



Project Management for Managers

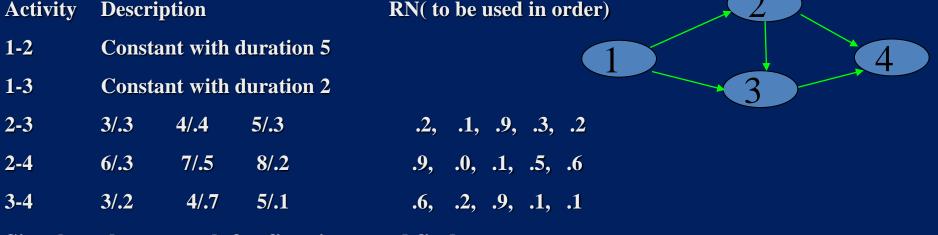
Lec – 44 Simulation of Networks- II

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A PERT network consists of five activities (1,2),(1,3),(2,3),(2,4) and (3,4) with following details.



Simulate the network for five times and find

- (a) Distribution of T the project duration,
- (a) Distribution of 1 the project duration,
- $\mathbf{(b)} \quad \mathbf{E}\left(\mathbf{T}\right),$
- (c) $P(T \le 14)$ and
- (d) Critical indexes of all the activities.
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First of all we find the relations connecting Tij to random numbers.

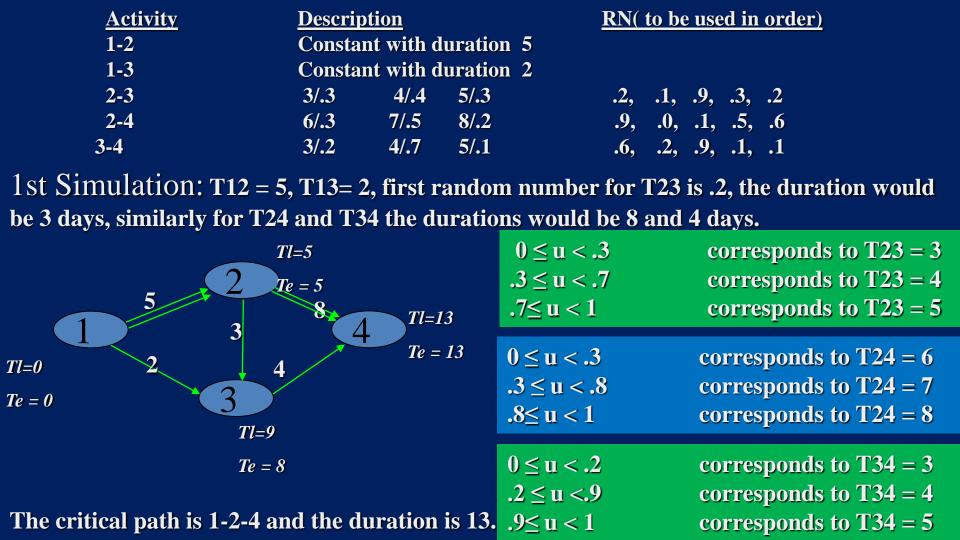
For T23:3/.34/.4 5/.3 $0 \le u < .3$ corresponds to T23 = 3 $.3 \le u < .7$ corresponds to T23 = 4corresponds to T23 = 5 $.7 \le u < 1$ Similarly, For T24: 6/.3 7/.5 8/.2 $0 \le u < .3$ corresponds to T24 = 6corresponds to T24 = 7 $.3 \le u \le .8$.8 < u < 1corresponds to T24 = 8and For T34: 3/.2 4/.7 5/.1 $0 \le u < .2$ corresponds to T34 = 3

corresponds to T34 = 4

corresponds to T34 = 5

.2 < u < .9

 $.9 \le u < 1$



| <u>Activity</u> | Description F | | | N(to be used in order) | | | |
|--------------------------------|--|-----------|-----------------|----------------------------------|--|--|--|
| 1-2 | Constant | with d | uration 5 | | | | |
| 1-3 | Constant | with d | uration 2 | | | | |
| 2-3 | 3/.3 | 4/.4 | 5/.3 | .2, .1, .9, .3, .2 | | | |
| 2-4 | 6/.3 | 7/.5 | 8/.2 | .9, .0, .1, .5, .6 | | | |
| 3-4 | 3/.2 | 4/.7 | 5/.1 | .6, .2, .9, .1, .1 | | | |
| 2^{nd} Simulation: T12 = 5, | T13= 2, secon | d rando | m number for T2 | 3 is .1, the duration would be 3 | | | |
| days, similarly for T24 and T | days, similarly for T24 and T34 the durations would be 6 and 3 days. | | | | | | |
| | Tl=5 | | $0 \le u < .3$ | corresponds to T23 = 3 | | | |
| 5 | Te = 5 | Tl=12 | $.3 \le u < .7$ | corresponds to T23 = 4 | | | |
| 3 | | Te = 12 | .7≤ u < 1 | corresponds to T23 = 5 | | | |
| Tl=0 2 | 4 | | $0 \le u < .3$ | corresponds to T24 = 6 | | | |
| Te=0 | | | $.3 \le u < .8$ | corresponds to T24 = 7 | | | |
| Tl=8 | | | .8≤ u < 1 | corresponds to T24 = 8 | | | |
| Te = | 8 | | $0 \le u < .2$ | corresponds to $T34 = 3$ | | | |
| The critical path is 1-2-3-4 a | nd the duration | on is 12. | $.2 \le u < .9$ | corresponds to T34 = 4 | | | |
| | | | .9≤ u < 1 | corresponds to T34 = 5 | | | |

| <u>Activity</u> | Desc | ription | | RN(to be used in order) | | |
|---|----------------------|-----------|----------|--|--|--|
| 1-2 | Consta | nt with d | duration | n 5 | | |
| 1-3 | Consta | nt with d | duration | n 2 | | |
| 2-3 | 3/.3 | 4/.4 | 5/.3 | .2, .1, .9, .3, .2 | | |
| 2-4 | 6/.3 | 7/.5 | 8/.2 | .9, .0, .1, .5, .6 | | |
| 3-4 | 3/.2 | 4/.7 | 5/.1 | .6, .2, .9, .1, .1 | | |
| 3rd Simulation: $T12 = 5$, $T13 = 2$, third random number for $T23$ is .9, the duration would be 5 days, similarly for $T24$ and $T34$ the durations would be 6 and 5 days. | | | | | | |
| 5 | Tl=5 $Te=5$ | Tl=15 | .3 ≤ | u < .3 corresponds to $T23 = 3u < .7$ corresponds to $T23 = 4u < 1$ corresponds to $T23 = 5$ | | |
| Tl=0 $Te=0$ | 5 Tl=10 | Te = 15 | .3 ≤ | u < .3 corresponds to $T24 = 6u < .8$ corresponds to $T24 = 7u < 1$ corresponds to $T24 = 8$ | | |
| The critical path is 1-2- | Te = 10 3-4 and the | duration | is 15. | $0 \le u < .2$ corresponds to $T34 = 3$ $.2 \le u < .9$ corresponds to $T34 = 4$ | | |

 $.9 \le u < 1$ corresponds to T34 = 5

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| <u>Activity</u> | Description | | RN(to be used in order) | | | |
|--|--------------------------|-----------------|--------------------------|--|--|--|
| 1-2 | Constant with duration 5 | | | | | |
| 1-3 | Constant with duration 2 | | | | | |
| 2-3 | 3/.3 4/.4 | 5/.3 | .2, .1, .9, .3, .2 | | | |
| 2-4 | 6/.3 7/.5 | 8/.2 | .9, .0, .1, .5, .6 | | | |
| 3-4 | 3/.2 4/.7 | 5/.1 | .6, .2, .9, .1, .1 | | | |
| 4th Simulation: $T12 = 5$, $T13 = 2$, fourth random number for $T23$ is .3, the duration would be 4 days, similarly for $T24$ and $T34$ the durations would be 7 and 3 days. | | | | | | |
| , | Γl=5 | $0 \le u < .3$ | corresponds to T23 = 3 | | | |
| | TI-J | $.3 \le u < .7$ | corresponds to T23 = 4 | | | |
| 5 | Tl=12 | .7≤ u < 1 | corresponds to T23 = 5 | | | |
| | 4 | $0 \le u < .3$ | corresponds to T24 = 6 | | | |
| Tl=0 2 | Te = 12 | $.3 \le u < .8$ | corresponds to T24 = 7 | | | |
| Te=0 | | .8≤ u < 1 | corresponds to T24 = 8 | | | |
| Tl= | 9 | $0 \le u < .2$ | corresponds to T34 = 3 | | | |
| The critical paths are | = 9 - 1-2-4 and | .2 ≤ u <.9 | corresponds to $T34 = 4$ | | | |
| The critical paths are | , I 2 7 and | .9≤ u < 1 | corresponds to T34 = 5 | | | |
| 1-2-3-4 the duration is | 12. | | | | | |

| <u>Activity</u> | <u>D</u> | <u>escriptio</u> | <u>n</u> | RN(to be used in order) |
|----------------------------------|---------------------------|------------------|-----------------|---------------------------------------|
| 1-2 | Consta | nt with | duration 5 | |
| 1-3 | Consta | nt with | duration 2 | |
| 2-3 | 3/.3 | 4/.4 | 5/.3 | .2, .1, .9, .3, .2 |
| 2-4 | 6/.3 | 7/.5 | 8/.2 | .9, .0, .1, .5, .6 |
| 3-4 | 3/.2 | 4/.7 | 5/.1 | .6, .2, .9, .1, .1 |
| 5th Simulation: T12 | = 5 , T13 = | 2, fifth 1 | andom num | ber for T23 is .2, the duration would |
| be 3 days, similarly for T | '24 and T3 | 4 the du | rations would | d be 7 and 3 days. |
| | <i>l=5</i> | | $0 \le u < .3$ | corresponds to T23 = 3 |
| 5 | e=5 | | $.3 \le u < .7$ | corresponds to T23 = 4 |
| 3 | 4 | Tl=12 | .7≤ u < 1 | corresponds to T23 = 5 |
| Tl=0 | 3 | Te = 12 | v ≥ u < .5 | |
| Te = 0 | | | $.3 \le u < .8$ | corresponds to T24 = 7 |
| Tl=0 | 9 | | $.8 \le u < 1$ | corresponds to $T24 = 8$ |
| Te = | : 8 | | $0 \le u < .2$ | corresponds to $T34 = 3$ |
| The critical paths are 1-2-4 and | | | $.2 \le u < .9$ | corresponds to T34 = 4 |
| the duration is 12. | | | .9≤ u < 1 | corresponds to T34 = 5 |

From above

(a) Distribution of T is

Prob.

12

3/5=.6

13

1/5 = .2

(b) E(**T**)

12*.6+13*.2+15*.2 = 12.8

$$(c) P (T \le 14)$$



(d) Critical index

| SN | 1-2 | 1-3 | 2-3 | 2-4 | 3-4 | T |
|-------------------|-----|-----|-----|-----|-----|------|
| 1 | 1 | | | 1 | | 13 |
| 2 | 1 | | 1 | | 1 | 12 |
| 3 | 1 | | 1 | | 1 | 15 |
| 4 | 1 | | 1 | 1 | 1 | 12 |
| 5 | 1 | | | 1 | | 12 |
| Critical Index | 1 | 0 | .6 | .6 | .6 | 12.8 |

