**Symbolic Logic**
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Lecture - 05
Concepts of Validity
**Soundness**
Consistency

Hello, we are starting the module 5 of the NOC course and Symbolic Logic. We have travel through some basics of this logic a little bit in a rather informal sort of way, and I have introduced you to kinds of arguments and that that we are going to only focus on deductive arguments and we are going to looking into deductive logic.

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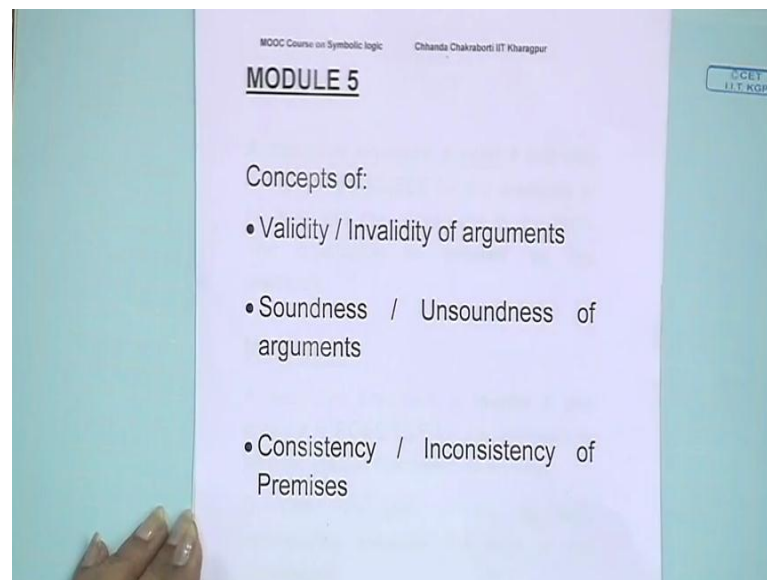
So, today we are going to talk about the concepts - the criterion concepts, the normative concepts by which we are going to assess the value of the deductive arguments. So, this is going to be the concept of validity and invalidity soundness, unsoundness, consistency, inconsistency of the premises and so on. So, this is going to be our plan for the module 5.

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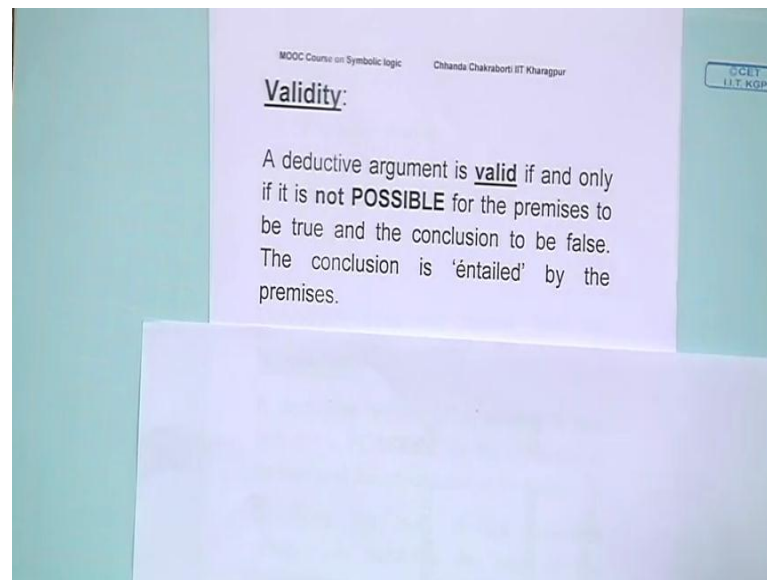
See will start with validity and I am going to define what makes a deductive argument valid in terms of possibility and impossibility. So, let us take a look into the definition of validity.

The way we are going to define it and understand validities like this that the deductive argument is valid, if and only if it is not possible for the premises to be true and the conclusion to be false. I will repeat that it should not be even possible, so there should not be even a smallest of the smallest possibility when the premises are true the conclusion to be false that is when we will call the deductive argument validity. So, elimination of even the smallest of possibility when premises are true the possibility of conclusion to be false is completely-completely eliminated. That is when we say deductive argument is valid, and this is when we say the conclusion is entailed by the premises that is what validity is. Please understand that validity is an all or non-concept in deductive logic.

So, either an argument is valid or it is what is known as invalid - invalid means which is not valid. So, if there is even the slightest chance that when the premises are true the conclusion can still be false then the argument is invalid. Only when all such possibilities are eliminated there is not even the mini school scope of that happening only then the argument is going to be called valid.
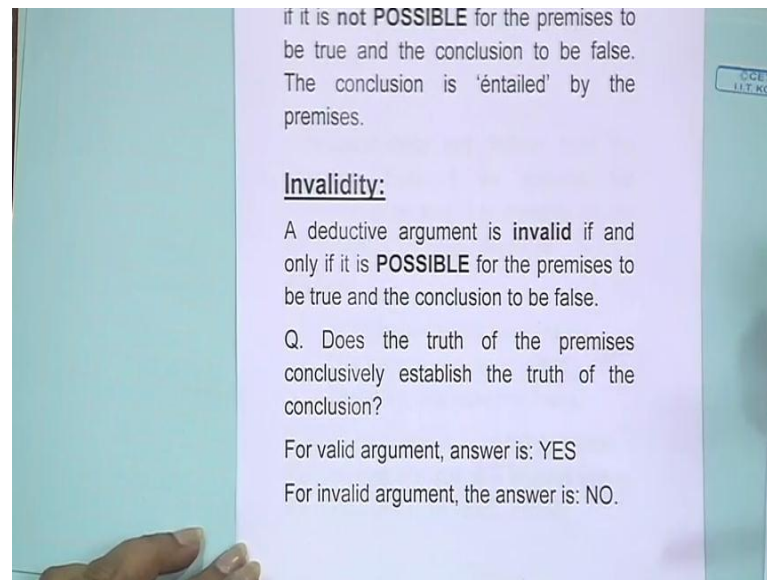
So, we will now going to invalidity as I said that it is again defined in terms of possibility. So, a deductive argument is invalid if and only if it is possible for the premises to be true and the conclusion to be false. Now even probably start to think what possibility means; let us think about situations. So, if there is even one situation when you can find the premises to be true and the conclusion to be false you know the deductive argument has to be invalid. We will give you examples in a second, but let us try to follow the concepts true.

So, if there is a question to settle in terms of validity and invalidity then what we are asking that when we know that the premises are true, when we know that the premises are true or when we assumed that the premises are true does that conclusively establish the truth of the conclusion. So, there is no doubt that the conclusion has to be truth. Now let us put it in a question sort of form. So, does it happen if the answer is yes then; you have a valid argument or for valid argument the answer is going to be always yes; when you know the premises to be true the conclusion must be true. And for invalid argument the answer is going to be no which means that even when you know that the premises are true or when you assumed that the premises are true there remains a possibility that the conclusion may still not be true.

How small the possibility will have be – Does not matter, as I said even the smallest of the chance if you think that there is a chance remaining then automatically it falls in the

category of invalid arguments. So, let us just go over what we just said. We are trying to understand what makes a deductive argument good, what makes a deductive argument bad and we said that we have introduced two concepts namely validity and invalidity. So, valid arguments are what we would call good deductive arguments, invalid arguments are what we would call bad deductive arguments and I will just recap that that validity is that kind of a property of an argument. Please note that it is not a property of a statement or stand alone proposition, it has to be an argument, it has to be a deductive argument and then what we need to look into is that what happens when the premises are true.

In case of valid argument as we said it is guaranteed that the conclusion is going to be true, but there is no such guarantee when you have an invalid argument I think it is time that we take examples and then may be the concepts will fall true. So, let us see what happens.

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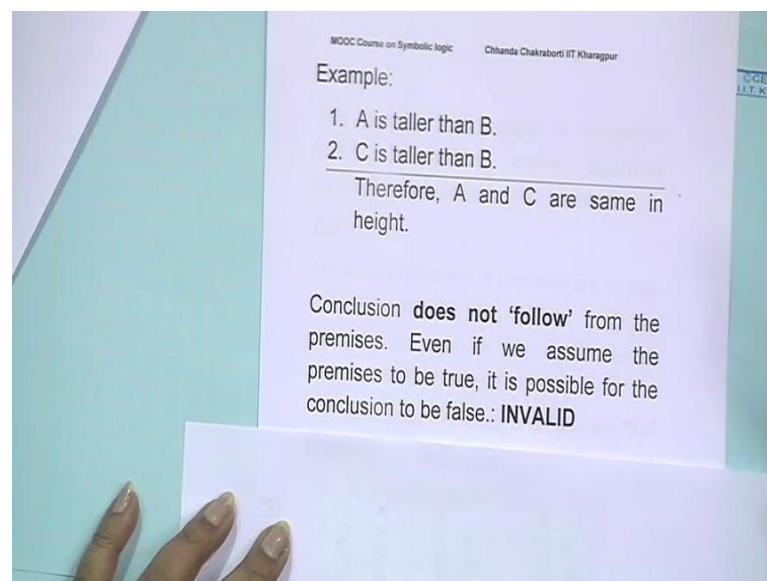
Let us take an example like this one, suppose the premises are like this A is taller than B, C is taller than B and then somebody claims that therefore, A and C are of the same height right. Now we do not know who this A B C are, whether they are persons, whether they are buildings, whether they are trees, does not matter - let us assume that it is true that A is indeed taller than B and let us also assume C is indeed taller than B. Now the question that you are going to ask here is that suppose given the truth of this and

given the truth of this does that guarantee that that (Refer Time: 06:47), the truth of the conclusion what you think? Even when you know that A is taller than B, C is taller than B does it follow that therefore, A and C must B of the same height the answer is no - it does not follow, because it is it there is nothing in the premises that warns the truth of this, there is no certification of truth for the conclusion.

It is just possible that A is taller than B, but A is also taller than C or vice versa C is taller than A does not matter, but there is no way we can say that it is conclusively true that A and C have to be of the same height. So, there is a possibility that the conclusion may be false even when the premises are true and that is when we say that it has to be an invalid argument, now why? Because in the deductive sense, remember what we say that it the deductive argument it derives the conclusion from the truth of the premises. So, the conclusion truth should follow from the truth of the premises. Now what is happening in here is that the conclusion does not follow from the premises, even when you assume the premises is to be true still it is possible for the conclusion to be false hence this argument is invalid.

So, it is a deductive argument that is gone, bad, or that is gone wrong. And if you now notice that the invalidity is about the truth of the conclusion and how it is conclusively or decisively shown by the truth of the premises that is what makes this argument invalid, the failure of to do.

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premises. Even if we assume the premises to be true, it is possible for the conclusion to be false.: **INVALID**

Example:

1. All Physical objects have mass.
2. This table is a physical object.
   Therefore, this table has mass.

Conclusion **'follows'** from the premises. If the premises are true, it is **impossible** for the conclusion to be false.: **VALID**

So, let us take another example. This one we have seen earlier, so here is your premises are all physical objects have mass this table is a physical object therefore, this table has mass. So, once more we are going to say let us see this is true, let us see this is true, combine truth of that does this guarantee the truth of the conclusion. So, when this is true this is true what happens to the conclusion and the answer is the conclusion follows from the truth of the premises. The truth of the premises are enough to guarantee that this has to be the case, if all physical objects have mass and this happens to be a table which is a physical object then it follows that this table also has to have mass, and that is why would call this deductive argument valid because it is impossible for the conclusion to be false when the premises are true.

So, with example you can still approach what we have earlier said about validity and invalidity that this possibility and impossibility will help you to understand what validity and invalidity are. Validity of course, as I said is a desirable characteristic in deductive argument invalidity it is not. Having said that let us proceed to a slightly settler discussion, remember what we have said is that validity is a requirement that when the premises are true what happens to the conclusion and then if it is valid conclusion must be true, even it is invalid conclusion could be false - possibly loss. This kind of definition of validity if you have understood it properly leaves some room open for spurious very questionable arguments to be also valid that is a problem of this definition.

So, once more I will say this we have a normative definition of validity something that we are going to apply to deductive arguments and it is going to work, to separate good deductive arguments from bad once. But what I am pointing out is that this definition in a way it is workable, but it is too wide it is somewhat loose why? Because it allows many spurious deductive arguments also to be come out as valid, such as what - I will try to explain the problem a little bit more.

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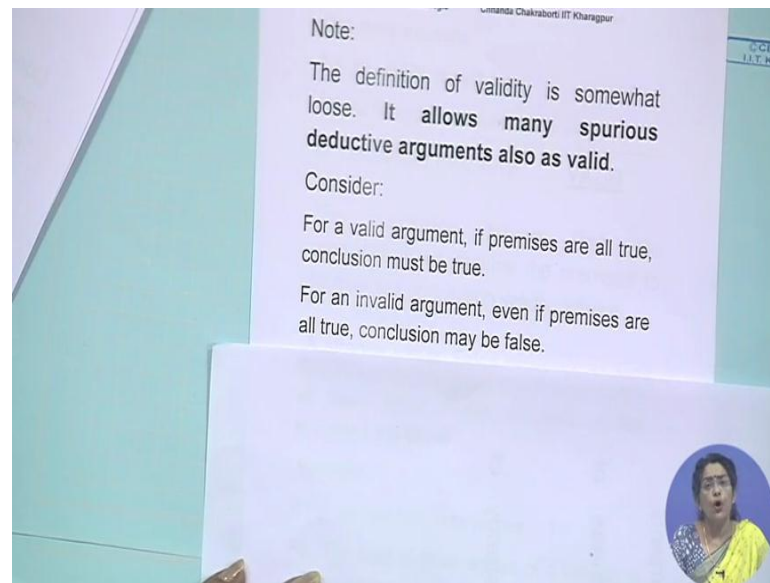
So, I will remind you that we just learnt that for a valid argument our main concern is what happens when all the promises are true and the conclusion has to be true. For invalidity again or concern is what if premises are all true even then the conclusion can be false. So, each time we are looking into the situation when premises are all true, you have number of premises and all of them are true then what is happening to the conclusion that is our concern.

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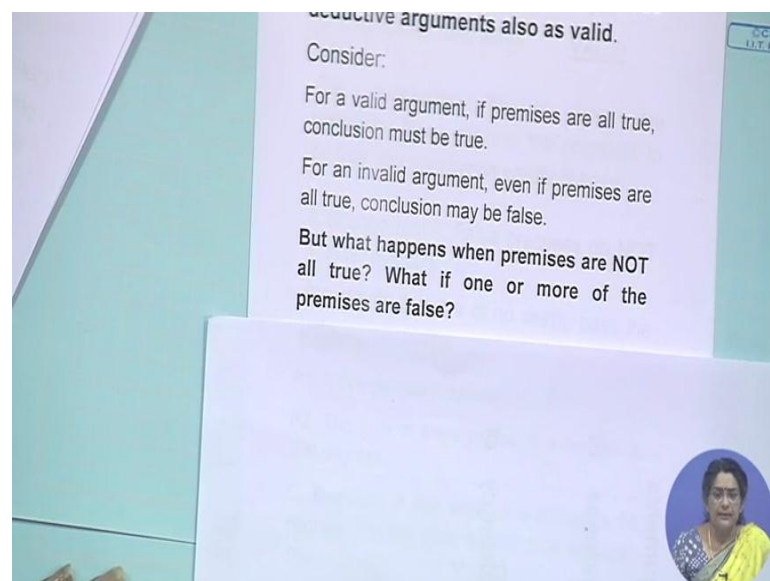
What we are not considering and which is where the problems are of shows up is what happens if the premises are not all true. That is suppose you have a false premise in the premise set or suppose you have all the premises is false then what - then does this definition work as efficiently let us see and this is the problem where through which we will go into the discussion of soundness.

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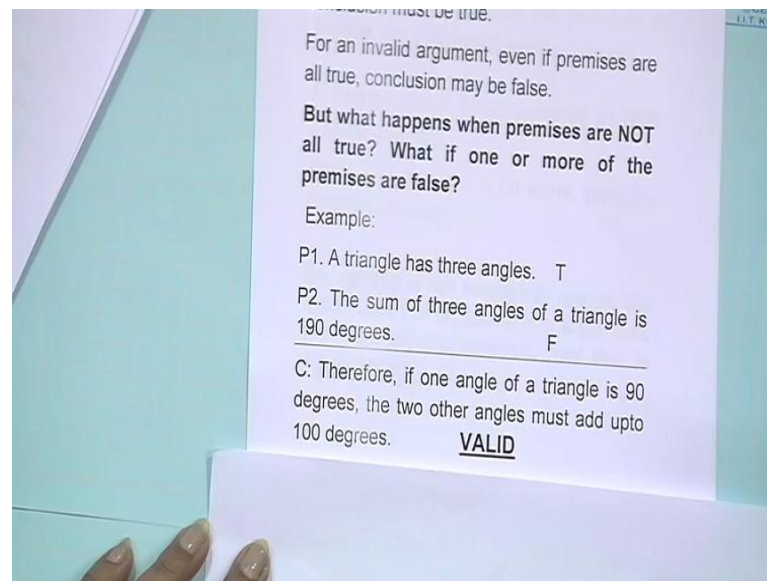
Let me show you an example suppose we tell you that here is a premise that a triangle has three angles true and then suppose somebody said that the sum of three angles of a triangle is 190 degrees that is a premise somebody has given now we know that that is false. Now the combination of this is kind of problematic you have one true premise, one false premise, and suppose given these two somebody has concluded therefore, if one of the angle of triangle is 90 degrees the other triangle must add up to 100 degrees. The question that you are asking first of all is it a deductive argument the answer is yes, if we think that the premises are like this does the conclusion follows and the answer is yes if this is true then this also comes out to be true.

So, in a way though we know that this premise is false, but suppose we assume this to be true then the conclusion does not it follow? So, we have no way, but to call it valid, and that is a surprise because you think that having a false premise should automatically eliminate this kind of argument to come out to be valid, but there is nothing in the

definition of validity which rules this kind of arguments out that is what I was trying to point out. Let us take other examples to make this point clearer.
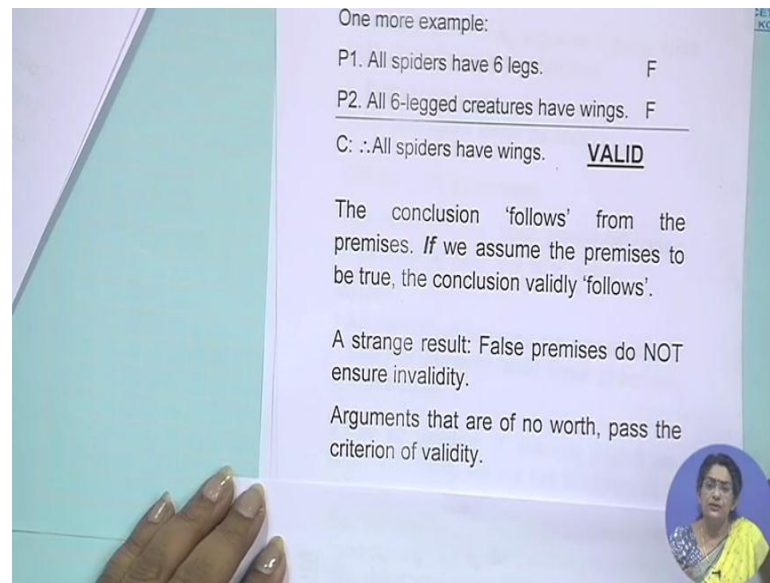
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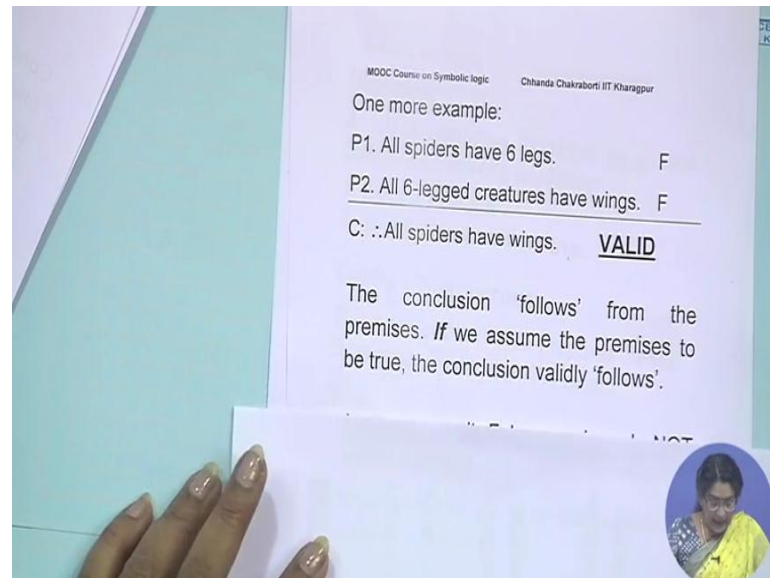
Let us make more radical examples suppose we have this argument in front - all spiders have 6 legs and that is patently, false; then somebody says all 6 legged creatures have wings, false. So, you have false premise, false premise, the entire premise set is false and then from these two premises somebody concludes therefore, all spiders have wings - the question is we know that the premises are individually false, but given this and given this does the conclusion follow can we deduce the conclusion the answer is yes, if this is the case, if this is the case, then it does follow that the conclusion is also entailed and in that case the argument comes out to be valid.

You cannot rule it as invalid because what you do not have technically true premises and falsity of the conclusion. Rather what you have is that even if the premises are false the truth of the conclusion is entailed by the premises strange, but true. So, this is where you see sort of a short coming up the definition of validity, you are going to have valid arguments of this kind. You are going to say what I will do with this argument because it is all useless it is kind of trivial it is kind of empty because it is all false, but it comes out through the definition as valid. So, this following from the premises especially when you have false premise set is a problematic sort of a situation it creates a problematic situation for the definition of validity.

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So, strange result is as you saw that just because you have a false premise or just because you are all premises in your premise set that does not ensure that you have an invalid argument at hand, which should have been the case, but it is not. In fact, as a result just as you saw like this argument for example, what leads arguments? Arguments that have a no value in fact, they are getting to be valid and passable. So, in a way that tells us there is something wrong with the criterion of validity, the way we have define it perhaps we have defined it rather loosely and this was my point that I was trying to make that validity is a good concept, but it does not rule out everything that is supposed to rule out some of the bad arguments also pass through.
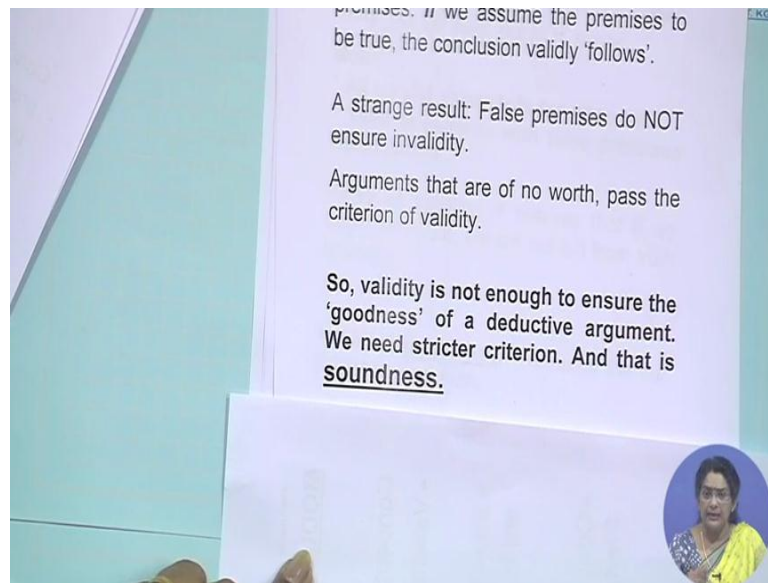
This is why, this is the reason why for deductive arguments validity is not enough as a criterion we need something stricter, we need some other notion to supplement the concept of validity, so that this kind of spurious trivial worthless arguments can be kept at way and that stricter notion is that of soundness.

So, our next topic is to look into what soundness is. We are still talking about deductive arguments, we are still learning what makes deductive arguments good and I said validity is surely a handy notion, but it is somewhat loose. So, we need to make a stricter notion introducing soundness.

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So, what is soundness? Soundness for deductive arguments requires that a deductive argument must fulfill both of these conditions, with a joint condition satisfaction - first of all the argument has to be valid in the way we have described it, so first it has to be valid and then the premises must be true. So, once more a sound deductive argument requires that two conditions are satisfied simultaneously at the same time, first of all it has to be valid and then the premises must be true. So, this the validity keeps out the totally invalid arguments out and the second condition keeps out the questionable once where you have premises going false and yet the argument is coming out as valid.

So, soundness brings in the necessary structure in the notion of what makes a deductive argument good validity is required, but on top if it you can get true premises then you have soundness. So, validity is the minimum requirement and after that what we ask for is it also sound; obviously, sound arguments are more desirable than barely valid arguments that is what you need to remember.
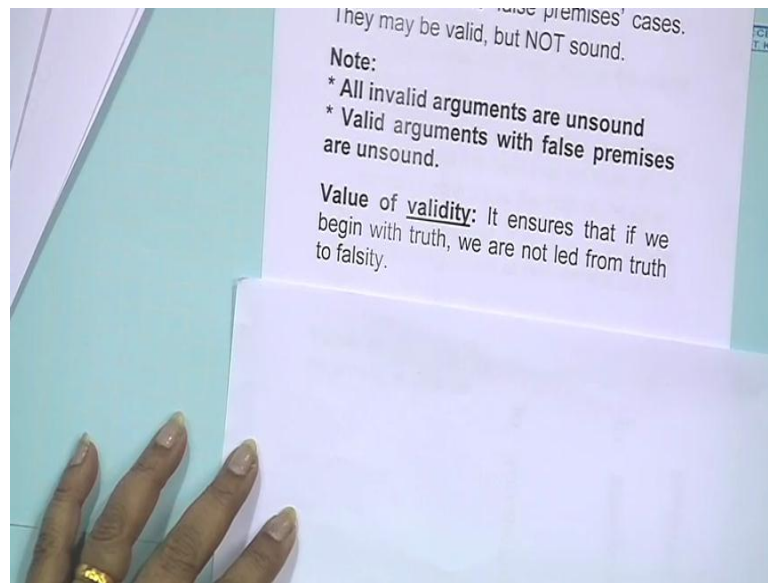
So, false premises situation is ruled out which are valid, but not sound. Now if you have understood what soundness is and what validity is then I will make this kind of a claim also in front of you that all invalid arguments are necessarily unsound because it comes out as a requirement for soundness that first of all argument has to be valid. So, all invalid arguments are necessarily unsound and then you may have valid arguments with false premises which are valid but unsound.

So, this kind of arguments you may try constructing your own examples to see this is how it works, so just because your validity does not ensure that it is also sound. But once you have invalid argument you know for sure that argument has to be unsound why are we looking into validity and soundness? Well here is my suggestion or here is my sought of insight from my side to you, why do we need validity? The answer is that it ensures that if we begin with truth in case of a deductive argument validity ensures that we are not misleading to falsity. Remember the definition of validity that if the premise is true, it is never possible that you land into a false conclusion if the argument is valid. So, that kind of guarantee it ensures that if you start with truth will not land into falsity.
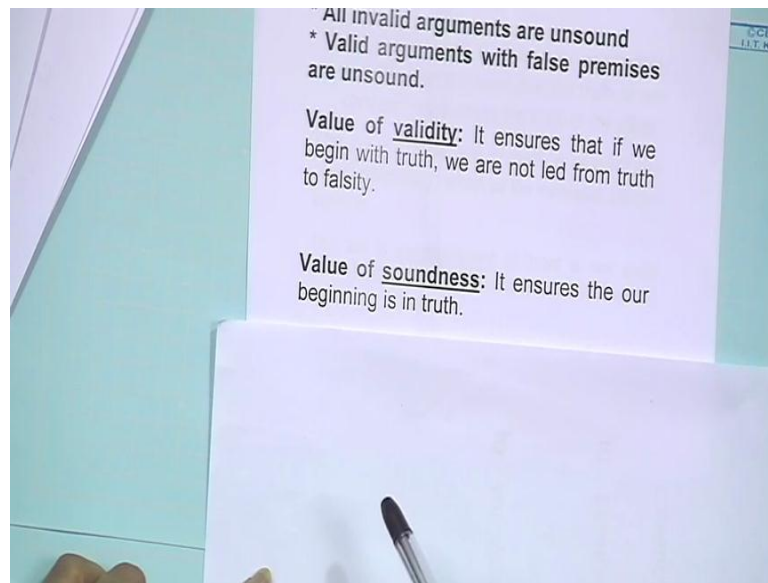
On top of that why do we need soundness? The answer is that it just ensures that our beginning is indeed in truth because you just saw that validity can also happen with false premises. What soundness guarantees that are premises are all true together these two criterions brings it the required amount of structure the required amount of the formal correctness in deductive argument. So, deductive validity and deductive soundness we have looked into.
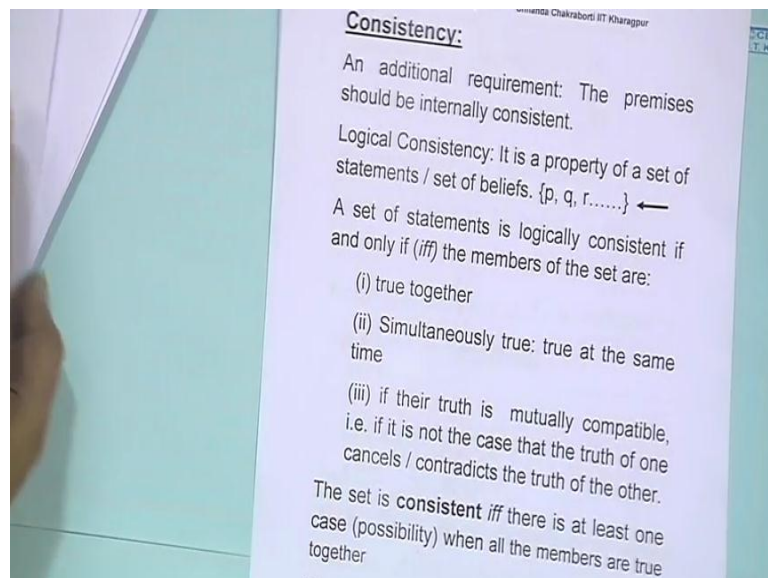
Then we have just one more consideration for deductive arguments and that is known as consistency. See, so far we have talked about the concepts of validity, invalidity, soundness in terms of the arguments as a whole. Consistency on the other hand is about a set of statements, consistency logical consistency is a property of a set of statements which you can apply in the case of the premises. So, what we have talking about where are the premises set is internally consistent or not, let us work the idea through. This is an additional requirement that the premises should be internally consistent otherwise you know if you have inconsistent set of premises as you know we often say that if somebody is inconsistent there is no value to the credibility is undermined, we do not think that the person is saying anything word.

So, in a way consistency is a requirement for arguments and for deductive arguments it is even more required why - because soundness remember it only ensures that the premises are true, but you will soon see consistency ensures that the truth of this premises are not in compatible. So, it is not like that when one premise is true it cancels the truth of the other premise. So, let us see how we have defined this logical consistency. First of all note as I said logical consistency is a property of a set of statements set of believes. So, suppose you have p q r these are propositions or statements, and we are looking into the entire set there may be many other members and we are asking whether this set is consistent or not; when is it consistent, when is it consistent, will give you the definitions in just a moment.

So, set of statements is going to be logically consistent if and only if the members of the set are one true together. So, individually true is one thing, but true together you are looking into that they are coherently true, or they could be there could be a time reference that at the same moment the same time slides they have all come out to be true this is what we require or the other way to understand is that the truth is mutually compatible. So, it is not the case that when one of them is true as I was saying that it cancels or contradicts the truth of some other member in the set. So, in a way we call logical consistency a property of a set of statements when either they are true together or they are simultaneously true or when their truth is mutually comparable.

Now, in terms of possibility remember we defined possibility a way we defined validity invalidity in terms of possibility. So, in a way consistency also we can define in terms of possibility like this – that, we call a set logically consistent if and only if this iff stands

for if and only if there is at least one case or at least one possibility when all the members are true together. So, if you can find even one situation when all the members are true together you can call the set as logically consistent.

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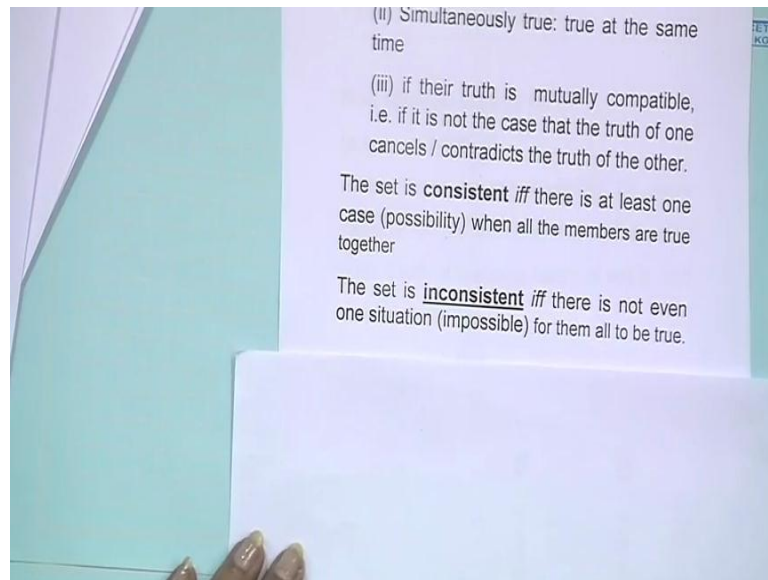
So, now you can imagine what would be inconsistency namely when there is not even one situation when you can find all of them to be true. So, it should be impossible for them to be all true together. Let us follow this concept a little bit, I will give you examples so that it stays and with this we are going to end this also, so let us follow this through.
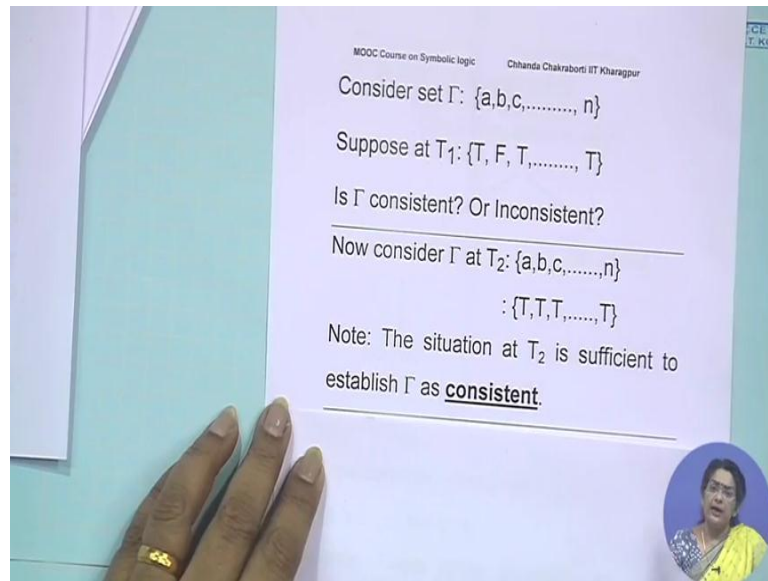
Consider set gamma which has this members a b c you know up to the nth statements, so many members. Now suppose we are looking at time slides at T 1 or moment T 1 we find that the value of a is true, value of b is false, c is true and so on so forth.

Now, you see this and you are asking yourself or I am asking you, is this set consistent or inconsistent. Now you will say that T 1 at T 1 this seems like it is not consistent fine let me give you another example. So, let us consider the same set gamma at T 2 where you have the same members, but truth values have changed at T 2 now a is true, b is true, c is true and the entire set is true I mean every member is true. So, what happens? What you found is that at T 1 gamma was not consistent, but at T 2 gamma is consistent. Does that mean that the state is inconsistent? No, that is what I am trying to explain. Let see, so you are going to say that at T 2 what we have found is sufficient to show that gamma has to be consistent.

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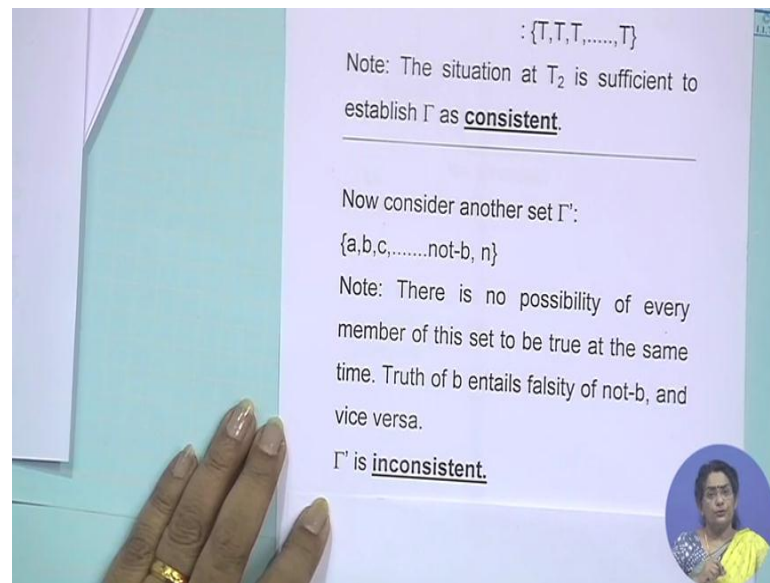
Now, here comes the (Refer Time: 27:39) how to understand inconsistency. Let us consider another set gamma dash where you have a b c and one of the member is not b, ask yourself could there be even one moment when every member of the set is going to be true, the answer is no. So, what will happen is that you will never find even one moment when every member is going to be true at the same time why not? Because b is truth is going to cancel the truth not b and c vice versa, and this is what we call an inconsistent set. So, gamma dash is inconsistent, but gamma was not. Even though in you found in one case that there not all true together, but it does not make the set inconsistent.

So, we are going to finish this module by looking at this sort of a flow chart that for deductive arguments what we did do is we first check whether the argument is valid or not.

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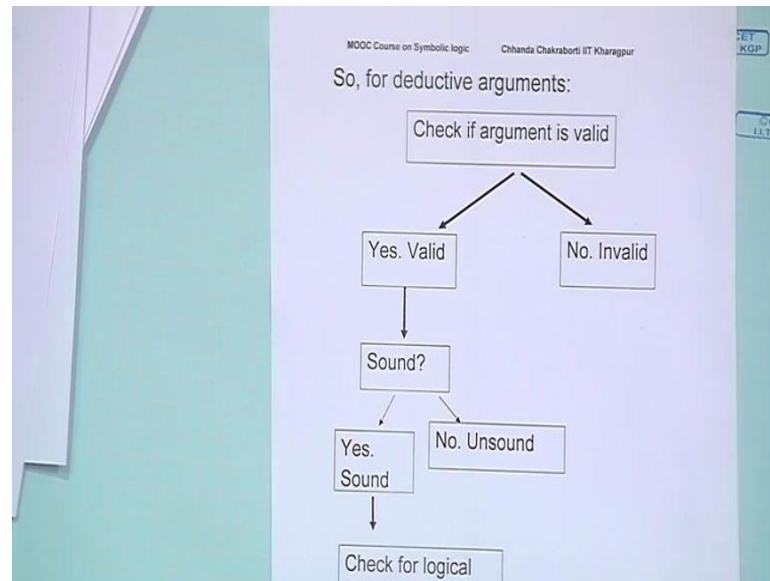
If not then it is clear is invalid and these are not desirable kinds. If yes and it is valid then we look further to see whether it is sound. If it is not sound it can still be valid even work with them, but these are not the best of the desirable kinds. So, if it is sound then you have some of the better arguments and still you can see determine whether they have premise set is logically or internally consistent or not.

With this we are going to end this module and please work with this concept so that we can proceed further to the next module.

Thank you so much.