

Symbolic Logic
Prof. Chhanda Chakraborti
Department of Humanities and Social Sciences
Indian Institute of Technology, Kharagpur

Lecture - 31
Limitations of Propositional Logic
Logic of Classes
Categorical Propositions
Quantity and Quality

Hello, we are back and from today we are going to look beyond propositional logic we have finished talking about propositional logic and today I will tell you why we need to go outside of proposition logic and how what is the route what where we are going to go.

So, our module 31 of symbolic logic today we are going to look into first of all what are the limitations of propositional logic and then through that we are going to look start looking into the logic of classes propositional logic was logic of propositions and today we onwards we are going to look into logic of classes and in that connection we are going to learn about a new set of propositions categorical propositions and the crucial concepts or quantity and quality of categorical propositions. So, that is going to be on our hand for this module 31.

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Consider this argument:

1. Roads are congested.
2. If roads are congested, we shall be late

∴ We shall be late.

It is valid, and its validity is demonstrable in Propositional Calculus / Logic.

1. R	} M.P.
2. R ⊃ L	
∴ L	

But now consider:

1. City Roads are congested.
2. All congested roads bother citizens.

∴ City Roads bother citizens.

Valid. But when symbolized:

1. C
2. B / ∴ R

Valid, but the validity is not evident in the symbolized form.

See I am going to just ask you to consider this that take a look into this argument knowing what you know about arguments roads are congested if roads are congested we

shall be late therefore, we shall be late if I ask you is it valid or invalid and you are going to say that this is with what you know that this is valid and not only I know this to be valid, but I can sure I can demonstrate its validity too using the propositional calculus what we have learnt.

So, first what will you do you are going to translate it like. So, roads are congested if roads are congested we shall be late therefore, we shall be late. So, there we go it is a classic application of no resonance by which you can show its validity also right, but now consider this other argument city roads are congested all congested roads bother citizens therefore, city roads bother citizens all right now if I ask you is this valid what do you think if the premises are true can the conclusion be false the answer is no.

So, in a way you understand that it is valid right when you reading this, but with the symbolization tools that you are learnt in propositional logic when you are going to symbolize this take a good look at this argument the symbolization takes the whole structurally simple sentence and assigns it a capital letter right that is what we have learnt. So, here is one sentence which you may pick c to represent then there is all congested roads bother citizens now that is again a structurally simple proposition. So, we need to and it is a different one. So, we need to assign it at different capital letter like. So, b therefore, city roads bother citizens which is another a third proposition structurally simple which we are going to again assign a capital letter say R.

Now, take a look at this argument when its symbolized c b therefore, r is it valid no and then not only that you can probably demonstrate that it can be invalid using the shorter route anytime we will just assign true and r it is a sign falls arbitrarily and that is about it. So, what happen what happened is that you can recognize that it is valid when you are reading this sentence you are processing in your brain the somehow the connection, but with propositional logic the kind of symbolization mechanism that you have its simply is not becoming evident the validity is no longer evident in the symbolized form somewhere we have lost it as we call it lost in translation. So, where have we gone wrong and what is the problem here I am; obviously, trying to make a point here. So, what is that point.

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What you sense, however, is a logical relationship: Things that bother citizens

Congested roads

City roads

But in the symbolization mechanism no access to show the relation that makes the argument valid

Similarly, consider:

1. It is not the case that rabbits are elephants
2. Bugs Bunny is a rabbit

Therefore, Bugs Bunny is not an elephant

Valid. But when symbolized, it is

1. $\sim R$
2. $B / \therefore \sim E$

Its validity is not captured

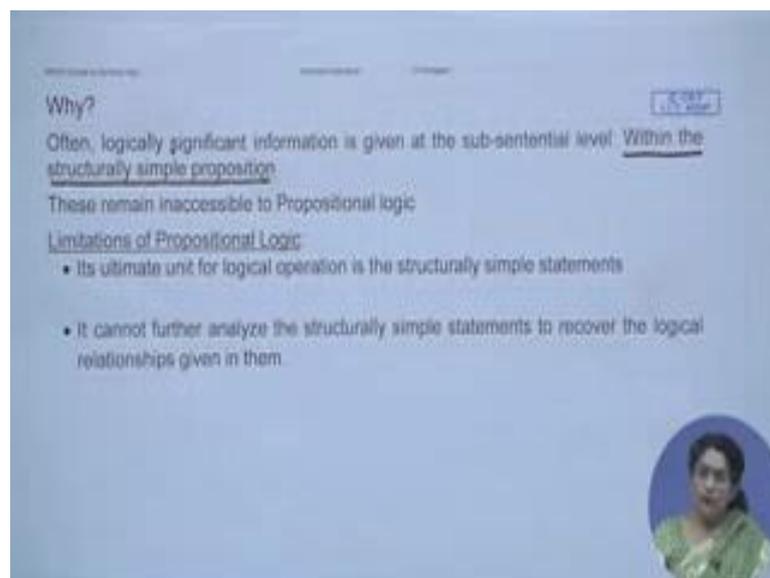
What you sense when you read that argument roads are congested all roads city roads are congested all congested things bother citizens therefore, citizens are bothered city roads bother the citizens then if you are reading in that way what you are recognizing is that there is a logical relationship given somehow these are connected and if I ask you with a figure to represent that probably you will give me something like this saying that look there are this broader set or class of things that bother the citizens the congested roads are class within that larger class. So, all congested roads are such that there are things that bother the citizens and city roads being congested are a part of this right. So, what we have is a sort of a circles within the circle of class within the class of somehow you have captured this logical relationship you are your acquaintance with the words, but your symbolization did not capture this logical relationship at all. So, that is where we have somehow missed out important logical information.

Let us consider another example before we make the point clearer take a look it is not the case that rabbits are elephants two second premise bugs bunny is a rabbit therefore, bugs bunny is not an elephant valid or invalid valid of course, if this is true this is true this has to be true, but then again the problem is that when symbolized somehow this whole validity notion is lost because symbolization it will come out as not or for example, because you all you have is not the case that rabbits are elephant that rabbits are elephant is a structurally simple proposition which you are going to represent like. So, with its not the case attached to it bugs bunny's is a rabbit that is b therefore, bugs bunny is not an

elephant somehow it is becoming a third one therefore, neither r nor b somehow it is we are bound to assign a different capital letter to it. So, this is the problem we could not capture the validity of these r comments using what we know from propositional logic why is that why are we missing out. So, much and where the problem with propositional logic is in this case and this answer is going to actually be rather interesting.

We remember what we said about propositional logic where what is its ultimate unit what unit propositional logic operates upon and the answer was simple proposition simple in what sense structurally simple. So, our basically means in propositions logic was structurally simple proposition right we could not analyze them any further. In fact, we added to them connectives to make more and more complete circle compound structures correct now that is where I think we need to concentrate now that this limit set on propositional logic is the root of this problem.

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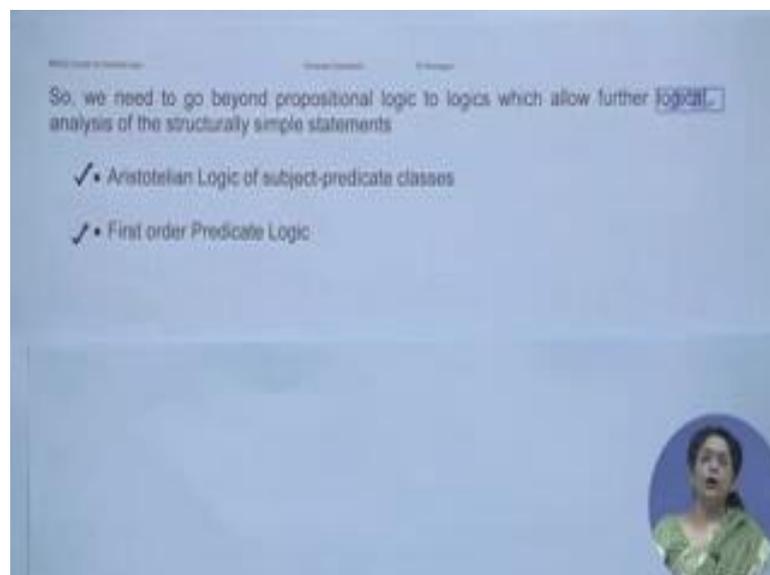


Why we could not they could not capture the validity of this arguments why because often logically significant information is given at what we call the sub sentential level beneath the structurally simple proposition level. So, there is a sub level that where within the simple proposition sometimes important logical information can be obtained and when that happens what happens is that propositional logic cannot access that important information why because its stops at only at the proper simple proposition level it cannot go any further deeper whereas, the information lies in the deeper level

right. So, this is as we saw that what we were dealing with in each of these arguments cases were structurally simple propositions say for example, in this one. So, all structurally simple propositions and some where there is a logical relationship that works out not apparently at the propositional level, but somewhere deep within the proposition. So, unless we can reach out inside the proposition itself, there is no way we can access that information. So, this is where we need to sort of check ourself and this is where the problem shows up as the limitations of propositional logic.

So, ultimately you need of its logical operation is the structurally simple statements or propositions and therefore, it stops at structurally simple proposition cannot further analyze those statements to recover whatever important logical information might be given in them inside them. So, somehow we need to now question that somehow we are going to push the boundaries of propositional logic or leave propositional logic and find out other advanced level of analysis that will allow us not to stop at this arbitrary stopping point of structurally simple propositions. So, that is our next step that we need to go beyond.

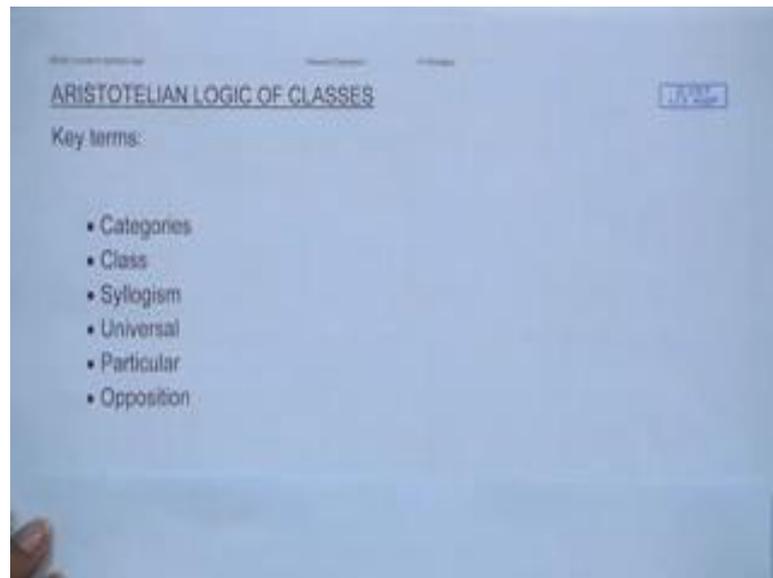
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The propositional logic which will allow us further logical analysis of structurally simple propositions and if we do that we if we embark upon such a journey then there are two possible stops in front of us one is what we would call the Aristotelian logic of subject predicate classes and this is what we are going to call the logic of classes and then there

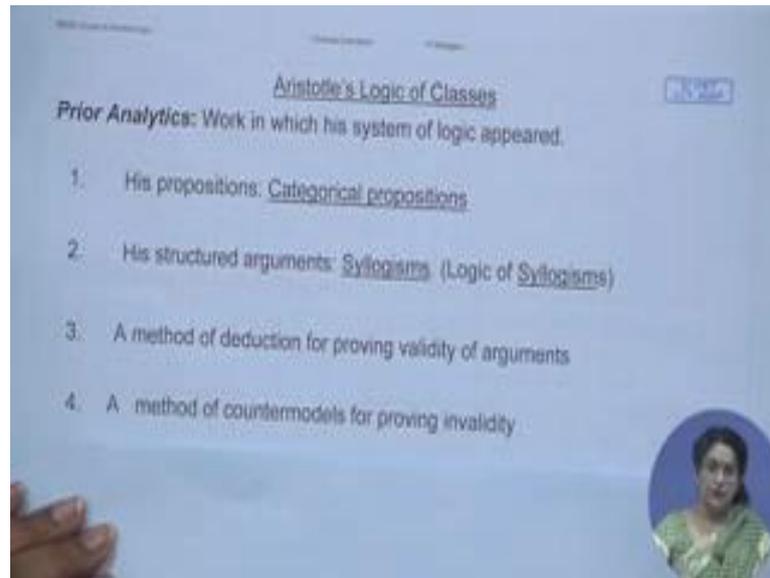
is first order predicate logic to get the which is going to be our next topic. So, first we are going to learn in to this Aristotelian logic. So, remember the limitations of the propositional logic sort of push us to go beyond propositional logic and look into this kind of directions this is what we are doing.

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When we are starting out Aristotelian logic of classes these are the key terms that you might just remember to get acquainted with and these are each one of this we are going to touch upon and explain in the lectures to come, but it is important that you sort of put a check list on whether you have understood each of this as we go along talking about this.

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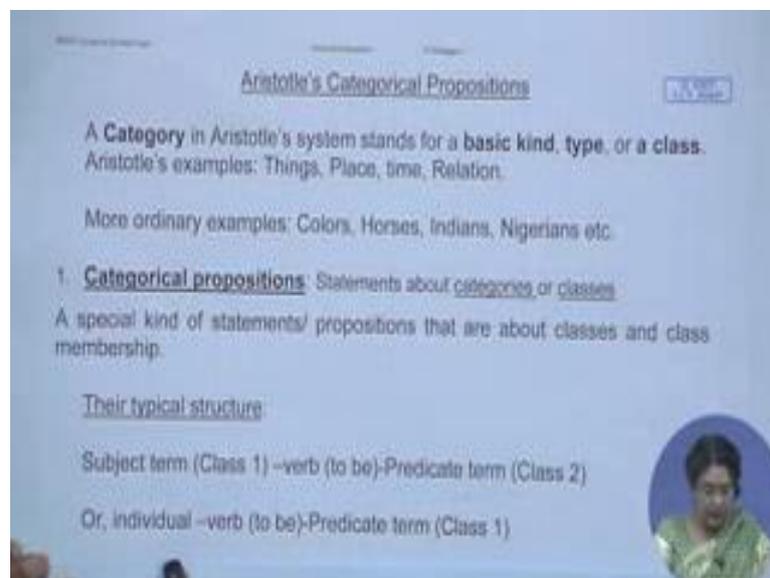
So, we will start with categories see Aristotle's logic of classes has been handled by many logicians after Aristotle also and as I have tried to tell you during my history lesson history of logic lesson that Aristotle became very popular in the medieval period. So, there were a lot of medieval logicians who have worked with Aristotle's logic, but Aristotle's logic was also popular during the Greek times also right. So, there is one academy also he was a well known established scholar. So, all that work together is known as Aristotelian logic where Aristotle's logic is also part of let us look into that.

So, when we talk about refer to this logic of classes you can look into what is Aristotle is saying about it you can also look into what other Aristotelian logicians are talking about it now our course here the NOC course is time bound short. So, we cannot do everything or we cannot look into every direction to understand Aristotelian logic. So, I will try to sort of give you an overview and try to make it as clear and as direct as possible now if you are interested then with the book or the work of Aristotle where we need to look at to know about his logic is prior analytics and this is where you will find that he is proposing a different set of propositions which we call the categorical propositions we are soon going to look into what categories are, but at the moment and he has his own structured arguments these are deductive arguments with very well defined structure and he calls them syllogisms and therefore, they are. So, famous they are. So, famous by their own merit that the entire logic is also called sometimes as logic of syllogisms, he

does have a method of deduction for proving validity of arguments and he also has a way to show invalidity using counter models.

You know counter examples and. So, on now we are not going to do all of this, but we are suddenly going to have a glimpse of at least one two and then look into a modern way not exactly Aristotle s way, but modern way to look into how to prove the validity of syllogisms. So, we are starting out with what categorical propositions are and before that we need to know what categories are otherwise how we can know what categorical propositions are.

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Now, in Aristotle s system a category is an abstract, but very fundamental kind of things what categories are basically are basic type's, kinds, you know. So, types or kinds when we talk about for example, you know mean you look around and you will see that there are different kinds of things now see what we just used different kinds of things. For example, you may be surrounded by books, at the moment may be you have some gadgets around you. So, there is a one kind the books kind and then there is the gadget kind and then there is you that is a human kind right. So, this is sort of a simple approach to understand what you mean by categories, but remember he actually meant some basic kinds, basic as in very fundamental like what physics talks about. So, his examples of categories would be things place time relation and so on. They are very fundamental

right I mean very, very basic you can carve the world into very fundamental sort of way using this.

Now, we will use more ordinary examples for example, colors, one kind horses, if you want mammals, you know Indians, Americans, Britishers, Nigerians and so on. So, they why? What are these are sort of what do you would call classes. Now when I say classes do not immediately jump into sets, because sets have become more accentuated and sort of more formalized this is a rather rough collection. So, keep it the language a keep the language at the level of classes and that is one we will talk about as category. So, statements about categories or classes will be called categorical propositions. Where you are referring to classes and we will show you more to say that that is not just enough there is more about categorical proposition, but this is a good beginning to start these are therefore, a certain kind of statements.

There are so, many kinds of propositions these are as special set the special kind that talks about classes and class inclusions only and that is the group that Aristotle is mostly interested. In the typical structure and now this comes from the Greek language itself which has been also carried in English for example, the typical structure of categorical propositions would be a subject term which is going to be a class you refer to a class then a verb of a special kind what kind that is to be verb. You know to be verb means is are so on and then followed by a predicate term which will refer to another class.

So, there are two classes in a categorical proposition one of them will occupy the subject position and with the subject of the proposition, another one will be the predicate and it will occupy the second position last position and in between them there would be a verb of the kind is, are, which we call to be verb in grammar. So, this is what the categorical proposition structures index is going to be. Now Aristotle allowed that the subject term could be also an individual one person instant that would be a class of only one member that is that was his understanding also. So, it could be also of the structure individual followed by to be verb followed by a class tag as the predicate. So, you are predicating something about this individual let me take some actual examples that we can proceeded further.

We have mentioned. So, many times about classes, but what is this class I told you that you take it as collection except that it is not a (Refer Time: 20:06) collection there is a binder that binding property is the common characteristic in that collection.

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2. **Class:** A collection of items, things with a common characteristic.

E.g. Class of Tennis players
Class of whales
Class of Fortune 500 companies

3. **Format of categorical propositions**

Subject class (1) verb to be (is, is not, are, are not) predicate class (2)

Examples:
Festivals are fun-events
Roses are not fruits

Subject and Predicate terms both used to Categorical or Class terms.

Subject: What or whom the proposition is about.
Predicate: Tells about the subject.
Predication: Ascription of a property to a subject through language.

Categorical propositions have a **standard form**. They must have:

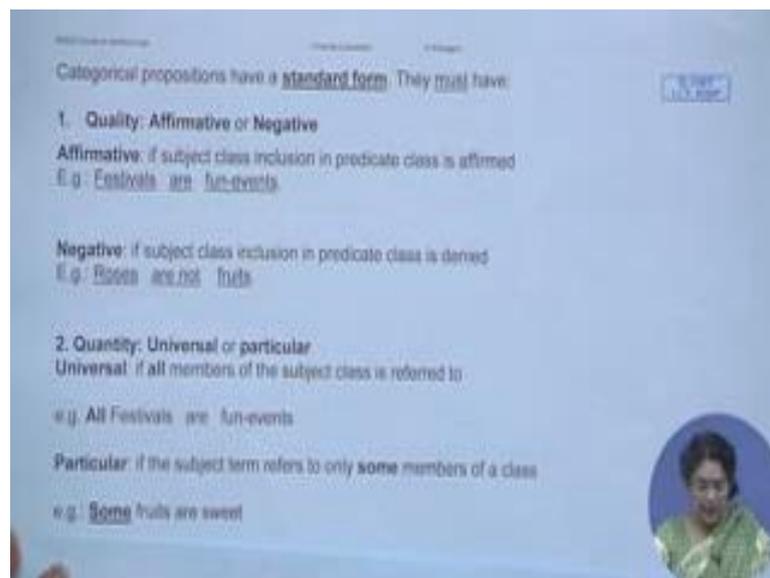
So, that that is how the class is formed now here is the class of tennis players. So, the common characteristics are being a tennis player and by that you bind this class it is a collection of all tennis players, class of whales, class of fortune 500 companies. For example, these are all classes you can imagine more you can think of more example and please do because this is how you are going to learn this logic also the format as already mentioned there is going to be a subject class followed by the to be verb for example, is you can also have the not in here is not are not, but that is about it this is how the verb is going to be and then there is a predicate class second class that will be predicate examples for examples you can say festivals are fun events, festivals class are fun events class get it now subject and predicate terms both are about classes that is the main thing to remember.

So, this is a categorical proposition this is how it looks like for example, this also is roses are not fruits notice roses is a class fruits is a class and the to be verb here is are not what are you saying that this class is not included in this class. So, you are still talking about classes and class inclusion here this class is included in this class all the members of this are also members of this right. So, in a way categorical propositions only do this they

talk about classes their inclusion or non inclusion this is how they go we will see more example.

Now, we have viewed some technical terms here. So, let us make it very, very clear subject we have said one class is going to be the subject of the categorical proposition which simply means that the proposition is about for example, this proposition is about festivals what is the job of the predicate it is says something about the subject that is the job and predication is the property of ascribing something a property to the subject through language. So, this predication we are going to look into in first order predicate logic also, but at the moment you need to pay more attention on subject and predicate now categorical propositions they do have a standard form and that form is going to be like this first of all.

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They must have something called quantity and quality quantity and quality let us take a look by quality we mean whether it is affirming something or negating something. So, affirmative would mean that if the subject class inclusion is being affirmed. So, festivals are fun events that are an affirmative quality proposition why? Because you are affirming that this class is included in this class that is a quality of the categorical proposition every categorical proposition if it is in standard format must have one of these qualities.

Let us take a look into the negative quality if the subject class inclusion is denied in the predicate class. For example, roses are not fruits right. So, the subject class inclusion is

being denied negated the quality, but categorical proposition has a quality and that quality is negative similarly. So, this was the first requirement that all standard form categorical propositions must have quality one of this either it will be affirmative or it will be negative second it must also have quantity. What quantity? Two kind quantities are only possible either it will be universal quantity or particular quantity, but let us first understand what do you mean by this quantity well quantity here refers to the size of the subject class that you want to get involved in your categorical propositions. So, universal quantity would mean that, if you want to refer to all the members of the subject class if you want to mean the entire subject class that is what this is all about.

For example, if you say all festivals are fun events then you were referring to all the members of this class whereas, particular would mean only some members of this class you want to refer to only certain members of the subject class for examples some fruits are sweet or the fruit class you want to mention only few members in that class as sweet. So, this quality quantity is going to be absolute requirement of standard form categorical propositions we will continue with this in our next module, but I hope you got a certain introduction into what categorical propositions are this is where we will stop here.

Thank you very much, bye-bye.