**Simulation of Business Systems**
Prof. Deepu Philip
Prof. Suman Samanta
Department of Industrial & Management Engineering
Indian Institute of Technology, Kanpur

Lecture - 18

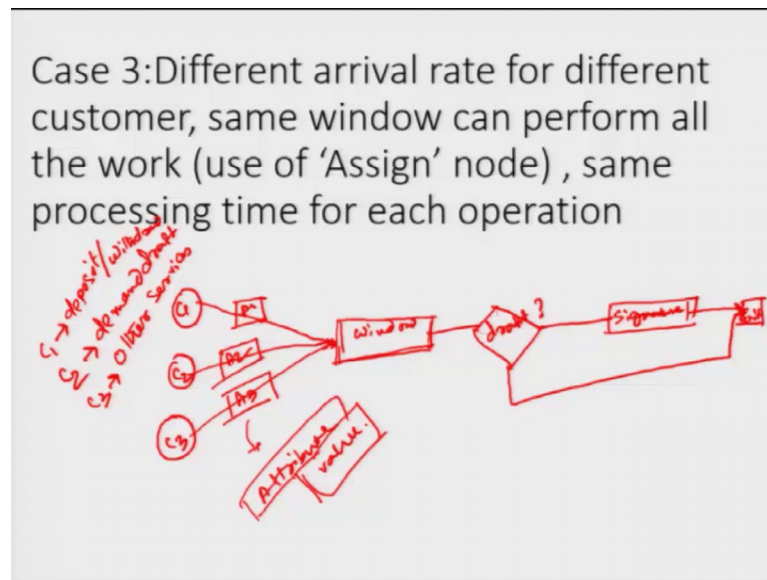**Simulation with ARENA: Use of Assign Node**

Hello everyone, welcome you to the, to here another lecture of Simulation of Business Systems and applied approach and I am Doctor Suman Samanta.

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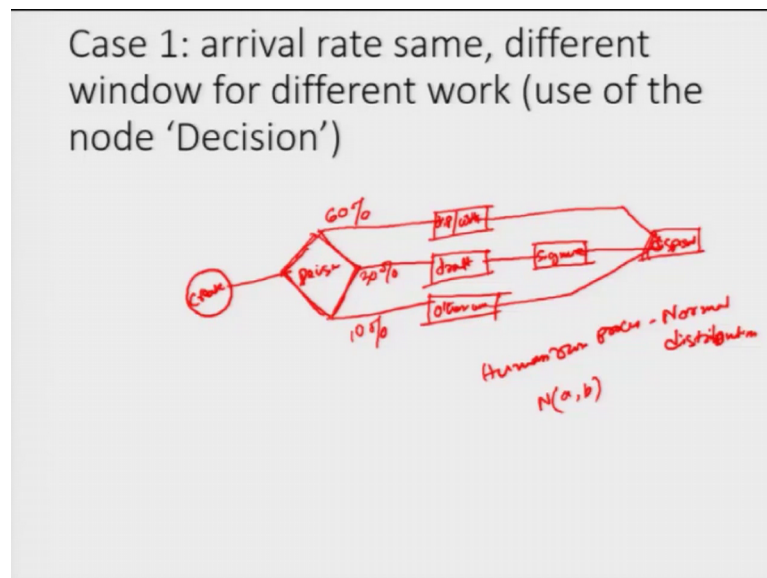
So, far we have discussed two cases on which we have shown you how a decision node can be used to develop arena model.

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And we also have seen that how different create nodes can be used on a single simulation model and that can be utilised to run a simulation model, and how we can analyse the simulation model [vocalised-noise]. And we find out that, where we need to put an resource and how to improve the model and how to improve the process.

Now, we will go to the third case in which we will discuss about the use of assign node. So, two discuss this using of assign node, first of all what you assume here is that the bank have common windows for all the three operations that we have discussed previously, which can serve a customer for the deposit and withdrawal can also do making the demand draft and can also do other things as well..

So, the customer depending upon the customers variety, the customer do not required to choose different window they need to go to a same window and then they need to find out they need to serve their work. So, we will first try to develop this thing, and in the pen and then we will go to the arena and we will tell you why and how this assign node can be used and required.

So, first of all say we will start with previous case we use three different create nodes; C 1 is for the customer that require money deposition, money deposit or withdraw C 2 is for the customer who require a demand draft, and C 3 are the customer who require other services. So, we will start with the previous convention as well and we have said that we have only I mean same window can serve all the three operations. So, we have one

process where I mean process window where all these three customer can reach and get it served. So, this is basically called as window and the process it can serve is all the three. But the problem is that as we have said in the previous cases as well the demand draft, making requires two processes. It is one is done at the window and the second is the draft requires to go to the manager for a signature.

So, the problem is that if we go in that way, in this in the way like this and we add a process here signature. Then the problem that will occur is that all these customers that reach to the window will go to the signature process as well. But we specifically do not require this thing what we require is that only the customers that came for making their demand draft, they need to go to the manager and get their signature on the get his signature on their draft. So, to do this thing what we need is that, we need to identify the customer separately. So, how we will do that? We will use assign node and we will assign some value to each customer. So, that that value will identify their customer and directed them towards the signature node.

How we will do that? We will put one assign node in front of each customer. These are assign node 1, assign node 2 and assign node 3 and we put some attribute value. These attribute value will significantly identify the customer significantly identify the customer and drive them to the next process. I mean next process means because the window process is same and the next process is signature and for the signature, we need only the draft making customers to go. So, we will put an attribute to all these customers. So, before this signature we will put another decision node draft or not. If the customer wants to make draft, then they will go to make the signature done and exit, and if the customer is of the other two types, then they will go directly to the exit understand this thing.

So, now since we have drawn this thing, this process flow on the pen and paper. Now we will go to the arena again and we will try to develop this in the arena simulation software.
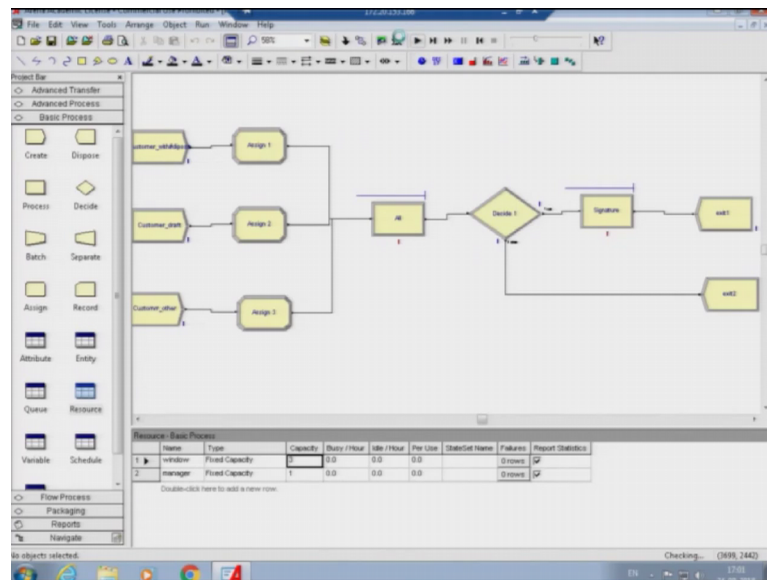
So, very like to the similar case, we will start with adding three creates create nodes, which will create specifically separate kind of customers. So, first customer is first kind of create node will develop the customer whose kind is basically a withdraw of money or deposit of money in a simulation we will put that in every say for example, three minutes one of such customer arrives at the bank.

So, the second case as well we will make this name as customer underscore draft, this one should be put as minute and the value maybe a say for example, every 4 minutes one customer comes to make a draft. Similarly for the third case which can be renamed as customer other (Refer Time: 06:45) randomly distributed randomly exponentially distributed and the value will be a say for example, per 6 minutes one customer comes for availing this other services.

So, as we have said previously here, we have only one window one kind of window maybe there may be more than one window, but all the windows can serve all the three kinds of such customers. So, we will put the process name as all, because it can serve all the processes we will use (Refer Time: 07:26) release, again we will put the resource name as window. Say for example, for this particular case what we assume is that, all the customers are getting served with similar mean and standard deviation using normal distribution. Say for example, all the customers are have got served by with a mean of say for example, 6 minutes and with a standard deviation of one minute; irrespective of

the what customers want to want to get their service. As I told earlier, we need to put assign nodes in between two specifically identify this three customers.

So, that for the customers who want demand draft, we can direct them to the manager and all the other customers who do not want demand draft they can be they can directly exit after they have completed their work at the window. So, here is the assign node. So, we will put a assign node in front of every customer.

So, as I said you earlier that we will put the attribute value as say for example, customer 1. For the customer 1 for the customer 2 customer kind of 2 who want to make demand draft we will change the we will add an attribute value, we will say attribute name as customer and value as attitude name as customer 1; we will put that attribute as a customer 1 and the value is 1. Similarly for the second case we will name the attribute as attribute 2 attribute as customer 2 customer 2 and the value is 1. Similarly for the third case as well we will put the attribute name as customer 3 and put the value as 1.

. So, we will connect them again with the process make the connections by using the connectors. Then we will have to put a decide node to decide whether the customer belongs to the draft making group or the customer belongs to the other two groups. So, similar to in the previous case we have used n way by chance in the first example; because we are basically dealing with the percentage of customers that are going to get served in various processes. But here the case is that we want to identify which customer is that which customer is of a particular type.

So, we will use this two way by condition. So the, what is the condition? Condition is that the attribute that we have already defined in the assign node. So, what attribute we are actually looking for? We are looking for customer 2 because customers two are dealing with the draft making. So, what is the condition now? Whenever these thing passes through the decide node; decide node will check whether the customer 2 value is equals to 1 or not if the customer 2 value is equals to one then they will direct it towards the manager and if not 1, then they will direct it towards the exit. So, that is what this decides node will decide.

So, similar to after the decide node, we need to add the process of signature which will be done by the manager. Add (Refer Time: 12:03) level is here normal distribution minute previous like the previous case we will put 10 minutes as a mean and 2 minutes

as standard deviation manager. So, we will add this two nodes and finally, we will put the. Now we can put a separate dispose node for the other cases as well, we can make the node dispose node same as well. I mean that does not have any difference in the output if we make this as a separate only to make the model more clear that others are going away I am making this a arrows more clearly visible I am just making this disposal node as different, but it can be made same disposal node as well when this is just and exit node.

Remember for this process, what we have we are assuming is that all I mean in this model what we are assuming is that, all the three processes that customer 6 will have a same time spends in the same similar kinds of time spends in the window, and all are having similar normal distributions standard deviation that will be within which the customer will be served..

So, now we will run this one more thing is that, previously we have used three (Refer Time: 14:06) windows and we are we have used only one windows for lets increase the window number initially. So, say that [vocalised-noise] there is not only one window there is three windows, and all the windows can are capable of serving all the three tasks. So, now, we will run this simulation model and we will check how the system is working.

As I said earlier, we need to find out the run setup again and again which time we run the process otherwise it can go up to the infinite length and we cannot get a result within finite times. So, so in order to previous case, we will also we will again add this application length as 50 hours and hours per day as 8 hours. Now we all set to done the simulation model, then you can see its running and is it running ok.
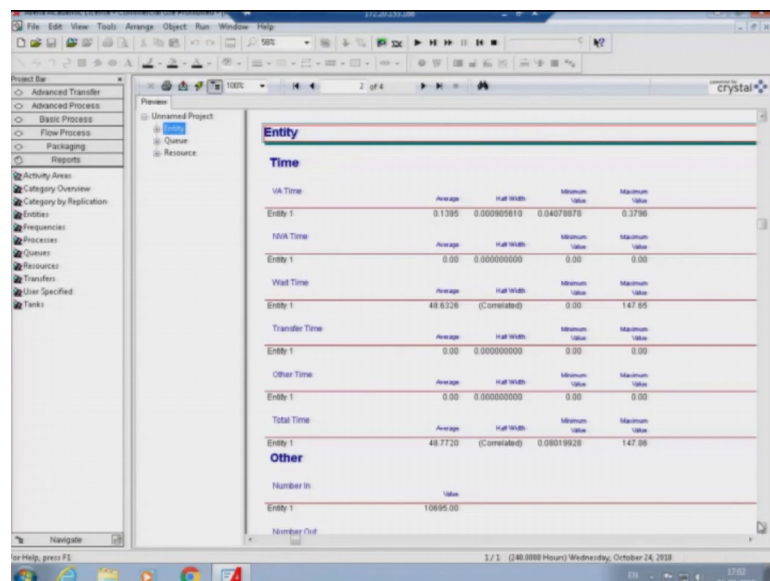
As you see it is running very quickly. So, I need to put it little bit faster so, that we can get the results earlier the results have come. So, let us check the result.

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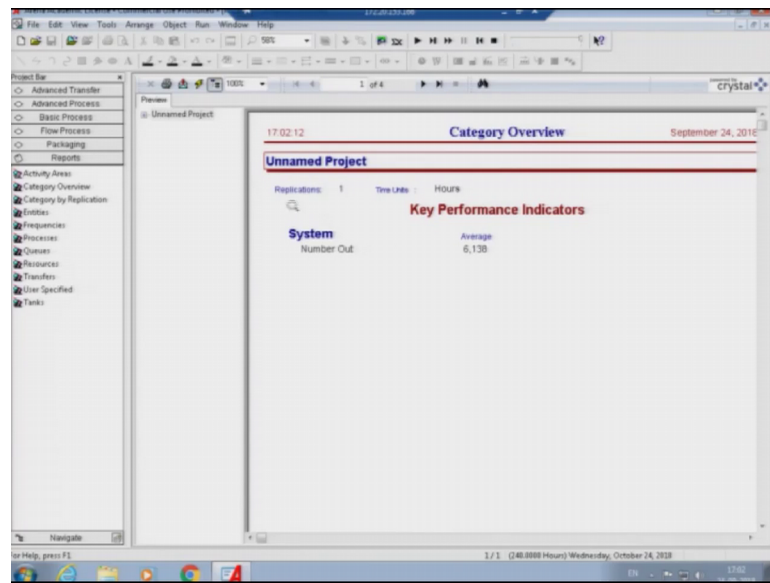
As you can see the total number of people gets served is 6138.

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Here again there is a huge discrepancy in number of people who came to the bank and number of people they who got out from the bank in. So, definitely there has some issue with the system, and there may have requirement of some entity some other resources.

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That will be again understood by analysing the queue and resource tab.

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So, when you see the queue tab, you can see that all I mean the windows three windows that we have introduced. They have an average queue length of 41.36 with a maximum queue length value as 80.416 similarly for the signature queue also there has an average queue length of 49, and maximum value of 99. So, definitely there are people who are waiting in the queue to get served, but they got not served they did not get served

throughout the day I mean throughout the period at within which we have run the simulation.

Now, are people waiting in the queue, that we can see that further in the all queue there has around 1800 people are waiting, with a maximum value of 3500 people are waiting. So, definitely there need to add some more number of windows. So, to get served in the bank it seems that the bank is very busy, but we have the only three windows to get them served and they are not getting served with these three windows. Similarly for the signature queue as well we see that there is only 500 number. There is around 500 numbers of on an average waiting in the queue, and with the maximum value of 1000. [vocalised-noise].

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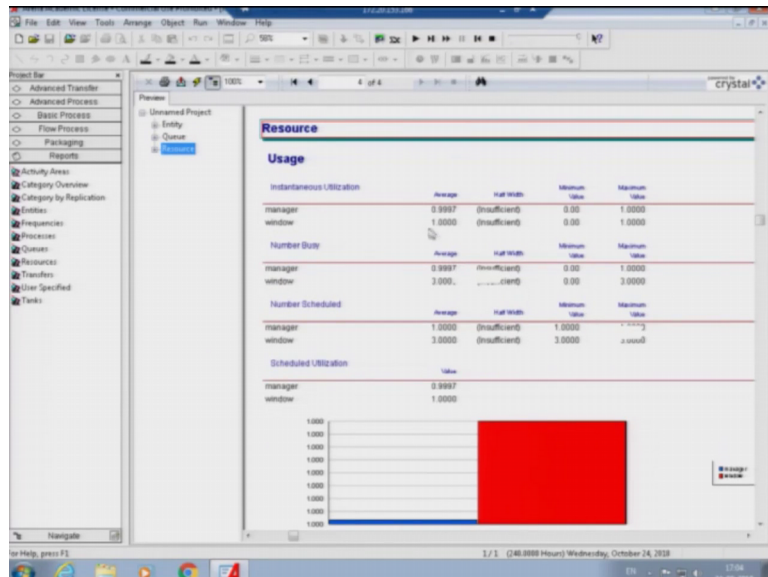
When you see the resource utilization, you can say that again the window is fully utilized with around with one utilization factor manager also having utilization factor near about one.
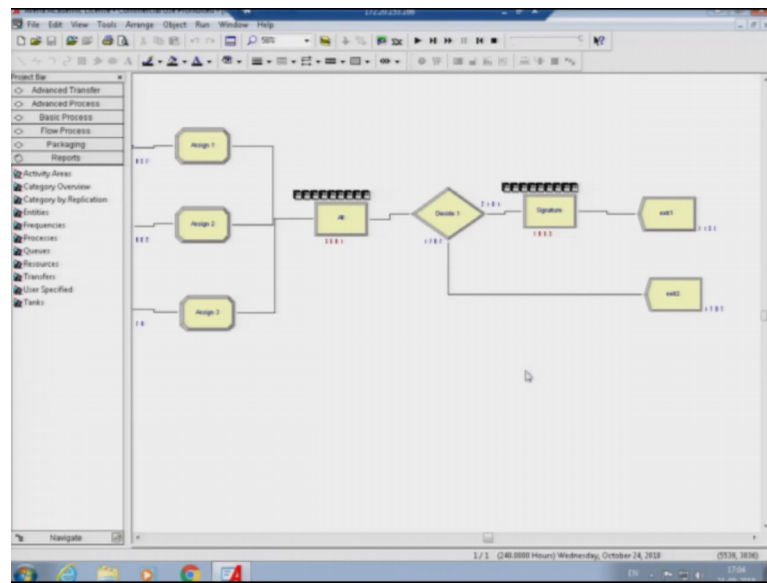
So, to do it is very much significant that we have to add more windows in the system to gets to get the people served. So, when you see this diagram I mean this after run GUI of this of this window, you can see that there are number of customers waiting in the queue in the all window, and similarly there are number of people who are waiting in the queue in the signature window after the end of the run. And similarly there are 3581 numbers though the numbers very hazy and not visible very well, but it says that there are around 3581 number of people who have not got served within the run period in the all queue. And similarly for the signature window there is around 81 853 number of people 1853 number of people who have not got served after the tenure of this run.

So, definitely we need to add some resources here in this all window and in the signature process as well. So, what we will do is that in the previous similar to previous case we will add the, we will go to the resource tab, we will increase the capacity from 3 to say 4 in the window, and we will increase the capacity of manager as converts to 2 from 1. Now after this change what we will do is I will run it again and we will check how much it has been the process has been improved with the addition of this two new.

So, you can see that the number of output that has been increased from the previous case; when you go to the entity tab a column tab then you can see that there are number of inputs I mean a number of people that has been enter into the bank throughout the tenure of the simulation is 10639 whereas, number got served is 9256 clearly there has still

some discrepancy in this number, and again we can see that how the queues are behaving you can found that by analysing this queue and resource. Second you can when you see this queue tab you can see that all queue still have an average waiting people still has a length of 13; the all queue still have number of average as 13.

Similarly, the with the maximum value of 22, I mean sorry waiting time this is basically the all queue has a waiting time of 13 minutes on an average with a maximum value 22.87 minutes. Similarly signature queue has an average waiting time of around 11 minutes and with a maximum value of 23 minutes.

Similarly, number of people that are waiting in the queue also can be analysed that in the all queue there is around 573 people are waiting on an average with a maximum value of 1060. Similarly for the signature queue as well there has a number of 146.70 people waiting on an average with a maximum value of 327. So, it signifies that when you see the resource then also you can see that the manager and the window also have almost weird out with their, I mean work they almost have one utilization factor.

That means they do not have do not get any time during their eight hour shift and they are all busy in during all the times. So, definitely there has a requirement of adding another resource in both the cases in both the processes. So, we will do that again and we will run it again. Say in the window we will add one more resource and say in the manager case tab, we will more we will again add one more resource. So, now, we will run it again and then we will see how the system performs.

So, it has been done. So, now, you can see that the number out has again been increased. Again the number input is around 7 1 10713 and number of output is around 10705 that is a pretty mean very much close and I think now the, perform has been the system has been performing a pretty much well.

Now, when we see the queue, and you can see that waiting time in the queue has been reduced significantly by means of that only the all queue has around 0.06 minutes waiting time with a maximum value of 0.5 minutes waiting time. Similarly signature queue have only 0.13 minutes of waiting time with a maximum value of 1 minute of waiting time that is that we can see that we have improved the process very significantly.

While we see the all queue I mean number of waiting in the queue, we can see that the all queue have around three people are waiting on an average with a maximum number waiting as a 28. And similarly for signature queue there is a two number of people waiting on an average and there are 19 numbers of people with a number of people are waiting at max.

So, when you see that the utilisation factor, then you can see you can find that the utilization has been predominantly reduced from 0.99 to 0.8489 that is pretty much acceptable that is pretty much acceptable resource utilisation, because if it is going above 9.95; this may lead into the conclusion that the process requires another window to for the customers to be served otherwise there will be very much and there will be a number of unsatisfied customers who got who did not got served after the completion of the time.

So, the issue is that here the thing is that to be point to be noted that when we start analysing the arena model Arena simulation model, we put resources one after one and then we try to find out how the model is behaving. We do not relevantly add more resources. So, that at the end of the time we find that the system is performing well, but that is not basically the aim we need to add one resource after another and then we will have to we need to check it by running it more than one time and then we will we need to be find out that how this is (Refer Time: 24:05).

As you can see in this window that one more a few more things that to be added in this wizard, you can see in this window that there are two customers which are not got served in the all the node where is there is no customer who has been got served in the signature node (Refer Time: 24:19) this is it says seven customers and it is called zero customer that has been got served not served in the signature window. Now if you closely see this values I am not showing sure that whether it is visible to you guys or not I am just trying to increase this so, that it can get little bit of visibility.
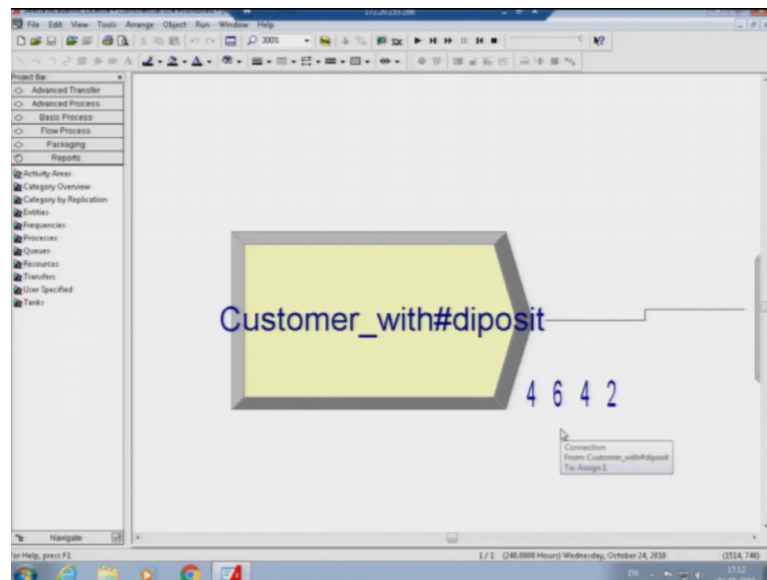
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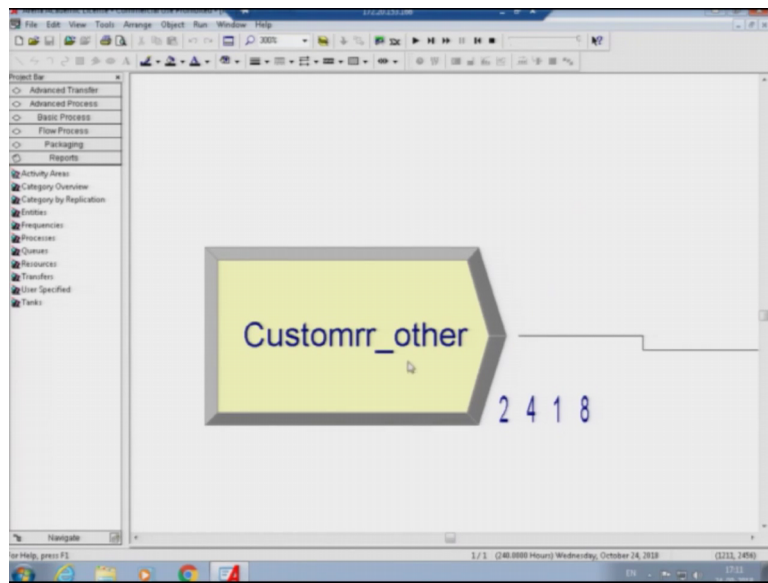
Say for example, this customer other you can see that there are 2 4 1 8 customer has been produce under the tagline of customer others.

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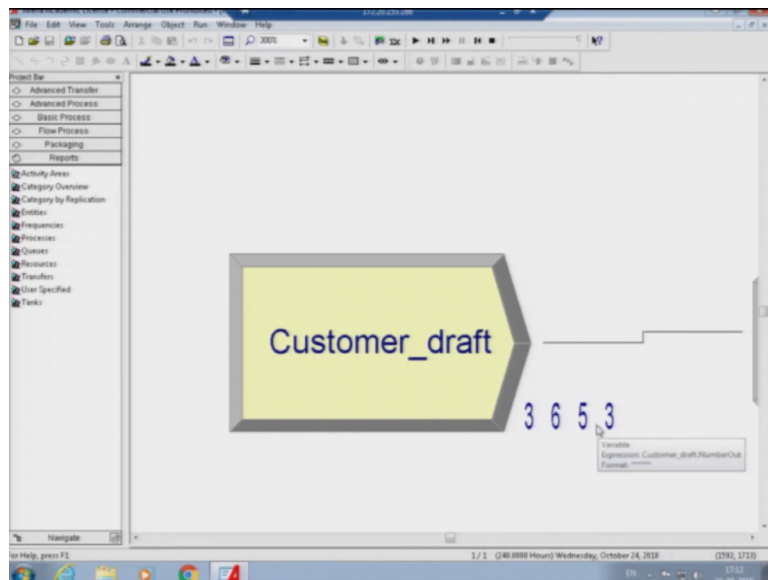
 Customer draft there is 3657 number of customers has been created in this by this create nodes.

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There are around 4642 number of customer has been created by this customer withdrawal deposition node. So, you can check this things here as well I mean for a small instance as well. Similarly, you can see at the decision node as well.

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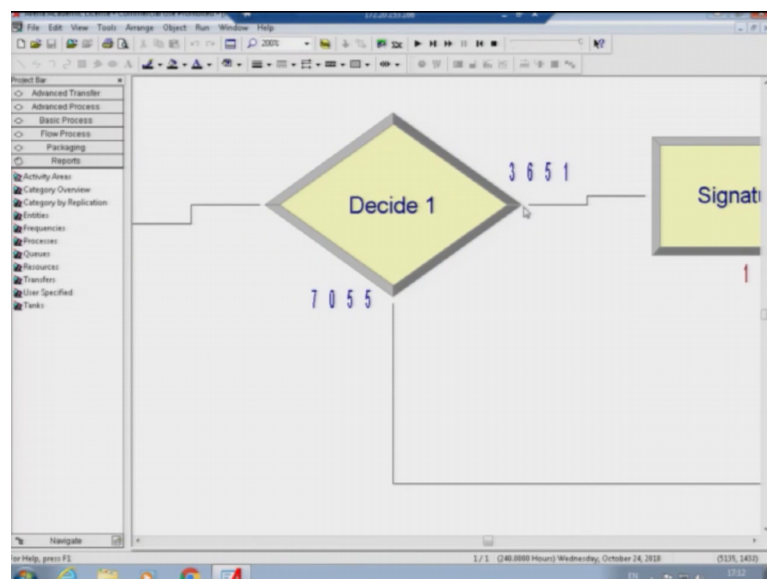
Decision node as well there are 3651 entities that have been divided by this decision node. For the 3171 cases the attribute became I mean the attribute basically became yes became truth. So, they went to this signature and for the 37055 number of people the

attribute of the attribute customer one customer 2 equals to one not became falls. So, they directly got exit.

So, in this way you can take a cross check here as well that whether the number of people who has been entered into the process and whether these two things are matching or not this also you can put a check in the simulation; arena simulation.

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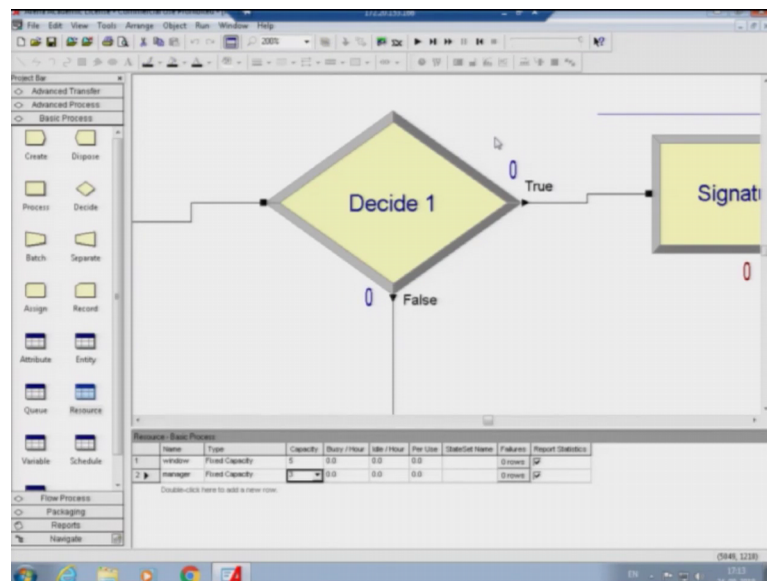
So, that is all for the second part of this lecture and we will go to the third part in the [vocalised-noise] next lecture.