Project Planning & Control

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Lecture - 33

Projects and Resources, Example of 2 Resources,

Exercise, Two Span Bridge Example

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So, we have now discussed, a single project single resource is a scenario discussed, but you can image in there are other scenario like single project - multiple resources, multiple project - single resource or multiple project -multiple resource, which do you think as a project manager what do you think you should be dealing with.

Student: Single project multiple resources

Yes, as a project manager certainly the challenge we have a single project multiple resource

Student: There are project managers who deal with different projects at a time

So, if you are for example, there are many builders to build homes, they will have project manager will have project managing multiple project, but sometimes when we have look at as what do you say this. When we are talking about single project multiple resource we mean a large project, typically is a single project manager, but they are right they we

can have a single project manager with multiple medium as small project. And in which case he has a some ways dealing with multiple projects multiple resources, but again in terms of scale that might not be as challenging as a single project, that the volume or the repetitiveness typically multiple project a single project multiple projects are residential buildings and things like that. Now who has to deal with multiple projects multiple resources?

Student: Large company.

Large company. So, like we said when we are taking about a buying materials in bulk, or you have a plant and machinery division which itself is the profit center, that my plant and machinery division owns equipment in the company, and I have to you know give a equipment at different sites I have to charge the site for the equipment and I have to show profit of the company for charging the site for my equipment. So, then you have these then there really are challenge with multiple project multiple resources. Another example of multiple project multiple resource, which is happening today is what we talk about metro ((Refer Time: 02:37)). You take a single company they might have multiple they they have multiple projects just on the metro rail in the city. So, they have a station building here, a station building there or a rail section here, and they have to share sources between these multiple projects that might be and its is a challenge, if you get to a.

So, if you really get to a sum of a large construction company there spread all over the country, they cannot there are very few resource, they can share across the country. You know very heavy cranes thing like that, but with in a region there is a lot of resource that sharing that needs to take place and really, it is quite a challenge, any question?

Student: It is when you have very valuable resource.

Yes.

that is not from a vendor's perspective, I have to take get material for multiple projects, and that material if I can get a bulk discount on the material.

Student: Equipment.

Yes, other example is equipment and typically it might be, it is a I mean there was for example, in some case you might have some, some kind of pumps which are heavy duty. And you can only use it we such high volume you are not going to have many of those

on a in a company, but you will need it on a certain projects. Common example is cranes.

Cranes.

Yeah, just heavy lift cranes, company will need it it's a very valuable resource because if you have it you can use it get on the side do a and leave the very efficiently, but invest an crane is a crores, but its usage has to be across multiple project, you cannot write it of on a single project. Any other example you can think of…

Student: ……

So, sometimes the owner decides that he has, so many project not its not the contractor who does the resource sharing it is the owner who actually invests in the crane, and all the equipment and then does it. So, our focus will mainly be on on single project single resource to illustrate how resources are modeled and the basics of it, but we will go on to the challenge of looking at a multiple project multiple resources in a later lecture. You will find there is a lot of subjectivity that comes in it, it is when we are trying to do scheduling, when we are trying to do the, an optimal schedule there is a lot subjectivity, and that's what still makes it a challenge.

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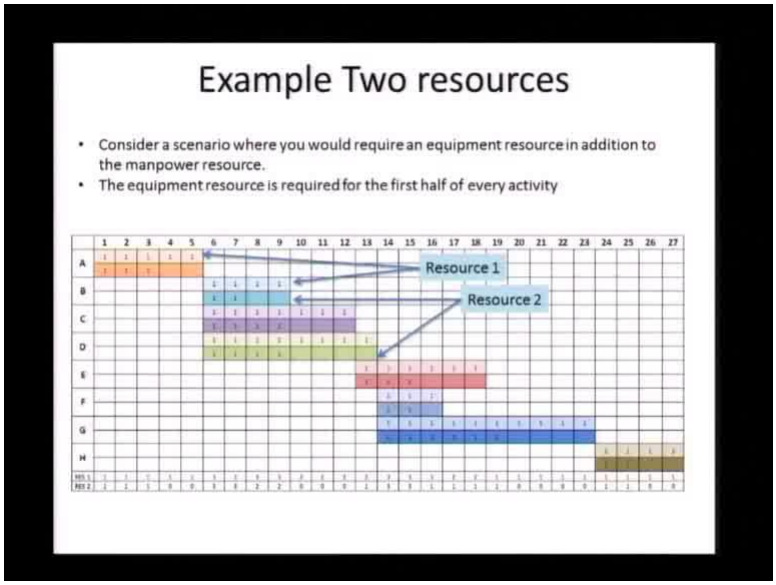

So, now let us go on to 2 resources everything remains the same, what we have taken as a resource one, resource two, and we are here we are taking a scenario where there is an equipment, and man power we are saying the equipment is required for the first half of ach activity. So, the equipment will be used for sometime, but the man power is required throughout in principle everything is exactly the same all you are doing is adding up the

total for each day here.

So, we have resource 1 resource two, and you will see this is for that day what the resource load is. So, you can see for equipment it goes up to 3 for man power also it goes up. And here we using unit quantities just for a illustration. So, everything kind of remains you know the number remains small.

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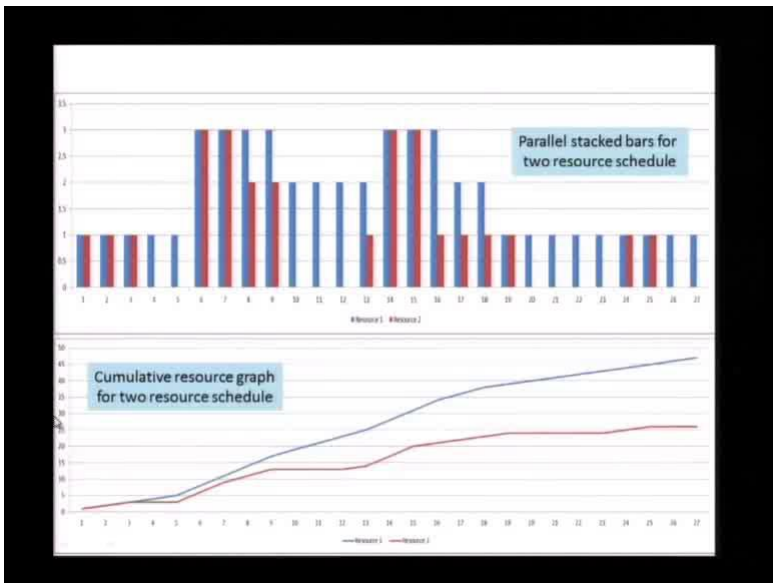

And if you want to visualize what is the histograms, we can kind of visualize the equivalent histogram in this way, and this could be the cumulative resource graph for the two.

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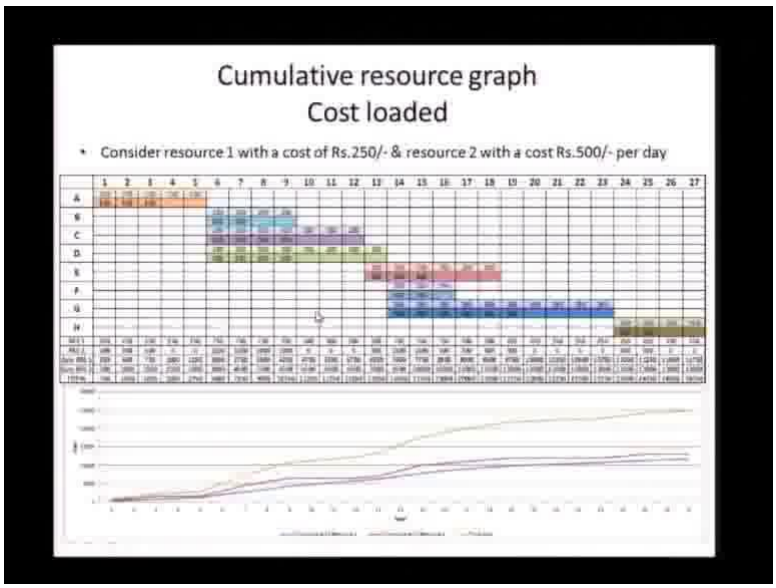

This becomes the cumulative becomes meaningful, when we put cost into it and we going to be. So, we are saying the cost of the man power is 250 per day, and the equipment is 500 per day. And now we have cost loaded the bar chart. So, all of these values now relate to cost. So, here you can see all of this, this is 250 for the resource one, and for resource 2 you can see the values and the cumulative values for resource one, cumulative values for resource 2 and the equivalent graph is over here. So, this is the blue line, shows you the resource one, cumulative graph the red line for resource two, and the green line the total. So, if this was my project I will have to be I will have to I can know, what my cumulative cost is how much money would have spend by day 10 for example, now let us do a small exercise.

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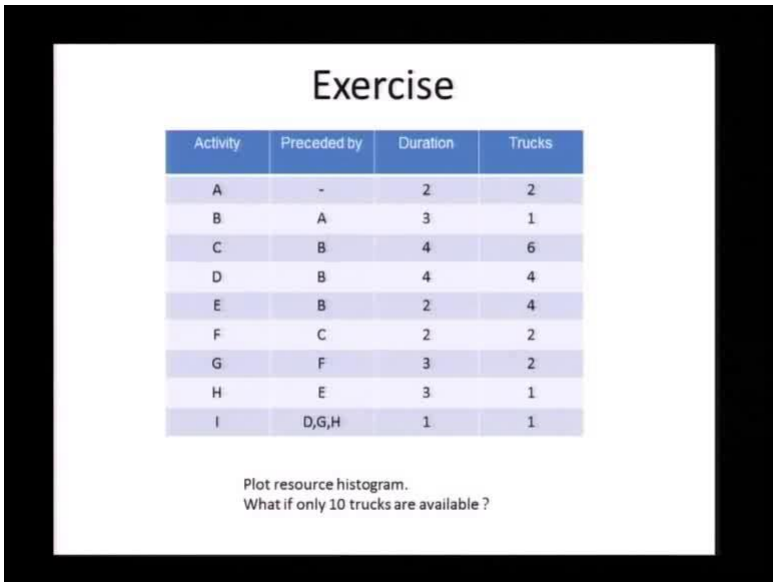

This is a network you are familiar with the durations are little reduced. So, that you can a get it within a reasonable time and you will able to a plot these do the calculations for a lesser number of days, but go ahead plot the network. So, give a given you the duration I have given you the resource I have given you as trucks, and we are also a going to ask ourselves question what if only 10 trucks are available what would you do, but before we get to the second question, lets just plot the resource histogram for the early start plot the resource program for the early start

Student: we need to draw…

We need to draw a network. How else are you going to do it.

Student: Gantt chart

Yeah how will you draw a Gantt chart? Try it

See if you can do it without the network analysis its something which you want to try. Yeah you want to try doing this without the network. You can draw it because it is simple enough, but we see that the any way doing a network analysis in your mind.

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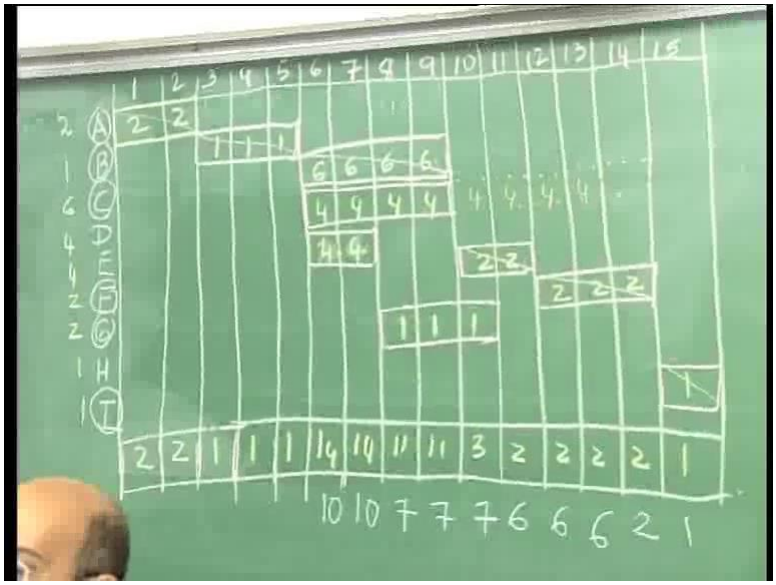

So, what we do not to plot what will do is will come out with numbers at the bottom just put the numbers a plot will be and does we will take it we will get. So, this is the network gives you bit of practice to do your network analysis. So, what I have here is basically a table which we are going to enter values in I have the resources number of resources, so when we take A what it goes from. So, that is the bar chart for A and we are entering 2 in each what about B, B goes from and we have 1 C

Student: 5 to 9,

5 to 9

Student: 6 to 10

That is what 6 that is that is when we say 5 here this is the end of 5, this is the start of day 6. So, this is day 6 to and it has 6 D is same, and it has 4 E is 5 to 7 F 9 to 11, I am going to it to 11 to 14, yeah which 1

Student: E….

E should have 4, thanks.

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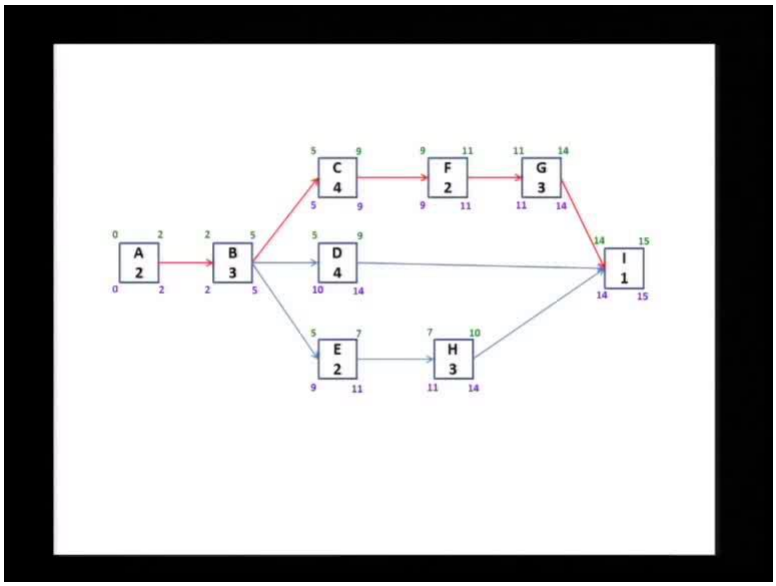

So, we are at G now we go to H H goes from 7 to 10 and it has 1 and I is fifteen and it has one. So, it becomes 2 1 1 1 14 14 11 11 3 2 2 2 2 1. So, this becomes the resource profile now which are our critical activities we know that, so the first thing. So, this is answers the first question this is the profile. Now the second is are there any questions on this once the profile is determined. Now I know I have a trouble right I will not able to do this early start profile, because I have 14 and 11 is there anything I can do about it?

Student: Utilize the floats

I have utilize the floats. So, in order to utilize the floats I have to the understand first of all which activities have floats, I know that A this is critical, B is critical, C is critical F, G and I. So, all of this I cannot there is no float on B, I had it is fixed I cannot move this at al F right G and I. So, whatever profile change I have to do is with by moving D E and H, and H that's it. So, now, we can see that we can see from the network and from here that the D is able to move how far can I move D I can move D all the way uptil here right?

So, I can basically move the float allows me to move D, all the way there right? So, if I move. So, I am going to put this in orange. So, now I am moving D all the way so this is my 4 days I want basically this is getting overloaded, here because of the 6. So, I am moving D out of the influence of C, and I am going to that is let us take it lets give it as much float I am going to move D here 1 I can move further, but is this enough 4 5 6 7.

Student: Its enough

Its ok. So, if I do this what I have basically done is move D away from the influence of the 6 so basically I land up with10 10 7 7 7 6 6 6 2 1. So, I have I am now within my equipment constraint the amount I have 10, and because I was able to use my float I am able to do my job still within my project duration. So, here we have talked about single resource single project you can imagine. Now if we are trying to do this with multiple resources where this might require more of another resource something else might recovery more of another resource and. Now I am trying to balance or and all my resources to be within my available the problem becomes more complex any questions on this.

So, we can now you know you can put cost plot the cost curve all of this becomes just procedural you will need to do it so that you get a feel of it, but it is it is relatively simple the key here is network. So, network again network analysis is what provides us the bar chart network analysis is what gives us the float we are only resource loading the results of the network analysis, we are calculating total resources on a day and that gives are lot of information to able to manage the project, let us a kind of look at the application of this into the two span bridge. So, this is its its you remember what were the resources we considered here, the key resources so if you remember this had things like delivery of piles, you know beams casting beams piling.

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Two Span Bridge

ID	Activity	Duration	Precedence	ES	EF	LS	LF	Float
A	Order & Deliver Piles	15	Start	0	15	0	15	0
B	Cast Beams	20	Start	0	20	51	71	51
C	Drive Piles East	12	1	15	27	15	27	0
D	Const East Pile Cap	08	3	27	35	27	35	0
E	Const E. Abutment	36	4	35	71	35	71	0
F	Drive Piles Centre	6	1	15	21	31	37	16
G	Const Centre Pile Cap	07	6	21	28	37	44	16
H	Const Centre Pier	27	7	28	55	44	71	16
I	Drive Piles West	12	1	15	27	15	27	0
J	Const West Pile Cap	08	9	27	35	27	35	0
K	Const W. Abutment	36	10	35	71	35	71	0
L	Place Beams E. Span	07	2(a),5,8	71	78	71	78	0
M	Place Beams W. Span	07	2(b),8,11	71	78	71	78	0
N	Deck Slab East	15	12	78	93	78	93	0
O	Deck Slab West	15	13	78	93	78	93	0
P	Lay Roads	25	14,15	93	118	93	118	0

So, we are just taking a few key resources, which which have to do with the crew.

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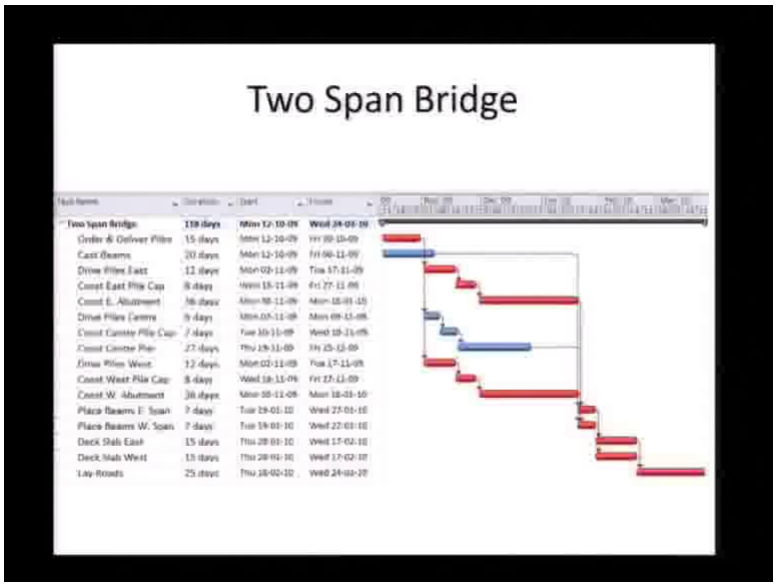

We are taking we are going to take just the concreting crew the piling crew and the bridge lunching crew and here is the bar chart of the two span bridge and if you recall this is with unlimited resources we have put it on to a project planning software. So, you will start slowly getting introduced to the project planning software tool, and you remember we had 2 critical paths, we had the 2 abutments that were critical the middle was not so critical you can see generally that is here.

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And we are using these resources we are using you know the precasting gang we are using a piling we are using concreting we are using a group of resources for girder launching and road block. So, these are the key resource group, we are going to use.

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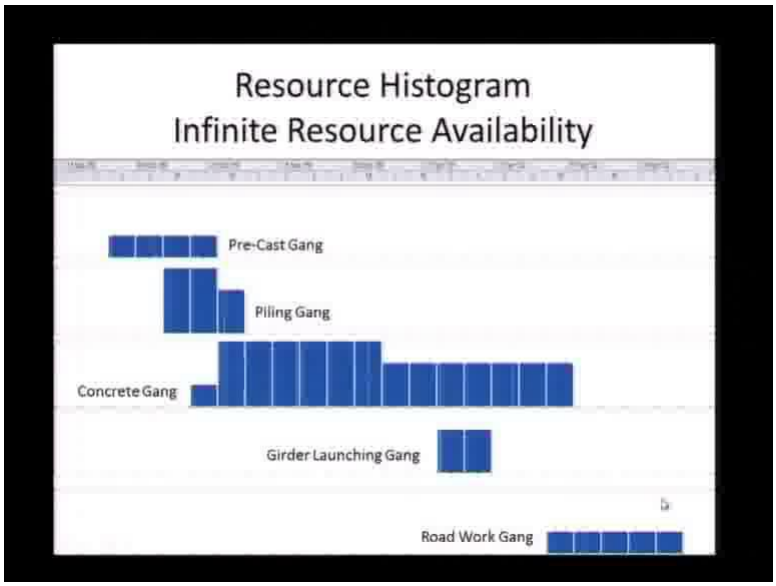

And we have basically loaded the resources, and you know we are taking about multiple resource single project, and you have to get it in you can see the software does it for you shows you the resource histograms for each of the resources, which we are considering. And if you have if you are going to say we cannot see the unit here, but if you going to say that only one gang is available for each each of the resources, only single is available the over allocated resources are shown. And now you have to take a decision If I really want to finished the project in that time it means I have to mobilize that amount of resources or we have to go to shift work it, If I had only assumed 1 single shift here I might have to go to multiple shifts If I finish it within the same a calendar days. So, these are the decisions a project manager has to make and resources have a lot to do with how there are made effect.

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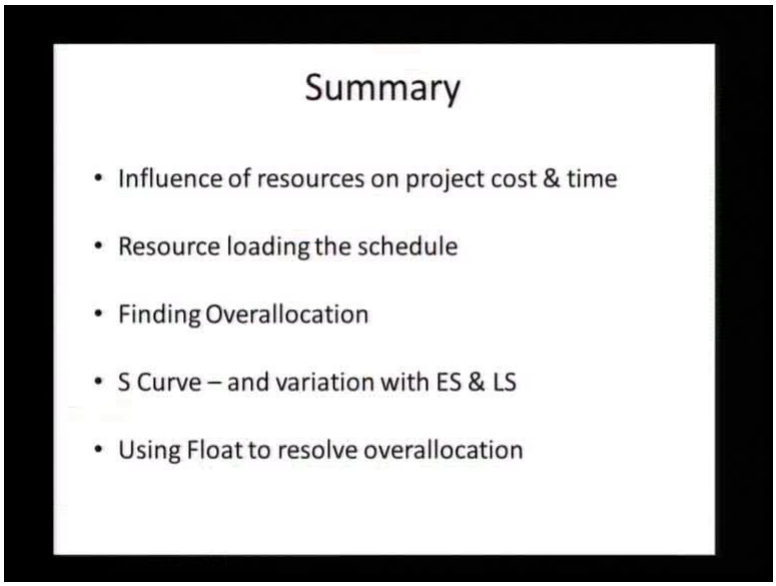

So, kind of s summarize what we covered here, we looked at the influence the resources on project cost and time we discussed it, and you know that it has significant influence. We resource loaded a schedule saw the histograms, saw the cumulative, cost curve, you know the cumulative. And then we actually used the histograms to find overloading of the resources. We looked at the curve the cumulative cost we discussed the S curve, we saw how it varies with early start and late start how that can influence the project. We also used in their example here we used float to resolve over allocation, and this is a very important step as to how to use float and how we can not only for over allocation, but in the later lecture will see a how we can use float to level resources.

Thank you.