Project Management for Managers
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Lecture - 35
Project Time Management- Numbering of Nodes

Hello friends. I welcome you all in this session. In previous session we were discussing about different types of networks. We have seen; what is CPM network what is a pert network. And we have also seen how to draw a network what are different rules of drawing networks. We have also seen network representation techniques there are 2 techniques activity on node and activity on arrow. Activities on node networks generally do not have dummy activities, because the activity gets represented through nodes and president's relationship is taken care of by those nodes.

So, let us look at couple of other things related to project time management. Whenever you have a network you need to represent a node and the node is to be labeled. On every node of a network you will have different information and you need to label that information accurately right. So, this is how you can a label a node. So, first of all let say every activity will have some ID number right identification number.

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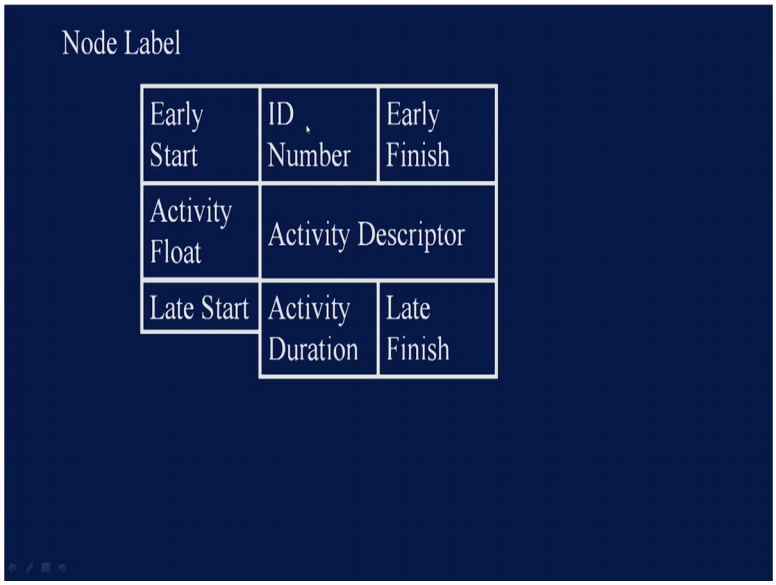

So, let us say if there are 100 activities in a project you will have ID number 1 to 100 or you can have let us say 1001 to 1100 right. So, you need to give ID number to each of

those activities right. And if you look at software's like primavera wherein ms project it has got facilities to give ID number according to your choice right. So, it is up to you how you are numbering different activities right.

Then there is something called activity descriptor, you should describe activity which is there in the project, let us say the description is digging foundation hovering a raw material right. So, the first activity descriptor is digging a foundation right. Second activity is hovering material right. Apart from this you have got float activity float now we will discuss in detail about floats in little later sessions, but you just keep in mind that you will always have some, some chances or some possibilities wherein you can shift your activities within given schedule of the project right. So, you can delay couple of activities you can start couple of activities bit early and so on.

So, there are different there are 4 types of floats we will discuss about those floats. Then you have got activity duration, activity duration is nothing but the time which an activity will take whether it is, whether it is taking 2 hours or 20 hours or whatever it is right. Then you have got early start time, early start means the time at as early as that activity can start right. If you add duration of the activity if you add activity duration in early start time you will get early finish time it is very simple right. Late start is that time with the time by which you can delay an activity. So, you cannot delay an activity after a particular time otherwise the duration of the project would be you know it would be more than the planned one right. So, that is late start, how late an activity you can start right. Late finish whatever is let us late start plus duration of the activity will give you late finish right.

We will discuss about all these things in detail. In previous class I have, I told you that in next class I would talk about how to number the events right.

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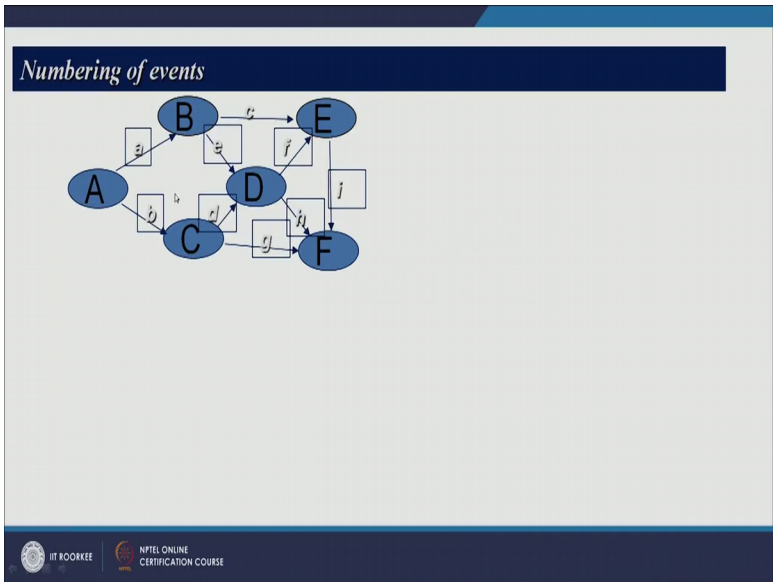

So, let us take this network there are 6 nodes right: A B C D E and F right. And there are different activities right. Let us say this is activity a right; so this A B. So, this activity is B right. This is you have got C right. So, B E this is activity C then you have got D E F this is G H and this is I right. So, E to F is activity I. Now I want to number these nodes right. So, there is something called Fulkerson's rule which will help you in numbering the events.

And it is very simple rule. So, what happens in every network you will have an initial node there would be a first node in which there will not be any activity entering into it. Only you will have activities outgoing from that first node right; so node that event as first number right. So, an initial an initial event is one which has a arrows coming out of it and not entering it.

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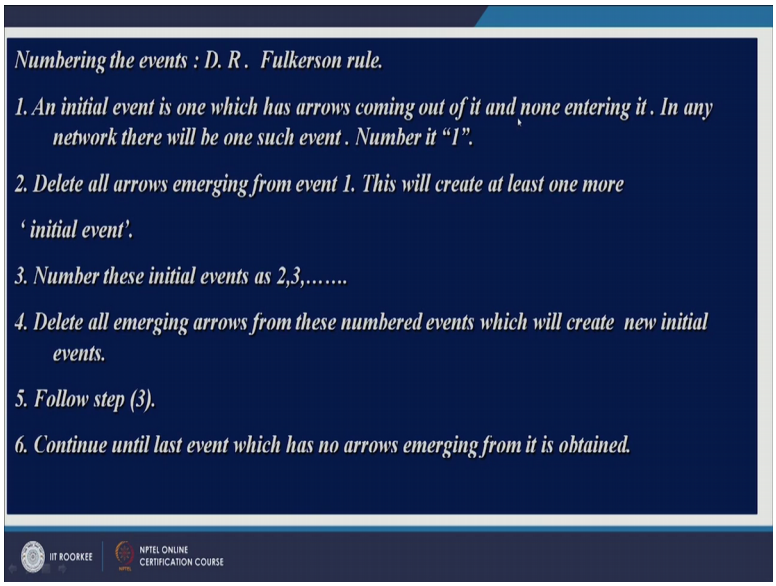

In any network there will be only such there will be only one such event number it as one right. So, the node which does not have any arrow entering into it, but only arrows coming out of it right. So, the number that event as one the second step is delete all arrows emerging from event 1 this will result in at least one more initial event and name that event are those events as 2 3 4 5 So on right.

After that delete all emerging arrows from these numbered events which number which events those events which you numbered as 2 3 4 and 5; so delete all emerging arrows from these numbered events which will create new initial events right. Then further you will have some more events right. And again do the numbering and keep on repeating these steps unless until you number the last node right. So, you need to continue until event which has no arrows emerging from it is obtained. So, at the end you will have only one an event which will have all arrows entering into it right. There would not be any arrow emerging out of that event right. So, that would be the last node.

So, let us look at an example we will take the same example, this example will we will take and we will try to number the nodes right. So, let us say this is a network.

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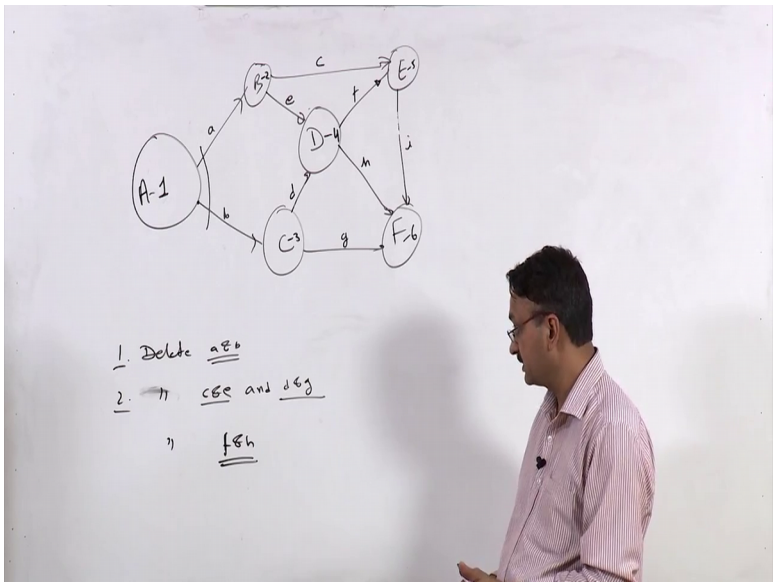

So, you have got A you have got B you have got C you have got D right. Then you have got E and F right. And these are the activities right. Then you have got this also and this also right. So, this is activity A this is B then you have got C you have got D you have got E you have got F, F G H and I right. So, these are 5 nodes A B C D E and F they are they are 6 nodes right. So, let us start numbering these events or these nodes right.

So, the first step in Fulkerson rule is delete all the arrows which are emerging out of first or the initial node right. Do not say first node let us call it initial node right. So, you will have a initial node which will not have any arrow entering into it, but only arrows having emerging out of it right. So, we will delete these 2 arrows. So, first step is delete A and B right. We will delete those values right. So, once we delete these 2 arrows let us number this as 1. So, we will number that node as number 1 which does not have any arrow entering into it right. So, there is no arrow entering into it, so this number 1.

So, what we are saying the node a has been numbered as 1 right. Let me write here itself right. So, node a is now numbered as 1. Now delete all the arrows emerging out of this node. So, we deleted these 2 arrows right, A and B now when we delete these we are getting these 2 nodes B and C. Now is there is there any arrow entering in B node and in C node no, there is no arrow entering into these 2.

So, now number this as 2 numbers this as 3. So, it is good to start from top and move towards bottom right. This is nothing wrong in number this as 2 and this as 3 right. You

could have done that also, but it is good to start from top right. Now after this we will delete, we will delete, we will delete which arrows C and D, C and D right; arrows coming out of node 2 C and D and D and G and D and G right. Isn't it? Now when we delete C and E, when we delete C and E we will get this node and when we delete D and G we will get this node and this node right.

When we delete C and E we will get D and D right. And when we delete D and G arrows we will get D and D, D and F right, but if you look at E and F these nodes have got entering arrows into them right. So, there is an entering arrow here and there is an entering arrow here only D is the event that does not have any entering arrow. So, we will mark this as 4. So, we will numbered this node as number 4 right.

Why we didn't give this node as number 4? Because when we deleted C and E there was one arrow entering into it right. So, we just postpone numbering this particular node right. Why we did not number this as 4? Because when we deleted D and G this was the node having arrows from here and here; so after numbering this as 4 now what we have got 2 more nodes for numbering. So, what to do now? We will delete which particular arrows in third step F and H.

So, delete F and H. When we delete F and H, what will happen? This will not have any entering arrow right, but this will have entering arrow from this side. So, will this we will mark this as 5 and finally, this is 6. So, this is how you should do the numbering in a network right. This is known as Fulkerson’s rule for numbering events.

Ok so, let us look at, this is what is the solution right? So, A has been numbered as 1, B as 2, C as 3, D as 4, E as 5 and F as 6.

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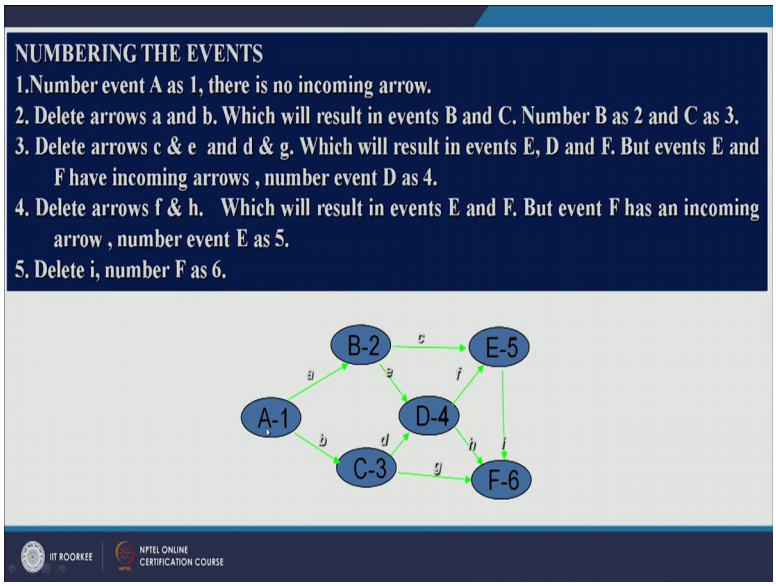

So, this is how you can do the numbering.

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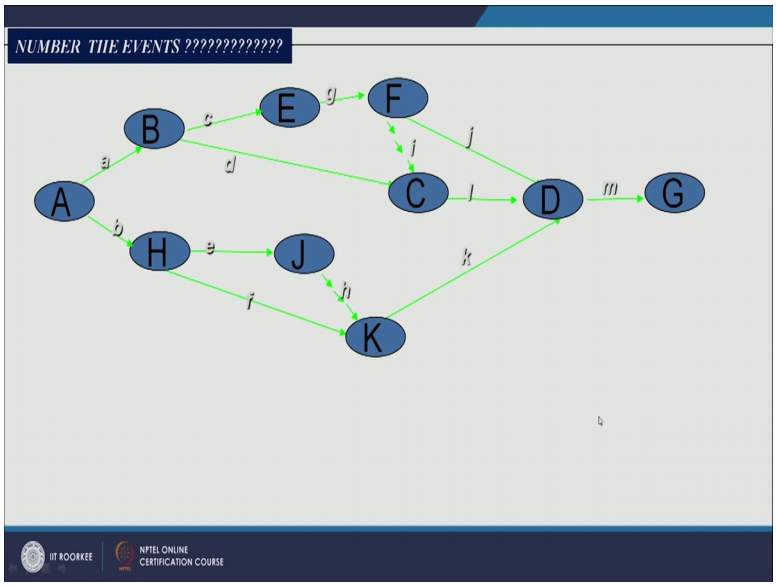

Let us do this one number the events let us go for numbering a this particular network right. So, let us go out go ahead with this particular example.

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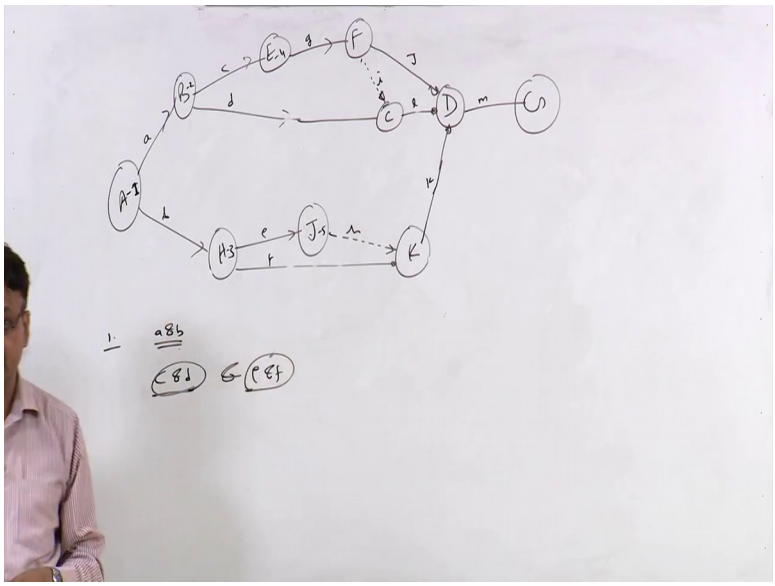

So, you have got A, you have got B, you have got H right. You have got E, you have got C, you have got F, you have got J, this is J right. Then you have got K, from H to K is also there right. Then you got F to C right. In fact, let me write it here, this is yours C and there is a dummy activity F to C right. Then you have got F to D and then finally, G right. So, K to D there is an activity, J to K it is there, H to J is there, B to C yes it is there, B 2 this E to I think we have done all the we have marked all the events right.

Now let us look at what are different activities this is A, this is B, you have got C and D then you have got E and F. Then you have got G and H, G and H, H I and K I is this K is this J C to D is also there. So, this is K no K is already we have marked this. So, this is J this is L and this is M right. I think this is the network which I have gone over there right. So, there is one more dummy activities J to K, J to K are dummy activity, this is dummy activity right.

So, how to number these events? What you should do first of all? Let us look at Fulkerson's rule and initial event is 1 which has arrow coming out of it right; so arrows coming out of it this is 1 right. Isn't it? Delete all arrows emerging from it. So, we will in first step we will delete what A and B isn't it? So, you will have these 2 nodes these 2 nodes do not have any arrows entering into them right. So, this is second and third right. Then delete arrows from second node and third node. So, we will delete C and D and E and E and F, right these two.

So, this is the second third right. When we delete these 2 we will get E event and when we delete these 2 we will get J right. So, this would be 4 and 5, 4 and 5. What would be the next step? What would be the next step? You need to delete H and G. So, when you delete G you will get F, this one right. When you delete H you will get this right. So, then you can number them as 6 and 7 and similarly you when you repeat this exercise you will get at the end of the day the last number to the event G.

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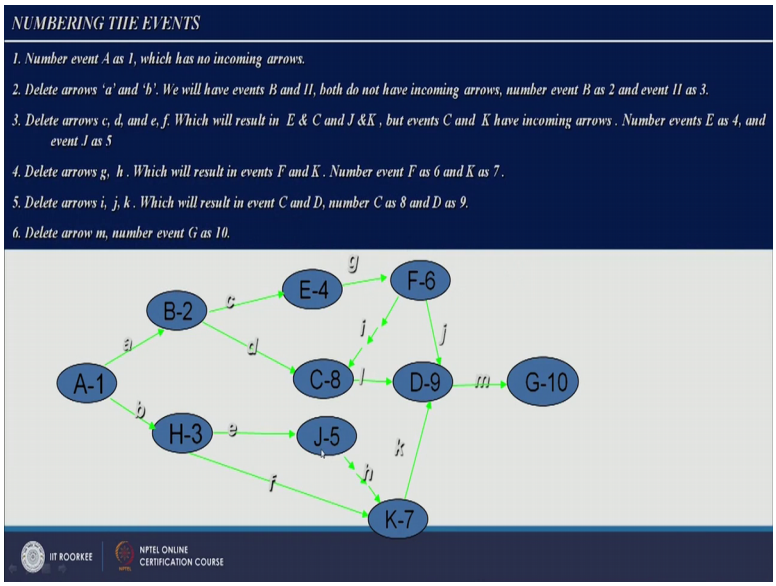

So, let us look at this. So, you got H is 3, E is 4, J is 5 right. Now what you are supposed to do? After 4 and 5 you would be an numbering this F event as 6 right. And case 7 right. Why did not mark to this event C? Why we did not number this F 6, because there is an entering arrow right. So, when we deleted this G and H we got F and K right. So, you just mark this as 6 case 7 right.

Now delete a arrow like this arrow I and J right. Delete these 2 arrows right. When we delete these 2 arrows you will get this particular event right, even C right. And there is no entering arrows in this event, now mark this as 8. Similarly 9 and finally, this is 10. So, this is very simple rule when you practice numbering of different networks it would be easier for you right. And you will not commit any mistake right. So, this is Fulkerson's rule you should know how to number different events right. So, these are couple of examples which I have taken for you just write down what are different numbers right,

on all these events. So, there are 2 networks right. So, in this case you will have how many total nodes 4 plus 5 9 and 1, 10.

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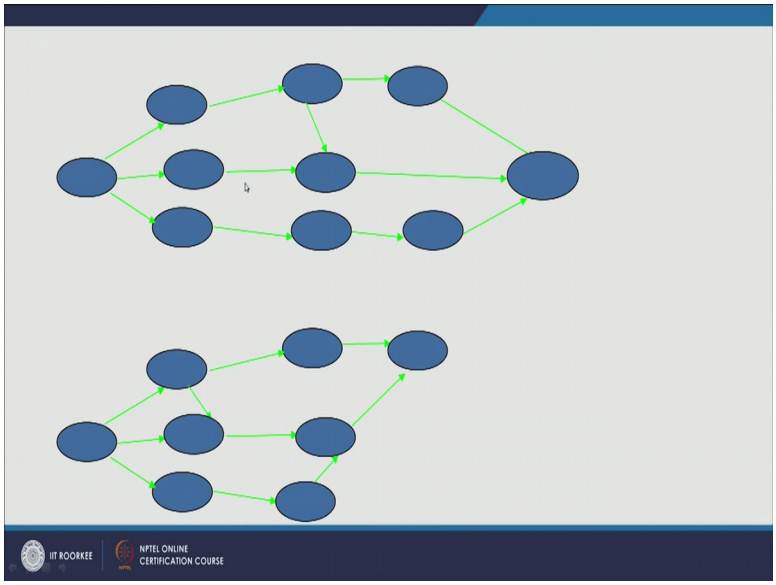

So, total 10 nodes in this particular network this. So, as this second network is concerned you have got total 8 events, right or 8 nodes right.

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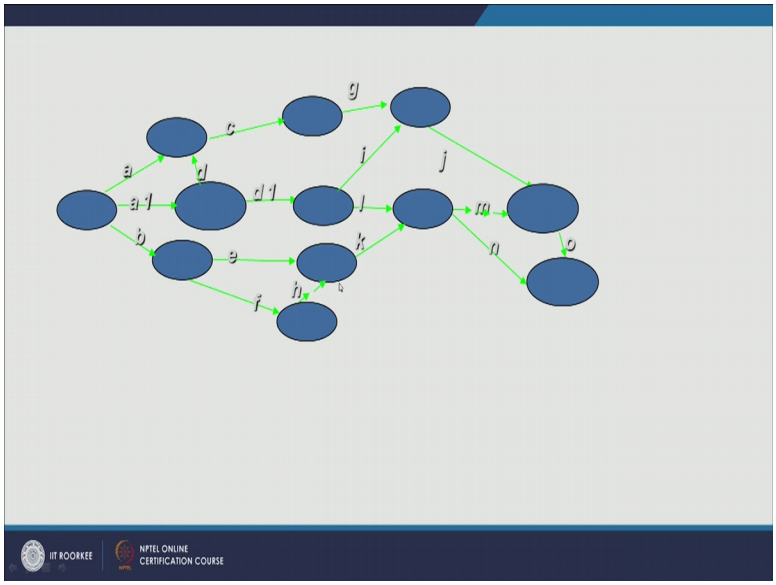

So, number this these 2 networks right. This is another network which again you can use for use for numbering right.

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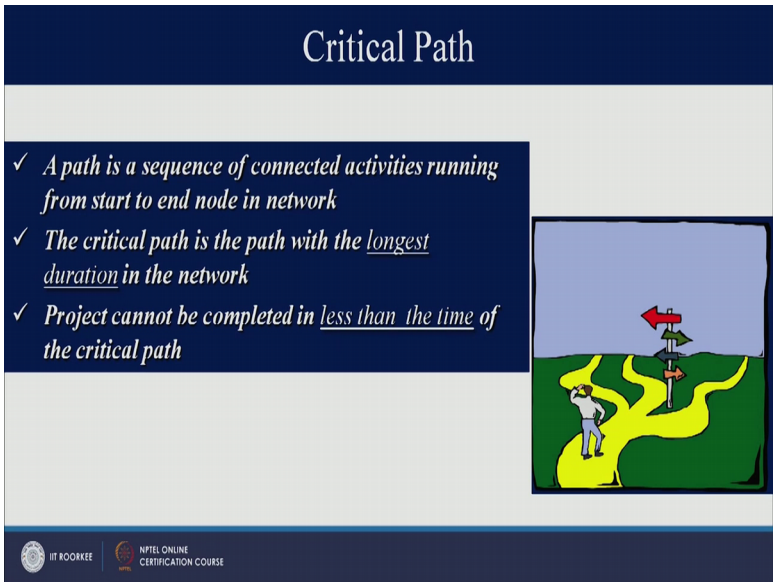

So, let us move on to the next point in project time management now there is something called critical path. A critical path in a project is a path which connects first node and last node through sequence of activities and that is sequence gives you the longest path right. It is it is chain of that path which gives you longest time and the duration of the project determine gets determined by critical path. When say when we say that critical path of this network is 28 means this project will take 20 days or 20 minutes to 20 minutes for completion right. So, let us look at some of the important point related to critical path. So, a path here critical path is a path a sequence of connected activities running from start to end node in a network. The critical path is the path which is the longest duration in the network, right it is not the shortest duration in the path right. It is the longest duration.

Project cannot be completed in less than the time of critical path. This is quite a generally statement, but let us say if there is a project which is taking let us say 20 days right. So, if you want to reduce the duration of the project you assign more and more resource resources to different activities. So, you can reduce critical path, but critical path is a path as I said in less than that time you cannot complete the project, right in normal conditions right.

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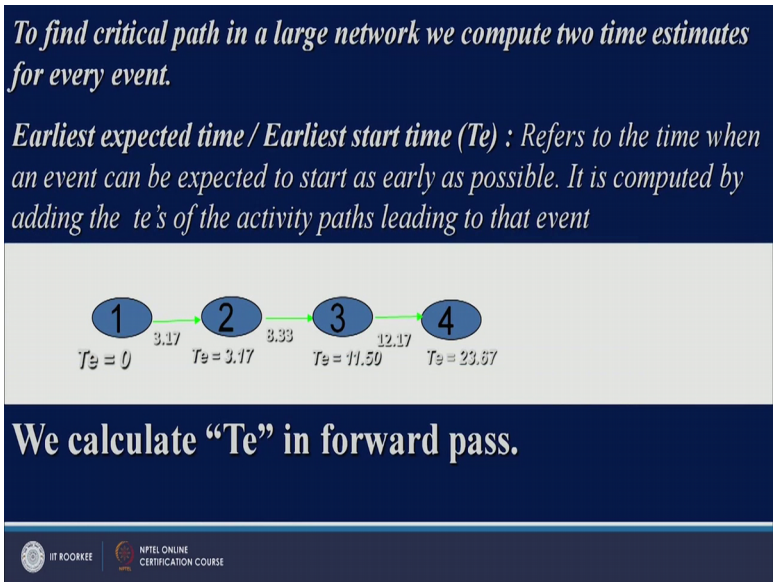

So, let us find out critical path in a project. So, this is the right. Time to define some more terminologies there is something called earliest start time or earliest expected time of an activity right. So, earliest start time is a time when an event can be expected are expected to start as early as possible. It is computed by adding the T e, T e is nothing but expected times of the activity path leading to that even right. So, let us calculate T e right. T e is nothing but earliest start time right.

So, earliest start time, let us say there are 3 activities and the there are 3 activities; activity this first activity second and third right. So, let us say T e is 0.

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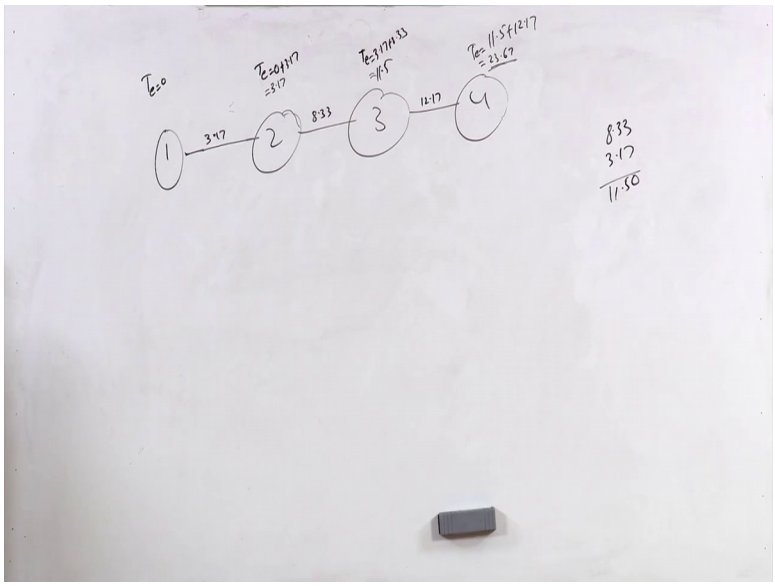

So, you can start this activity as early as 0 unit of time right. So, this is this is known as earliest start time. So, at this node earliest start time is 0 and let us say the duration of this particular activity is 3.17 minutes right. And for this it is 8.33. And the duration of third activity is 12.17.

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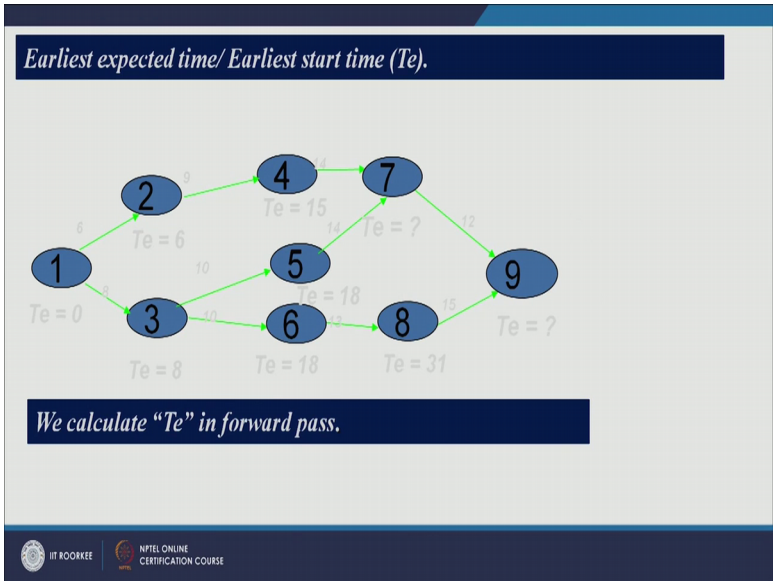

So, 3.17, 8.33 and 12.17 these are 3 activities connected by 4 nodes right. So, we are now calculating earliest start time of all these nodes right; so first of all what you should do? Calculate earliest start time of this node let me write it over here. So, T e is equal to

0, T e is equal to whatever is the earliest start time at the previous node plus duration of the activity. So, this is 0 plus 3.17. So, this comes out as 3.17. So, earliest start time of this particular activity is 3.17, you cannot start this activity before 3.17 unit of time right.

Now, what is the earliest start time of this as for as this activity is concerned? It will be whatever is T e of previous event. So, 3.17 plus 8.33. Now this is equal to what 11, I think it is 12. So, just add these 2 numbers; so 8.33 plus 3.17. So, this is 11.5. So, this is 11.5. What is earliest start time for this activity this particular event this is 11.5 plus 12.17. So, this becomes 12.17. So, this becomes this is 23, 23.67.

So, we say and we will say that this particular project will take this much time 23.67 minutes right. So, what we did in this case we calculated earliest start time of all the events right. Isn't it? It is very simple and this and this we calculated using something called forward pass right. So, this is known as forward pass calculation we calculate earliest start time in forward pass right. So, let us look at another network. Calculate earliest start time for this particular network.

Now if you look at this particular network you need to find out what is the earliest start time at each of these nodes. So, before I take up this particular question let me summaries what we did in this session. In this session we did, we did talk about labeling of node. And a node should be represented by it is ID number, it is description. It is earliest start time, earliest finish time, latest start time, latest finish time and it is it is duration. In fact, sometimes you need you write more than these information on a particular node.

Then we have seen how to number a particular network right. How to number events in a particular network and for this we have seen something called Fulkerson's rule right. So, in Fulkerson's rule you need to number the very first event the initial event is number 1 which does not have any entering arrow into it. And you delete all the arrows coming out of it and you just keep on repeating those steps which I have just shown in that slide and by following those steps you can easily number the events of a network.

So, with this let me stop here.

Thank you very much.