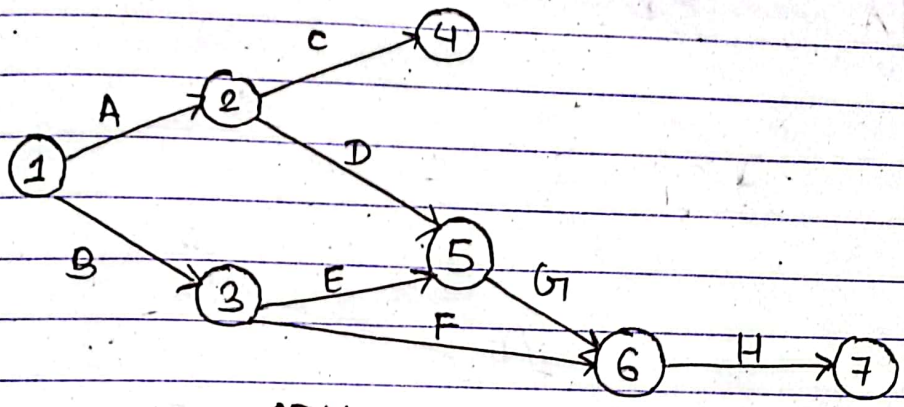
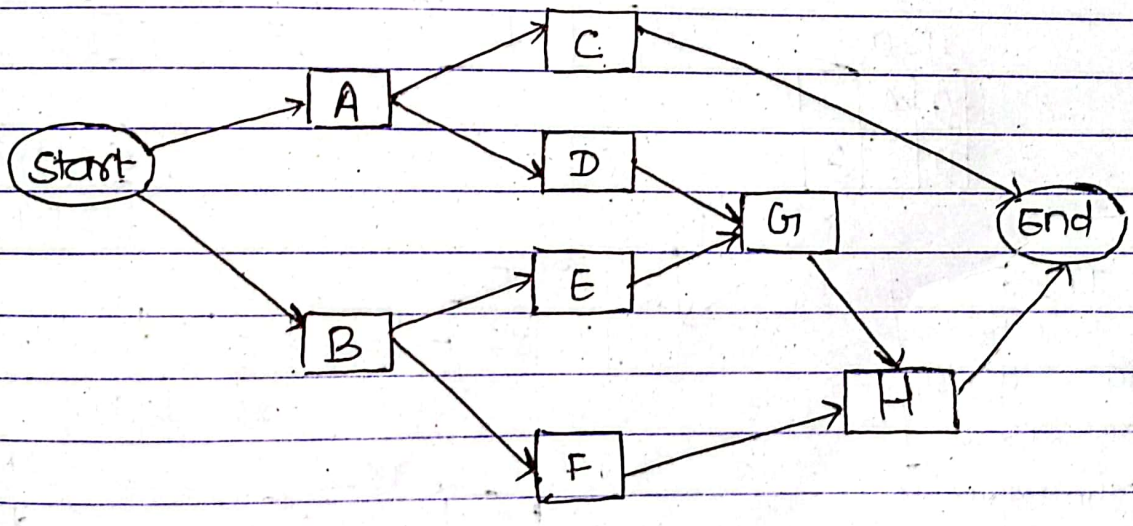
ICT-PM

Q) Generate the Network Diagram for the following data:

Activities	Predecessors
A	--
B	--
C	A
D	A
E	B
F	B
G	D,E
H	F,G



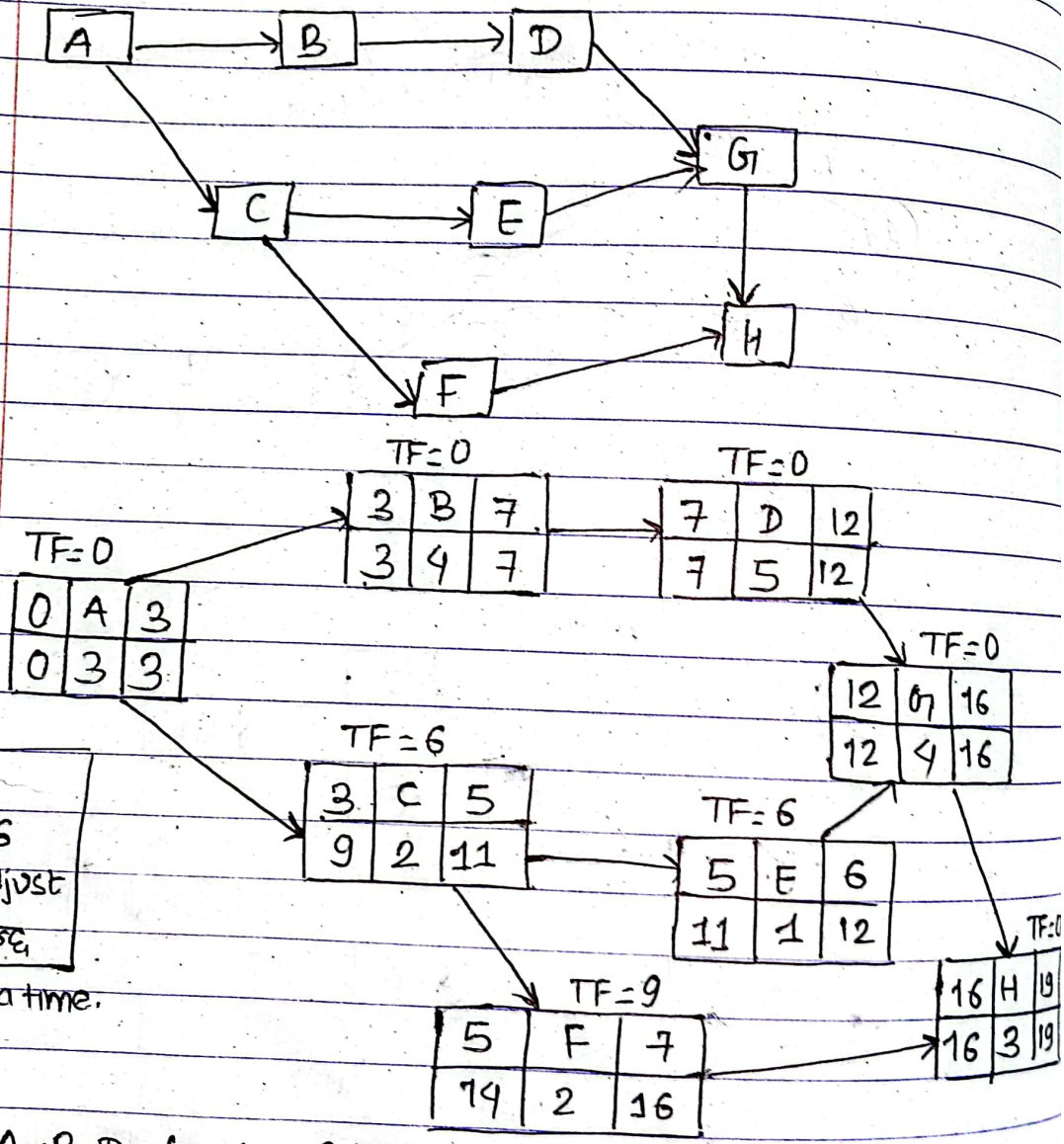
ADM



PDM

Act	predecessor	Duration (days)
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

Calculate the earliest duration of project completion.



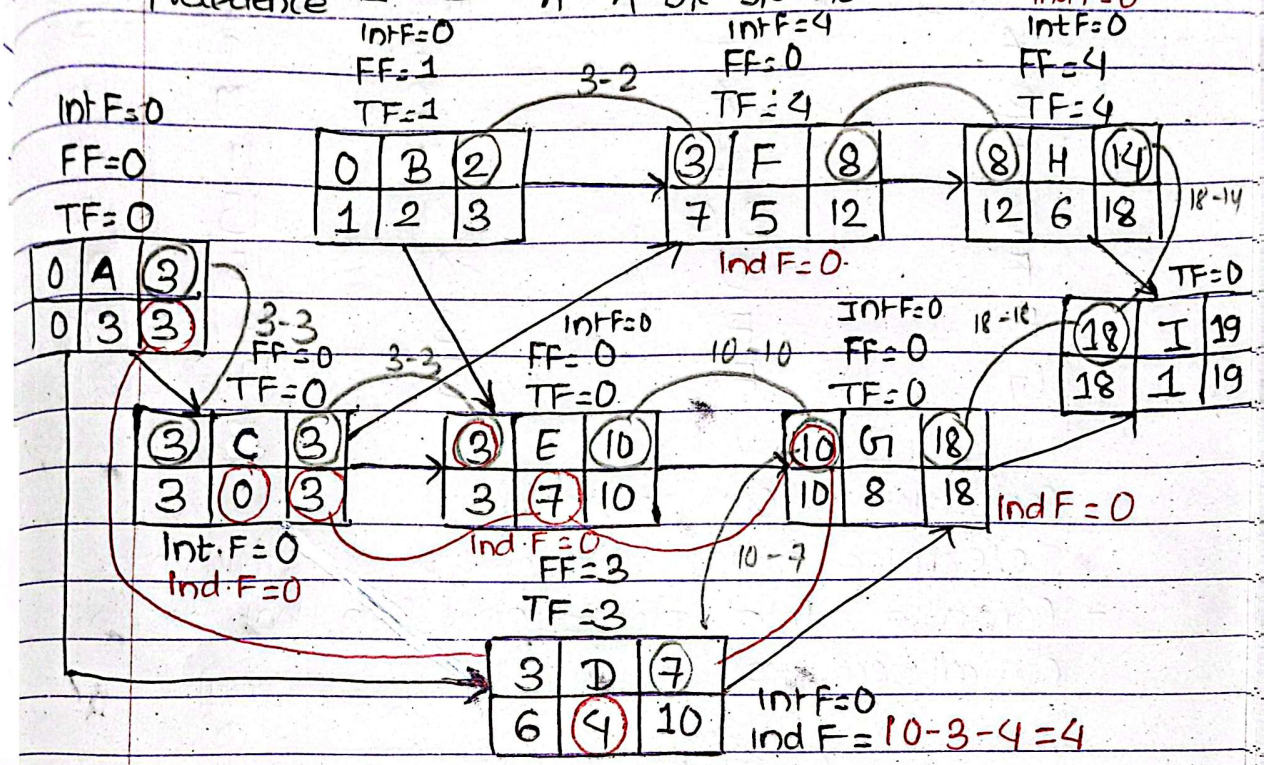
TF=6
Project 6
न ले adjust
र्न सकिन्छ
din extra time.

A-B-D-G-H = 3+4+5+4+3 = 19
A-C-E-G-H = 3+2+1+4+3 = 13
A-C-F-H = 3+2+2+3 = 10.

Total Float (TF)
TF = LF - EF
TF = LS - ES

Total Float: कुनै पनि activity maximum कति दिनले ढिला गर्न सकिन्छ, without affecting the project completion time.

# Activity	A	B	C	D	E	F	G	H	I
Duration	3	2	0	4	7	5	8	6	1
Precedence	—	—	A	A	B,C	B,C	D,E	F	G,H



A-C-F-H-I = 3+0+5+6+1 = 15

A-D-G-I = 3+4+8+1 = 16

B-F-H-I = 2+5+6+1 = 14

B-E-G-I = 2+7+8+1 = 18

A-C-E-G-I = 3+0+7+8+1 = 19

Free Float (FFi) = min(ESi+i) - EFi

Int. Fi = TFi - FFi (Interfering Float)

Ind. Fi = min(ESi+1) - max(LFi-1) - Duration.

Act	D	ES	EF	LS	LF	TF	FF	Int. F	Ind F
A	3	0	3	0	3	0	0	0	
B	2	0	2	1	3	1	1	0	
C	0	3	3	3	3	0	0	0	0
D	4	3	7	6	10	3	3	0	4
E	7	3	10	3	10	0	0	0	0
F	5	3	8	7	12	4	0	4	0
G	8	10	18	10	18	0	0	0	0
H	6	8	14	12	18	4	4	0	0
I	1	18	19	18	19	0	0	0	

EF = ES+D

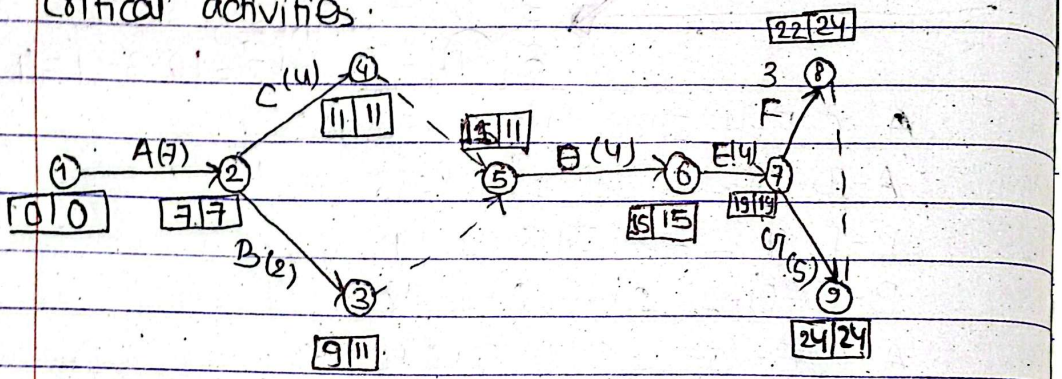
LS = LF-D

AOA

Consider the details of project as shown:

Activity	predecessor	Time (days)	ES	LS	EF	LF	TF
A	–	7	0			7	
B	A	2	7			11	
C	A	4	11			11	
D	B,C	4	15			15	
E	D	4	15			19	
F	E	3	19			24	
G	E	5	19			24	

- Construct a CPM network.
- Determine critical path and project completion time.
- Compute total floats and free float for non critical activities.



1-2-4-5-6-7-8-9 = ~~7+0+3~~ 7+4+4+4+3 = 22

1-2-4-5-6-7-9 = 7+4+4+4+5 = 24

1-2-3-5-6-7-8-9 = 7+2+4+4+3 = 20

1-2-3-5-6-7-9 = 7+2+4+4+5 = 22

A	D	ES	LS	EF	LF	TF	FF
A	7	0	0	7	7	0	0
B	2	7	9	9	11	2	2
C	4	7	7	11	11	0	0
D	4	11	11	15	15	0	0
E	4	15	15	19	19	0	0
F	3	19	21	22	24	2	2
G	5	19	19	24	24	0	0

ESi	LFj

ESi = Early start time (tail event)

LFj = Late finish time (head event)

FF = TF - Si (slack of head event)

Slack time for each activity ⇒ TF ⇒ LS-ES or LF-EF

PERT

- to
- tp
- tm

t_e

$$\Delta = \frac{t_o + t_p + t_m}{3}$$

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

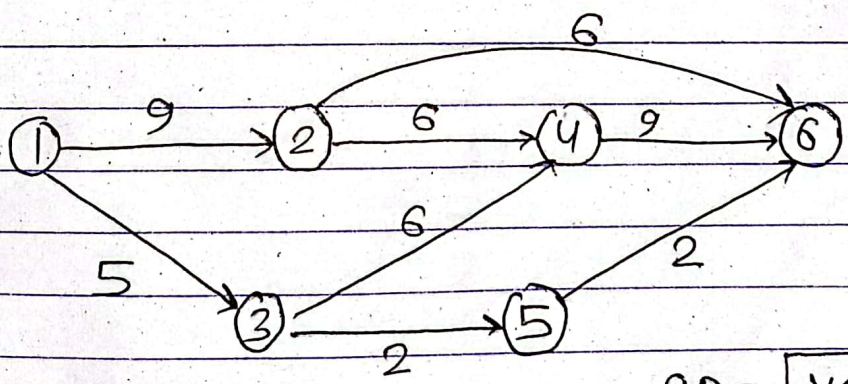
$$V = \left(\frac{t_p - t_o}{6}\right)^2$$

$$S.d = \sqrt{V_1 + V_2 + V_3 + V_4}$$

where ($V_1, V_2, V_3 \cdots$ are the variance of critical activities).

process — total estimate

activities	to	tm	tp	te	V	Remarks
1-2	6	9	12	9	1	C.P
1-3	3	4	11	5	1.78	
2-4	2	5	14	6	4	C.P
3-4	4	6	8	26	0.44	
3-5	1	15	5	62	0.44	
2-6	5	6	7	56	0.11	
4-6	7	8	15	95	1.78	C.P
5-6	1	2	3	2	0.11	



P1 = 1-2-6 = 15

P2 = 1-2-4-6 = 24 | C.P

P3 = 1-3-5-6 = 9

P4 = 1-3-4-6 = 20

S.D = $\sqrt{V_1 + V_3 + V_7}$

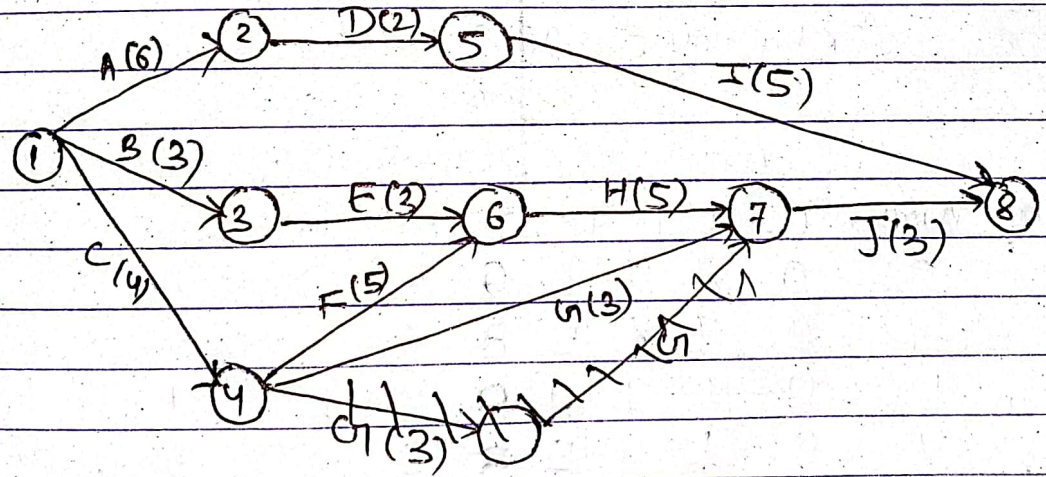
= $\sqrt{1 + 4 + 1.78}$

= 2.60

For the given project with following details:

a) Find the expected duration and variance of each activity.
b) Find the critical path and expected project completion time.
c) Find the probability of completing the project on or before 22 weeks?

8 Remarks	1 Activity	2 Predecessor	3 opt time (to)	4 most lik. time (tm)	5 pessimi time (tp)	6 Exp. duration $t_e = \frac{t_o + 4t_m + t_p}{6}$	7 Variance $v_i = \left(\frac{t_p - t_o}{6}\right)^2$
	A	–	5	6	7	6	0.11
	B	–	1	3	5	3	0.44
C.P	C	–	1	4	7	4	1
	D	A	1	2	3	2	0.11
	E	B	1	2	9	3	1.78
C.P	F	C	1	5	9	5	1.78
	G	C	2	2	8	3	1
C.P	H	E, F	4	4	10	5	1
	I	D	2	5	8	5	1
C.P	J	H, G	2	2	8	3	1



P1 = A – D – I = 6 + 2 + 5 = 13

P2 = B – E – H – J = 3 + 3 + 5 + 3 = 14

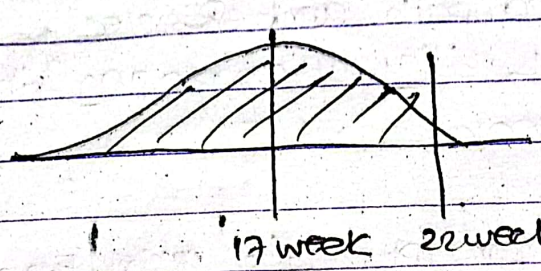
P3 = C – F – H – J = 4 + 5 + 5 + 3 = 17

P4 = C – F – G – J = 4 + 3 + 3 = 10.

Ind.F = FF - Si

Expected project completion time.

te = 17 weeks.



$$Z = \frac{X - te}{S.d}$$

$$S.d = \sqrt{1^2 + 1.78^2 + 1^2 + 1^2}$$

$$= 2.18.$$

$$Z = \frac{22 - 17}{2.18}$$

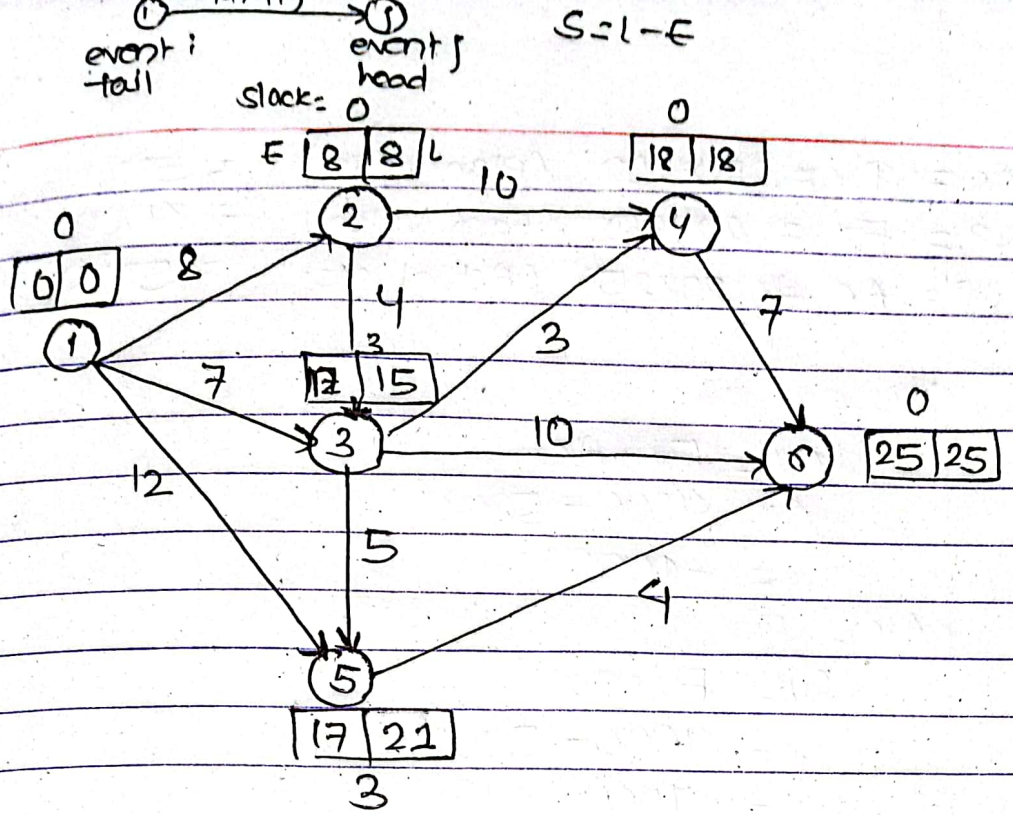
$$= 2.28$$

From z table

Probability = 0.9887

= 98.87%.

Activity	Duration	ES	EF (ES+D)	LS	LF	TF	FF	TF-SH	FF-SF	TF-FF
1-2	8	0	8	0	8	0	0	0	0	
1-3	7	0	7	8	15	8	5	5	3	
1-5	12	0	12	9	21	9	5	5	4	
2-3	4	8	12	11	15	3	0	0	3	
2-4	10	8	18	8	18	0	0	0	0	
3-4	3	12	15	15	18	3	3	0	0	
3-5	5	12	17	16	21	4	0	-3	4	
3-6	10	12	22	15	25	3	3	0	0	
4-6	7	18	25	18	25	0	0	0	0	
5-6	4	17	21	21	25	4	4	0	0	



Control costs: Tools and Techniques:

Earned Value Management (EVM / EVA) Analysis:

PV: Plan value: budgeted value. $Work_P$ $Cost_P$

AC: Actual cost: $Work_A$ $Cost_A$

SV: schedule variance: EV - PV ⇒ SV +ve ⇒ काम ज्यादा (EV बढ़ी)

CV: cost variance: EV - AC ⇒ CV +ve ⇒ खर्च कम्ता काम ज्यादा काम बढ़ी
-ve ⇒ खर्च ज्यादा काम कम.
पैसा अनुसार काम गएना।

SPI: Scheduled Performance Index = $\frac{EV}{PV} > 1$

CPI: cost performance Index = $\frac{EV}{AC} > 1$

Example:

50 units of plantation have to be done in two weeks period. Per unit cost of plantation is estimated at Rs 200 of which progress monitoring was done one week after the work was started. only 40% work was found completed and the account record showed that the actual expenditure (cost) for plantation per unit was Rs 250.

Compute: PV, EV, AC, SV, C.V, SPI & CPI.

BCWS = PV = 25 X 200 (plan value) = 5000
BCWP = EV = 20 X 200 (Earn value) = 4000
ACWP = AC ⇒ 20 X 250 (Actual cost) = 5000

NOW,

$$CV = EV - AC$$
$$= 4000 - 5000$$
$$= -1000$$

ALSO,

$$SV = EV - PV$$
$$= 4000 - 5000$$
$$= -1000$$

$$CPI = \frac{EV}{AC} = \frac{4000}{5000} = 0.8$$

प्रति खर्च आइ रहेको 80% काम भएको छ।

$$SPI = \frac{EV}{PV} = \frac{4000}{5000} = 0.8$$

S-curve:

TCPI : To complete performance index
BAC : Budget at completion. BAC = 50 X 200 = 10,000.
VAC : variance at completion.
EAC : Earned at completion. $EAC = \frac{BAC}{0.8(CPI)} \Rightarrow \frac{10000}{0.8} = 12,500.$
ETC : Estimate to complete ⇒ EAC − AC ⇒ 11000 − 5000
= 7000.

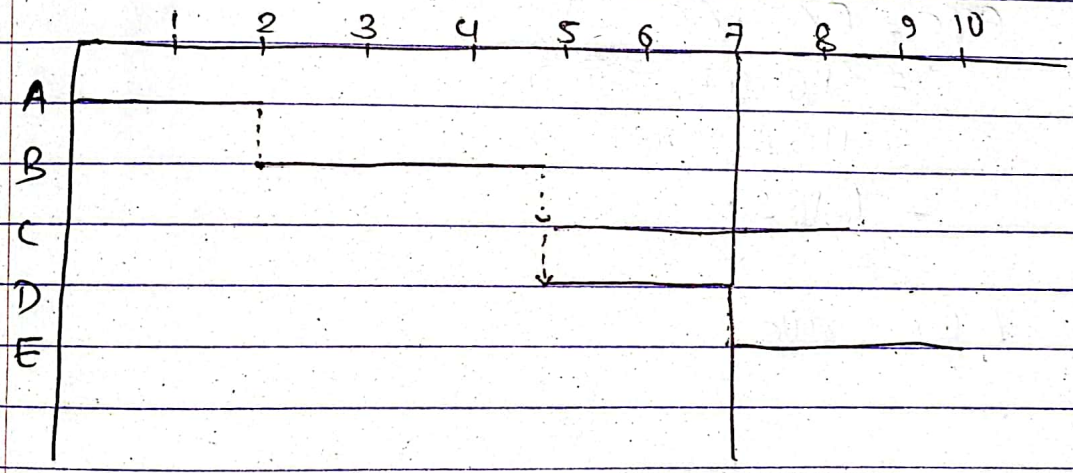
2021 - spring :

Total cost = BAC

Activity	Predecessor	Duration (days)	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

After 7th day, field report says something like below.

Activity	Actual % complete	Incurred cost.
A	100	600
B	100	1400
C	33	500
D	50	200
E	0	0.



Act	Pred	Dur	PV	EV	AC (Incurred cost.)
A	–	2	600	600	600
B	A	3	1200	1200	1400
C	B	3	800	400	500
D	B	2	400	200	200
E	D	3	0	0	0
			3000	2400	2700

EV = Actual work (%) x budgeted value.

CV = EV - AC
= 2400 - 2700
= -300

SV = EV - PV
= 2400 - 3000
= -600.

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

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

BAC = 3700.

$EAC = \frac{BAC}{CPI} = \frac{3700}{0.889} = 4161.97 = 4162.$

ETC = EAC - AC
= ~~4161.97 - 2700~~
= 4162 - 2700
= 1462.

* 7-basic rule: