

Slack :- It is a time duration by which an event can be delayed without affecting the completion time of project.

$$S = T_L - T_E \text{ of any event}$$

Note :- ① Slack is used in PERT Network.

② In PERT Network critical path is that path along which the value of slack for each event is zero or minimum.

There may be three type of slack :-

① (+ve) Slack :- When $T_L > T_E$

① positive slack represent excess of resources.

② An event having positive slack is called non-critical or subcritical event.

③ zero slack :- $S = 0$ $T_L = T_E$

① It represent that activity are on schedule or we can not effort this event to get delay.

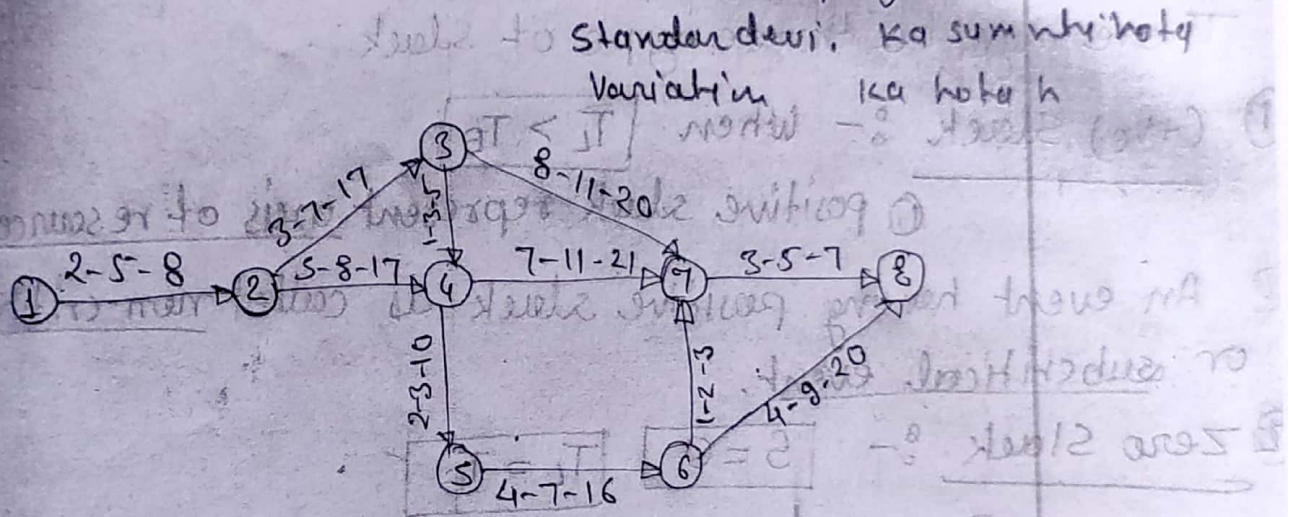
② An event having zero slack is called critical event. If any of the critical event is delay then whole project will delay.

④ Negative Slack :- $S < 0$ $T_L < T_E$

It represent that the event is behind the schedule. It represent lack of resource.

Any event having negative slack are called super critical event.

Question The time estimate in days for optimistic, pessimistic and most likely time of various activity are shown below. in the network diagram, obtain the expected time, Latest Latest time for each event - draw the critical path and estimate the approximate value of standard deviation and variance for the project.

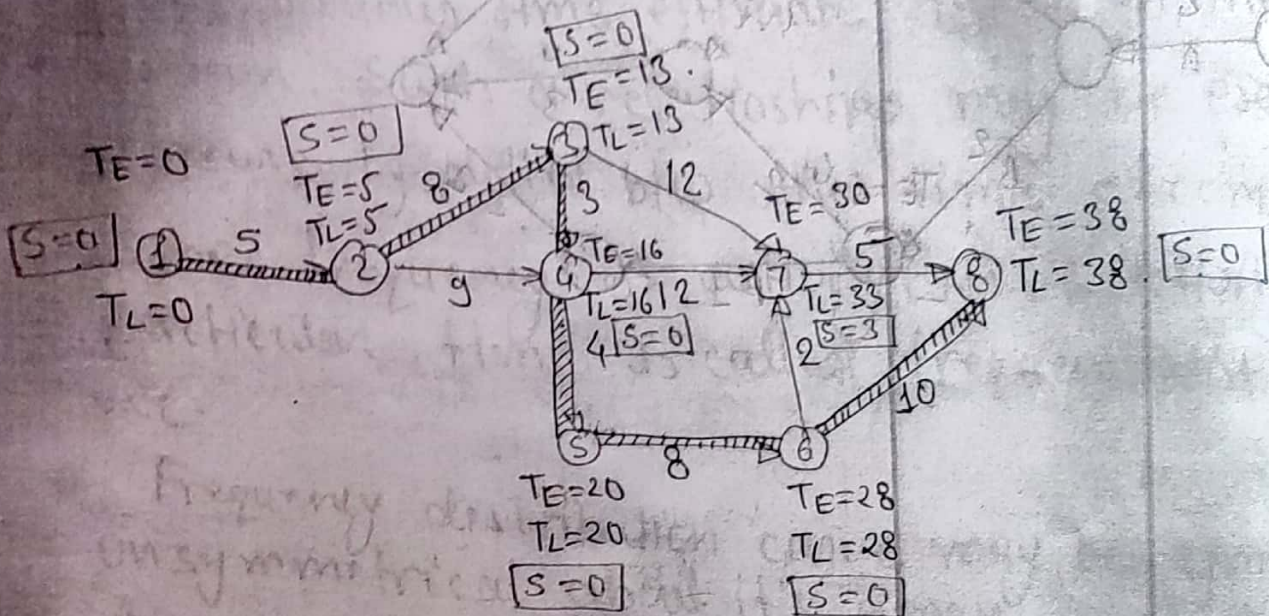


Solution:

| Activity | t_o | t_m | t_p | t_e | σ | σ^2 | Critical Path | |
|----------|-------|-------|-------|-------|----------|------------|---------------|--------------------|
| 1-2 | 2 | 5 | 8 | 5 | 1 | 1 | ①-②-③-④-⑤-⑥-⑧ | |
| 2-3 | 3 | 7 | 17 | 8 | 2.33 | 5.43 | | Expected time = 38 |
| 2-4 | 5 | 8 | 17 | 9 | 2 | 4 | | ② Variation |
| 3-4 | 1 | 3 | 5 | 3 | 0.66 | 0.45 | | |
| 3-7 | 8 | 11 | 20 | 12 | 2 | 4 | | |
| 4-5 | 2 | 3 | 10 | 4 | 1.33 | 1.77 | | |
| 4-7 | 7 | 11 | 21 | 12 | 2.33 | 5.43 | | |
| 5-6 | 4 | 7 | 16 | 8 | 2 | 4 | | |
| 6-7 | 1 | 2 | 3 | 2 | 0.33 | 0.11 | | |
| 6-8 | 4 | 9 | 20 | 10 | 2.67 | 7.13 | | |
| 7-8 | 3 | 5 | 7 | 5 | 1 | 1 | | |

① Expected time $t_e = \frac{t_o + 4t_m + t_p}{6}$

② Standard deviation $\sigma = \frac{t_p - t_o}{6}$



② Variance of project

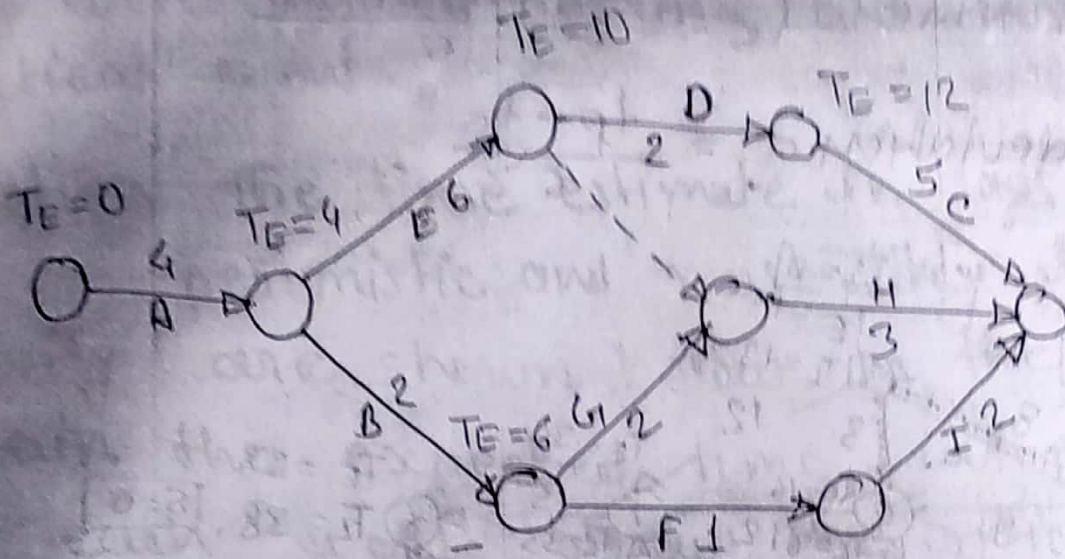
$$\sigma^2_{\text{project}} = 15.43 + 0.45 + 1.77 + 4 + 7.13$$

$$\sigma^2_{\text{project}} = 19.78$$

③ Std. deviation $\Rightarrow \sigma_{\text{project}} \Rightarrow \sqrt{\sigma^2_{\text{project}}} \Rightarrow \sqrt{19.78}$
 $\boxed{= 4.45}$

Case A: Network is form by the following activity the duration of activity is given below.

| Activity | A | B | C* | D | E | F | G | *H | I* |
|-------------|---|---|----|---|---|---|---|------|----|
| Preceded By | - | A | D | E | A | B | B | E; G | F |
| Duration | 4 | 2 | 5 | 2 | 6 | 1 | 2 | 3 | 2 |



$TE = 0$
 $TE = 4$
 $TE = 10$
 $TE = 6$
 $TE = 12$

Variance of project
 $\sigma^2_{project} = \sigma^2_A + \sigma^2_B + \sigma^2_C + \sigma^2_D + \sigma^2_E + \sigma^2_F + \sigma^2_G + \sigma^2_H + \sigma^2_I$