**Project Planning & Control**

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**Lecture – 20**

**Lesson – 02**

**Example 4, Usage of Floats for Project Decisions**

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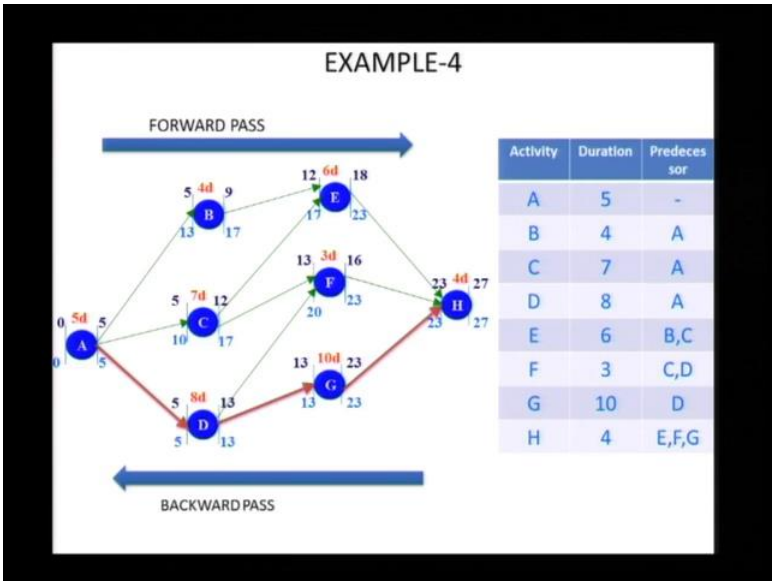


Let us take this network now, I would like you to start working on this network we will solve it in this class. This is a network which we did our analysis on in the last class. So, the analysis results are given there, I would suggest, you could actually do a little bit of the analysis of the basic analysis to kind of refresh your memory and then, let us come back and calculate the various float parameters. You will get a few more insight into float when you analyze this network. Right now we just all the networks we took, now it is only introductory. Your question.

**Student:** When we have a range of floats, when we start calculating, so.. ((Refer Time: 00:58)).

It is not so much a range of floats that your total float should be within, I will not say total float should be 0 for an activity to be critical. I say total float should be less than your, only if any total float less than 5 is considered critical float.

**Student:** It meas that there can be more than one critical path.?

There can be multiple critical paths, so that is something which we will get, we will see a lot of it in the next session or when we do time cost trade off. As my duration starts reducing or I have to start crashing, multiple critical path is a really a fact of many projects. Only in some of these idealized simple examples which we do, we get single critical paths.

**Student:** In crashing also, if we do crashing then multiple critical path will be generated one at a time ((Refer Time: 01:48)).

No, you will get multiple. When we get to that we will see, but the question what you are asking is very relevant, a lot of times this never almost in all practical case there could be a single critical path. But, typically people want the project done as fast as possible, in which case I do not have time for float I am going to even try to get things done in a starts crunching the critical path itself and as the critical path starts reducing, my float from the other activities go away, all paths starts becoming critical.

**Student:** Sir how would you decide upon the number of days .

No, it depends on how much control you have on your project. Now, what is the level of uncertainty with which you can predict? So, this having total float equal to 0, so an activity is critical is ideal and if we go only by the definition, let say there is another path with the float of 1 and you can easily loose one day on a activity. You might find that you are still tracking a critical path, which is now not critical.

Because, if there is 2 day delay on that path, what will happen? Critical path changes and you are now pumping resources into what you thought was critical, but the critical path has changed. So, you have to keep your eye on all of these activities, which are near critical. And; obviously, when you say criticality and near critical the problem becomes much more interesting than and more complex than just saying there is a unique critical path and that is the only one I have to deal with. Ok So, just start of on this problem, there are quite a few interesting issues when you get into the details of this.

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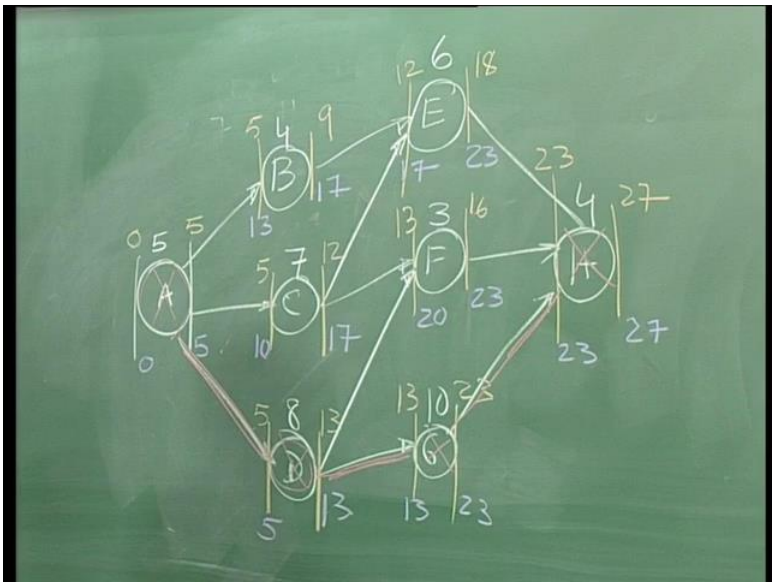


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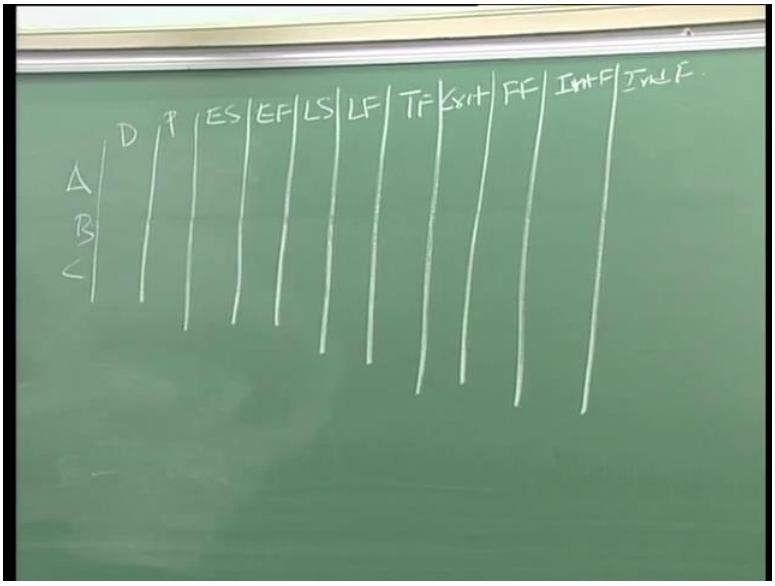


So, you can make the table, , put this in a tabular form, where we have A, B, C, D, we will have the duration, will have the predecessor, will have early start, early finish, late start, late finish, total float, we can talk about criticality here, free float, interfering float and independent float . So, this will be the table, but once you have done the analysis, basic analysis it gets you back into kind of thinking in terms of the forward pass backward pass, let us then talk about, discuss the floats.

So, here we know that A, D, G, H around critical path need little more time ?. So, this is on critical path and we have no floats on that, let us take B,

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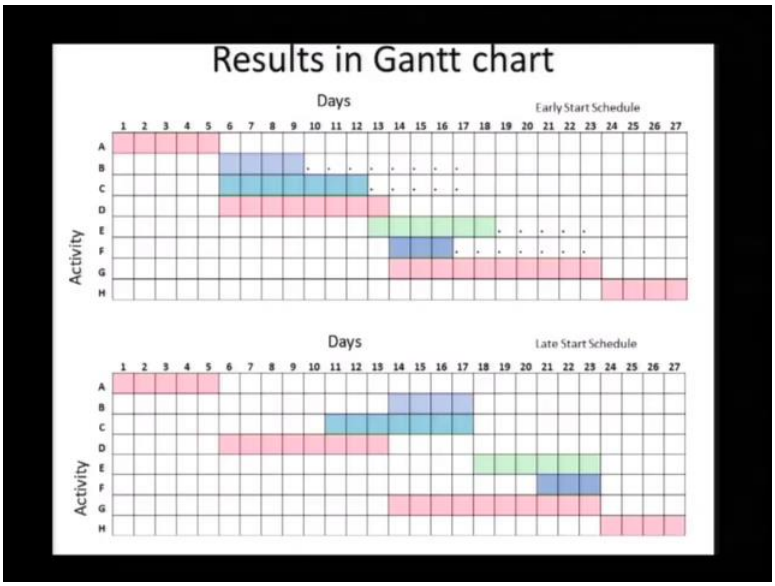


So; obviously, B, C, E, F have floats I think I will show the output on to this, … So here we have, so in a basic bar chart we can have the early start schedule, we can have the late start schedule and so this is showing the full extent of float used in all the activities for the late start schedule.

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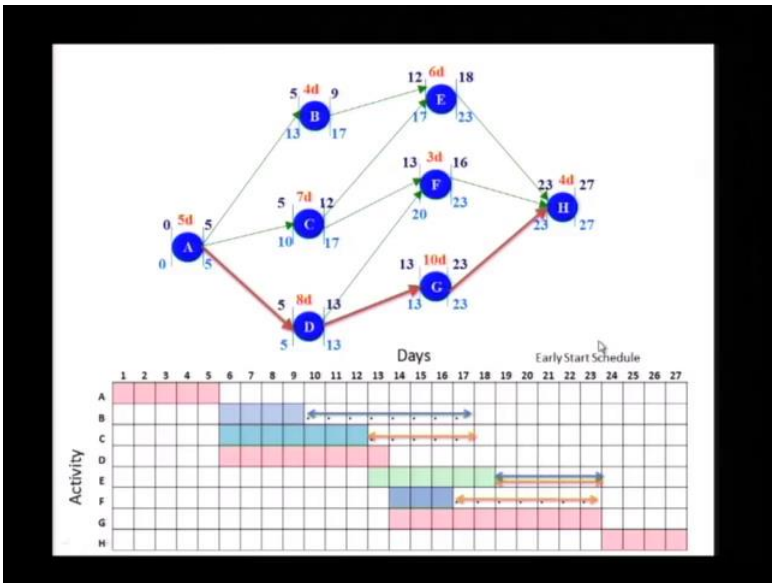


So, if this analysis is done let us actually try to discuss this, the different floats on the visual you can see here. So, let us take B, we know that B can move all the way here, it is late finish is 17. So, as I start moving B, so what is this whole distance which B can move?

**Student:** Total float.

Total float, so that will be the total float of B and how many days is that?

**Student:** 8 days

8 days, is that total float of B. But, when B starts moving beyond a certain degree, what happens?. After it starts moving beyond is what happens?

**Student:** It starts effecting E.

It starts effecting E, actually beyond here, because B is connected to E, after B goes beyond 12 it starts effecting E. So, one way before it effects E, what is the float of B, what is that kind of float called? free float. So, B has 3 days of free float, so it can move 1, 2, 3, if it moves of 4th day, then E starts, the early start of E starts getting affected .

So, B has 8 days of total float, 3 days of free float, we can see that. Is there any questions?, please raise it. What about E? We will come back to the other two floats, we just take total float and free float first. What about E or we take C next? What about C?

**Student:** 5 total floats, total float is 5

Total float of 5 days, so here is C, I can move it all the way, but if I when I start moving C what happens. Does it have any free float?

**Student:** It has 1

No it has no free float, because the minute I move C to the 13th day E will start moving and you can see that in the bar chart. So, here is C and E starts right here right there, at the minute I move C by 1, E will also start moving by 1. What… So; of course D does not have. Now, we go to E. What is the, how much of, so here is E, so when I am moving E for total float and free float I am going here, I can move here all the way here for 5 days; that is my total float. Free float is also there, same. Because, it does not affect; it is converging to a critical activity and I can move it all the way to 23 without affecting H. Now, F? total float of 7.

So, I can move again, F can move all the way to the end. It can end on 23 and then, there is no there is nothing; it will not hamper anything else and the free float is also set. So, any questions on total float and free float that is fine. Now, we come to interfering float. So, if we take B you can see that end as B start moving it interferes with E, how much can interfere with E?, so…

**Student:** 5

5, so the first 3 days it does not interfere with E the remaining 5 days it interferes with E. So, out of 8 days of total float and 3 days of free float 5 days interfering in float does not it give any clue to interfering float.

**Student:** Sum of total float = Free float + Interfering float

And you can see that visually, so that is what do you expect any other activity to interfere in float C has C have, so now, if you think of total float minus free float is equal to interfering float you will see that C has total float it does no have free float, so it will have which same thing. So, I can keep moving C , I will be interfering all the way E until B and until it that becomes critical, what about F? Student: zero, cannot interfere, because if it starts interfering that the project duration will change.

And you will find that F that the total float and free float are same, so total float minus free float is 0, now we come to the independent float. So, we take an let start with C although we start with B A cannot be delayed. So, A has no influence on B, if I delay B from the early start of B or you know if I delay B will E get it delay ? no, no it has free float till 3 days. So, remember the definition when independent float?.

**Student:** Amount by which an activity can be delayed without delaying the project

Yeah the successor, so we are going to constrain B as much as we can, how we can strain B as much as we can?, then A should start of the at its late finish and E should start in its early start. So, E wants to start at 12 A will still finish at 5 still B has room to move correct? 3 days that is independent float. Let us go to see E, E wants to start at 12, A wants to finish at? 5 no it has no independent float we go to H wants started 23 there room there, but C wants to ended 17 , no it cannot, what about F? H wants to start on with 23 either C can start on 17 which is more constraining? C.

So, C can finish on 17 and still there is 3 days of space, , so if I was going to think of an equation for independent float. What would it look like?

**Student:** ((Refer Time: 15:58)) maximum of let us take a, it will ((Refer Time: 16:06)).

So, as far as the late finish of the predecessor goes it is the maximum value you have to take.

Minimum of the early start of the successor.

**Student:** So, minus activity,

Yeah Minus activity duration. So, there is a minimum early start of successor minus maximum late finish of the predecessor minus the activity duration. So, , so the challenge them becomes you will have the look through the predecessor as successor a make show you identify them properly and then, do this calculation.

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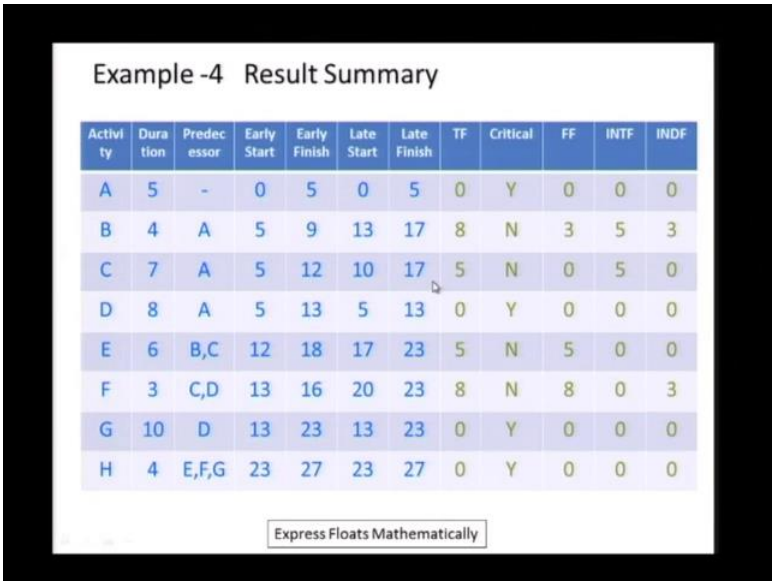


| Activity | Duration | Predecessor | Early Start | Early Finish | Late Start | Late Finish | TF | Critical | FF | INTF | INDF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 5 | - | 0 | 5 | 0 | 5 | 0 | Y | 0 | 0 | 0 |
| B | 4 | A | 5 | 9 | 13 | 17 | 8 | N | 3 | 5 | 3 |
| C | 7 | A | 5 | 12 | 10 | 17 | 5 | N | 0 | 5 | 0 |
| D | 8 | A | 5 | 13 | 5 | 13 | 0 | Y | 0 | 0 | 0 |
| E | 6 | B,C | 12 | 18 | 17 | 23 | 5 | N | 5 | 0 | 0 |
| F | 3 | C,D | 13 | 16 | 20 | 23 | 8 | N | 8 | 0 | 3 |
| G | 10 | D | 13 | 23 | 13 | 23 | 0 | Y | 0 | 0 | 0 |
| H | 4 | E,F,G | 23 | 27 | 23 | 27 | 0 | Y | 0 | 0 | 0 |

So, this is the table, which gives summaries all what we discussed and we have also discuss the float terms mathematically.

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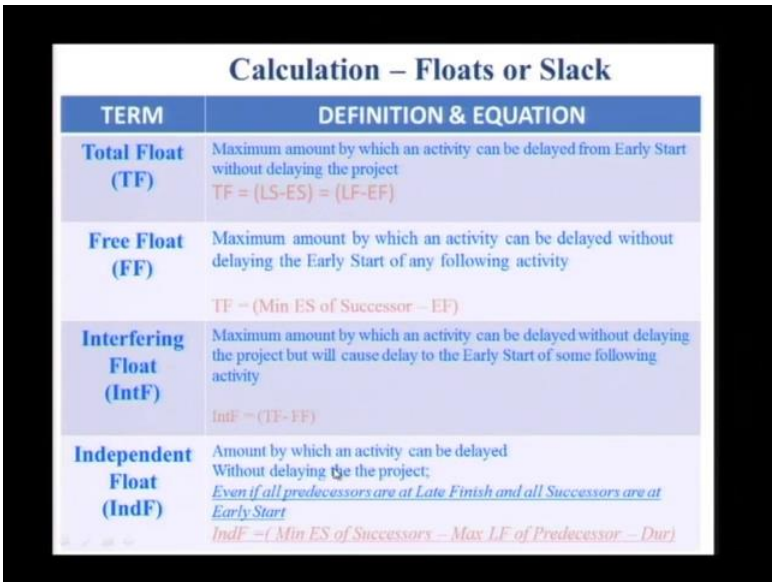


So, if we put in the various terms we have this is how we are looking at a total float is a

LS-ES early start when we take a free float = minimum ES a successor - minus EF, interfering float we talked about TF-FF and we just discussed independent float. So, in a large network you understood the concept of each of this, but you would tend to use the formula little or more then going and you know checking if you know using the bar graph for anything like that, but again when you using the formula understand what is behind a formula.

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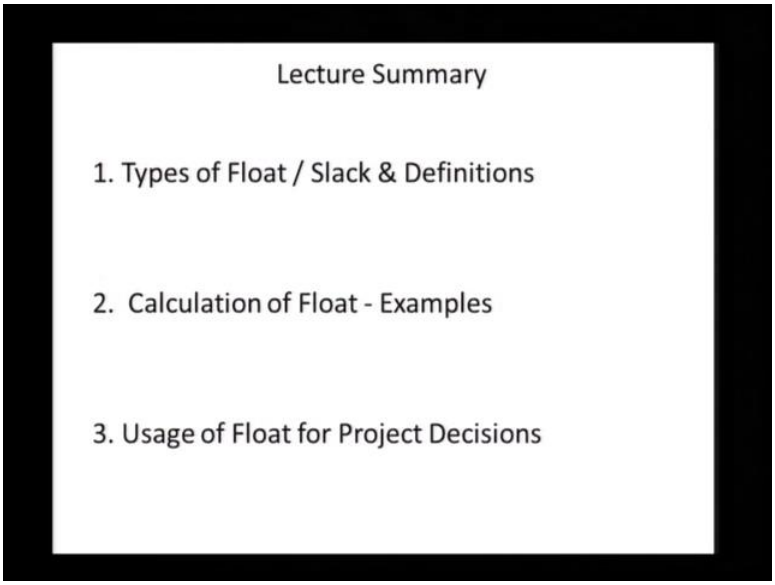


So, we looked the different types of floats and we went to the definition we did the few calculations went through examples and I think all of your actually understood it from the concept perspective. We looked at the equations also we also discuss the use of float for project decisions and this will come upand this keeps recurring. So, I am not spending a lot of time and the third point, because in every other aspect of critical path planning float becomes a very important issue specially the total float and the free float.