Construction and Project Management
Lecture 5

PERT

PERT Stands for Program Evaluation and Review Technique and CPM stands Critical Path Method. PERT is more of a probabilistic tool, using three estimates of duration as we don't know the exact duration of a particular activity. CPM is a deterministic tool using only one time estimate because the activity's duration is known as it is a routine kind of activity. PERT is basically a tool for planning, while CPM can be used to control both time and cash. PERT is more suitable for R and D projects, i.e. where we do not know the duration of a particular activity. CPM is best suited for routine projects where time and cost are accurate.

PERT

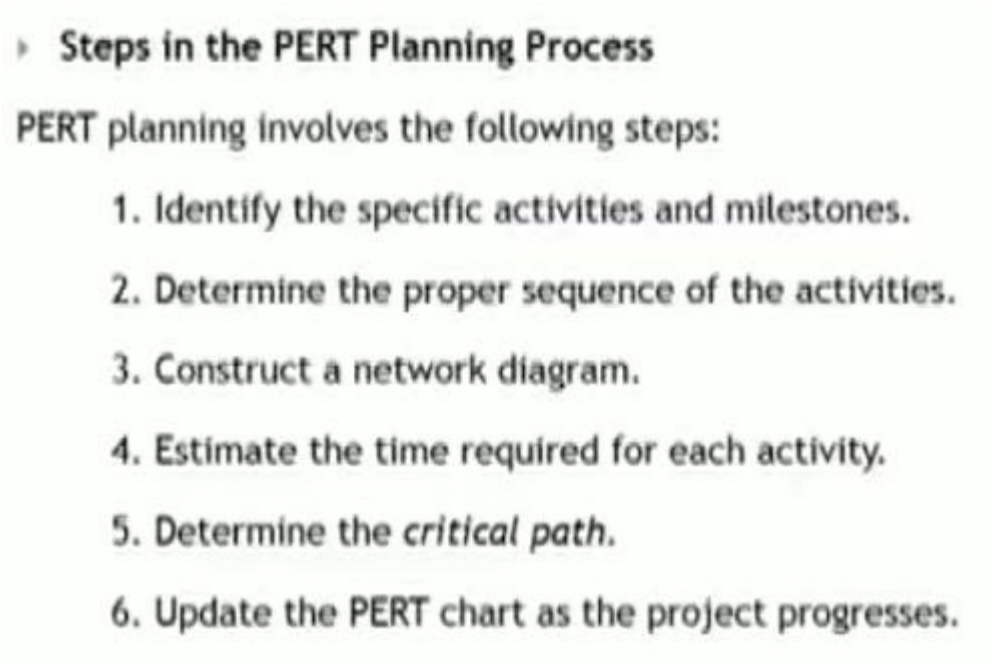
- The Program Evaluation and Review Technique (PERT) is a network model that allows for randomness in activity completion times.

PERT	CPM
PERT stands for Program Evaluation and Review Technique	CPM stands fro Critical Path Method
It's a probabilistic tool using 3 estimates of duration	It's a deterministic tool, uses only single estimate of duration
It's a basically tool for planning	CPM can be used to control both time and cash
PERT is more suitable for R&D related projects	CPM is best suited for routine projects where time and cost is accurate.
PERT is event oriented	CPM is activity oriented

In routine projects such as construction of hotels, roadway, highway, etc, we know the time and cost involved in that particular activity. Hence, in such cases, CPM can be used. PERT is a planning tool because the activity's duration is not certain. PERT is event oriented and CPM is activity oriented. That is why we work on

activities in networks in CPM, whereas PERT concerns events, for instance completion or end of a research project. End is nothing but an event, whereas the process is called activity.

After understanding the differences between CPM and PERT, let us talk about the steps involved in forming a PERT network.

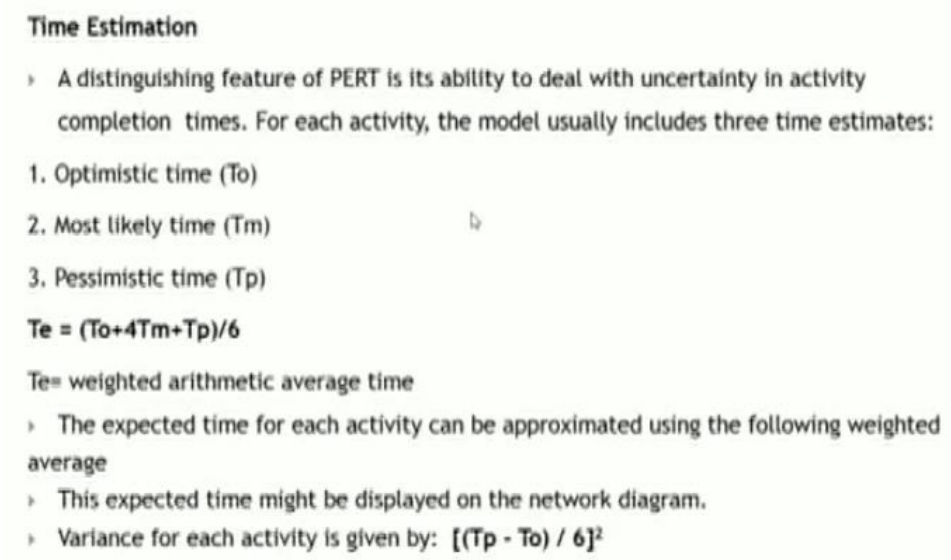


PERT planning involves the following steps. 1. Identify the specific activities and milestones. For instance, for a research on solar energy, I need to first identity the activities involved in the research like studying the geographical area of where I am going to do the research, the climatic aspects of that particular area, and so on, and I need to identify milestones. The solar energy that I will be able to achieve for a particular project is a milestone, how I am going to use it is a milestone and the cost to time analysis is another milestone. Duration is not determined for each activity. So, first identify activities and milestones. 2. Determine the proper sequence of the activities: After identifying the activities, we should determine the sequence of activities, i.e. which activity will be taken up first and in which order the other activities would be done. Activity A will start first, after which B will come and the sequence will start only after the completion of A and B. This kind of listing of the activities and the sequence of the activities is to be done. 3. After working out the sequence of activities, the next step is to construct a network diagram. Till this stage, there is no major difference between CPM and PERT. The

steps that we followed for CPM are employed for PERT too, though the type of activity is different. 4. Estimate the time required for each activity: In CPM, we know the activity, its duration and how much resources are required. But in the case of PERT, the activity's duration is not known. So, we give each activity three types of duration – optimistic time, most likely time and pessimistic time -- and we calculate the arithmetic mean of the durations and take it as the activity's duration. 5. The next step is to determine the critical path. 6. Update the PERT chart as the project progresses: For example, I allocate 10 days as the duration for a particular activity, but it extends to, say, 235 days. PERT, being a probabilistic process, you cannot assign a date to any particular project. So, when the particular project's duration extends, the network will change. So, I keep on updating the PERT chart as the project progresses. These are the steps involved in PERT planning.

Time Estimation

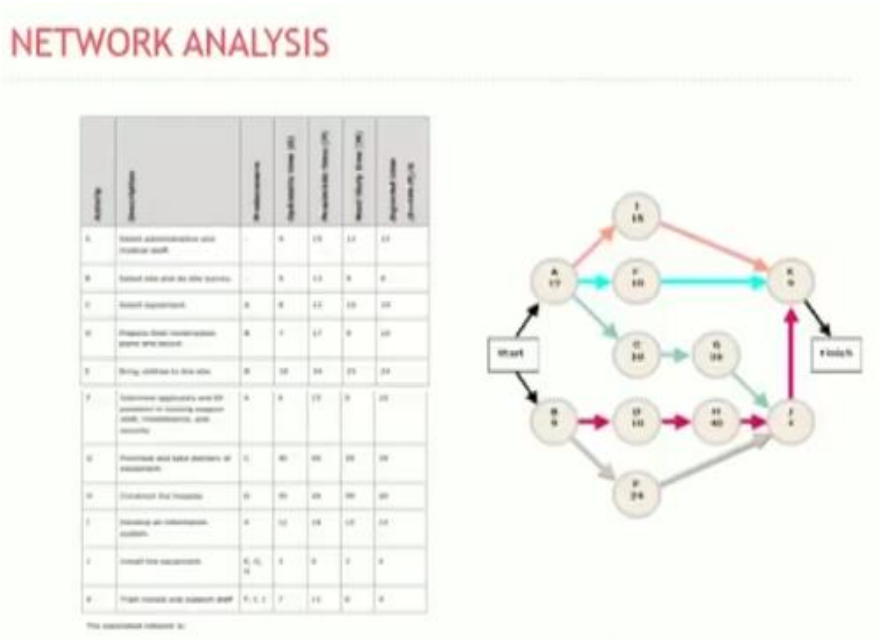
As we have seen, each activity will be assigned three times -- optimistic time, most likely time and pessimistic time -- and they are denoted as To, Tm and Tp respectively. The optimistic time is the time assigned when you are confident that the activity will be completed in this particular duration. Optimistic time is like an optimistic person, being confident, positive and taking lesser duration. Pessimistic time is the maximum duration required to execute the activity. Most likely time is the time in which the activity is most likely to be completed. Now, I calculate the arithmetic mean of the three to arrive at each activity's expected duration. This is done by using the formula Te = (To+4Tm+Tp)/6.



This expected time might be displayed on the network diagram and the project duration is ascertained. Variance involved in the time calculation of each activity is nothing but [(Tp-To)/6]^2.

Network Analysis

In network analysis, let us look at an example of how it is being done, how the critical path is being calculated and how the time estimates are given.



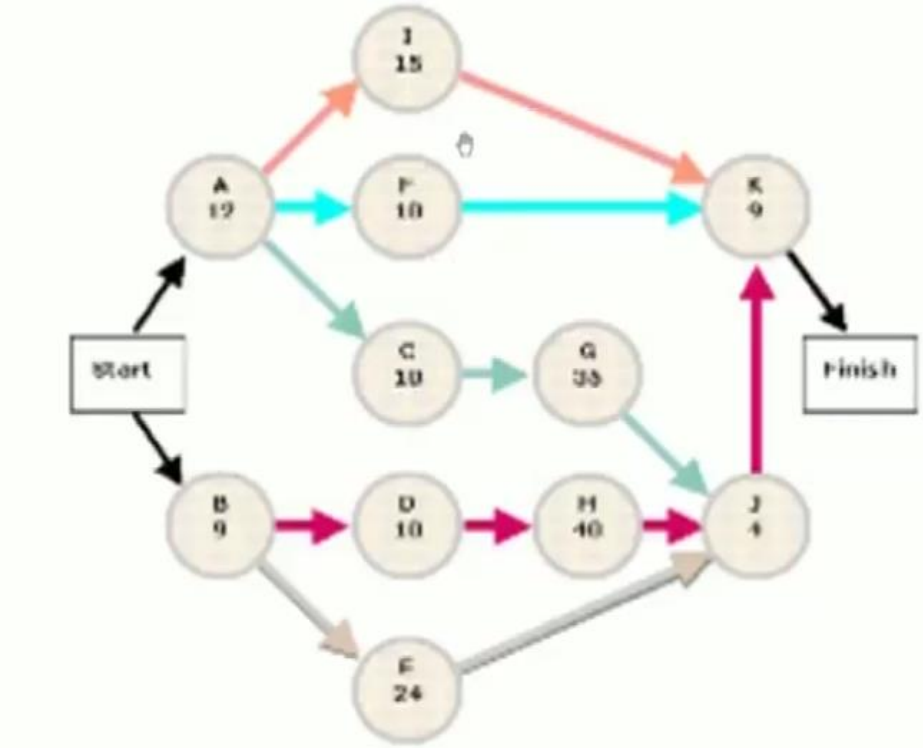
Activity	Description	Predecessors	Optimistic time (O)	Pessimistic time (P)	Most likely time (M)	Expected time (O+4M+P)/6
A	Select administrative and medical staff.	-	9	15	12	*12*
B	Select site and do site survey.	-	5	13	9	9
C	Select equipment.	A	8	12	10	*10*
D	Prepare final construction plans and layout.	B	7	17	9	*10*
E	Bring utilities to the site.	B	18	34	23	*24*
F	Interview applicants and fill positions in nursing support staff, maintenance, and security.	A	9	15	9	*10*

G	Purchase and take delivery of equipment.	C	30	40	35	35
H	Construct the hospital.	D	35	49	39	40
I	Develop an information system.	A	12	18	15	15
J	Install the equipment.	E, G, H	3	9	3	4
K	Train nurses and support staff	F, I, J	7	11	9	9

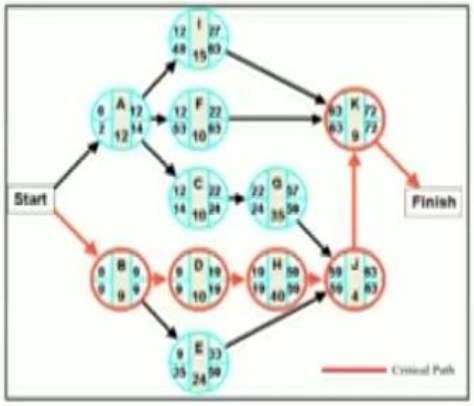
The associated network is:

Here, for selecting administrative and medical staff, the optimistic time is nine days, pessimistic time is 15 days and most likely time is 12 days. With these three figures, you calculate the expected time to be 12 days. Likewise, for all activities, calculate the expected time and tabulate it. You have the predecessor relationship here. You can see that A and B have no predecessors, meaning that A and B are the starting activities. A is the predecessor of C, so C is the activity which starts after activity A gets completed. Likewise, D will start only after B is over. E activity will start only after B is over and F will start after A is over. G will start after E gets completed, H after D, I after A, and activity J will start only after E, G, H are all over and K will start after F, I, J are over. So, with these activities we can form the network.

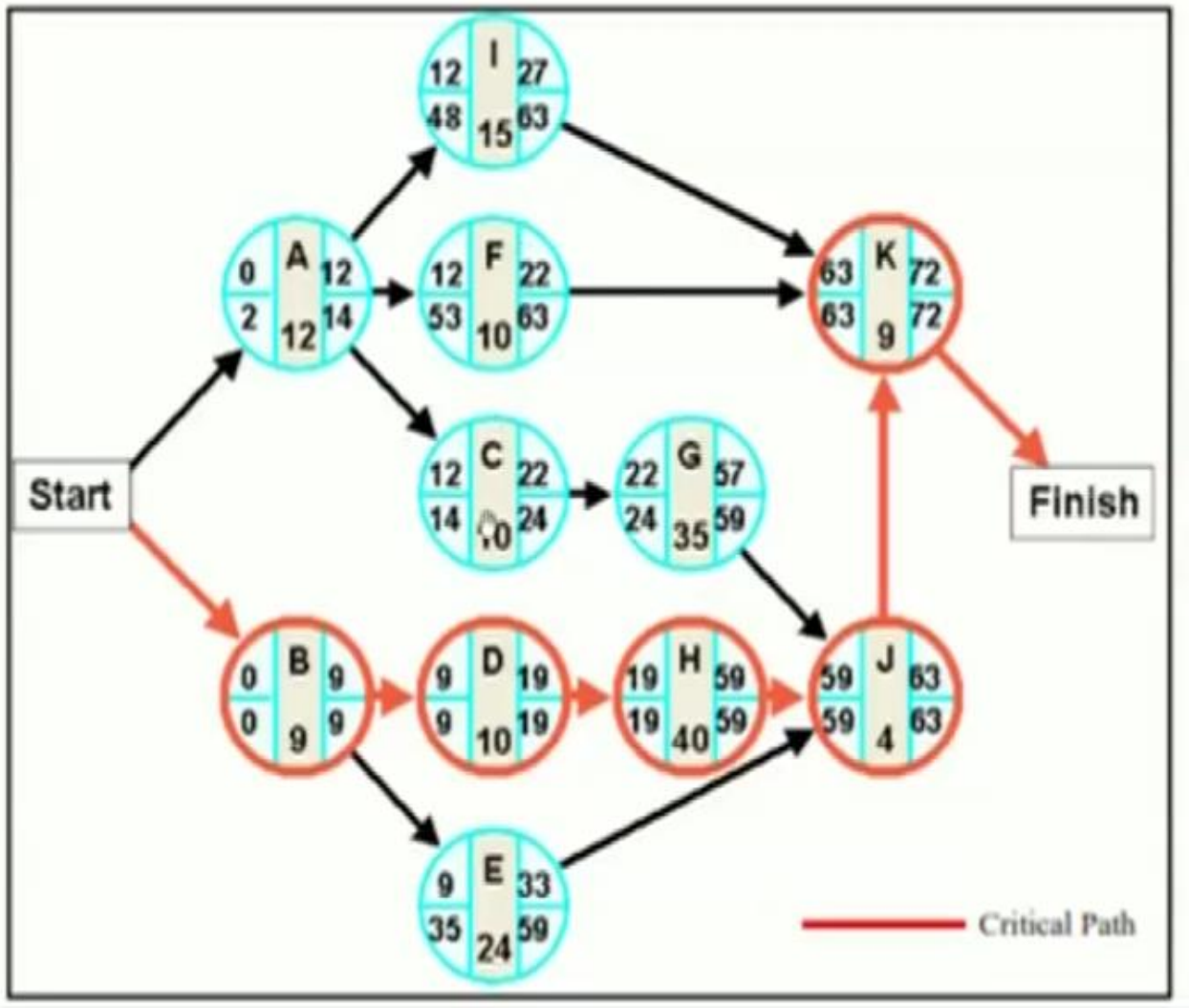
Activity A is on node network and the activities are numbered at the node here, whereas in CPM, arrow type of networking was followed and activities were marked on arrows. That's why we have named it A, B, C, etc inside the circle. A and B are both the starting activities. So, A and B are here and the calculated duration is mentioned here. Activities I, F, J are preceded by A, hence the three activities come out of A. After A is completed, these three activities will start. Activities D and E will start only after B gets over and hence the two come after. Activity K starts at the completion of activities F, I, J.



NETWORK ANALYSIS



Node	Duration	ES	EF	LS	LF	Slack
A	12	0	12	2	14	2
B	9	0	9	0	9	0
C	10	12	22	14	24	2
D	10	9	19	9	19	0
E	24	9	33	35	59	26
F	10	12	22	53	63	41
G	35	22	57	24	59	2
H	40	19	59	19	59	0
I	15	12	27	48	63	36
J	4	59	63	59	63	0
K	6	63	72	63	72	0



It is your expecting the particular project to get on this time, because it is calculated time. And the time is calculated with all the three type of time considerations and the arithmetic mean is taken and the estimated time is calculated and their by completion of project the estimated problem is which we do. The probability of completion before a specific day is more because both are calculated time that you have taken. With all the activity complete within the optimistic time itself. Because the estimated time will definitely more than your optimistic time. In that case the project will get over a specific day and critical path activity and completion time. Likewise the same critical path method is form the major part of the method and the CPM is the durations are not ascertained in case of PERT. The activity that has slack time can lend resources to critical path

activities. In the activities here no define activity so activity not have a flow or have a slot here so if there is a slot here that those resources can be given to other area resources to be allotted and the critical path activity can be given concentration and the project duration can be maintained .

LIMITATIONS:

Limitations is that the time is estimates that we worked on is not ascertained. It is all the calculations that you have made. So incase when you assume the project optimistic durations are the most likely pessimistic any mistakes can be done. The overall project duration's calculations that durations make is not correct that is incorrect. Depending upon the assumption the whole networking will fail or it is stand good. The activity time estimate the somewhat subjective and depended on the judgment. In case were the little experience performing an activity, the number 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.

The critical path method PERT also. The critical activity form the major part. The major difference between the CPM and PERT ascertain in case of PERT. The activity that has slack time and that can lend resources to critical path activities. In the activity here no define activity so activity have not the flow had a slack here there is a slack can be given to other areas resources are to be allotted. Then the critical path activity being concentration in the project duration can be calculated.

Limitations are calculations that have made. So in case when you assume that the project time durations are most likely any mistakes is done overall project duration's calculation that you have made correct or that is incorrect. Depend upon the assumption that you made the whole networking will fail and not standard. The activity time estimates are somewhat subjective and depend on judgment. In case where there is little experience in performing an activity, the numbers may be only a guess. In other cases, if a person or group performing the activity estimates the time there may be bias in the estimate. That is what we obtain the network project that obtain the duration the system in which the sequencing of activity like on that you do. In PERT the updating here. The project completion time due to alternate paths becoming critical is perhaps the most serious. If you see the particular activity see the duration of the F the whole activity of J and K have been extended in the certain cases that the instead of

being critical path D, F, J and K are diverts after the D becoming more even go to A, C, G, J and K possible of J and K in case of PERT in K is not realize that is almost completion are then whether the legalizing not been done in case of PERT. In case of CPM the path will not release like will not change unless any particular as it is done for critical path the CPM networking while in case PERT of that get altered until update the network regularly it not known to us .