These time-estimates are used in the time-cost optimization, in the critical path method. We have specified the relations between resources as cost which can be worked out separately.

*PERT time estimate*: In this technique, it is assumed that the activity durations follow a stochastic duration. Generally, - distribution is assumed in the model. To specify the procedure, following three activity durations are chosen

a. Most likely time,

   This time is the time when activity has more probability to occur than any other activity. This is the tallest pick in the probability distribution, i.e. mode.

b. Most optimistic time,

   This time has 95% fastest occurrence than the occurrence of any other activity. This is the shortest duration assumed .We mean here is that optimistic time has 19 times fastest in every 20-occurrence time.

c. Most pessimistic time.

   This time has 95% slowest occurrence than the occurrence of any other activity. This is the longest duration assumed .We mean here is that pessimistic time has 19 times slowest in every 20-occurrence time.

   Based on the above time estimate, the average time taken for the completion of the activity or job is called expected time. Taking weighted average, we can obtain the expected time as

## Network Based Project Management(Activity Time)

### Activity Time

In the network, it is important to know the criticality of the activity, time available to perform the activity provided date of completion of a project. In the previous section we have already talked about various method of obtaining activity duration. We shall be interested in the question that

1. How early we can start the activity.
2. How much we can delay the activity such that target date of completion of project is not affected
3. What the time available to perform the activity.

To answer the above question we shall associate (define) following time with an activity

a) Early start time

b) Early finish time

c) Latest start time

d) Latest finish time

a) **Early start time: - It is the earliest time by which an activity can started.**

**Let $t^{ij}$ be the activity between events i and j. Let $T_E^i$ is the earliest expected time of the event i then**

**Earliest start time is equal is to**

$$EST = T_E^i$$

**b) Earliest finish time: The earliest finish time of an activity is the time by which an activity can be finished earliest. The earliest finish time of an activity is earliest start time plus activity duration.**

$$EFT = EST + activity\ duration$$

**c) Latest finish time: The latest finish time is the time by which an activity must be finished such that completion of the project is not delayed the latest finish time of an activity between events i and j is the latest allowable event time of**

$$LFT = T_L^j$$

**d) Latest start Time: The latest start time is the time by which an activity must start such that completion of project is not delayed. The latest start time of an activity between events i and j is latest finish time minus activity duration.**

$$LST = LFT - activity\ duration$$

**Float:**

In the last reading we have discuss that in the project with art interested in time available to execute particular task(activity) during the project period. We shall introduce the concept float which tells us how much an activity can fluctuate without affecting the completion of a project. We shall introduce following float

a) Total float.

b) Free float.

c) Independent float.

d) Interfering float.

a) Total float is the maximum time available during which an activity can fluctuate. It is maximum time available minus activity duration. The maximum time available in the difference between latest finish times minus earliest start time. *Maximum time available to execute the work = LFT – EST*

Hence

*Total float = maximum time available – activity duration*

$= LFT - EST - t^{ij}$

$= LST - EST$

b) Free float: - Free float is the time available to fluctuate the activity without the affecting the succeeding activity. The mean of without affecting succeeding activity is that the activity must finish before the earliest occurrence of the head event.

$Time\ available = T_E^i - EST$

*Free float=Time available–activity duration*

$= T_E^i - EST - T_E^{ij}$

$Free\ float = T_E^i - EFT$

c) Independent float: - It is the time available to fluctuate if the preceding activities get completed as late as possible and succeeding activities get started as early as possible.

$Hence\ time\ available = T_E^i - T_L^i$

This is the minimum time available to execute

*Independent float = Minimum time available – activity duration*

$$= T_E^i - T_L^i - T_E^{ij}$$

d) Interfering float is defined as difference between total float and free float.

## Event

Event is the important point (mile stone) during execution of particular work or task. Many a time we only are concerned about commencement or completion of the task. Event is defined as start or end of an activity or activities. Thus, event is followed by more than one activity. In this case event is marked by completion of all activities or start of any one of the activity.

Example: -

1. Start of plastering is an event.
2. Completion of excavation for piping layout is an event.
3. Start of floor tiles is an event.
4. Giving power supply to fan and light.

Event is characterized by completion and start of an activity. We can defined

a) An event is said to occur if all the activity leading to it has been completed.

b) An event is said to occur if any of the activity has started.

**Limitations OF PERT**

The following are some of PERT's weaknesses: The activity time estimates are somewhat subjective and depend on judgment. In cases where there is little experience in performing an activity, the numbers may be only a guess. In other cases, if the person or group performing the activity estimates the time there may be bias in the estimate. Even if the activity times are well estimated, PERT assumes a beta distribution for these time estimates, but the actual distribution may be different. Even if the beta distribution assumption holds, PERT assumes that the probability distribution of the project completion time is the same as the that of the critical path. Because other paths can become the critical path if their associated activities are delayed, PERT consistently underestimates the expected project completion time. The underestimation of the project completion time due to alternate paths becoming critical is perhaps the most serious of these issues. To overcome this limitation, Monte Carlo simulations can be performed on the network to eliminate this optimistic bias in the expected project completion time.

**Benefits of PERT**

PERT is useful because it provides the following information: Expected project completion time. Probability of completion before a specified date.

The critical path activities that directly impact the completion time.

The activities that have slack time and that can lend resources to critical path activities.

Activity starts and end dates