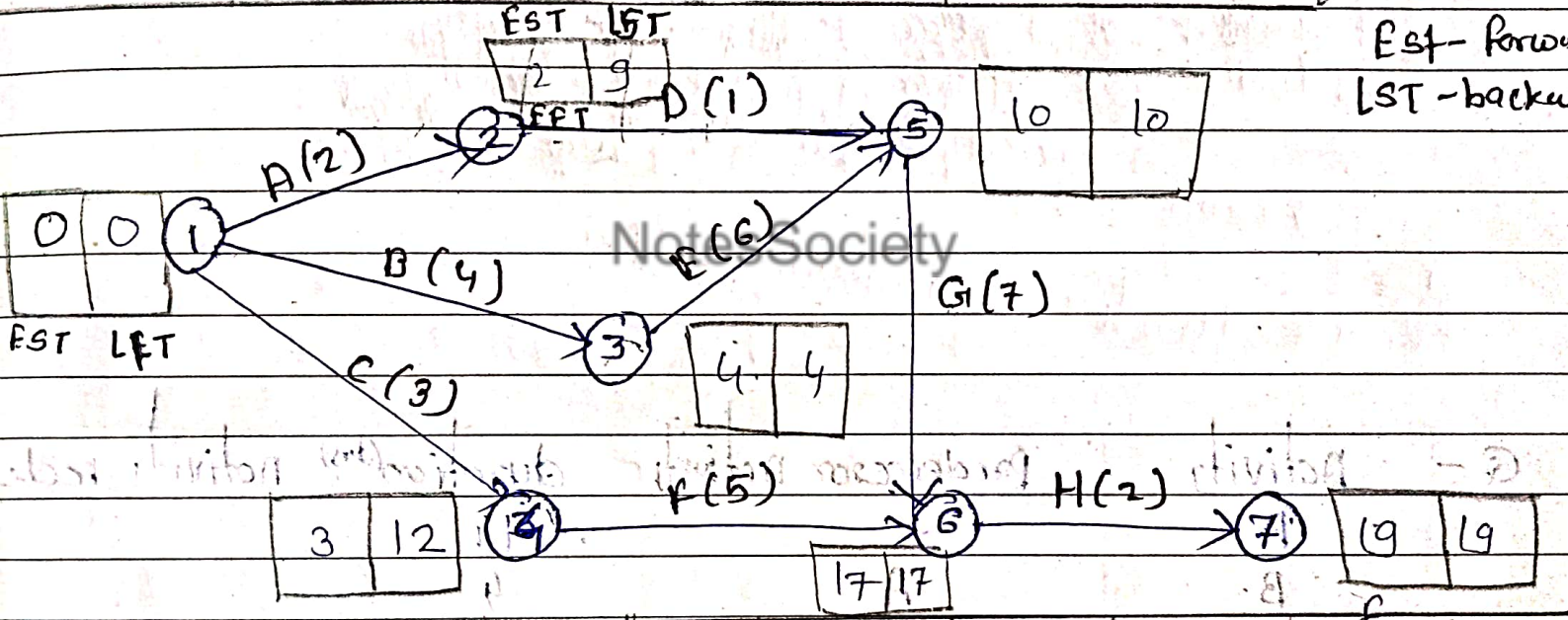
5-10 marks) Theory

unit II

4/02/2025

Activity	Predecessor activity	duration (month)	Activity nodes
A	–	2	1-2
B	–	4	1-3
C	–	3	1-4
D	A	1	2-5
E	B	6	3-5
F	C	5	4-6
G	D, E	7	5-6
H	F, G	2	6-7



Activity	duration	Est ij	EFT ij	Lst	LFT	T.f	f.f	Independent f	I.f
1-2	2	0	2	7	9	7	0	0	7
1-3	4	0	4	0	4	0	0	0	0
1-4	3	0	3	9	12	9	0	0	9
2-5	1	2	3	9	10	7	7	0	0
3-5	6	4	10	4	10	0	0	0	0
4-6	5	3	8	12	17	9	9	0	0
5 6	7	10	17	10	17	0	0	0	0
6-7	2	17	19	17	19	0	0	0	0

Estij = max.

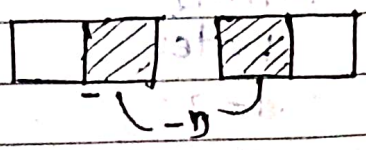
Est(i-j)2 =

CP = EST = LFT

T.F = LFT − EFT

FF = 

= 10 − 1 − 2 = 7

Ind. F = 

Internal float = TF − F.F

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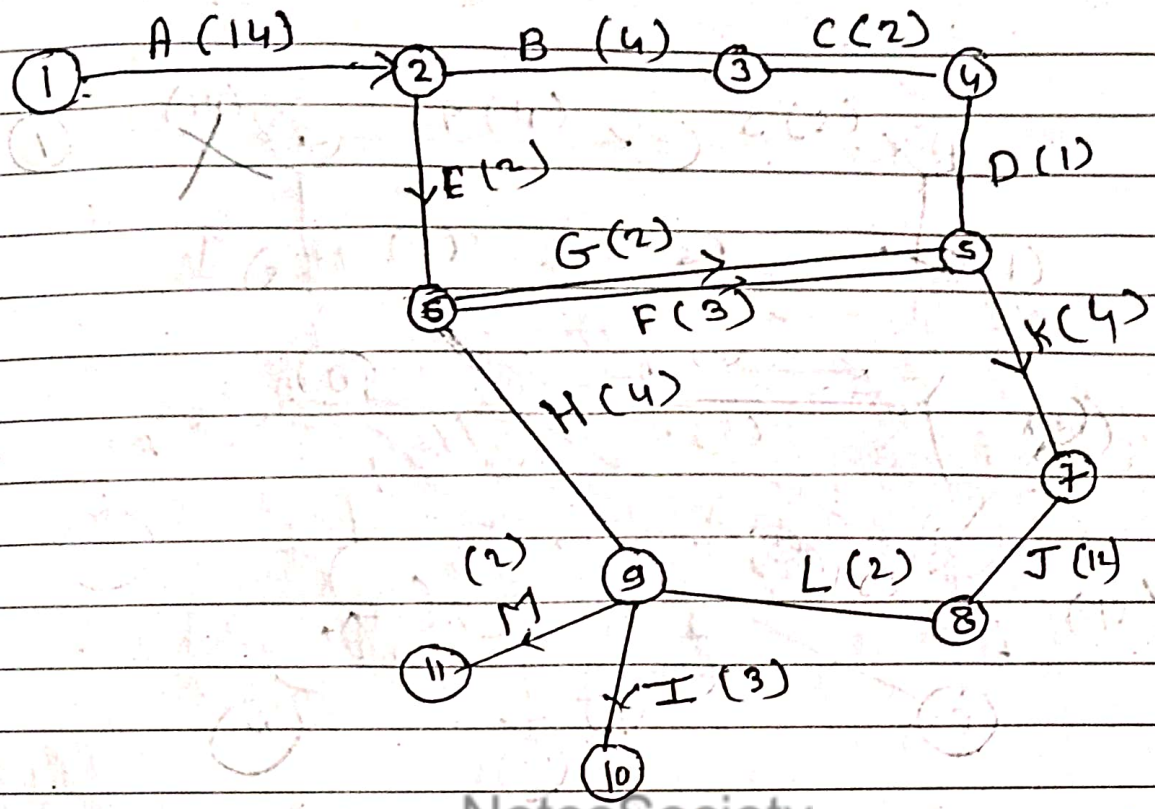
Q-	Activity	Predecessor Activity	duration(day)	Activity node
	A	-	4	
	B	A	4	
	C	B	2	
	D	C	1	
	E	A	2	
	F	E	3	
	G	E	2	
	H	E	4	
	I	H, L	3	
	J	K	12	
	K	D, F, G	4	
	L	J	2	
	M	H, L	2	



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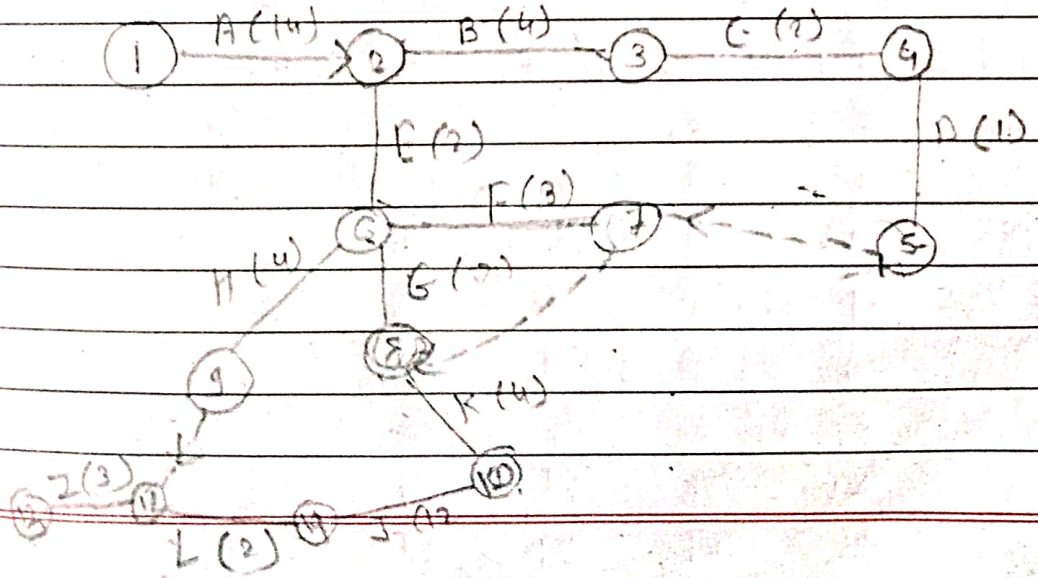

Activity	I-Predecessor	Duration
A	—	2
B	A	4
C	A	3
D	A	1
E	A	6
F	B, C	5
G	F, D, E	7
H	E	2
I	F	5
J	F G H	2

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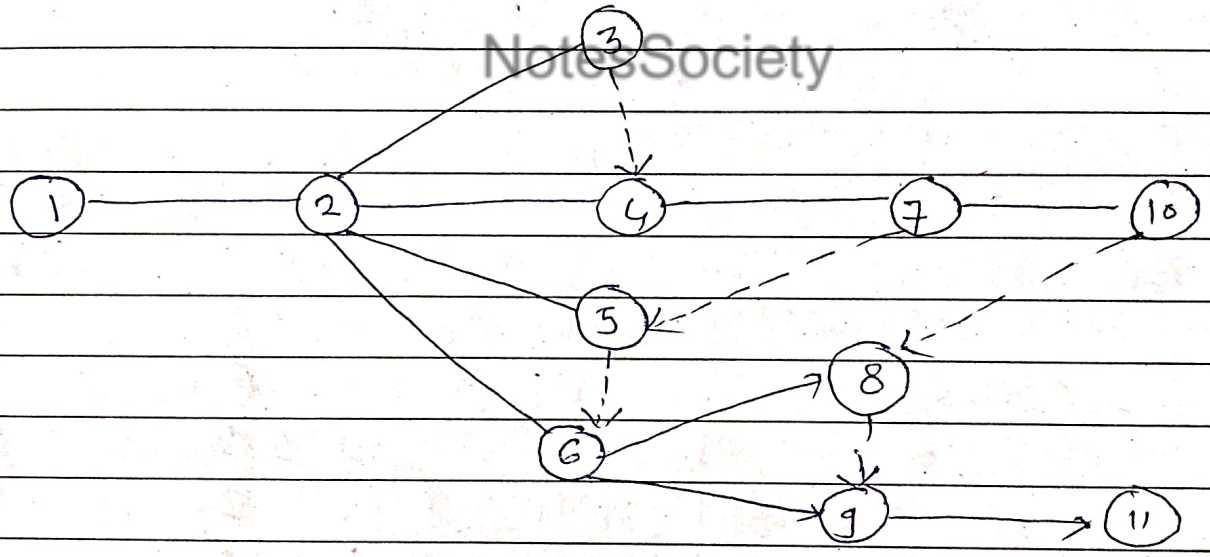

Activity	Predecessor	Duration	
A	—	2.	1-2
B	—	5.	1-3
C	—	4.	1-4
D	B	5.	3-5
E	A	7.	
F	A	3.	
G	B	6.	3-8
H	C, D	6.	
I	C, D	2.	
J	E	5.	
K	F, G, H	4.	
L	F, G, H	3.	
M	J	12.	
N	J, K	8.	

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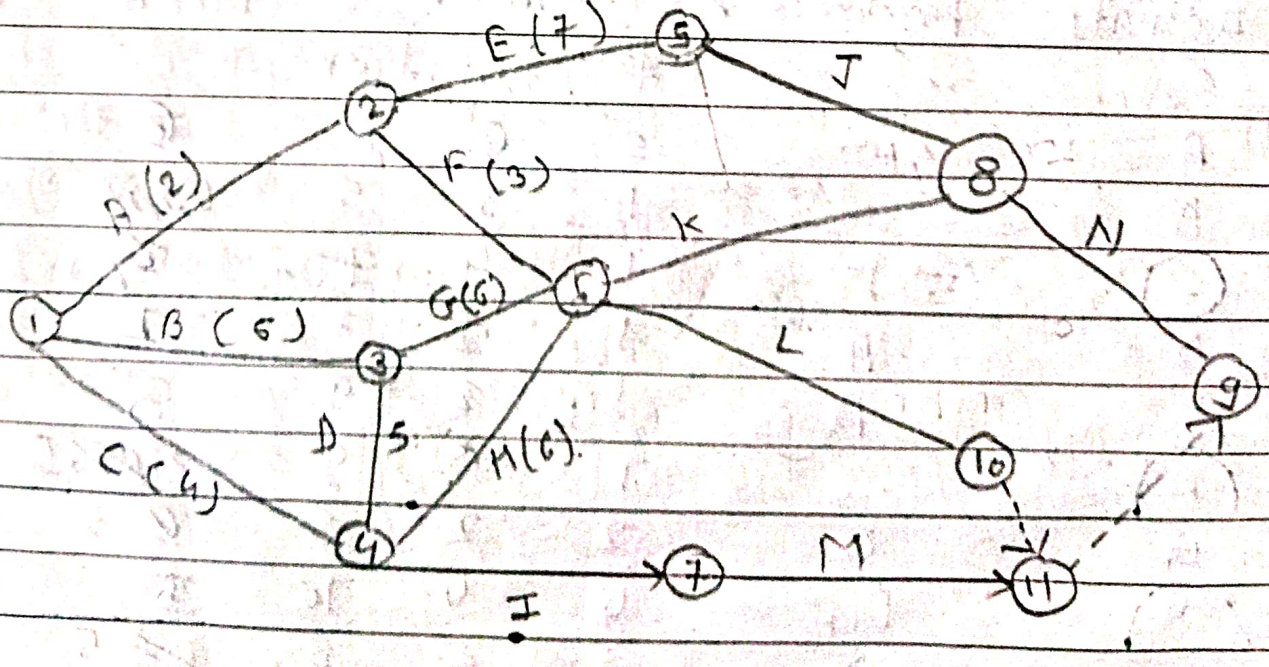

★ PERT :-

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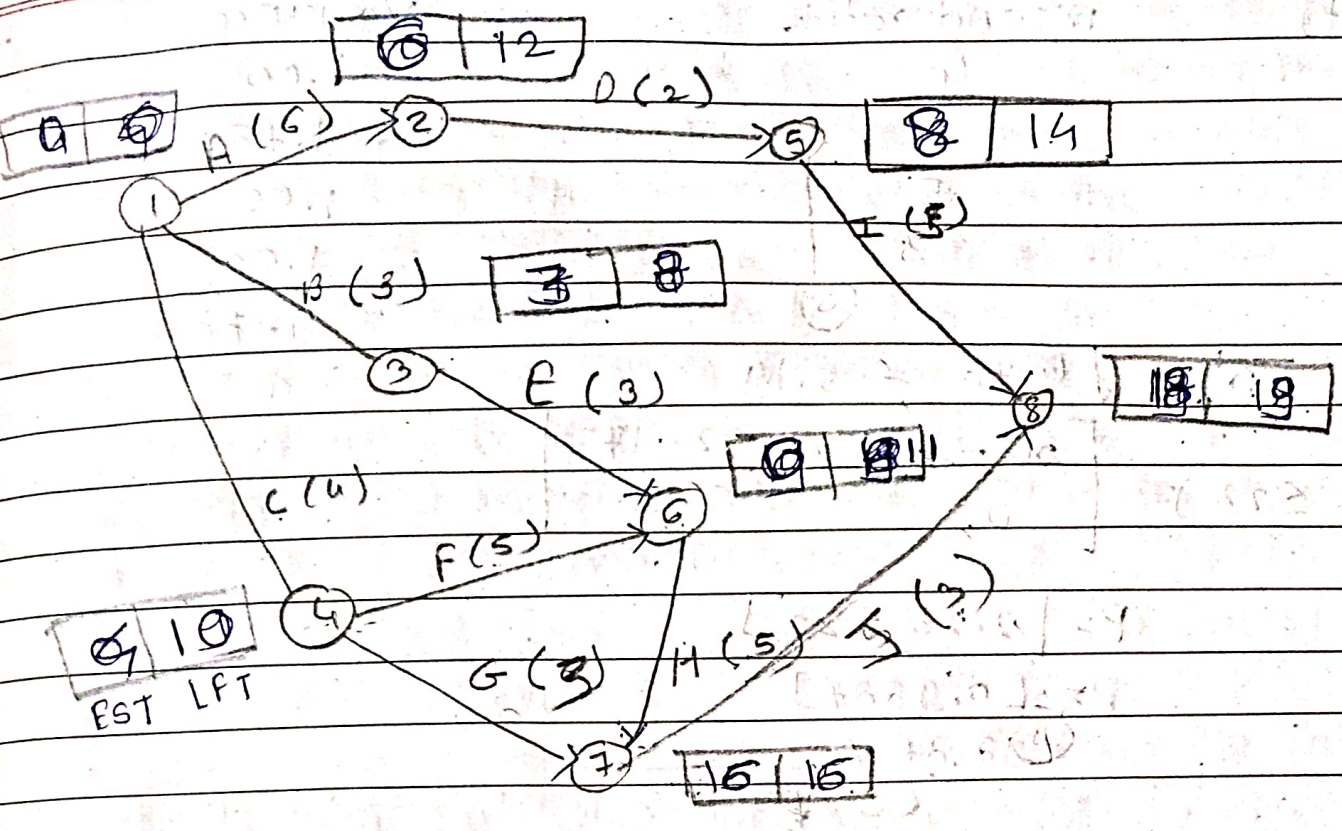
Activity	Predecessor	Duration			Mean	Variance
		t_o	t_m	t_p		
A	–	5	6	7	6	0.1111
B	–	1	3	5	4 ~~3~~ 3	0.4444
C	–	1	4	7	~~4~~	1
D	A	1	2	3	2	0.1111
E	B	1	2	9	3	1.7777
F	C	1	5	9	~~5~~ 5	1.7777
G	C	2	2	8	~~3~~ 3	1
H	E, F	4	4	10	~~5~~	1
I	D	2	5	8	~~5~~ 5	1
J	H, G	2	2	8	3	1

$$\text{Mean} = \frac{t_o + 4t_m + t_p}{6}$$



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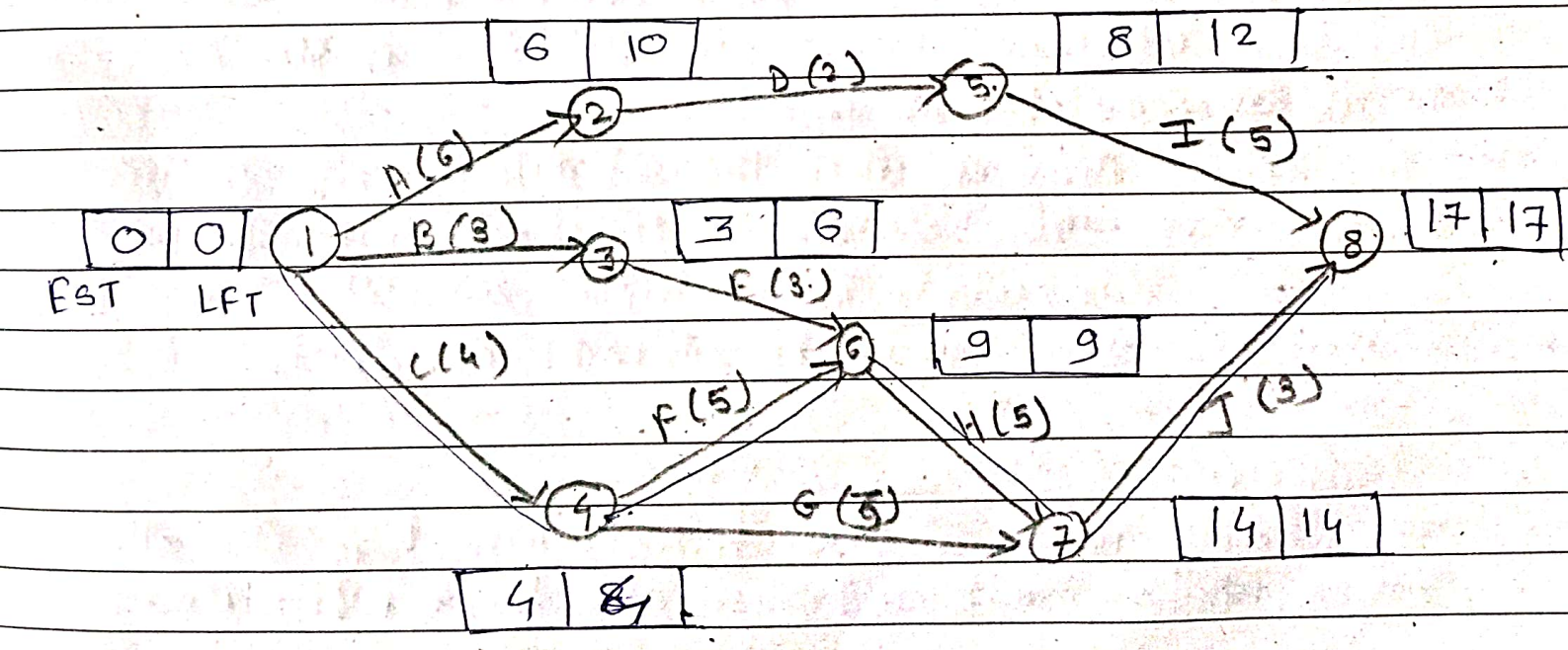

critical path =
1-4 = 4
4-6 = 5
6-7 = 5
7-8 = 3

(3) V = variance = $\left[\frac{t_p - t_o}{6}\right]^2$

μ Poputions x - sample $\delta = \sqrt{var}$

Total. c.p Given

Activity	meanduration	Variance
C	4	1.00
F	5	1.78
H	5	1.00
J	3	1.00
		4.78

$$\delta = \sqrt{4.78} = 2.19$$

$$P(x \leq 22) \left[\frac{x - \mu i}{\delta} \leq \frac{22 - 17}{2.19} \right]$$

$$P = [2.28 \leq 22]$$

$$P = [0.9887]$$

98.87 %.

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Q what is Network Analysis ?

-> - Nlw Analysis is a technique that is adopted in planning and Controlling of unique & Complex projects.
- It is a system of planning project outline by analyzing different activities associated with it
- In network analysis Complex projects are broken down into smaller activities or tasks, which are then organized according to a sequence
- Then, the order of tasks / activities is also decided according to a logical sequence

* Network techniques.
- PERT
- COPAC
- CPM
- ECS
- RAMS
- MAP
- PCS
- RPSM
- GERT

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* Basic steps in PERT / CPM

1) planning
- The planning phase started splitting the total project in to small projects, These smaller projects in turn are divided into activities & are analyzed by the department or section
- The relnship of each activity with respect to other activities are defined and established and the corresponding responsibilities & the authority are also stated
- Thus the possibility of overlooking any task necessary for the Completion of the project is reduced substantially.

2. Allocation of resources
- Allocation of resources is performed to achieve the desired objective. A resource is a physical variable such as labour, finance, equipment & space which will impose a limitation on time for the project
- when resources are limited and conflicting demands are made for the same type of resources a systematic method for allocation of resources become essential.
- Resource allocation usually incurs a compromise & the choice of this compromise depends on the judgment of managers

3 Scheduling :-
- The ultimate objective of the scheduling phase is to prepare a time chart showing the start & finish times for each activity as well its relationship to other activities of the project.
- morrover the schedule must pinpoint the critical path activities which requires special attention if the project is to be completed in time
- for non-critical activities, the schedule must show the amount of slack or float times which can be used advantageously when such activities are delayed or when limited resources are to be utilized effectively

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4. Controlling
- The final phase in project management is Controlling. critical path methods facilitate the application of the

Principle of management by expectation to identify areas that are critical to the completion of the project
- By having progress reports from time to time and updating the network continuously, a better financial as well as technical control over the project is exercised
- Arrow diagrams and time charts are used for making periodic progress reports. if required, a new course of action is determined for the.

* Nlw Diagram Representation.

1. Activity.
- Any individual operation which utilizes resources and has an end and a beginning is called activity.

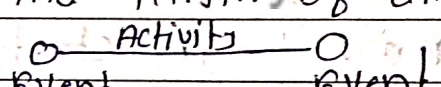
1. Predecessor activity - Activities that must be completed immediately prior to the start of another activity are called predecessor activities.
2. Successor activity - Activities that cannot be started until one or more of other activities are completed but immediatly suceed them are called successor activities.
3. Concurrent activity - Activities which can be accomplished concurrently are known as concurrent activities, it may be noted that an activity can be a predecessor or a sucessor to an event or it may be concurrent with one or more of other activities
4. Dummy activity :- An activity which does not consume any kind of resource but merely depicts the

* Advantages of PERT & CPM

1) A PERT / CPM chart explicitly defines and makes visible dependencies between the elements.
2) PERT / CPM facilitates identification of the critical path and makes this visible
3) PERT / CPM facilitates identification of early start, late start, & slack for each activity.
4) PERT / CPM provide for potentially reduced project duration due to better understanding of dependencies leading to improved overlapping of activities and tasks where feasible.

Rules of Nlw Construction

- In Network diagram arrows represent activities and circles the events, the length of an arrow is of no significance



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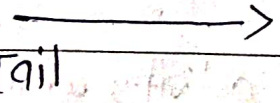
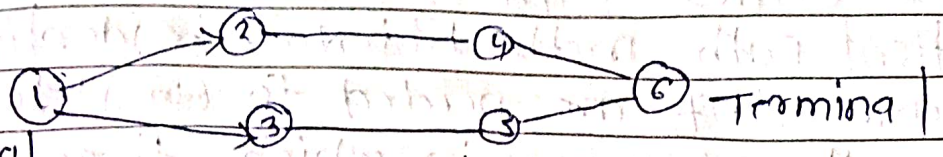
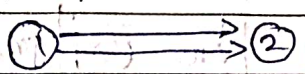
- Nlw Diagrams flow from left to righ.
- An activity cannot begin untill all preceding Connected activities has been completed
- Each activity should be represented by only the arrow and must start & end in a circle
- The tail of an activity represents the start & head the Completion of coork



- Events are identified by numbers
- A Netcoork should have only one initial and one formingl node



- The general rule for numbering the event is that the head event should always be numbered larger than that at it's tail
- An event number should not get repeated or duplicate
- A dummy activity does not consume either any resource or time
- parallel activities can not accepted between the events.



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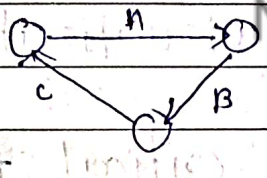
- Looping is not permitted.



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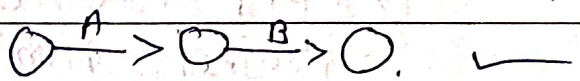
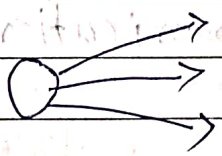
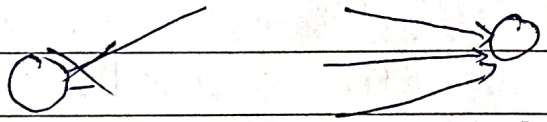


- burst event



- Merge event



* what is critical path

- The critical path method involves identifying all the tasks that are needed to complete a pro determining the sequence in which these tasks must be carried out and the calculating the most prolonged duration of time it will take to comple the project from start to finish
- The most prolonged project duration is known as the critical path, it provides a clear timelin for project completion

* Benefits of using the critical pathe method in project management

1) CPM provides a clear visualization of the project timeline
2) CPM clearly identifies critical tasks
3) CPM aids in risk identification & mitigation
4) CPM promotes better communication within the project team

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Not CT

☆ Crashing of Project Network

Activity	Normal time (weeks)	Normal Cost	Crashing time (w)	Crashing Cost	Slop
1-2	7	700	4	850	50
1-3	5	500	3	700	100
1-4	8	600	5	1200	200
2-5	9	800	7	1250	225
3-5	5	700	3	1000	150
3-6	6	1100	5	1300	200
4-6	7	1200	5	1450	125
5-7	2	400	1	500	100
6-7	3	500.	2	850	350
		6500			

If the indirect cost is ₹ 200/-, find the optimal crashed Project Completion time

Slope = Crashing Cost − Normal cost / Normal time − crash time

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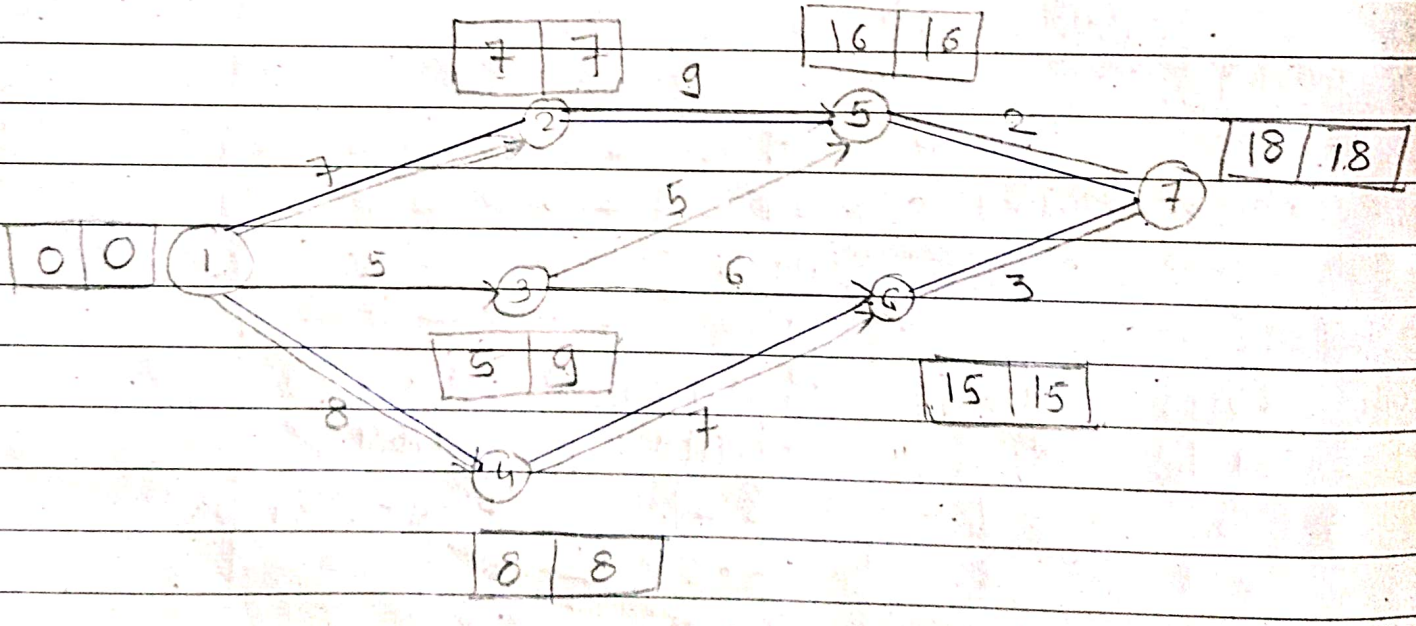


1 - 2 - 5 - 7 = 18

1 - 4 - 6 - 7 = 18

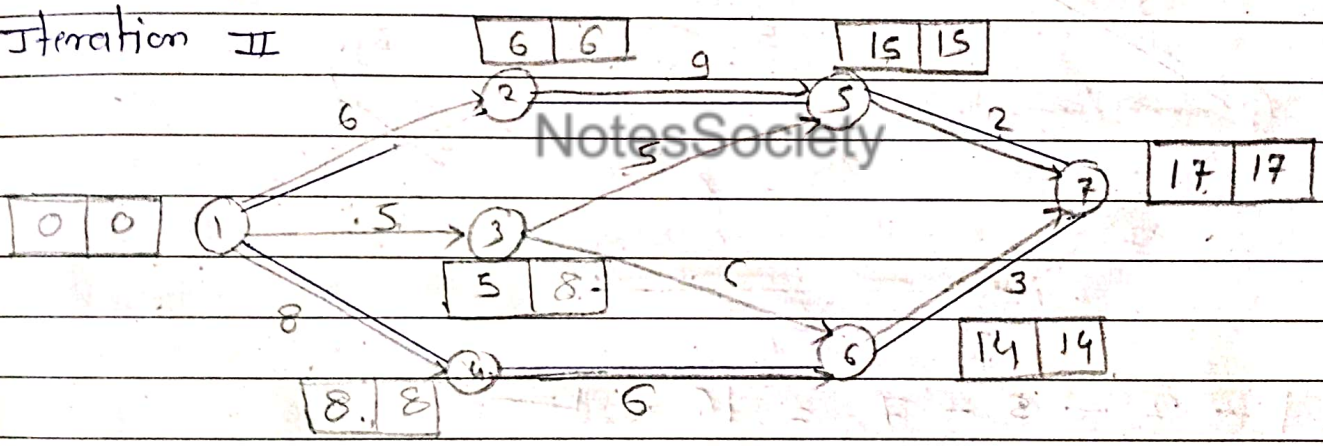
Standard project Completion time = 6500

For total indirect Cost = 200 X 18 = 3600 +

10,100

Critical Path	critical activity	crash limit	crash Slope	direct crash
1-2-5-7	1-2	3	50 ★	slope =
	2-5	2	225	50+125
	5-7	1	100.	= 175
1-4-6-7	1-4	3	200	
	4-6	2	125 ★	
	6-7	1	350	

Iteration II



1 - 2 - 5 - 7 = 17 ✓

1 - 4 - 6 - 7 = 17 ✓

1 - 3 - 5 - 7 = 12

1 - 3 - 6 - 7 = 17

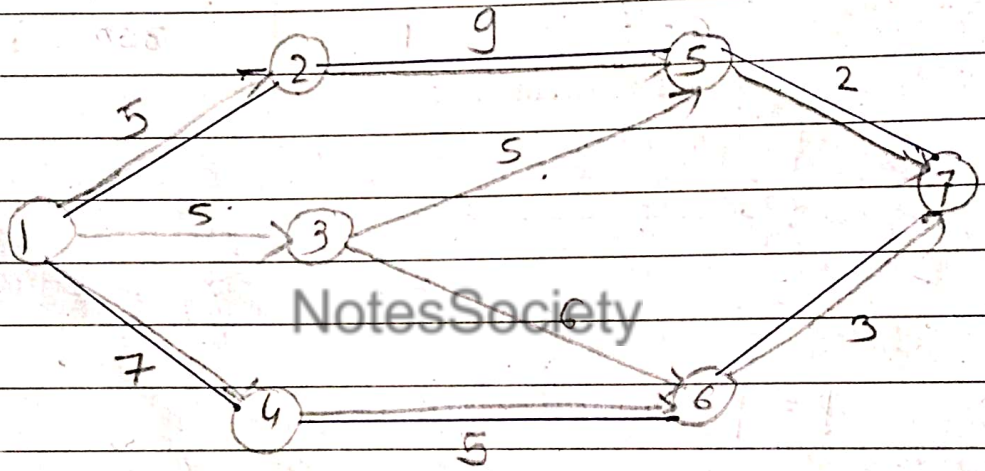
= Normal-Cost + direct crash - Indirect cost

= 10,100 + 175 - 200

= 10,75

Iteration	critical path	critical activity	crash limit	crash slope
	1-2-5-7	1-2	2	50 ★
		2-5	2	125
		5-7	1	100
	1-4-6-7	1-4	3	200
		4-6	1	125 ★
		6-7	1	350

Iteration III



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1 – 2 – 5 – 7 = 16 ✓

1 – 3 – 5 – 7 = 12

1 – 4 – 6 – 7 = 14

1 – 4 – 6 – 7 = 16 ✓

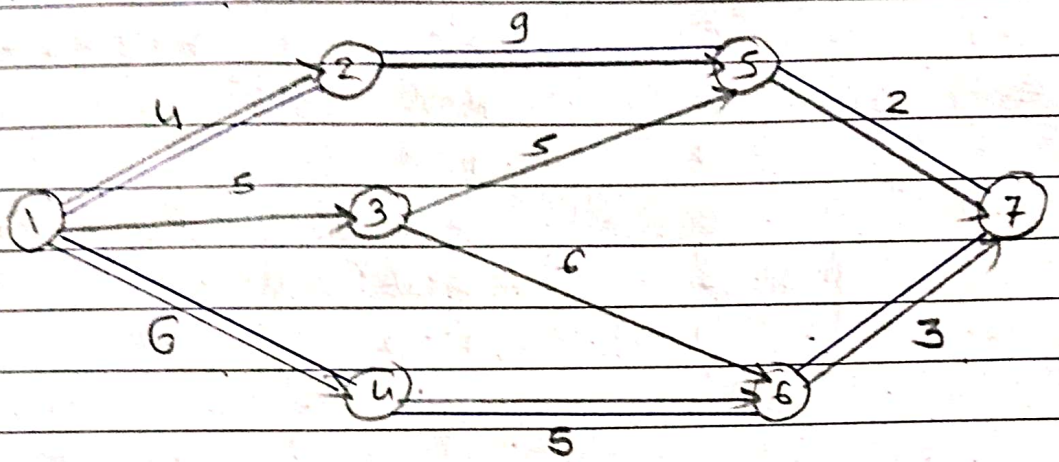
critical path	critical activity	crash limit	crash slope
1-2-5-7	1-2	1	50 ★
	2-5	2	125
	5-7	1	100
1-4-6-7	1-4	3	200 ★
	4-6	0	125 ★
	6-7	1	350

∴ Normal Cost + direct crash slope − Indirect cost

∴ 1075 + 175 − 200

∴ 1050.

Iteration IV



1 − 2 − 5 − 7 = 15

1 − 3 − 5 − 7 = 12

1 − 3 − 6 − 7 = 14

1 − 4 − 6 − 7 = 15

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Here direct crash slope = 50 + 200 = 250.

∴ Normal Cost + direct crash slope − Indirect Cost

∴ 1050 + 250 − 200

∴ 1050 + 50

∴ 1,100

∴ Here the optimal crash project Completion time is 1050.