Dummy PERT problem 2

Draw the network and identify the critical path for the following project. Please calculate the earliest-latest start and finishing times for each activity. Please show the expected time for 68%, 90% and 95% confidence limit for the project:

Activity	Preceding Activity	Time (weeks)	Optimistic Time.	Pessimistic time
A	___	5	4	6
B	___	4	3	5
C	A, B	7	5	9
D	B	8	7	9
E	B	5	2	8
F	C	5	1	9
G	D	13	10	16
H	D, E	8	6	10
I	F, G, H	4	3	5

Please note
1. A and B Activities originate from the Start Node
2. C needs both A and B to start, but they are at different times
3. A Dummy activity has 0 time, ES=EF match end of preceding activity, LS = LF match the beginning of following activity
4. Activity H needs both D and E to finish before starting
5. Activity I is the end activity with the 3 input activities: F G & H

Critical. /Optimal path is
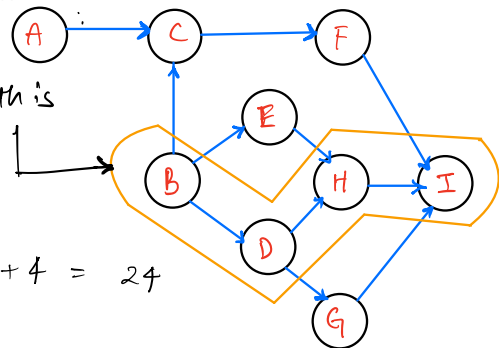
Project completion time for Critical Path = $4 + 8 + 8 + 4 = 24$

$$\sigma_B = \frac{Pen - Opt}{6} = \frac{5-3}{6} = 0.333$$

nly

$$\sigma_D = 0.333$$

$$\sigma_H = 0.666$$

$$\sigma_I = 0.333$$

$$\sigma_P = \sqrt{\sigma_B^2 + \sigma_D^2 + \sigma_H^2 + \sigma_I^2}$$

$$= 0.8811$$

i) for 68%.

$$CI = 24 \pm \sigma_{Project} = 24 \pm 0.8811$$

ii) for 90%

$$CI = 24 \pm 1.645 * \sigma_{Project} = 24 \pm 1.4494$$

iii) for 95%
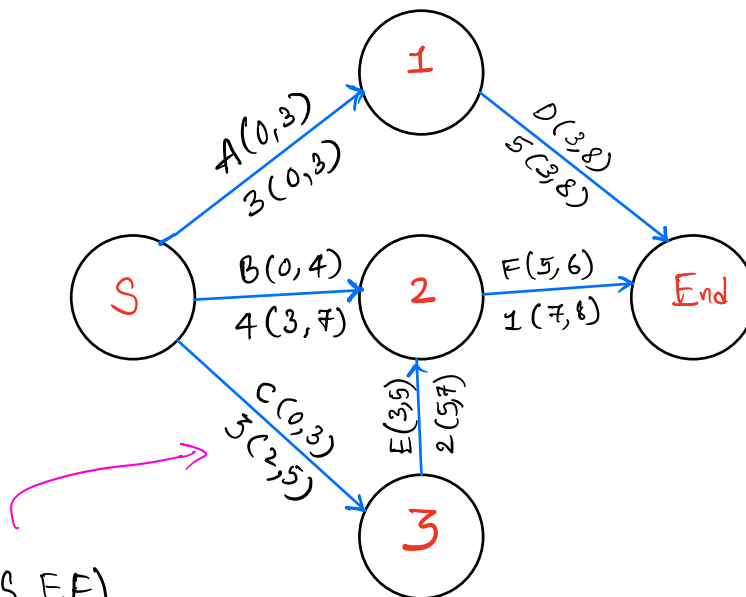
$$CI = 24 \pm 2 * \sigma_{Project} = 24 \pm 1.7622$$

Problem 7.2

Activity	Start Node	End Node	Activity Time	Staff Required	Slack Time
A	S	1	3	2	
B	S	2	4	4	
C	S	3	3	1	
D	1	End	5	3	
E	3	2	2	1	
F	2	End	1	3	

a. Draw a PERT chart with earliest and latest start and finish times. Fill in the slack time of all activities and show the critical path.

b. For the project duration, show the staffing profile in people, beginning at the earliest time (forward pass).

c. For the project duration, show the staffing profile in people, beginning at the latest time (backward pass).

d. Suggest moving only one activity to best level staffing requirements (from either forward or backward pass).

e. Which one activity is best to crash to shorten the project time? Show the results and the new critical path(s) if you crash the one activity.

Sol

a) Pert chart.

Activity (ES, EF)

time (LS, LF)

A(0,3) 3(0,3)

B(0,4) 4(3,7)

C(0,3) 3(2,5)

D(3,8) 5(3,8)

F(5,6) 1(7,8)

E(3,5) 2(5,7)

Activity	Start Node	End Node	Activity Time	Staff Required	Slack Time
A	S	1	3	2	0
B	S	2	4	4	3
C	S	3	3	1	2
D	1	End	5	3	0
E	3	2	2	1	2
F	2	End	1	3	2

Slack = LS - ES

Activity slack = 0

b) forward Pass

Activity \ Week	1	2	3	4	5	6	7	8
A	2	2	2					
B	4	4	4	4				
C	1	1	1					
D				3	3	3	3	3
E				1	1			
F						3		
Total	7	7	7	8	4	6	3	3

Staff required:

→ 2
→ 4
→ 1 } → 8
→ 0
→ 1
→ 0

= 45

Δ = 8 - 3
= 5

c) backward Pass

Activity \ Week	1	2	3	4	5	6	7	8
A	2	2	2					
B				4	4	4	4	
C			1	1	1			
D				3	3	3	3	3
E						1	1	
F								3
Total	2	2	3	7	7	7	7	6

Staff required:

→ 2
→ 4
→ 1 } → 9
→ 2
→ 0
→ 0

= 41

Δ = 7 - 2
= 5

d) If we move activity E in forward pass to a time period later, i.e currently E is starting at 3, if E starts at 4, we can further reduce a staff, as 4 staff from B will be free, from which, 3 can be used for F, and 1 can be used for E.

∴ The total staff required in this case would become 7

⇒ Staffing Profile :⟶ 7 staff needed

Problem 7.4

7.4. A construction company successfully bid on a contract to repave 20 miles of city road @ $30,000/mile with eight weeks to complete. Two (2) weeks into the project, the company spent $100,000 and completed four miles. Calculate the following terms, making sure that the sign of each term is correct, and indicate whether the company is ahead or behind schedule and budget.

Planned versus snapshot (at two weeks) activities:

BAC

PV or BCWS

EV or BCWP

AC or ACWP

CV

Company is ahead _____ or behind _____ budget

SV

Company is ahead _____ or behind _____ schedule

CVI

SVI

Project Completion Estimate Activities:

EAC

ETC

VAC

Sol^r

a) BAC = cost per mile × total miles

= 30,000 × 20 = $600,000

Total time = 8 weeks.

Cost per week = $\frac{600,000}{8}$ = 75,000 $

b) PV/BCWS = $75,000 @ 2 = $150,000

c) EV/BCWP = $30,000 @ 4 = $120,000

d) AC/ACWP = $100,000

e) CV = BCWP − ACWP

= $120,000 − $100,000

= $20,000 (+ve)

Company is under budget

(Project is under budget)

f) SV = BCWP − BCWS

= $120,000 − $150,000

= −$30,000   (−ve)

∴ Project is behind Schedule
& Company.

g) CVI

= $\dfrac{BCWP}{ACWP}$ = $\dfrac{\$120,000}{\$100,000}$ = 1·2 > 1

↓↓
Earnings are more
than amount spent

h) SVI

= $\dfrac{BCWP}{BCWS}$ = $\dfrac{\$120,000}{\$150,000}$ = 0·8 < 1

↓
Less work completed
than planned.

i)

EAC = AC + (BAC − EV)

= $580,000

ETC = BAC − EV

= $480,000   (company under budget)

VAC = BAC − EAC

= $20,000   → +ve → Budget Underrun