

19/9/19

## 8. Scheduling

Network scheduling Techniques.

① PERT

② CPM (CPDM)

① Activity on Node

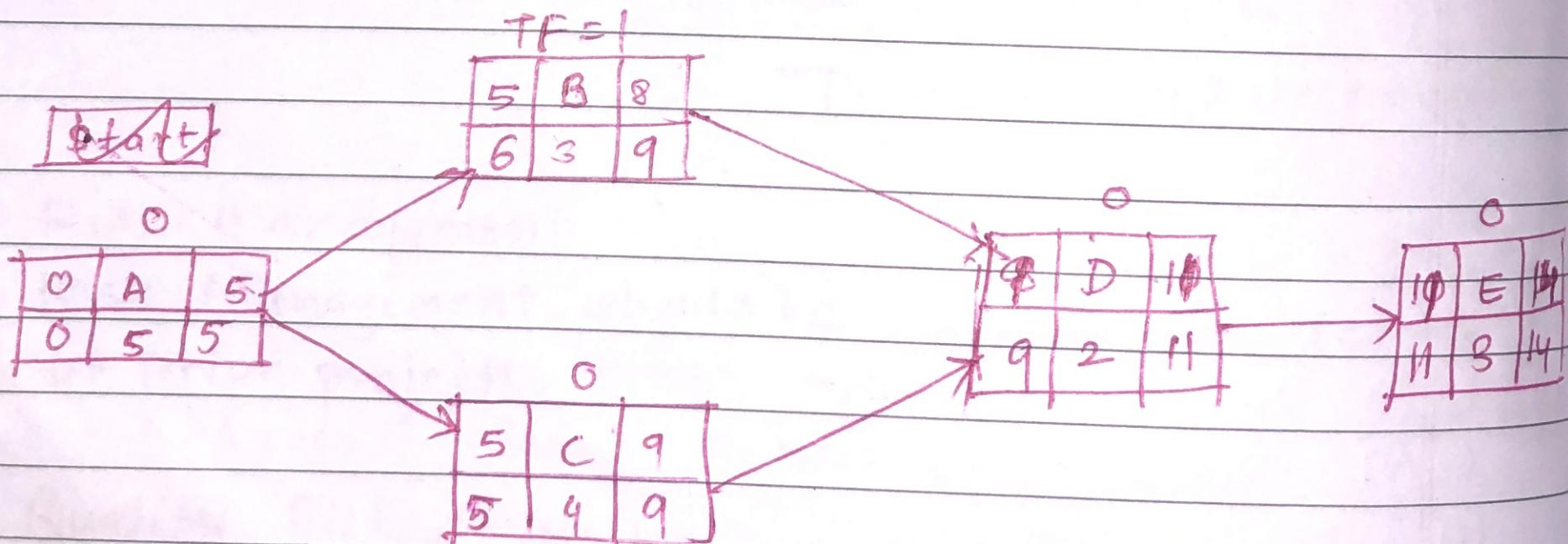
② —||— Arc

$$\text{TF} = \text{EF} - \text{LF} \quad \text{ES} = \text{LS} - \text{TF}$$

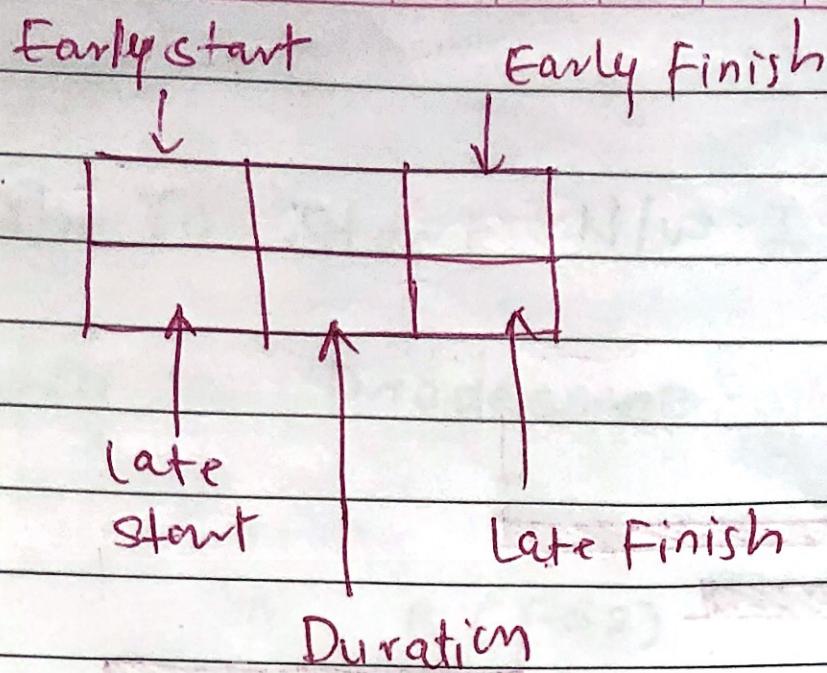
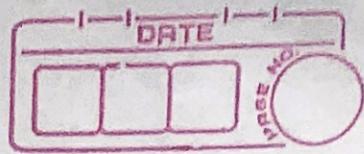
Q. Find critical path, Draw AON Diagram

Activity	Procedure	Duration
A	-	5
B	A	3
C	A	4
D	B, C	2
E	D	3

AON N/W Diagram



ACDE → critical path



Q)

Activity      Procedure      Duration

A      -      3

B      A      4

C      A      2

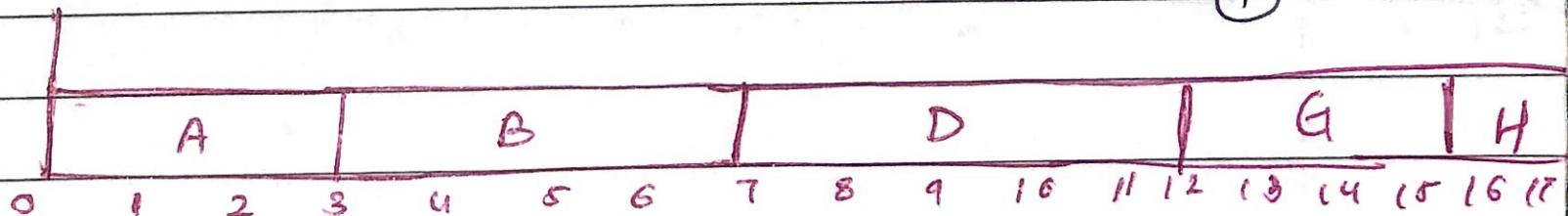
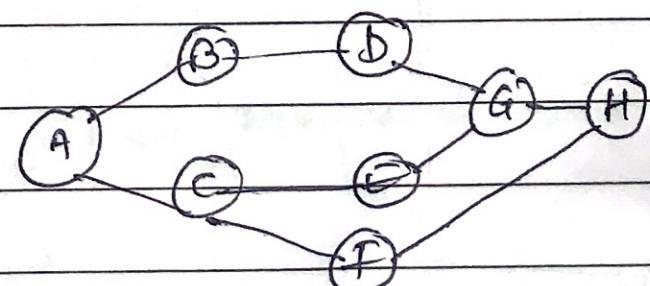
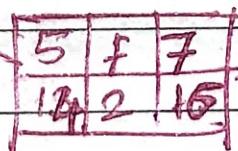
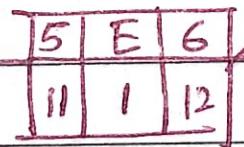
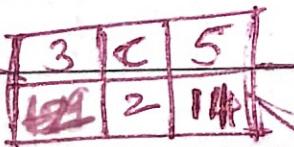
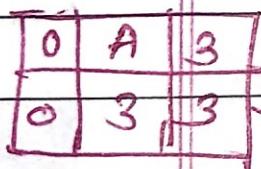
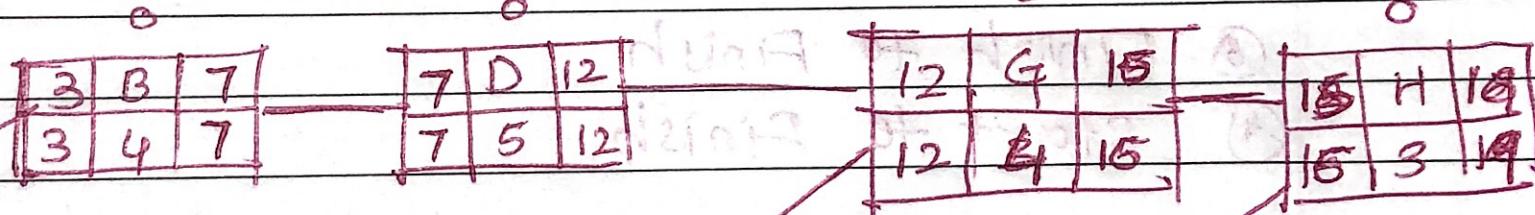
D      B      5

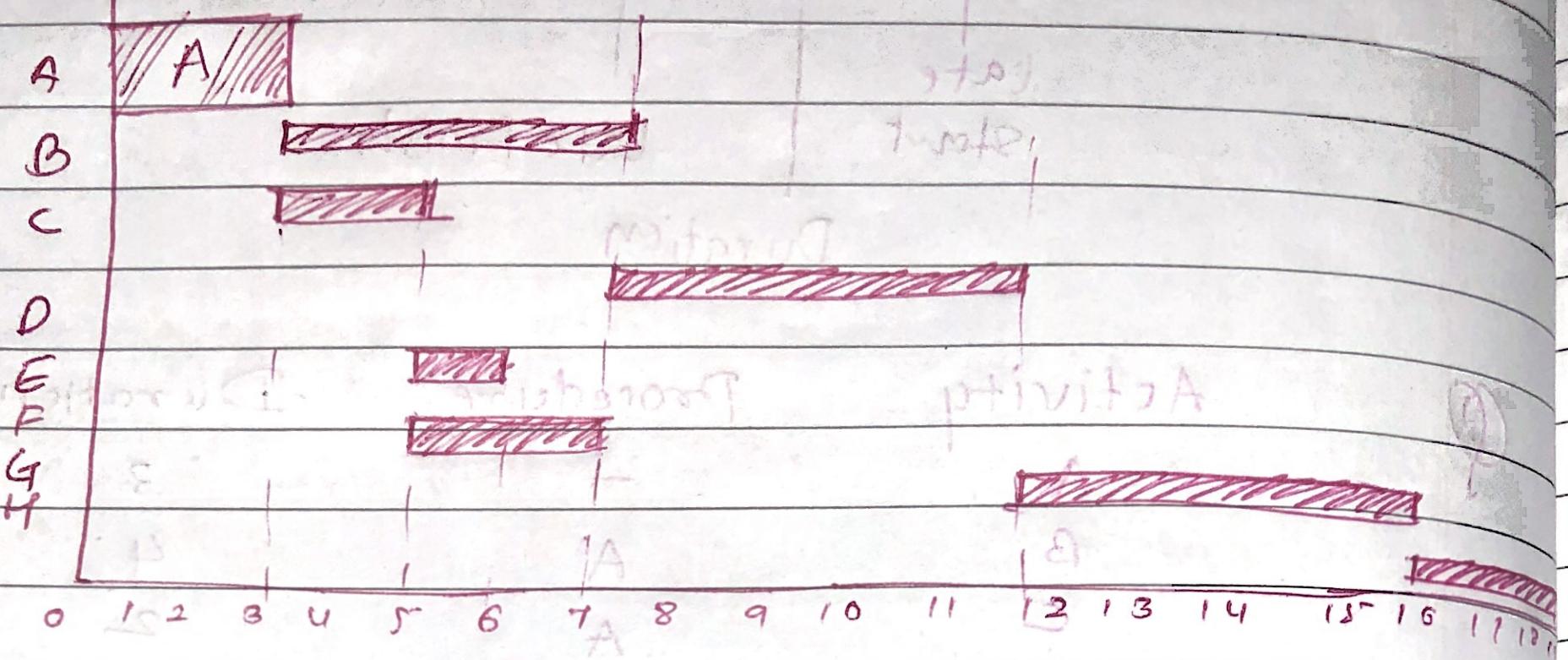
E      C      1

F      C      2

G      D, E      4

H      F, G      3





Gantt chart

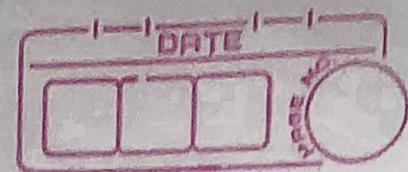
\* NW diagrams 3.0 p.9. 35°

① Finish to start

② Start to Start

③ Finish to Finish

④ Start to Finish

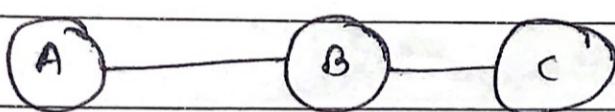


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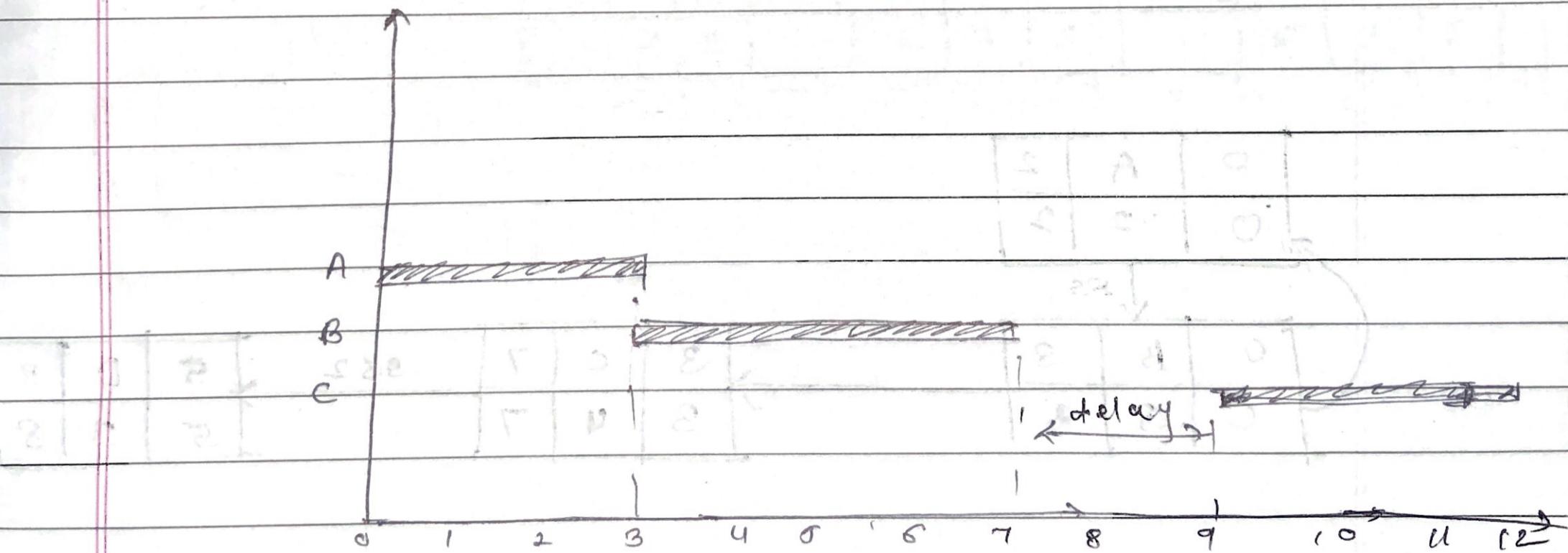
\* Finish To Start + N/w Diagram.

Activity	Predessee <u>r</u>	Time
A	-	3
B	(23) A	4
C	B (FS2)	3

delay of 2

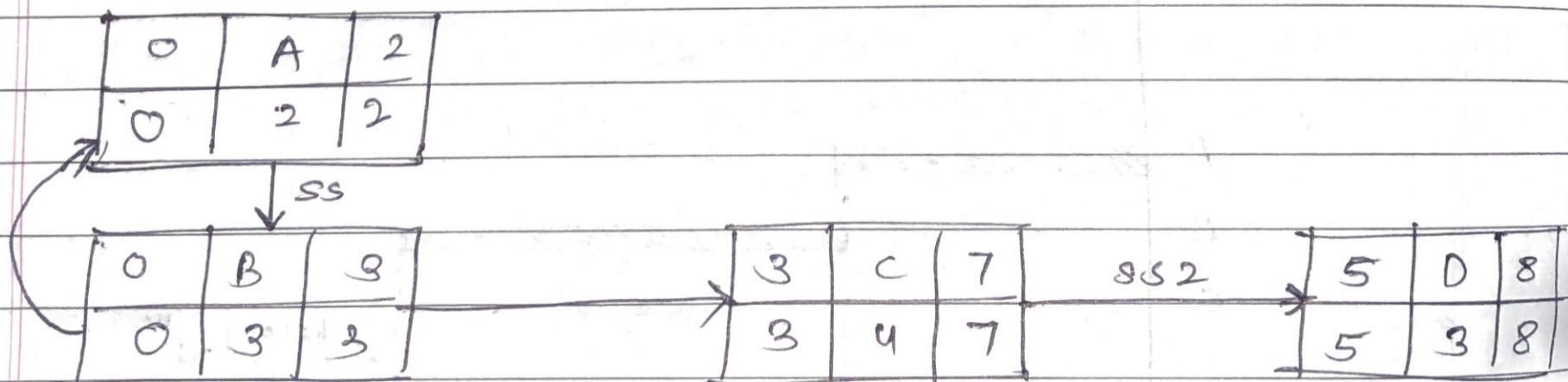
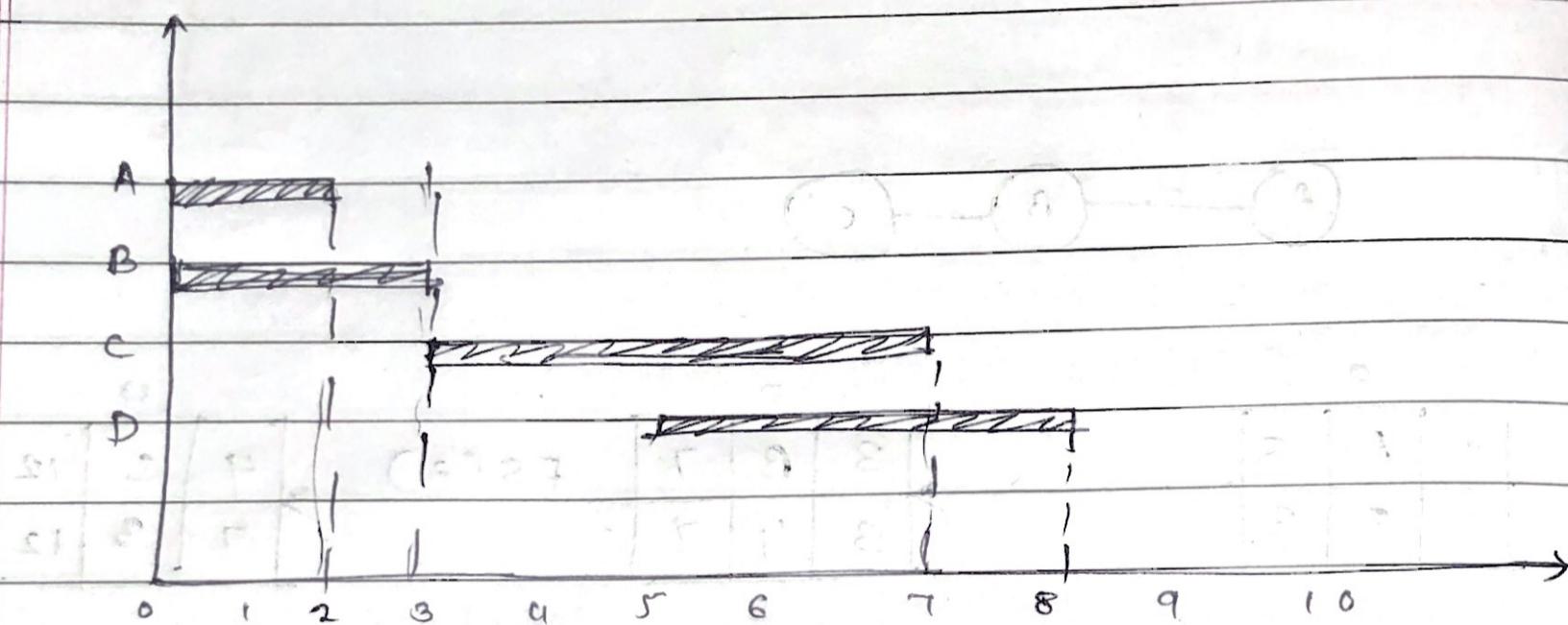


0	A	3		3	B	7	FS(2)	9	C	12
0	3	3		3	4	7		9	3	12



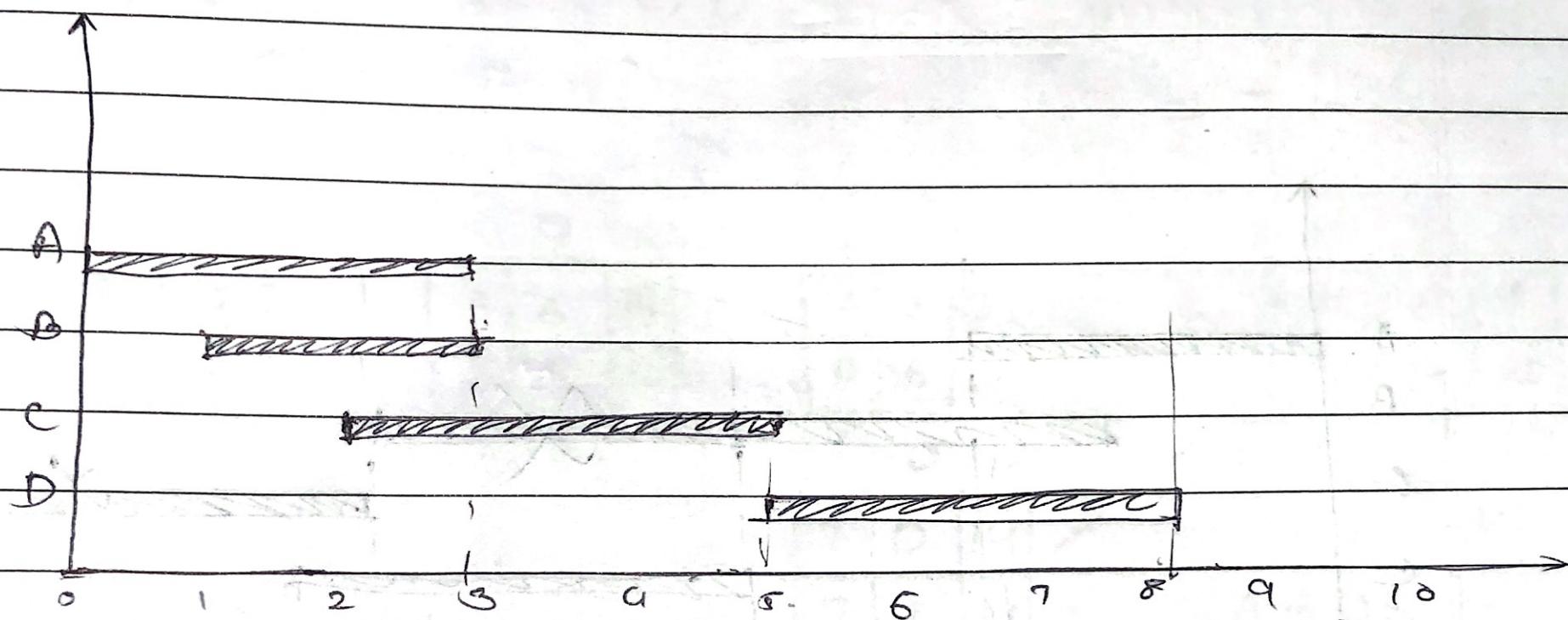
## \* Start to Start N/W Diagram

Activity	predecessor	Time
A	-	2
B	A(ss)	3
C	B	4
D	C(ss2)	3



\* Finish to Finish Network diagram

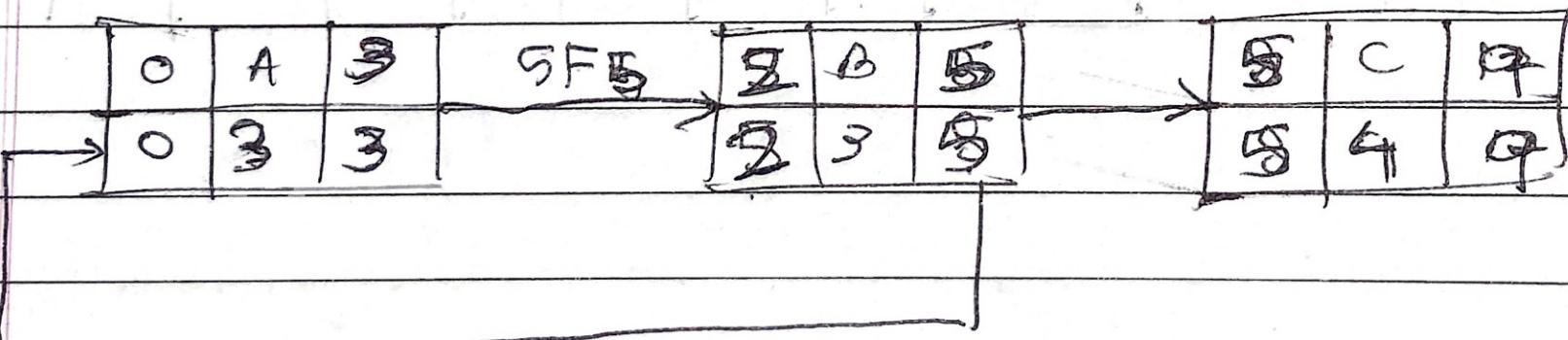
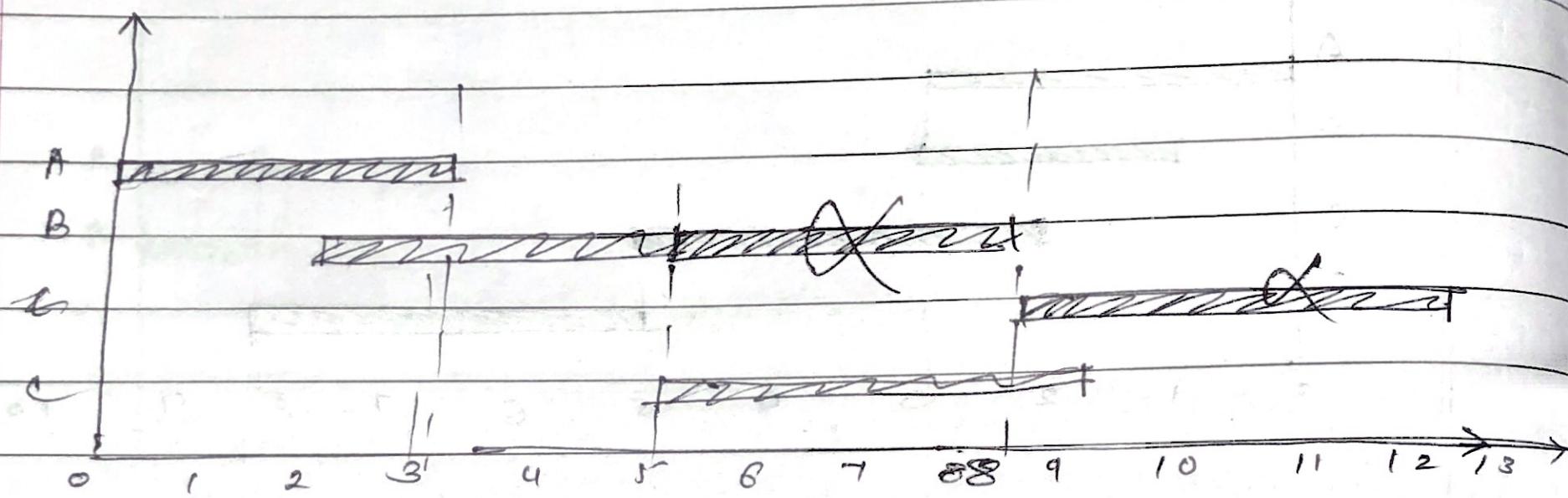
Activity	Pred.	Time
A	-	3
B	A (FF)	2
C	B (FF <sup>2</sup> )	3
D	C	3

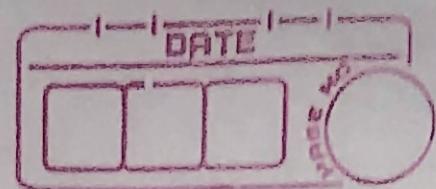


0	A	3	FF	1	B	3	FF <sup>2</sup>	2	C	5		5	D	8
0	3	3		1	2	3		2	3	5		5	3	8

# \* Start to Finish N/W Diagram

Activity	Pred.	Time
A	-	3
B = A	A (SF5)	3
C = B	B	4

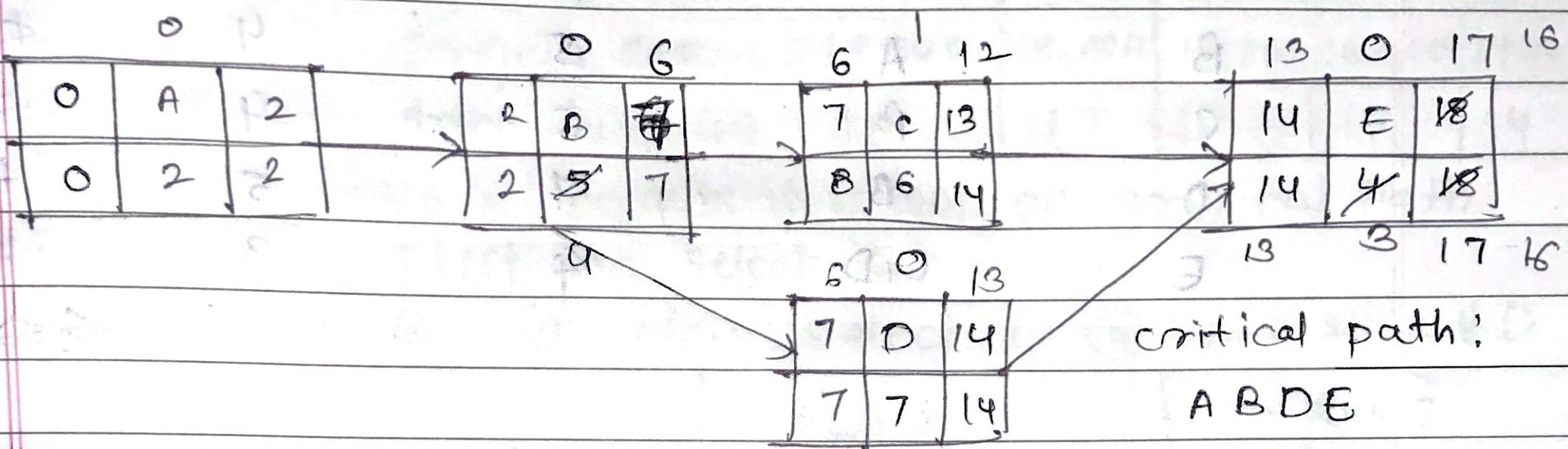




pg. 350 H. 1a.

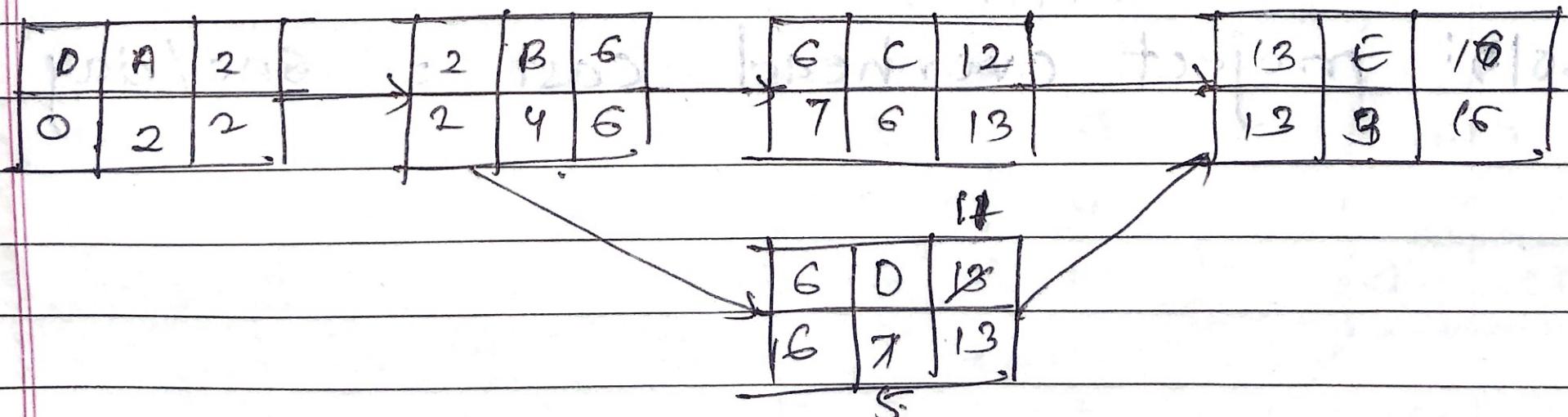
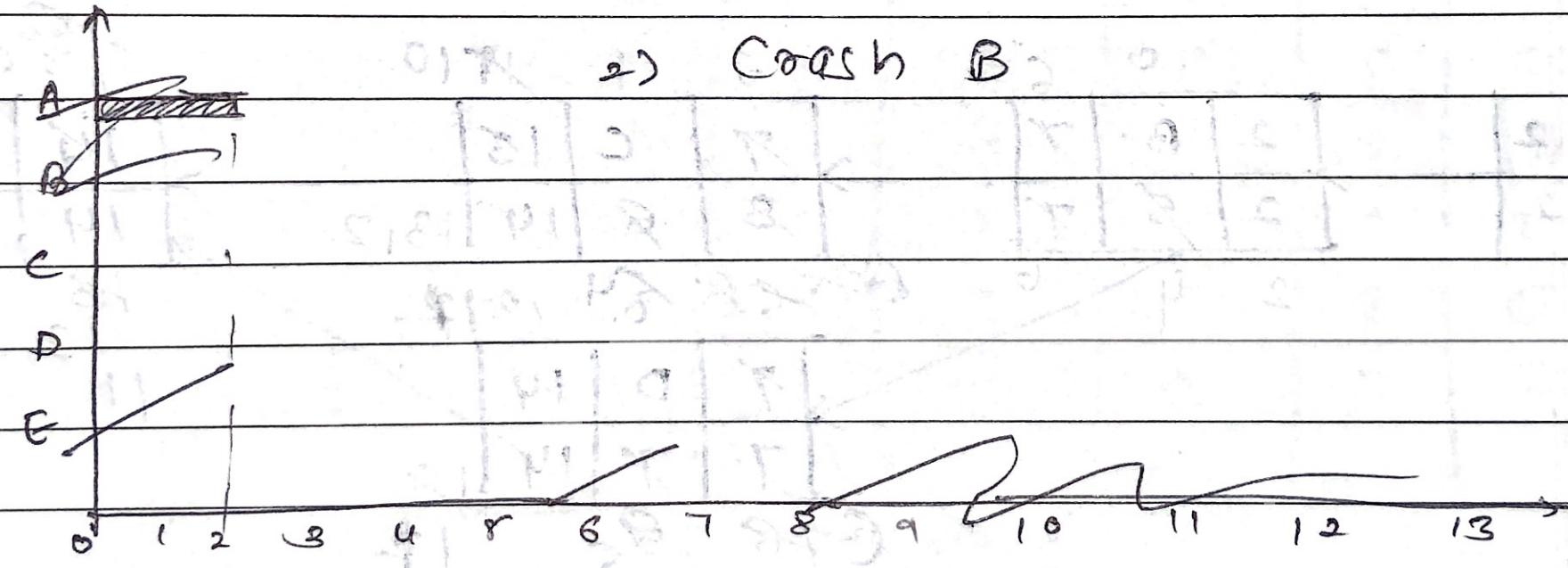
## \* Project crashing.

Activity	Preed.	Normal Durat.	Crash Duration
A	-	2	2
B	A	5	4
C	B	6	4
D	B	7	5
E	depends on C, D	long	3



" If we crash 'E'

then



$$18 \times 600 = 10,800$$

$$8 \times 100 = 800$$

$$\underline{\quad \$18,800 \quad}$$

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### ~~Procurement~~ (~~To Get~~)

- ↳ acquiring a goods or services from ~~outsourcing~~



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### Activity

Activity	Normal	Crash	Cost of cost
A	-	2	\$1200
B	5	4	\$1800
C	6	4	\$1700
D	7	5	\$1500
E	4	3	\$1900

$\sum \$8100$

- ① Now crash B ② Now select E

- ③ Now crash C ④ Now crash D ⑤ Now crash E

WE cannot crash 'C' because it is not on critical path

For crashing first we select E

Now crash B

Now select D

Now crash C

Now crash D

Now crash E

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Now crash B

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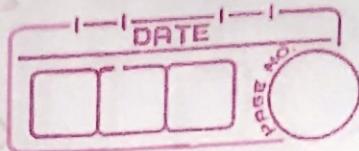
Now crash C

Now crash D

Now crash E

Now crash B

Now



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## Resource Leveling

## Resource Loading and Leveling.

Activity	Predecessor	Duration	Cost/day
A	-	2	300
B	A	3	400
C	B	3	400
D	B	2	200
E	D	3	100

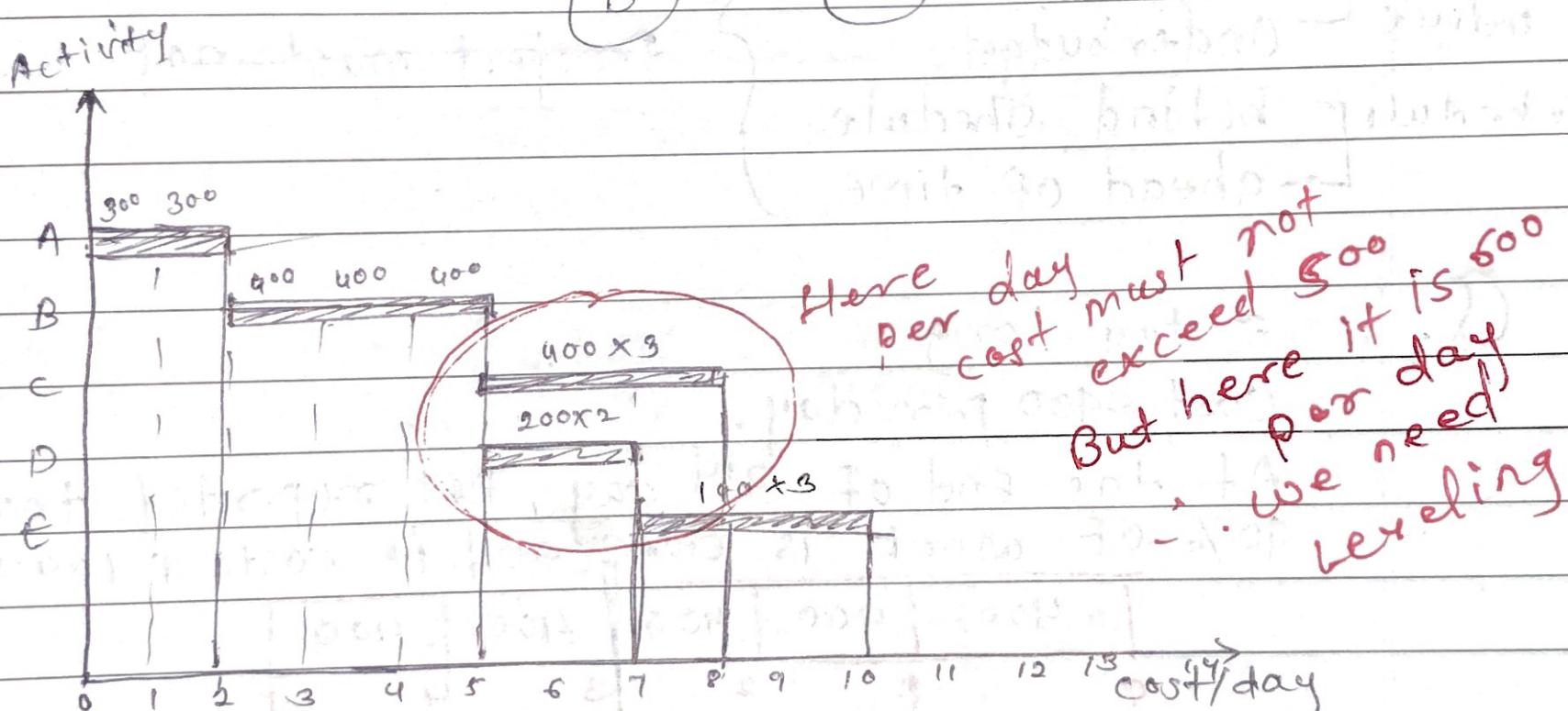
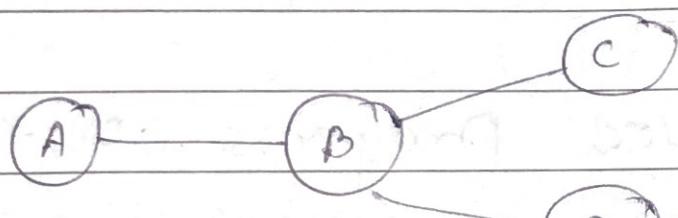


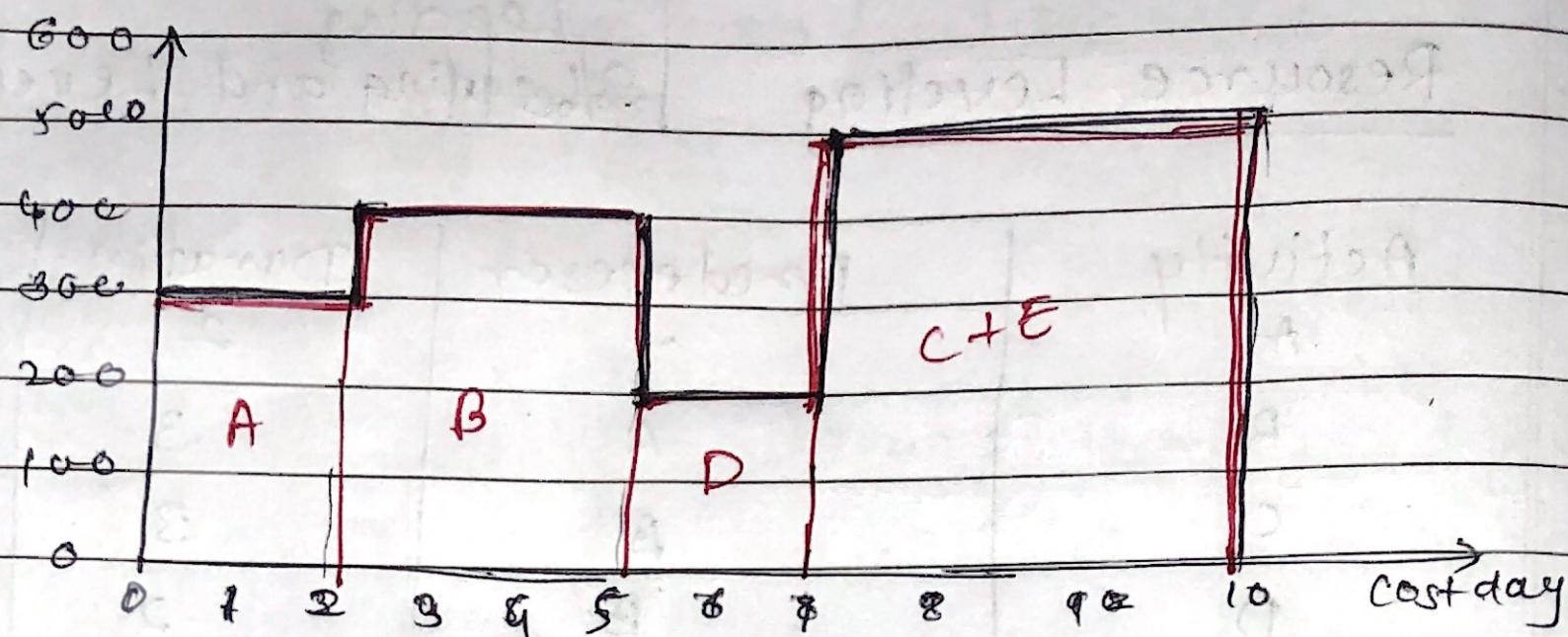
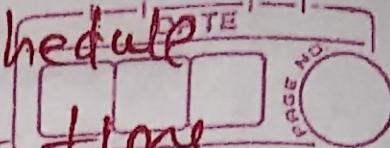
Fig. Load diagram.

$SPI < 1 \rightarrow$  behind schedule

$SV$  is -ve  $\rightarrow$  behind schedule

$SPI > 1 \rightarrow$  ahead of time

$SV$  is +ve



## Earned Value Analysis

It is used to measure progress of the project

Cost performance

Over budget

Under budget

Schedule performance

Behind schedule

Ahead of time

Project must not

Q. 5 day long

Cost \$400 per day.

At the end of 3<sup>rd</sup> day, PM reported that only 40% of work is done and it costs \$1000

400	400	400	400	400
0	1	2	3	4

Reporting day

Find earned value and decide

AC  $\rightarrow$  Actual cost (Actual cost of work scheduled) ACWS

EV  $\rightarrow$  Earned value (BCWP) Budget cost of work performed

PV  $\rightarrow$  Planned value (BCWS)  $\rightarrow$  u  $\longrightarrow$  schedule

$CPI < 1$  — overbudget

$CPI > 1$  — Underbudget

$CV$  is -ve — Overbudget

$CV$  is +ve — Underbudget



$$AC = \$1000$$

$$EV = \$800$$

$$2000/40 = 800$$

$$PV = \$1200$$

$$CPI \text{ (Cost performance Index)} = \frac{BCWP}{BCWP} - \frac{EV}{AC}$$

$$= \frac{800}{1000}$$

$$CPI < 1$$

$$CV = EV - AC = 800 - 1000 = -200$$

As  $CV$  is negative AS  $CV$  is -ve

∴ It is Overbudget.

$$SPI = \frac{BCWP(EV)}{BCWS(PV)} = \frac{800}{1200} = 0.67 < 1$$

$$\text{If } SPI < 1$$

∴ It is behind schedule

$$SV = EV - PV = 800 - 1200 = -400$$

as  $SV$  is negative

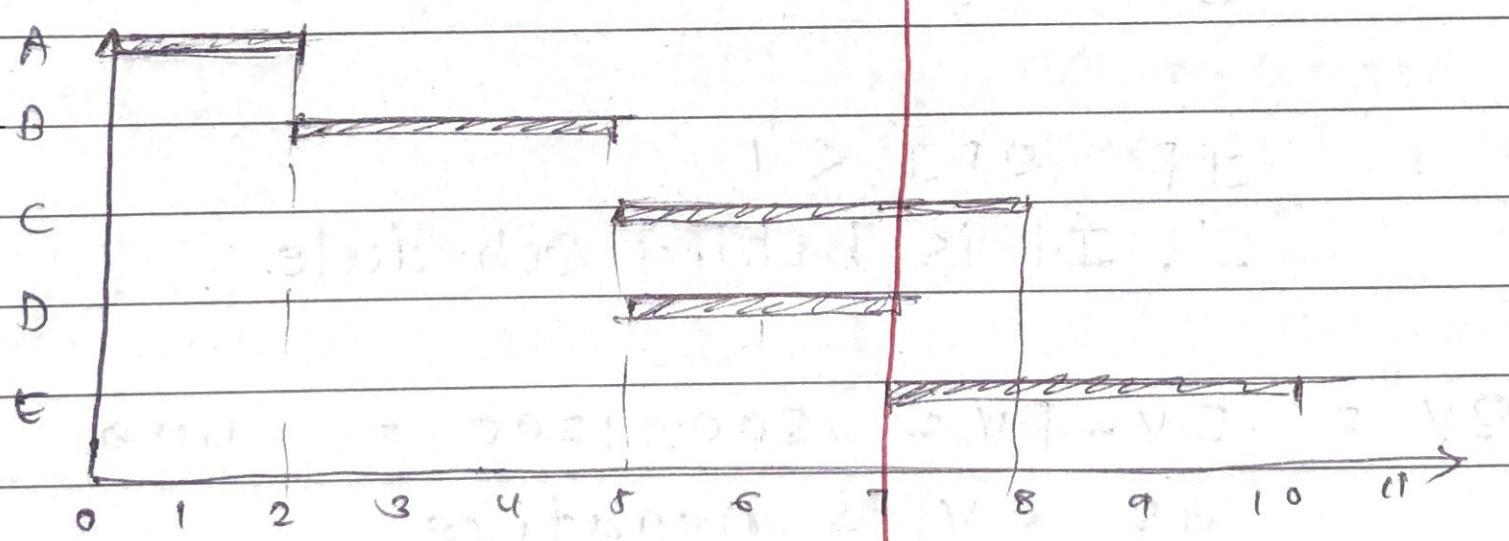
∴ It is behind schedule.

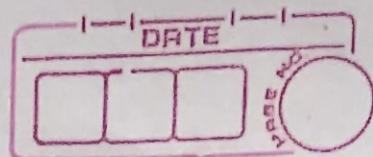
## Example

Activity	Predecessor	Duration	Cost / day	Total cost
A	-	2	300	600
B	A	3	400	1200
C	B	3	400	1200
D	B	2	200	400
E	D	3	100	300

At the end of 7<sup>th</sup> day it is reported that  
Field report

AC	EV	PV	Activity	Actual % completed	Incurred cost
600	600	600	A	100	600
1400	1200	1200	B	100	1400
500	400	800	C	80	500
200	200	400	D	50	200
0	0	0	E	0	0





$$AC = 2700$$

$$EV = 2400$$

$$PV = 3000$$

$$SPI = \frac{2400}{3000} = 0.8$$

$$SV = 2400 - 3000 = -600$$

$$CPI = \frac{2400}{2700} = 0.889$$

$$CV = 2400 - 2700 = -300$$

as SPI < 1 and SV is -ve, the project is behind schedule

as CPI < 1 and CV is -ve, the project is overbudget.