Stochastic Processes - 1
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Lecture - 20
Example of Classification of Stochastic Processes (Contd…)

The next example. The example two.

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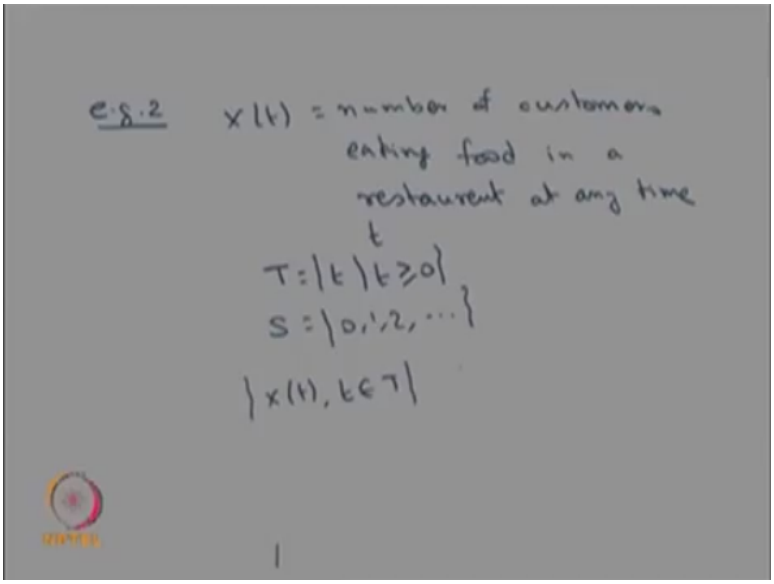

In the example two, when we make x of t that is going to be number of customers eating food in a restaurant at any time t. Therefore, you are observing the system you are observing the restaurant. How many customers are taking their food? Therefore, the possible values of parameter t are going to be t greater than or equal to zero. And the possible values of S still it is a count therefore the possible values are accountably finite or countably infinite.

Therefore, this collection of random variable over the t that is going to be a continuous time or continuous parameter discrete state stochastic process. This is a very typical example so it could be countably finite or countably infinite also.

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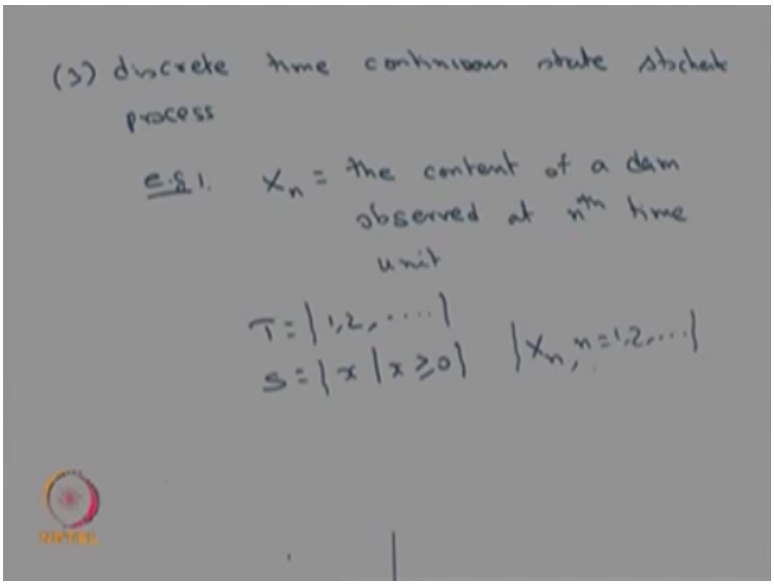

Now let us see the third type that is discrete time continuous state stochastic process that means we need to have the capital T value has to be countably finite or countably infinite. Whereas the possible values of state base has to be a countably many of that type. So, let us create example for that. The x of xn is nothing but it is a random variable that denotes the content of a dam or water reservoir observed at nth time unite.

So, here the time unite could be every one hour or that could be because you are seeing what is the content of dam or water reservoir. It could be everyday fixed time of everyday or it could be fixed time of weekly once so that is going to be the time. So that is going to be the time period. So at the end of each nth time unit we are observing what is the content of dam. So that is nothing but it is real quantity.

Therefore, T is going to be you are observing only at that time unite. So, either it would be one or daily once or weekly once or so on. So, therefore I can make a one to one correspondence with the countably finite or countably infinite numbers so that they will form a parameter space and the S this is going to be possible value of xn for all possible values of n. So, this is water content of dam that is going to be the real container that is going to be for some x where x is always greater then equal to zero.

So, that means parameter space is going to be a discrete whereas the state base is going to be a

continuous therefore these two stochastic process x of xn for possible values of n is going to be 1, 2, 3, 4 and so on and this is going to form discrete time continuous state stochastic process. Let me give one more example for the same type that is example two

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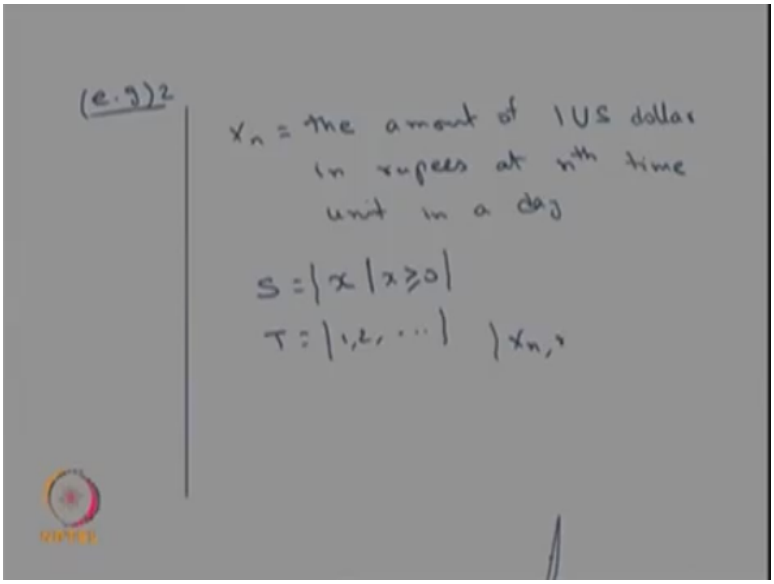

That is nothing but example two xn is nothing but the amount of 1 US dollar in rupees at n th time unite in a day. That means I am just observing what is the value of 1 US dollar in rupees in a day for the n th time unite. It could be every five minutes or it would be every minute or it could be every hour of any particular day and that is going to form a random variable and that collection is going to form a stochastic processes.

In, this the possible values of x is going to be since it is the amount of 1 US dollar in rupees it could be some fraction also. Therefore, you do not want to take it as the integer number. It could be real numbers therefore it is going to a possible values of x greater than or equal to zero and the T that is going to the time unite either it is every minute of every once in five minute or once in ten minutes or every one hour or so on.

So, this is going to form a countably finite or countably infinite one and this stochastic processes will form a discrete time and continuous state stochastic processes. Let me go for the fourth time

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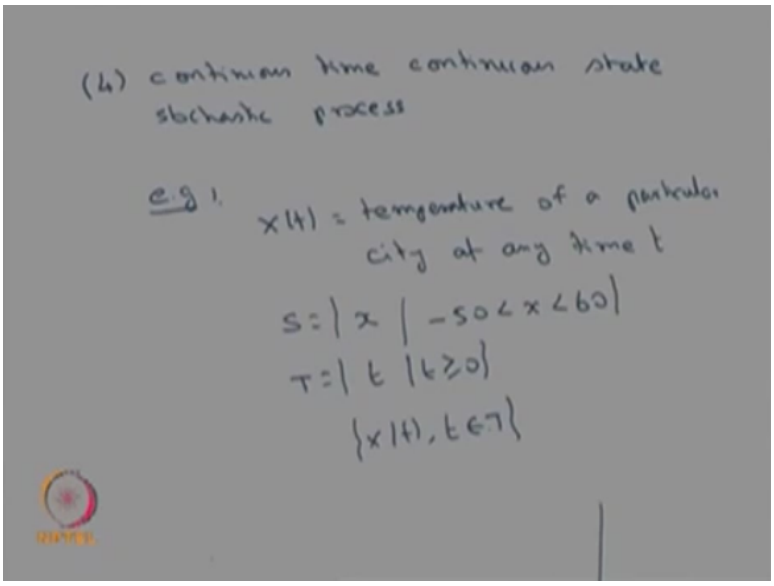

That is the fourth classification of the Stochastic Processes that is continuous time, continuous state stochastic process that means the possible values of the parameter is going to be countably many therefore you get the continuous time or continuous parameter and the possible values of the state base that is going to be countably many therefore you get the continuous state stochastic process.

The examples or the first one x t is going to be temperature of a particular city at any time t. So whenever I use anytime t you can take any value therefore the possible value of S is going to be the temperature so you can think of temperature suppose a particular city lies between minus 50 to 60 degree Celsius So this quantity is going to be the Celsius of minus 50 to positive 60 and the parameter space t is going to be observed over the time.

Therefore, this time is going to be greater than or equal to zero. Therefore, the parameter space is continuous one and the state base is continuous one therefore this collection or random variable form continuous state stochastic process.

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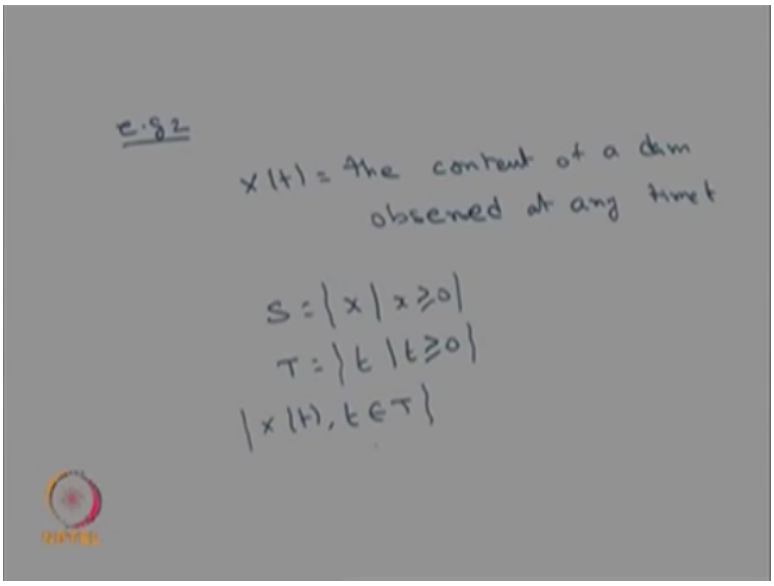

So the content of dam reservoir that is going to be the real quantity therefore s is going to be a collection of x such that x is going to be greater than equal to zero. And you are observing over the time therefore that is also collection of T such that t is going to be greater than or equal to zero.

Therefore, this will form a stochastic process in which it will be under that classification of continuous time, continuous space stochastic process and this can be created with the help of the first approach that means for fixed t find out what is the random variable and you collect the random variable over the all possible values of t. Therefore, this is going to be of the continuous time and continuous state stochastic process. So in this lecture what we have seen what is the meaning of

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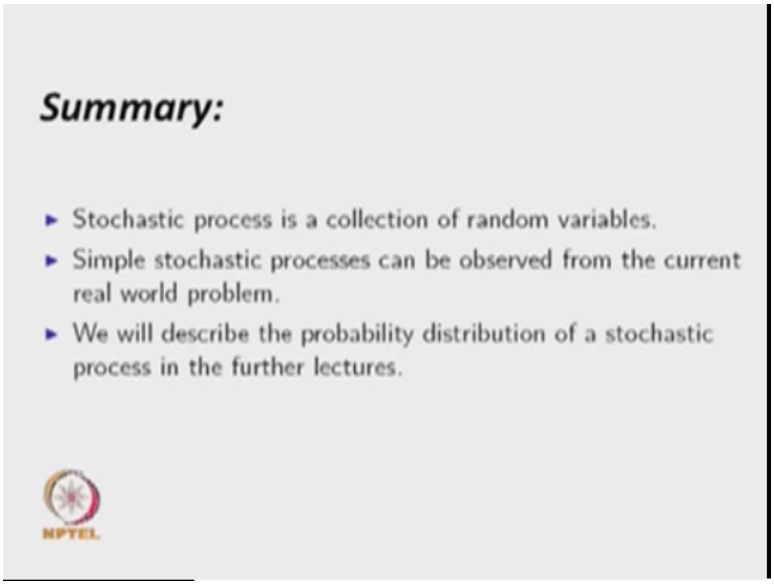

stochastic process or how to create the stochastic process so that is nothing but it is going to be a collection of random variable. So, we have defined stochastic process as well how to create the later we have given what is parameter space and what is state space and we have given the classification of stochastic process based on the parameter space and state space and also some of the real world problems from that we can create stochastic process.

And that stochastic process and there are many more stochastic process can be created with the help of the definition and so on so that will be discussed in the lecture two. And these are all reference

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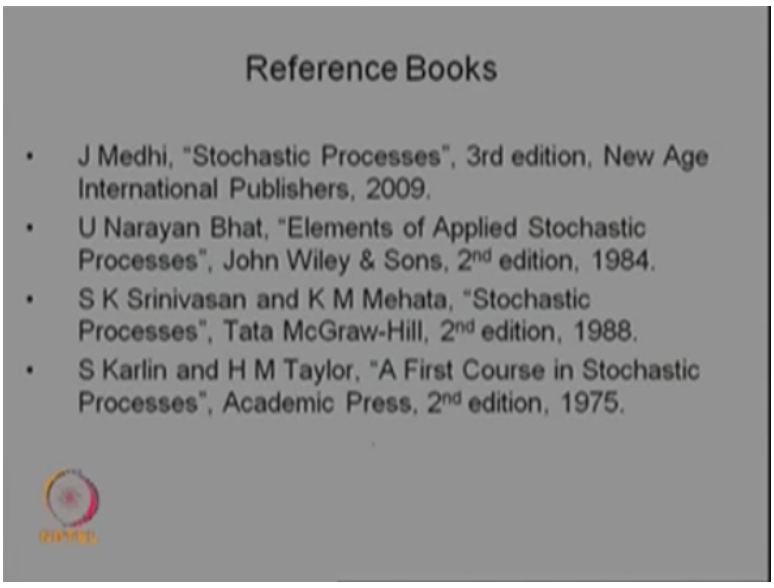

books we have used it for preparing this lecture one material. And I will be continuing the lecture two with the some more stochastic process which is very useful in later stages. Thank you.