un-evenly located.