

Project Planning & Control
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Lecture - 35

Problem 1-Two Resources; Resolving Resource Allocation Problems

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Problem 1 – Two Resources

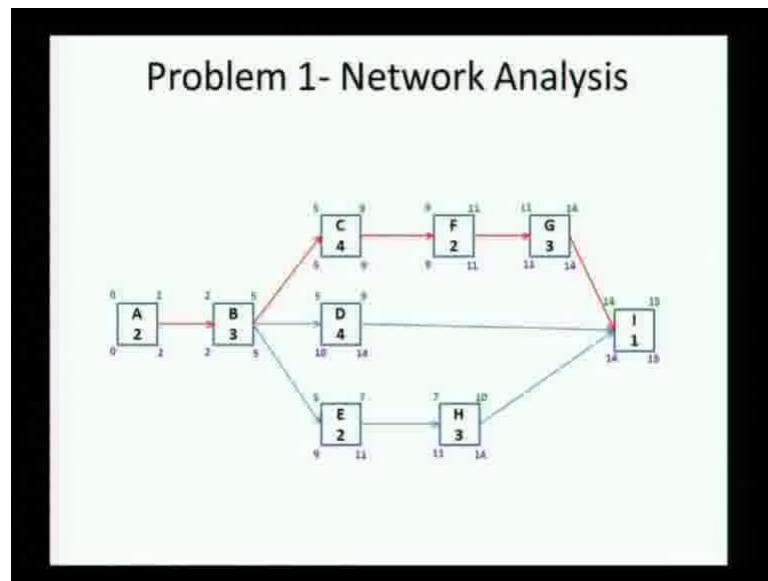
Activity	Preceded by	Duration	Trucks	Workers
A	-	2	2	4
B	A	3	1	2
C	B	4	6	3
D	B	4	4	8
E	B	2	4	2
F	C	2	2	3
G	F	3	2	8
H	E	3	1	1
I	D,G,H	1	1	3

Extension of Problem -1 Illustrating multiple resource conflict.
Use same network analysis results

If only 10 trucks & 15 workers how can over-allocation problem be resolved ?

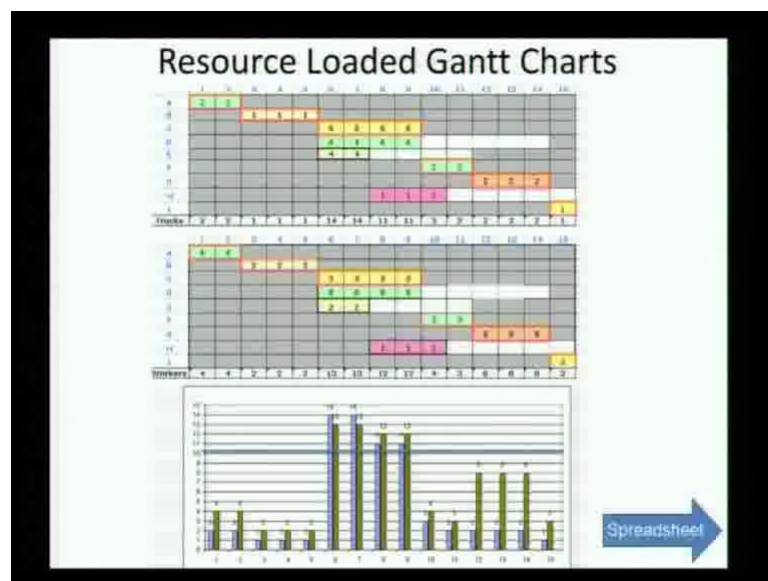
Let us now go to, we are taking the same problem the same network we took in problem one, but we are going to go with 2 resources. We are going to now we have remember, we had this problem with trucks as the resource, I am going to now add workers as resources and you have you have solved network. So, I am not going to ask you are of familiar with the network, that is why we are taking this problem. Now we are going to look at multiple resources and the possible complex multiple resources can cause, and I am limiting now with same 10 trucks and 15 workers, because we limited the same 10 trucks and but 15 workers.

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Remember this was the network.

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And I am going to the spreadsheet this resource loaded Gantt chart, what you have here. Let me explain this you have the bar chart, this is for resource 1 for trucks, this for resource 2 for the workers. So, you can see that this is the early start schedule, and you have the truck, so you remember here the 10 trucks, 15 workers, the trucks are over allocated, no workers actually are 15. Let us understand the network, we have been seen this C F G. So, we have C F and G, C F G is the is the critical path. So, you will find the C here, it is highlighted in red. So, A B C F and G cannot be moved; all of the other activities have float, and when you look at D it has float all the way till the end, we

have and then E. E right now as no free float unless H moves. So, to get any float for E I have to move H and H moves only upto 14, let us go to the spreadsheet. So, here is the spreadsheet for this and actually this also goes out.

So, you can see these are the critical activities we have here, which we cannot move and what we have here right now is D has shifted. So, now I let us in the early start solution what did I have, I had D here.

Student: ((Refer Time: 03:14))

Yeah, and which k and I have to go down here and shift D too. So, in case I forget to do that remind me. So, this is for each of the resources. So, we have we have 14 trucks and 13 workers the truck is over allocated, because I am only allowed 10. So, now my first reaction at least as a simple, might be it go to the late, if I just do that how am I? It is Fine yeah, but now but I have to do this too. So, now my trucks are okay, it is within 10.

Student: ((Refer Time: 04:16))

Yeah, the workers have exceeded like 15. So, you have conflicting resources not conflicting resource you have 2 resource with balancing conflicting, if the balance one other seems to be unbalanced.

Student: ((Refer Time: 04:34))

There is no relationship between them.

Student: Independent.

Independent.

Student: ((Refer Time: 04:43))

No, because I have got this, I have got this in to F. Now let us question need to ask, because that is, you know I model this as 2 spread, 2 parts of the spreadsheet one showing the resources of trucks other showing the resources of workers. If I could pull this and this could automatically good go with a macro, I would used what I am just using at in this form for now.

Student: ...In the spreadsheet we can place one with another

Absolute, I could just use a factor for that.

Student: Yeah.

So, right now they are not necessarily related for example, some might require 4 workers to load up a truck and other one might require just a backhoe, I mean a fork lift operative might just need one depending on material on what we are using I think ((Refer Time: 05:33)). So, right now we are assuming this no real relationship, but you have seen the problem which I want you which I am bringing that, there are 2 resources resolving the over allocation of one now causes over allocation of the other. So, how do we now resolved this. So, Is there a trial and error procedure I can use. So, let us take this back,. So, it is the almost like...

Student: ((Refer Time: 06:13))

Yeah, . So, E can now move because H has actually go gone to the end. So, lets us... So, moving E to the late start and it can move all way to here. So, 10, 11, yes. So, the solution here is that I move H all the way to the end, and then move E to the end now, H is now what has happened to my path, yes. E and H have become critical in achieving that E and H is also become critical, any other solution.

So, right now we cannot see anything else, but this is where an automated system would be used. Now for argument let us say that. So, we were able resolve this with you know you can find a resource profile here. So, for example, something here which will make it impossible, which will make it totally contradicted, the minute I resolve the worker issue become over allocated and there is no way there is no solution possible within the floats, it is possible its possible I give you exercise later to work out which we will contain such a situation, what you do then?

Student: ((Refer Time: 08:23))

Yes. So, one is to be able to go in a multiple shifts of work if that is possible.

Student: ((Refer Time: 08:30))

Yeah or we draw remember the strategy has been discussed earlier, I can say that I am not going to instead of taking I can use my float to stretch out, either split the activity..

Student: So that will dependent on activity.

It will depend on the activity it certainly depend on activity, but these are potential strategies. I can take the float, I can split the activity, I can stretch the activity. So, something like this for example, So, let us take here I have I mean I have I need 4 trucks and I will finish it in 4 days what if I give it only two trucks. So, if it is a linear

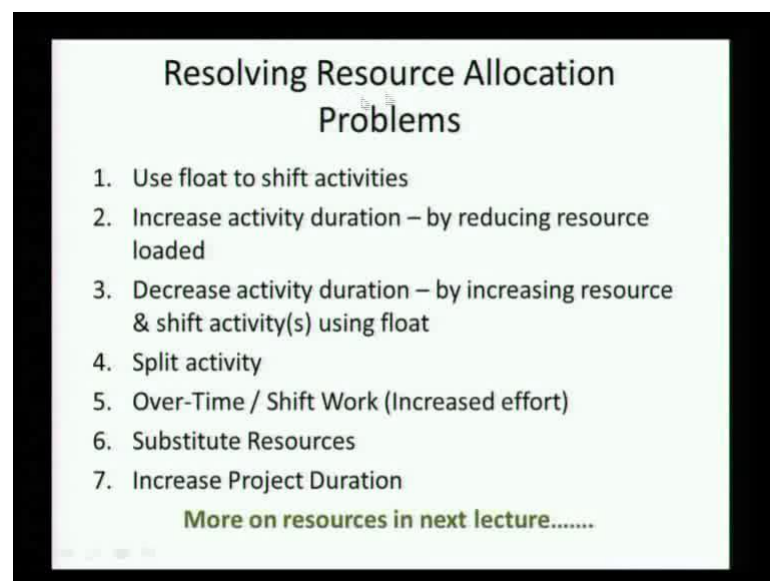
assumption. So, I can then I can go with this saying 2, it might change certain things in some places it might not, but I can I can do that and now it has actually brought my whole truck load down to 8 trucks, but it is a it's a potential strategy which a project manager might choose to use. And this is this happens in reality something is not available they say let the activity continue but we will continue at the slower pace is, but it will quantum of work will take longer to get done.

The other option like we said is to take the 4 from here, I could move it elsewhere now I have to obviously, move this also, yes yeah. So, now the workers are assigned, but these are I mean these are, you know strategies which you have to do and remember when I moved it 2 here, this will also it will not stop here, this bottom will also exceed. So, let me go back to that. So, here what did we do...

Student: 2

We did 2, 2; in which case I would reduce this to it's a strategy. Now I have to decide if that is workable or not. So, these are the various options we have.

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So, when we look at what we have covered today. We looked at resolving resource allocation problems, the basic way we learned was to use float to shift the activities. We also discussed that we can increase activity duration by reducing resources, and that gives us control on the overall allocation, and its possible strategy. And other one is to decrease the activity duration by increasing resources, we are not done this is an example, but you can visualize that this could also be done. Split activities we have over

time or shift work where we increasing effort then other ways is to substitute resources, you say I am not going to use a truck, I am going to use something else, I am going to use people to shift what I am going to do I have workers I do not have trucks it is going to be slower but it is going to work for me kind of a real thing.

And finally, if you have no option, you increase project duration, and you know kind of justify why the project duration has increased in this ((Refer Time: 12:17)). We need to cover more on this topic in the next lecture we will take up mostly on on the cash flow problem, but looking at cash outflow and inflow. And how do we balance are... the cash is a resource when we looking at billing the client and spending on work.