Symbolic Logic
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Lecture - 32
Basic 4 Types of Categorical Propositions
Their Representation by Venn Diagram

Hello. And we are back and this is Module 32 of the Symbolic Logic course that we are continuing on.

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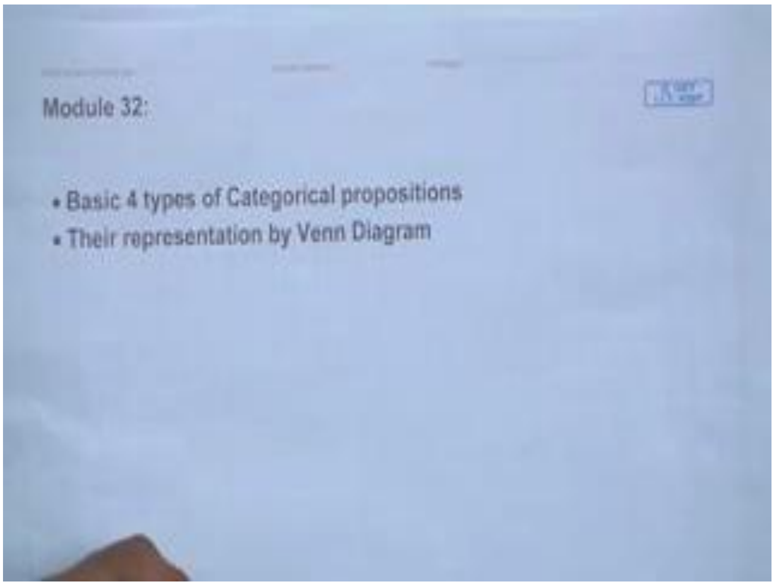

In the last module we have talked a little bit about the categorical propositions and what their standard for means. So, we are going to continue with that. And then I am going to tell you about the basic four types of categorical propositions that there are, and how we are going to represent them using a relatively modern technique called the Venn diagram.

So, this is on our agenda for the module number 32. See in the last module I have already told you that there is a certain standard form of categorical propositions, and the requirements that we said that every categorical propositions if it is in the standard format must have quantity and quality. You know that quality means either it is going to be affirmative or negative, or quantity means either it has to be universal or it has to be particular so that we are going to now start with.

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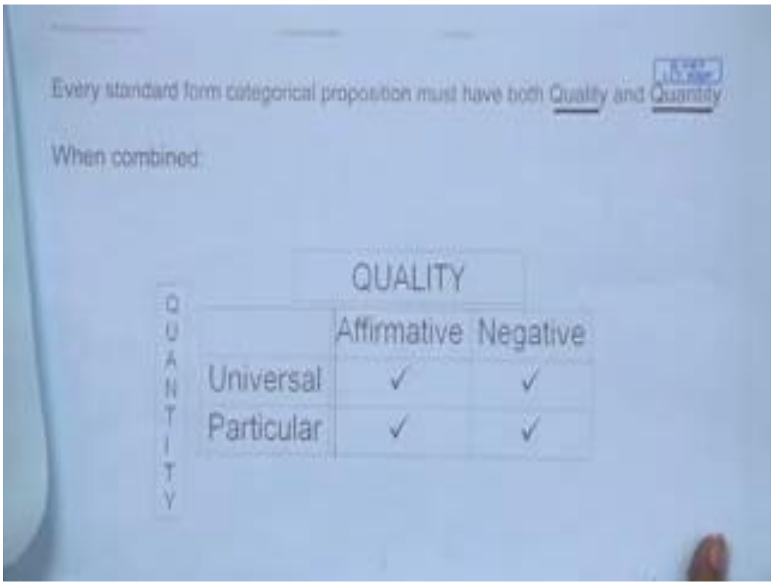

That if we now say that every standard form categorical propositions is going to have quality and quantity both in this sense then there are four possibilities that show up. When you are combining quality and quantity together then what happens is that something like this. So you are going to have four kinds of categorical proposition. This is the quantity this is the quality, so we are going to combine this. So, universal affirmative, this is going to be one kind you are referring to every member of the subject class and you are affirming that the subject class is included in the predicate class, got me. So, this is one kind.

Then there is universal negative; so every member of the subject term, but they are not included in the predicate class and that is the second kind. Here is particular affirmative. This is some members of the subject class, but they are included in the predicate class. This is some members of the subject class they are not included in the predicate class. See there are four kinds that are turning up. And now we are going to learn about them schematically.

So, what are they and how are we going to refer to them and so on. Basic four types of standard form categorical propositions types when we are combining like this are going to be like this.

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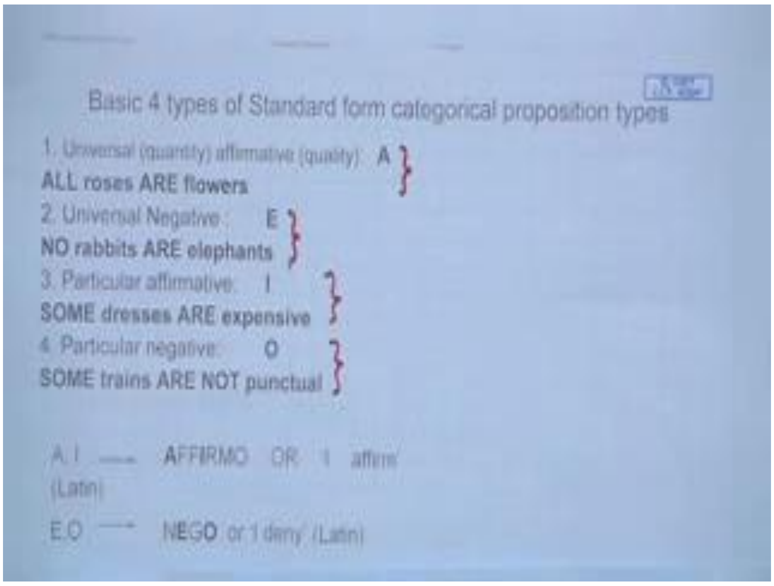

The first one is as we said the universal affirmative. In case you have missed out universal stands for the quantity it has, affirmative stands for the quality it has; so universal affirmative. Note that we are going to call it in short A, just like we call people by their nick names, the universal affirmative that is a long expression, but we are going to simply abbreviate and call it A, propositions A; that is a capital A.

The example you can think of I am sure but let me give you mine, 'all roses are flowers'. First of all notice that the subject is a class, predicate is also class. Next you have to have a quality and a quantity, the 'all' stands for the universal quantity and the 'are' stands for the quality which is affirmative. This is why they are in capital letters so that you immediately you can see that this propositions has a certain combination of quality and quantity. This is universal affirmative which we are going to call A.

Next is universal negative, which we are going to call E; the E propositions. And examples you can think of your own its better to have in fact your own examples at this point, but let me give you my example 'no rabbits are elephants'. How it did this happen, well universal is captured in 'no' why, why it is not all because you want to deny it in the predicate class. So, instead of saying all rabbits are not elephants which are not exactly clear you want to say no rabbits are elephants. So, you were thinking still about the rabbit class every member of that and none of them is an elephant. So, the structure of E proposition is ‘no’ rabbits ‘are’ elephants. This ‘no’ and ‘are’ combination gives you negative remember. The quality of e proposition is negative.

Then come the particular affirmative which we are going to refer to as I. ‘Some dresses are expensive’. So, ‘some’ that is the quantity ‘are’ that is your quality, and you are affirming this class of some member of this class are included here. Then comes particular negative O, O propositions. For example, ‘some trains are not punctual’. So, ‘some’ ‘are not’; ‘some’ quantity ‘are not’ quality. So, A E I O these are the four basic types of categorical propositions. In fact, what you are looking at are the four standard form categorical propositions, there is no other form. If there are other categorical propositions you will have to reduce them into this four fundamental force.

So, A E I O. Why are we calling them A E I O? Now you might think that well may be we are thinking about the vowels A E I O U you know, but I have to remind you that the A E I O that those vowels are English vowels this is Greek logic. Much ahead of the English language, right time wise it is much more before this whole English grammar has come to be. So that is not what this A E I O is about. We can make a surmise that you know that A and I came from the Latin root ADFFIRMO, where you are affirming something. So here is A here is I which stands for I affirm. So that is where the A and I got to their names from.

And the E and O came from NEGO, which in Latin means I deny. But this A E I O is what we will be going with. From now on if I do not mention the full forms say particular negative, but instead I say O please make sure that you understand it in the correct way. So, A E I O this is where we need to get really acquainted with the four basic forms.

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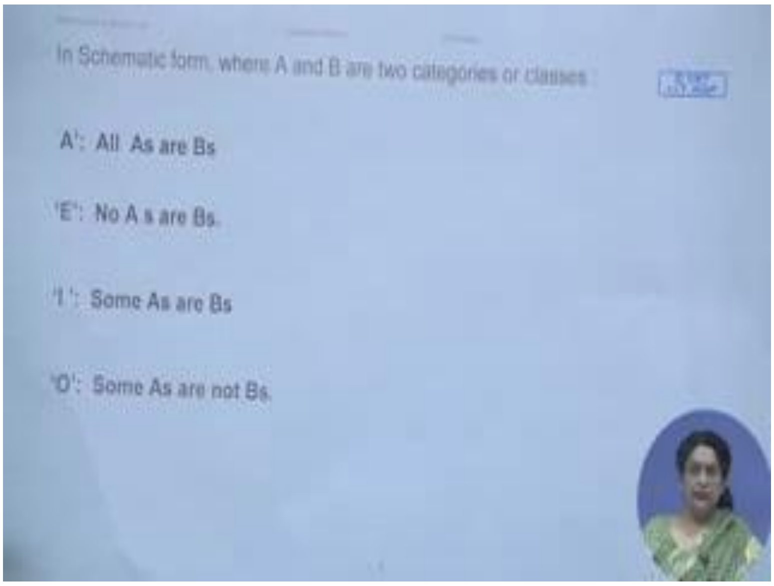

Schematically presenting they look like this, that A E I O form will be like so. A will always be all say A’s are B’s where A and B are two arbitrary classes. So, all A’s are B’s that is the classical form of A proposition. E on the other hand is no A’s are B’s. I is some A’s are B’s. O is some A’s are not B’s. Now this schematic form if you can really grasp then our job is really done here. We wanted to ask you to remember the schematic forms of this.

Here comes now we will now try to connect the dots. Remember what I said that we are going beyond the propositional logic and our stop is categorical logic Aristotle logic of classes. We are now trying to get inside categorical propositions and analyze whatever information is available there, specially the logical relationships. The quantity and quality of course is some sort of a way to look at them, I mean in a way you are analyzing them, in a way you are trying to understand what they are about. But the logical relationship that A E I O may have it inside them if you can analyze them with sort of more diagrammatical more visually that might help you, so keeping that in mind let us try to represent the categorical propositions using certain diagrams.

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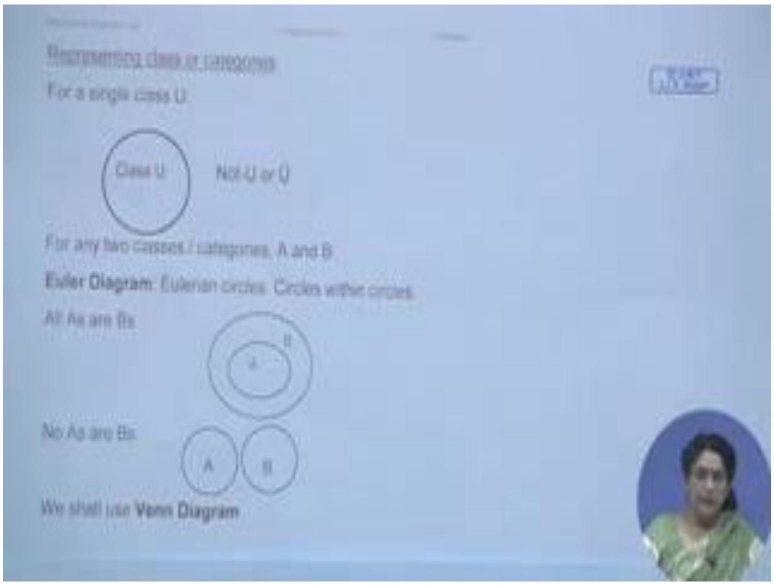

Now, our usual way of representing class or categories is something like this. You know if this circle is a class then outside what we have is the complementary class. So, if this is your class U then this is U bar there is a small bar above the U; so this is U bar. U bar stands for what is not U. This is our very simplistic understanding of the world is carved it in two we are referring to a class and then whatever is outside the class; this is one way to understand it. You may have understood also when we are dealing with two classes or categories you may have used what we call Euler’s diagram. The Euler’s diagram it is a mathematical way to represent classes they use what is known as Eulerian circles. So, that they used circles, but circles within circles. So, two classes will mean one circle is within the other circle.

This is for example Eulerian representation of all A’s are B’s where B is the larger class and A is the smaller class that is included in it. So, this is one we have to represent. And in Eulerian diagram if you are trying to understand no A’s are B’s it is probably like this that they have no connection. So, circles, circles but not one within the other separated out, so no A’s are B’s. Now we are not going to go the Eulerian way we are going to use the Venn diagrams. I do not know how many of you have already been exposed to Venn diagram but I am sure many of you have been, but still let us not presume anything will start from the scratch considering that we are all together in this.

So, only thing to remember that we are not going to use the Eulerian technique at all rather we are going to use the Venn diagram to represent categorical propositions. The Venn diagram also uses the circles, but these are intersecting circles not one circle within the other circle but intersecting. So, you are going to have circles areas which are completely independent of each other and there will be areas which are overlapping areas. Let us take a look.

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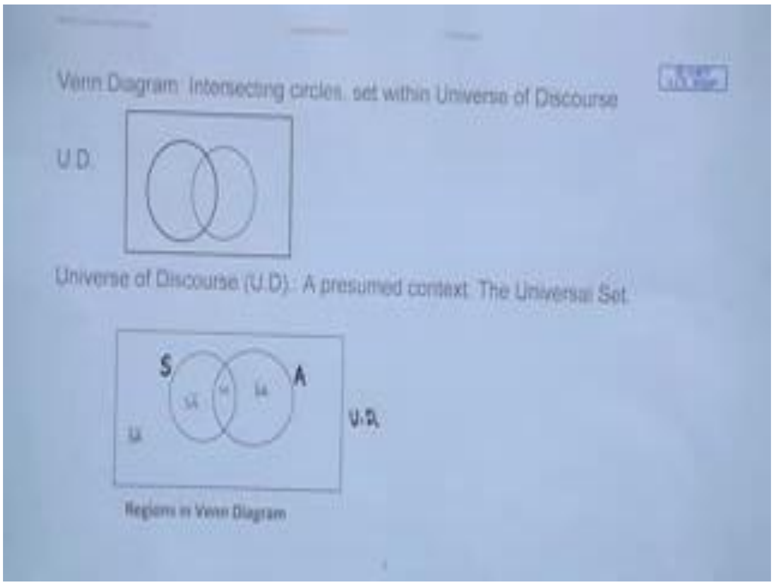

And there is one more thing about Venn diagram that they have the Universe of Discourse, what we call the UD. Let us take a look. What do they look like? They look like sort of this. So, intersecting circles of overlapping circles see this is one class, this is one class and there is an area where they intersect. What is this? This is what we call the universe of discourse that rectangular shape. Without it, remember that the diagram is not even complete, it does not mean anything. The universe of discourse is the presumed context of your talk, whenever you are referring to a class you have context in your mind and the universe of discourse represents that context. Note, within the context there is space for what is not this class or what is not of that class; namely, the area within the rectangle, but not within any of the circles.

This is one way of saying that there may be many things outside the purview of this class consideration, and those things are here outside the purview. But what you have defined as universe of discourse there may be things that are still within the purview, but not exactly contained in the classes that are been considered, did you understand. So, this is going to be something to remember. We need the universal discourse for Venn diagram, no Venn diagram is complete without the universe of discourse, and then within this presumed context you place your circles; overlapping circles.

If we use, remember we are talking about two classes so let us call this two arbitrary classes S and A, then let us see how we can understand the areas within the Venn diagram, the regions within a Venn diagram. This rectangle represents as I said the universe of discourse, in short we are going to call it the UD. Let us take a look in here, this is my S class and this is my A class, let us (Refer Time: 15:38) that you level them this is your S class this is your A class.

But inside there are so many regions. Take a look into this region for example; what does it represent, it represents S that is not A, so S A bar. This on the other hand is the area where there is A's there is also A, we call it the intersection area of S A. Look at this is labeled as S A, this area on the other hand is A but not S; so you have S bar A. This represents all the regions within this two overlapping circle, but there is still an area within your UD where there is no S no A, but still it is within the context and that area is S bar A bar, got me.

So, this is how to read the Venn diagram regions when you are using two categories or two classes. Now we are going to use this understanding of the Venn diagram and apply them to represent the four basic categorical propositions. So, get ready with the pencil and or pen and a paper.

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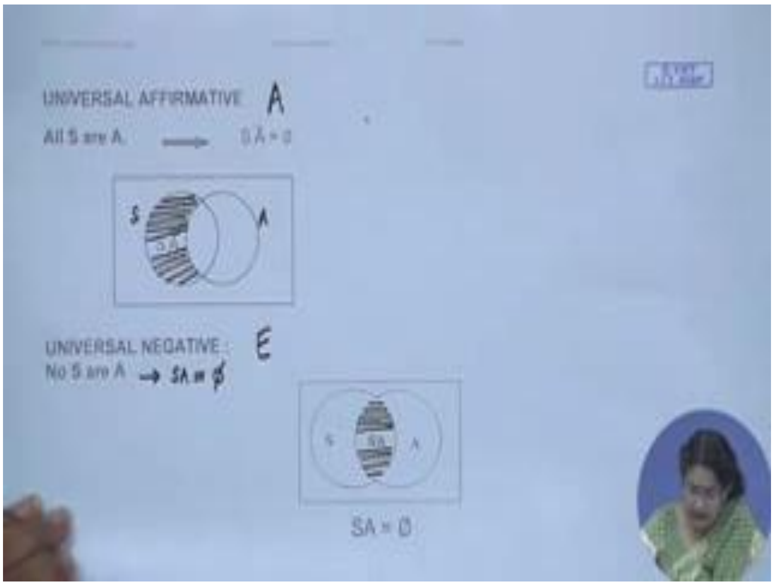

This is universal affirmative, remember all S’s are A’s or all A’s are B’s something like that. If you saying that all S are A basically what you are claiming is that there is no S that is not A right, there is no S that is not A. In other words something that is S and not A that area is empty, the empty class sign you understand that. So, that is what you mean all of S is A. So, S A bar that area has to be empty. How do we represent that in our Venn diagram we will like so. This is your UD, this is S and this is your A, and this is the area therefore which is S A bar. This is where you have S, but you do not have A. This area you are going to call it the empty area. How do you indicate the empty area? By shading it like so, when you are shading you are claiming that has to be an empty area where there is no member what so ever. And that captures the meaning of all S’s are A, see whether you understood that.

Let us come to universal negative; this is our E proposition. What are you saying? You are saying no S is A which means what; that the S A that area is empty. Because no S’s are A there is no member which is both S and A that area has to be empty. If we go to draw it in using the Venn diagram what will happen this is your picture. This is S, this is A, this is the area which is known as the intersection area of S A. So, this is S A area will be shaded out which indicates this area is empty, S A is empty.

So, this was our representation of two basic types of categorical proposition A and E. Take a good look at this and try to do this on your own so that your understanding of this is complete. Now this two were universal propositions, and please note that we have utilized the notion of empty set in this to demark it the areas that must be shaded out to capture the meaning of this two propositions. The other two propositions that is still left are particular in quantity; particular affirmative and particular negative I and O.

But particular means some members are there. So, there the shading is not going to help us instead we are going to talk about areas that are not empty. Areas that are not empty, there is at least one member in that area. This is going to be our crucial understanding for representing I and O. So, let us go there; so with one last look at the universal affirmative and universal negative. This is your A this is your E. And this is the representation by Venn diagram of A, this the Venn diagram representation of E proposition.

Let us take a look at the last two; the particular affirmative and particular negative.

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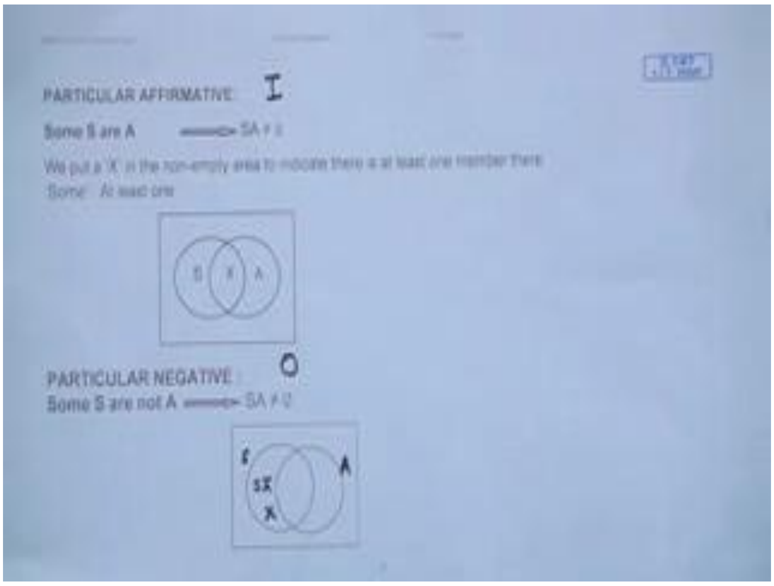

Particular affirmative says some S’s are A. So, there is at least one member of S which is also A. So, the S A area is going to have at least one member which means it is not empty. Once more we have brought in the empty set concept and we have utilized it like so. So the S A area is non empty. How do we represent that? I said by not by shading, but we are going to indicate that this area is non empty like so. Here, we are interpreting the some as at least one. How many members you mean by some the answer is at least one and we represent it like this. We wanted to talk about that is area is non empty which has put one x a token x to show in the area that we want to call non empty.

So, this is the area in question now this area is non empty. This is our representation by Venn diagram of I proposition fine. Now here comes the particular negative and I will remind you the O propositions speaks about some S are not A's; some S are not A's. Can you try that can you just try to do the Venn diagram of that on your own? Remember to draw the UD, remember to place the two overlapping circles within, call one of the circles S the other one A. You are trying to represent some S are not A which means that the area that is S A bar which is S but not A, S A bar area is going to be not empty. This is what you are going to represent.

Therefore, your picture is going to look like this. This is your S and this is your A, and this is the area that is S A bar. This area you are going to place a cross in, that cross represents this some. So, there are some members of this which are not A, did you see that. I will let you take a look in to this; this is how we are going to represent the four basic kinds in our Venn diagram. This is I and this is your O, let us put that down. And this is how all I's and O's are going to be represented as we consider them.

So, in a way what we have done today is really important. We have learnt the four basic kinds of the categorical propositions. We have learnt the names A E I O but we have seen that they have certain characteristics quality and quantity represent something. And then we looked into how we are going to represent them using some visual diagrams. So, we did not opt for the Euler diagrams, but we went for the Venn diagrams. And I have shown you how to represent the categorical propositions in Venn diagrams.

So once more, this was your A and E representation, and this was your representation of I and O. Keep this in mind choose any example of standard form categorical propositions of this kind and try to just do the Venn diagram for practice so that you can see that this is how it is going to go. And this is where will end this lesson for today, and we will come back with more in the next module.

Thank you very much.