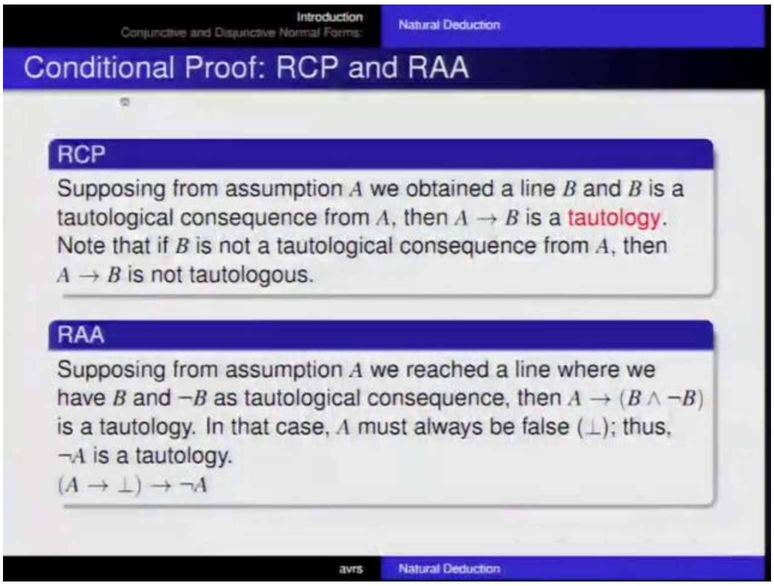
Introduction to Logic
Prof A.V. Ravishankar Sarma
Department of Humanities and Social Sciences
Indian Institute of Technology Kanpur

Lecture - 23
Natural Deduction Examples

Welcome back, in continuations to the last lecture, where we discussed in some detail about 1 of the important decision procedure method which is called as Natural Deduction method. So, Natural Deduction method the idea here is that will be employing only some of the basic principles of logic such as: more respondents, more rest alliance, etcetera and all. And then we will be deriving some of the theorems and all soar the our program is like these that.

So, all the valid formulas in all we are trying to find to proof for that. So, if all the provable things are true and all the true formulas are provable, then your system is considered to be complete. In this sense, natural deductions as a formula axiomatic system is considered to be sound and is considered to be complete, in sense at all provable de terms are true; all true things are provable and all. And also it is the case at it is also said to be consistent and all.

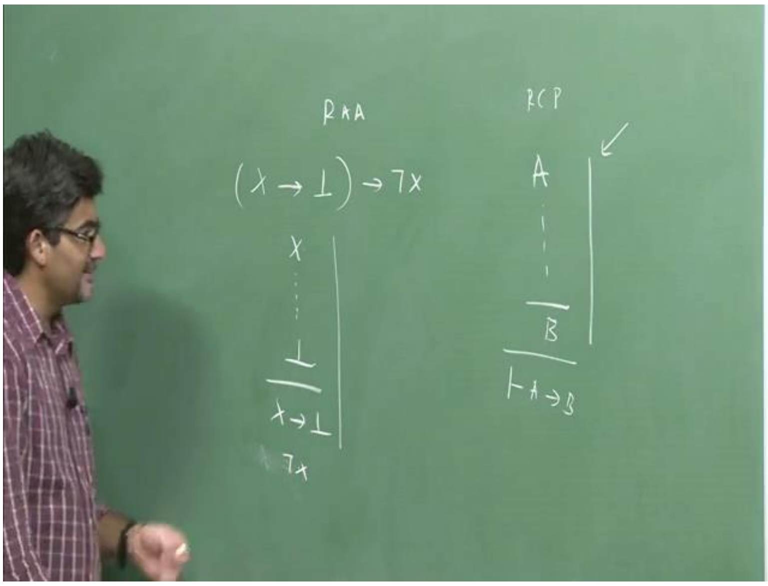
(Refer Slide Time: 01:16)



So, in this class I will be considering some more examples, so that you will understand this method in a better way. So, Natural Deduction Method has mainly 2 important methods in all. So, 1 is 1 in 1 of these things we will employ rule of conditional proofs in the second 1 we will be using reduction and absurdum method. So, what is considered to be a rule of conditional proof in case of natural deduction it is like this.

Supposing from an assumption is we obtained in A proof something called B. So, now, B is tautological consequence from A; that means, a last step of your proof is considered to be theorem. So, it is also considered to be a tautology. So, then what you will do here is it that, you will discharged the assumption A and then you will start writing A implies B. So, you have to note that B is a not a tautological consequence from A then; obviously, A influence B is also not tautogous.

(Refer Slide Time: 02:29)



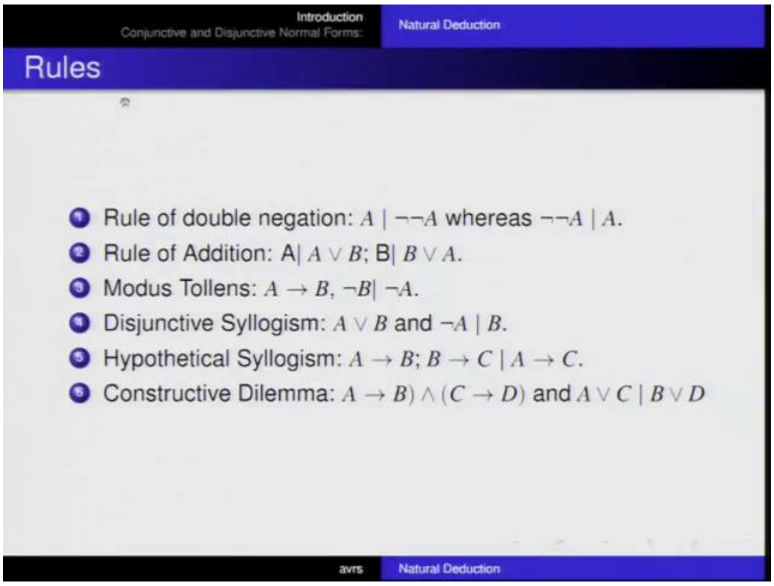
So, what A essentially we are trying to do here is that you start with A, and then you will go to B and then you will draw a line like this and you will say that A inflects B this is that used from this things. So, this is 1 way of 1 method and which you can prove in theorems in natural deduction; what you will be doing here is, you will be making use of some of the natural principles of logican.

So, together with that we have an assumption A and that let to B and since, A let to B and all you will draw a line from A to B and you will be say that A implies B reduced. So, this is what the first one is and we will be trying solve some problems by using this particular kind of method. And the second one is what we will call it has Reduction Ad Absurdum method.

So, the basic idea of this one is like suppose, we will give formula x and you derive contradiction and all x implies something falls our contradictors; that means, which should not be x in all which should be not x. So, the same thing can be represented this way taking x assuming x into consideration, you will generated a contradiction. So, when you generated a contradiction, whenever you come across a literal and its negation and all like p and not p contradiction; that means, it is not x is true and all.

So, instead of x you have to assume not x in all. So, that is called is consistence or in consistently or contradiction in all. So, if that is case then. So, this means x implies contradiction so; that means, you will draw a line like this and in you will say that x implies.

(Refer Slide Time: 04:21)



So, this is what is called as a reduction ad absurdum kind of method. These are the 2 things which we will employing in a natural deduction method apart from there are some natural principles of logic; mean simple rules, which we employing logic just like in a person an assuming that you are playing a some game in all every player is supposed to learn some kind of rules and all.

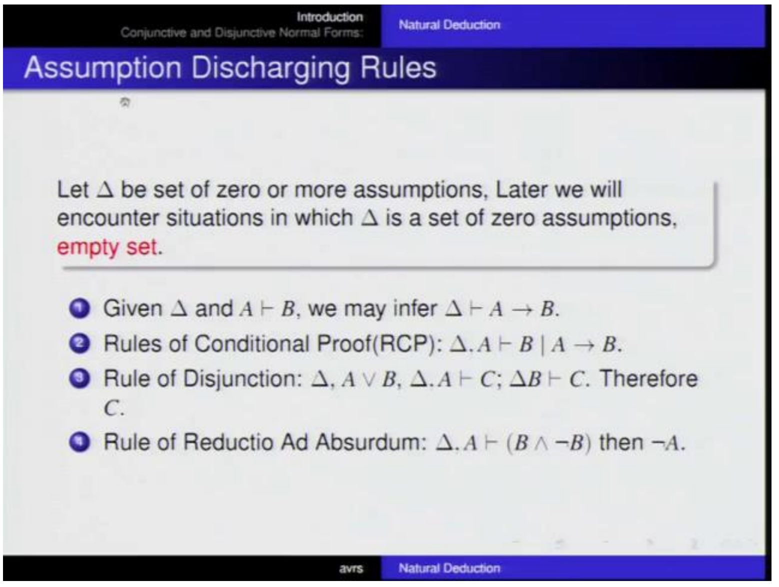
If we knows a rules minimal rules, then you will be able to play in a satisfactory or better way and all you will not make faults and all. So, in the same way;, so if you know this rules an all you will employing this things. These rules together is some assumptions leads to a conclusions that you are trying to derive. So, basically what we are essentially doing is simply this that we are trying to prove some theorems.

So, why we are doing it we want to have a some kind of proof mechanism for all the valid formulas and all. So, this also considered as 1 of the important decision procedure method which is simple at. So, the first rule is simple and straight forward; whenever, you have negation of negation of A you will replaced it with A. This is what is called has rule of double negation and rule of addition says that, if A is true then since A is already true that A semantics of disjunction allowses to add other any other kind of proposition B; without distributing the value truth value of A.

That means, from A you can reduce A or B or from B you can reduce B or A. So, now, the Modus Tollens more rule is it that, in the conditional A implies B A is considered to B antecedent and the same rate B considered to A consequent. And if we derive the consequent and if we have to derive the antecedent as well. So, now the disjunctive syllogism A or B and if we derive 1 of this possibilities then; obviously, the other 1 follows hypothetical syllogism like transitive property A influence B; B influence C and A hence to go to C.

These are simple rules and all classical logic obvious these particular kinds of rules and all. And you should note that, this supplies to classical logic and all, but when you are applied to day to day situations are some of the things; which you make use of it day to day discourse. Then it mightily to some kind of countering due to it might generate countering due to inferences all.

(Refer Slide Time: 06:44)



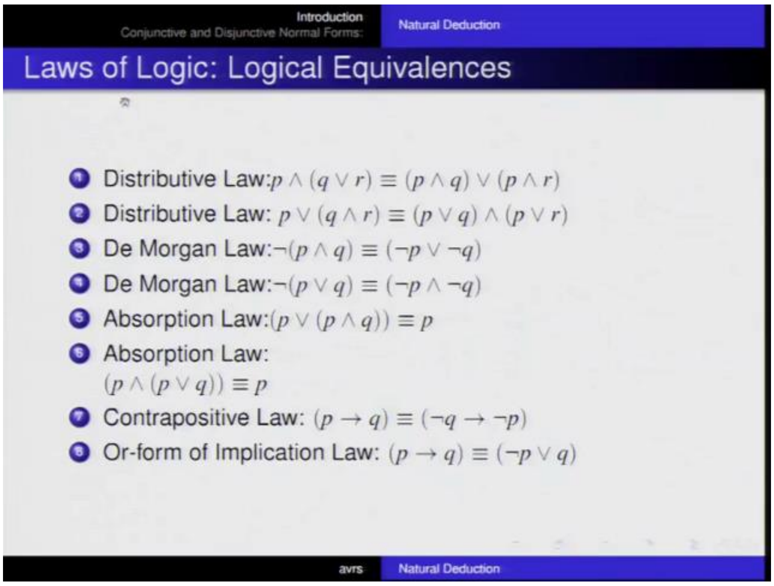
So, that is not our interested this movement, but all these rules are truth preserving rules is obeyed by the classical logic that we are trying to talk about. So, there are some other rules and all these rules are called as assumption discharge rules. So, what are these assumption discharge rules they are like this. Let delta B set of 0 or more assumptions, mean if you us if you start with 1 assumption it is something some assumption is to be there or you can start with 0 assumption also that means, it is a tautology something.

So that means, already be a tautology is does not require any proof and all the self-evident truths you can take it first they are all true absolutely true. So, now assumption rules are assumption discharging rules are like this a given delta and for example, B is reduce from A then we can discharged assumption A and you can say that it is aA influenced B is reduced from delta.

So, this is what is the conditional proof given delta and A suppose if we reduce B from it, then you can discharge assumption A and you can say that influenced B is reduced from that 1 delta. The rule of disjunction tells us that given delta and A or B and you already reduce C from A if there is A case and you already reduce C from B given delta. So therefore, you will also reduce C.

So, these are some of the truth preserving kind of rules. And all then the fourth rule tells us that, suppose we reduce the contradiction from A given assumption A and delta then; obviously, it should be not rather than A.

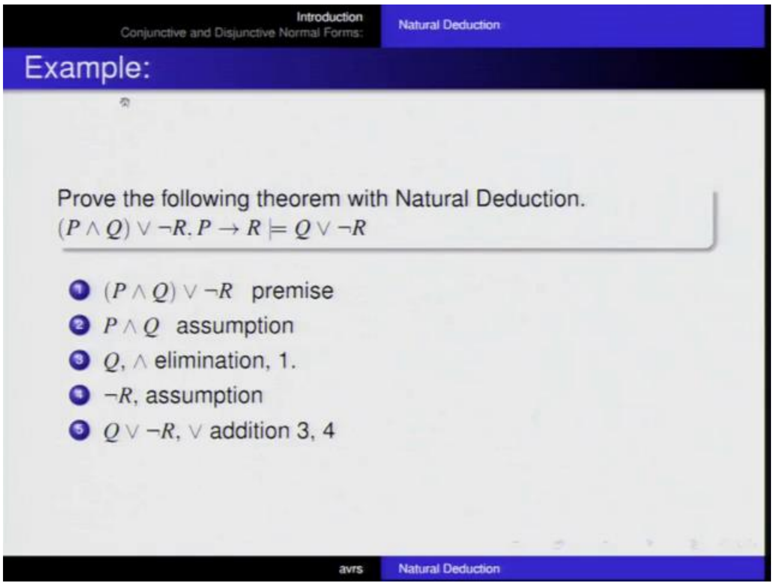
(Refer Slide Time: 08:26)



So, these are some of the simple rules which we follow then there are some other logical equivalence relation which we employ it in the natural deduction method. There simple rules such as, deduct distribute you law p n q or r is p n q r or p n r some De Morgan laws especially, when you trying to translate conjunctions in to disjunction used De Morgan Laws.

And then one of the surprising thing for a this Absorption Law if p are p n q it will become p. In the other law is, other were on p and q and p are becomes p. So, whenever come across a formula p r and p n q just replaced with its logically coherent relation that is p. So, contrapositive role is straight forward p implies q implies not q implies not.

(Refer Slide Time: 09:18)



So, now you will make use of what is a what essentially we are trying to do is that, we are trying to show whether are not the conclusion follows from the premises or not. So, let us assume that these are the 3 things premises are P n Q R not a and second 1 is P implies R from the we are trying to deduce Q R. So, now it is like this.

(Refer Slide Time: 09:54)

So, what will be doing P is simply is that will be using some principles truth preserving principles plus the assumptions that there in the particular kind of problem. And then it we will reduce P and Q R not at all this is the first 1 and the second 1 is P and Q and from this you are reducing Q R not R. So now, we are trying to prove this particular kind of thing using rule of conditional proof and we will also prove it with the help of R a a.

So, now, in this RCP you have to list out all the premises and then this is what you are trying generate after using this assumptions take into whether with the principles which are sitting at our background. So, if you add this things to it somehow we need to a generate its particular kind of conclusion. So, now a there will be n number of ways to come to this particular kind of conclusion. Sometimes you might imply 4 steps or may be 5 steps etcetera and all.

So, a what constitutes and effective proof is this that whenever, your proof ends in finite, in finite steps, in finite intervals, of time then it is considered to be an effective proof. Suppose, of if I showed that Q or R follows after 15 steps and all. So, that is how to be a an effective proof and all, but some others comes with a proof in which it includes only 6 or 7 steps. Then, that is definitely considered to be a an effective kind of proof.

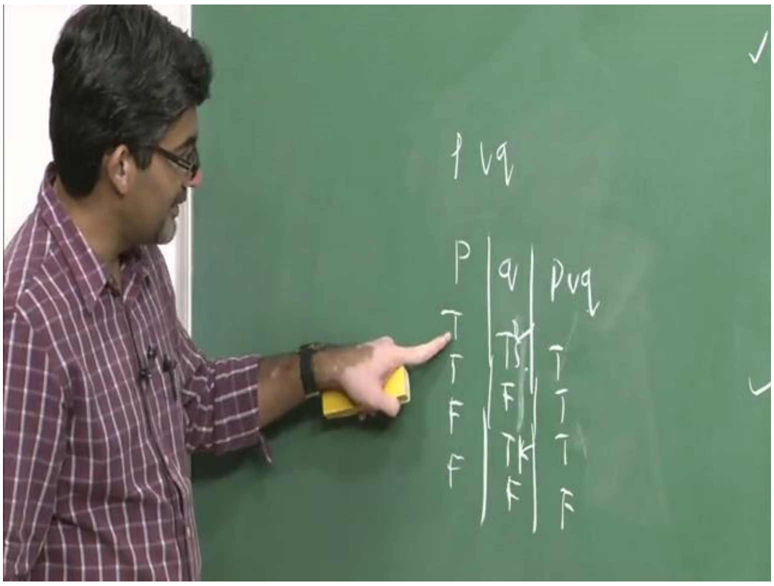
So, now taking this assumptions into consideration a the first thing that we will be doing is this thing. So, now, p and q r not r. So, this is the first assumption on either p or not q is true or not r is true that is what it essentially says. So, now, we assuming that the first 1 is true. Because, the movement you say that p and q are not r then one of this things is true; p and q are r p implies r, the second 1 is p implies r. So, now, this is the assumption that we have begin with. So, now p and q the convention rule says that from p and q we can reduce p and from p and q and even reduce q also a simple law of conjunction.

(Refer Slide Time: 12:40)

So, now fifth step this is law of conjunction the same thing. So, now, a 6 step now we need to observe these 2 things 2 and 4 more respondents will give us r. So, now, we need to observe 1 and 6. So, now this is exactly opposite of this 1. Now we have a rule distinctive syllogism suppose if x r y is a case and not y is the case; that means, you are ruling out this possibility; that means, whatever is left is the 1 which is the 1, which you will be defusing x is the case.

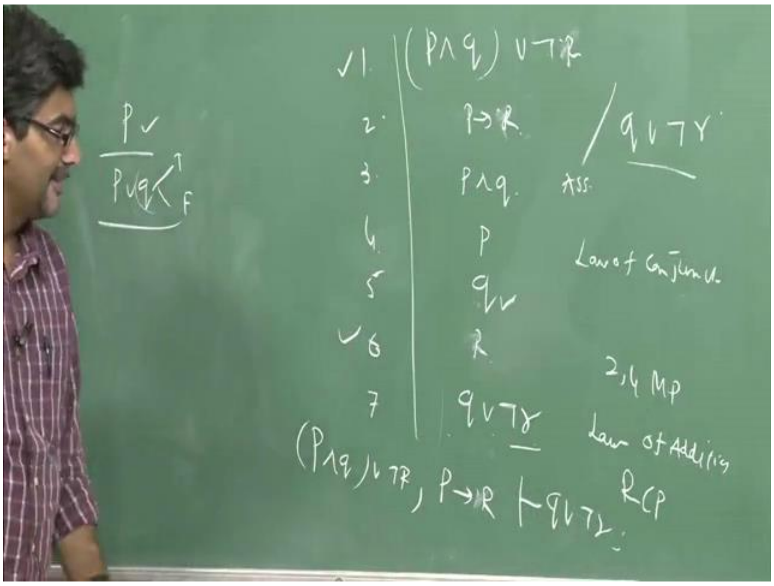
So, now here. So, we can take it as R. So, this is r and you are not r and all. So, this possibility goes out and then what will have. So, p and q again you will be deducing the same thing and all its not making a big thing and all. So, now since q is already true. So, we know that under fifth step q is already true. So, now we can safely add another kind of a proposition any kind of same kind of proposition without disturbing the truth value of it because, q is already true.

(Refer Slide Time: 14:01)



So, why it is the case cause semantic of this 1 p r q is like this p q. So, T T F F T F T F. So, this p r q will become falls only in this case, when both these things are false. In all other cases it becomes T. So, now, it is in this sense q is already true. So, now we need to observe these particular kind, so these rows and all. For example, q is already true; that means, these 2 things which we need to take into consideration. So, now irrespective of whether p is false or p is T and all. So, now p or q is also going to be T only.

(Refer Slide Time: 15:00)

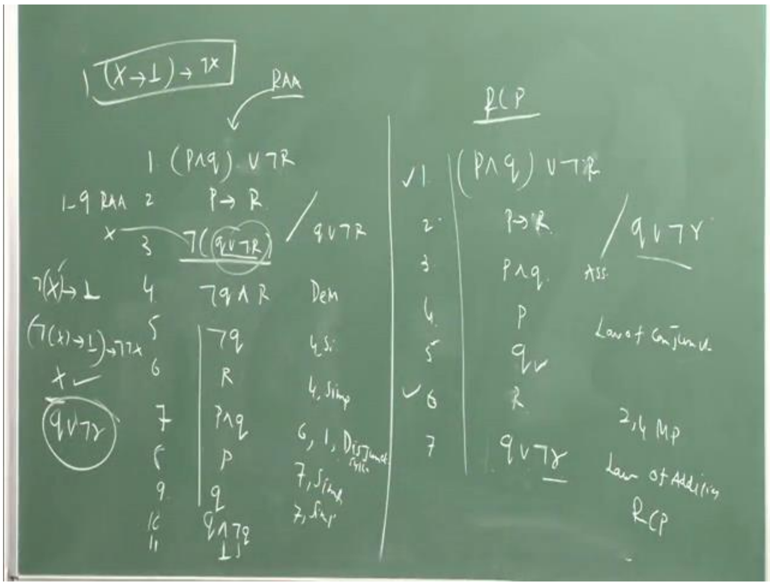


So, it does not matter whether not r is true or false, but it still holds and all, so this rule is called as law of addition. For example, if you have p you can say p and another q to this 1 without disturbing the truth value of this 1. So, ultimately what we are trying to do is, we are moving from truth to another truth and all. It is may not disturbing the truth values of this thing. If p is true p r q has to be true irrespective of whether q is to true or q is false and all.

It is in that sense we have written this particular kind of step q r not r. So, now this is exactly the 1 which we are trying to true. Now, we need to write justification on the right hand side otherwise, will not be able to make out what exactly we have done, so it is Law of Addition. So, that justifies why we are writing this particular kind of thing. So, now, you draw a line from here to here and then.

So, this is what I can say that rule of conditional proof. Now we can formulate the same problem and all we can say, that p and q r not r comma p implies r, and then sleeps to q r not r. Because, we showed that q r not a follows from these 2 premises and all. So, in this way 1 can prove this particular kind of a whether or not the conclusion follows on the premises are not. But there is another way of proving it that is, what is called as reductio and absurdum method.

(Refer Slide Time: 16:35)



So, this goes like this first will we start the premises and all r not r and then you list out the same thing now we are following reductio ad absurdum method. So, the idea here is that if x leads to its contradiction needs to some contradiction; that means, it is not x and all, but it should be not x. So, this is the idea which is commonly implied I proving many theorems in mathematics. So, instead of showing that something is true; what you will start with negation of that 1.

And I will show that assuming that the negation of for particular thing leads to contradiction. So, that is why not x is false and all let means, x has to be true. So, now p r r this is this is the 2 premises now separated by that you have a conclusion. So, now in the third step what will do is in the reductio ad absurdum method; what you will do is, you will negate the conclusion and then you will construct a you will see whether or not a it leads to contradiction or not.

So, now, if you simplify this 1 using De Morgens Laws it will become not q and r. So, now this can be further simplified into not q and r. So, this is 4 simplification 4 simplification you get this 1 and this is De Morgens Laws we have used here. So, that is why I wrote Dem. So, now observe this this. So, now, p r and this 1. So, what you will get is p and q. So, how did we get this 1 6 and 1 disjunctive syllogism you got this 1. So this is nothing, but writing the same thing p and q.

So, now 7 simplification you get this 1; 7 simplification you got q. So, now in this proof the problem is this that we have q here and you have not q here. So that means, in the tenth step what we need to write is q and not q. So, now what you do here is that starting from 1 to 9 r reductio ad absurdum n. So, what is happened in the eleventh step what you whenever you come across q and not q, you mention it with this particular kind of symbol it is a contradiction.

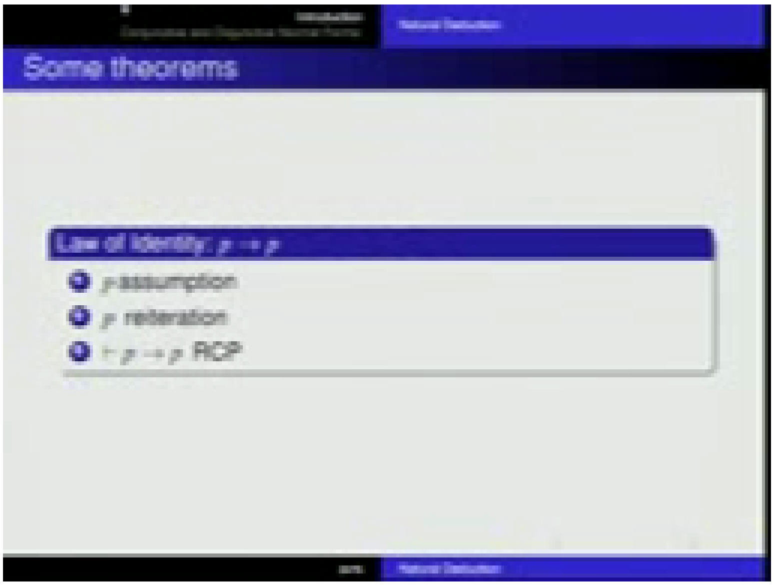
So, negation of the conclusion leads to contradiction and all. Suppose if you take this as x so now, x led to this 1 contradiction we showed that negation of x deeds to contradiction; that means, a it should be its should not be negation of a, but it should be negation of negation of x. That means, if negation of x leads to contradiction; that means, it is negation of negation of x; that means, x. So, what is our x here? It is q r not r.

So, what essentially we did here is that we have taken into consideration that the conclusion does not follow from the premises and all. Then, we used principles of natural principles of logic and then ultimately we came up it like contradiction, and then since taking the negation of that 1 lead to a contradiction it is negation of x; x is this 1 q r not r that leads to contradiction.

So, that why its negation of negation of that particular kind of thing is true; that means, not of the x is using double negation rule of double negation you can say that x is true. So, what is x for us x is nothing, but q r not r a original conclusion remains and all. So, this is sometimes it is simpler than the first method that we have used using rule of conditional proofs.

Sometimes it will be so difficult for example, suppose if you are given if you are given a something which is not a theorem and all. So, then you will keep on proving it, proving it and all and then ultimately you will not be able to prove anything. So, instead of that a maybe you can use a reductio ad absurdum method (Refer Slide Time: 09:18) and things will become simpler now.

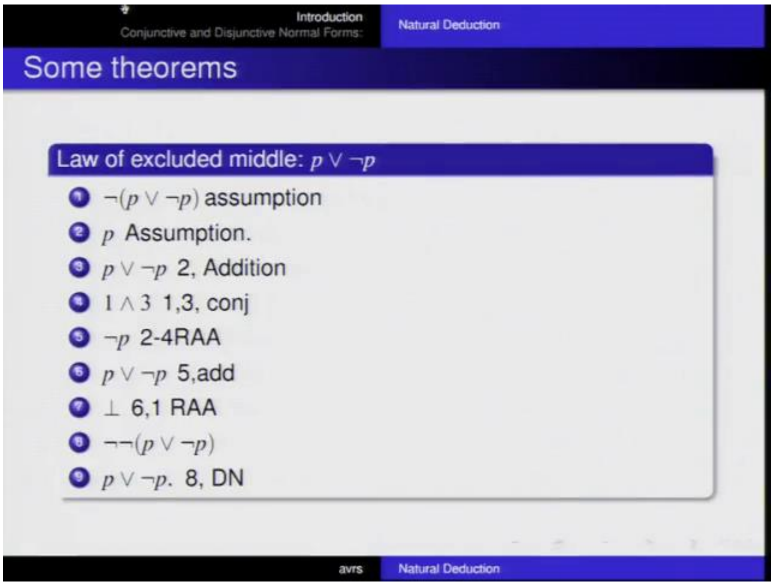
(Refer Slide Time: 21:13)



So, now any formal axiomatic system a this 3 thing should come as and outcome and all they are: Law of Entity, Law of excluded middle which say p or not p and Law of Non-contradiction. These this not the case that simultaneously p and r not p are true. So, now, this is considered to be sound 1 of the trivial kind of proofs and all. But still it holds it involves only 2 steps and all. So, in s for f u p plus p start with an assumption we need to note that all assumptions are; obviously, considered to be true.

You take your assumption itself is to be falls and all and nothing you can proof it's already assume that it is true it is true and all. So, now in this case what you will do is you write the state the assumption and then you retreat the same assumption p since you got p from p only. So, now, you draw a line from p to p and you say that p implies ps by using rule of conditional proof nothing actually we did not to anything here, but still this is considered to be effective proof in the natural deduction.

(Refer Slide Time: 22:29)



So, what we have used is reiterated rule which we have used and then r c p. You can also prove p implies p is in reductio ad absurdum method also you take into consideration negation of p implies p. And then it is p and not p and that is a contradiction. So, that is why negation of p implies p deeds to contradiction; that means, not not of p implies p is truth that is p implies p.

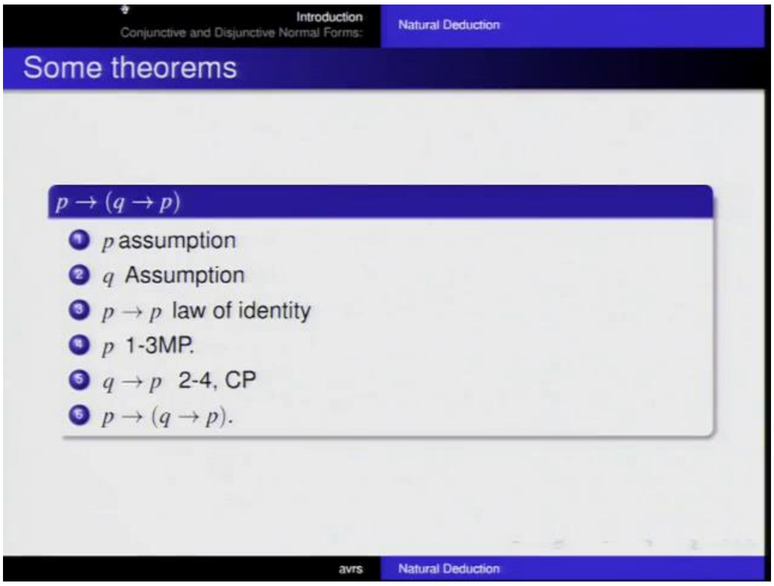
So, in the same way in your natural deduction system or any formal logical system and all. These are the things you should come as and outcome and all. So, later we are when we considered axiomatic propositional logic. There we trying to proved this theorems logic using a some of the important axiomatic systems such as, axiomatic system. So now, let us assumed that let us considered in proof a laugh excluded milt p or not p.

This we are trying to prove to it with a help of reductio ad absurdum method. So, as a first time what you will do is you negate the a formula well found formula that given to you, that not of p or not p. So, now, in that let us considered that p is your assumption that in the law of excluded middle and then. So, p is a assumption that we have and then you can add since, p is a already true you can add any proposition well it is true or false; that means, you adding not p here using Law of and Addition.

So, now 1 and 3 that is not p or not p and p are not p. These are contradict a 1 and 3 in conjunction leads to contradiction and all. So, because it is not p or p p or not p and p or not p and all it is extend not extend. So, that a forget what in each do it. So, you whatever you assumed is wrong and all that mean it is not p is the case. So, now, again to add for 5 you add a p to it because, not p is already in true you add p to it to the become p or not p.

And again 1 and sixth 1 is not of p or not p that is a assumption that we have, and then we got p or not p we list to contradiction each other. That means, it should be not of p or not p it is a case; that means, by double negation we can prove that p or not p is a case.

(Refer Slide Time: 24:54)



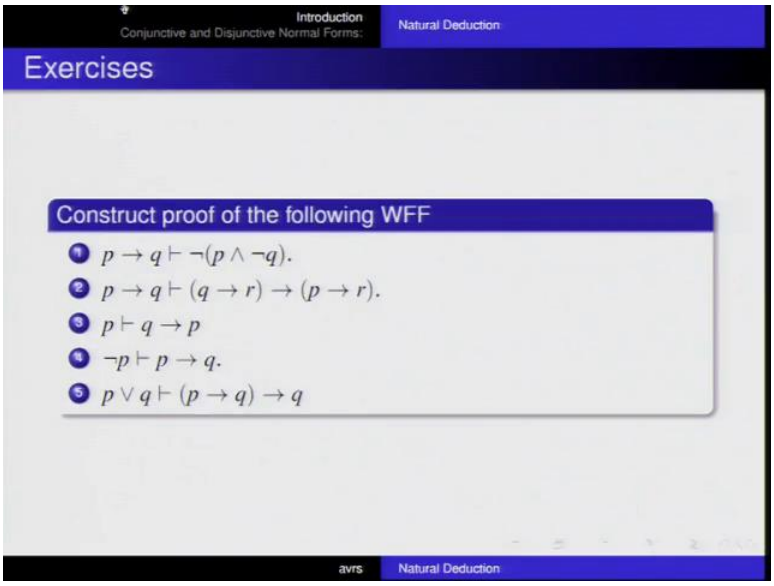
So, this is a some other ways to prove these theorems and all. So, this is considered we 1 of the important instances paradox of material implication. So it says that, a true preparation is implied by any kind of strange kind of proposition and all. In p implies q implies p when p is true; that means, the consequent is true or semantic allowses that; obviously, p implies q is a going to be true respective of whether q is true or false.

And that makes a since in p implies q implies p q implies p is already true and p implies q implies p is also become true in all. So, that makes the whole condition true. So that means, any true proposition is implied by any strange kind of proposition like q here this this case. So, how do you prove these particular kind of things; it is considered to be a valid formula and trasical logic.

So, all the valid formulas needs to find a proof we have to find a proof of those valid formulas. So, again you will start with… So, whenever you have formula like this. You assume the antecedent part of your conditional that is p. And then you will also considered the inner condition and all that q implies p in that q is considered to be the antecedent. So, you assume these 2 things. So, now we are already proved that p implies p is a case earlier.

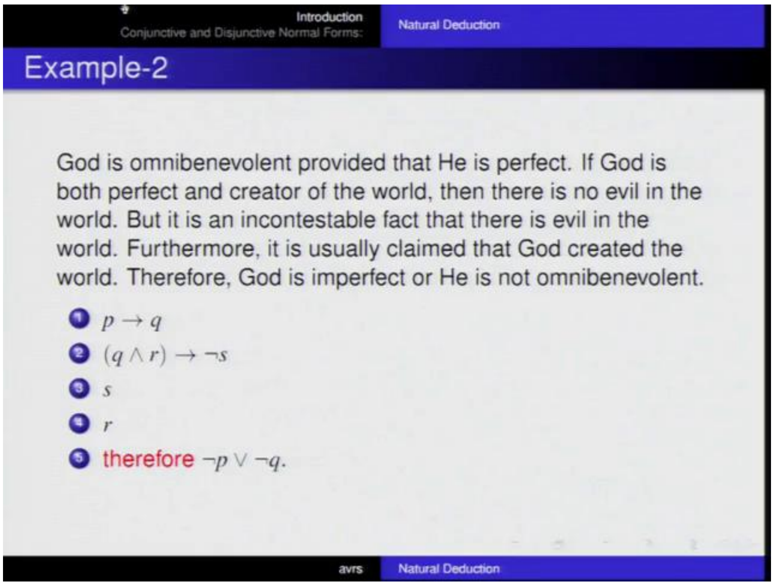
So now, 1 and 3 more respondents of you will get p and then since, p is proved some q; that means, from 2 and 4 if we observe it and from q you got p in your proof. After travelling certain distance you got p. Since you got p from q you write it as q implies p and then you will stayed from where you got this particular kind of things 2 to 4 using rule of conditional proof you get q less p. Since q implies p you got it from 1 that is p; that means, p implies q less p is the case.

(Refer Slide Time: 26:55)



So, this is the way to prove some theorems in this way.

(Refer Slide Time: 27:00)

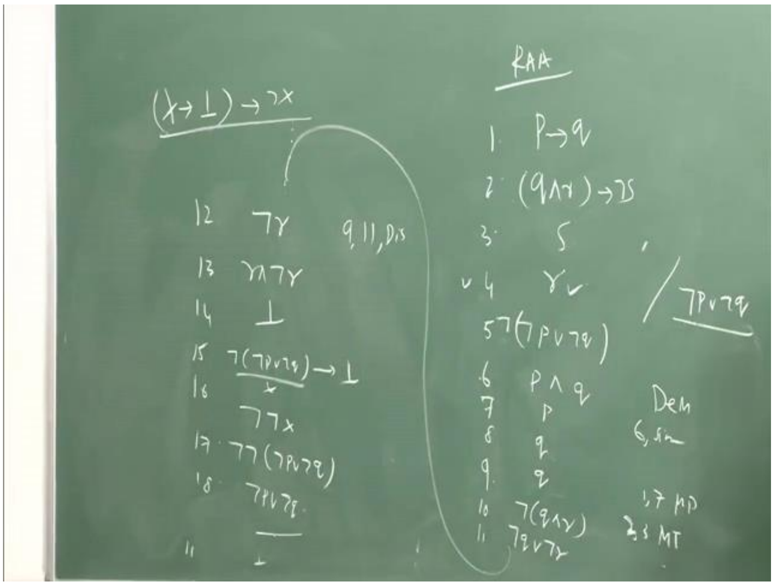


So, now what we will do here is it that. So, we can extend it extend the natural deductions is a principles of this method to solving some kind of problems which we commonly come across we have day to day discuss. So, we will use the English language sentences first what we will do is, you will translated into the language of propositional logic, and then you will talk about a whether or not; the argument is valid or not.

So, this argument goes like this God is omnibenevolent provided that he is perfect. Suppose if you represent God is omnibenevolent is as p and he is perfect is represented as q for examples if we say that it is not perfected, it becomes not q. Now the second premise: God is both perfect and creator of the world that is a conjunction and forward by that it is conditional. Then, there is no evil in the world; there is a evil in the world is yes no evil in the world is represented here as not evils.

Now the third proposition is it is supported by some other things premises, but is an incontestable fact that there is a evil in the world that is yes is the case. So, now, furthermore it is supported by some other statement that is, it is usually claimed that god created the world that is represented as r. So, from that you got the conclusion is that the god is imperfect that is not p or he is not omnibenevolent.

(Refer Slide Time: 28:58)



So, now how to show that this argument is valid using natural deductions method. So, there are 2 ways to show that whether or not; the conclusion follows from the premises or not. So, either we can use rule of conditional proof or you can use reductio ad absurdum method. So, this is the first premises and second 1 is q and r q and r like implies not s and then s and r. And followed by that there is a conclusion not p r not q.

So, now, we will translated the English language sentence into simply the symbolic form and all. Now, we will forget about to god and all these thing and all. So, now we will be manipulating symbols and all. So, in there reductio ad absurdum method I will be using the second method and all; which is have I told you simpler. So, what you will do is you will start with denial of the conclusion. So, what conclusion here? So, this is the conclusion not p or not q.

So, now you will denial the negation of the conclusion. So, there are 2 ways of showing that whether or not whether this argument is valid or not. So, we are not sure whether this argument is valid or not that is why we are taking into consideration the reductio ad absurdum method. So, taking the negation of the conclusion whether or not this leads to contradiction or not this is 1 way is which we are trying to see.

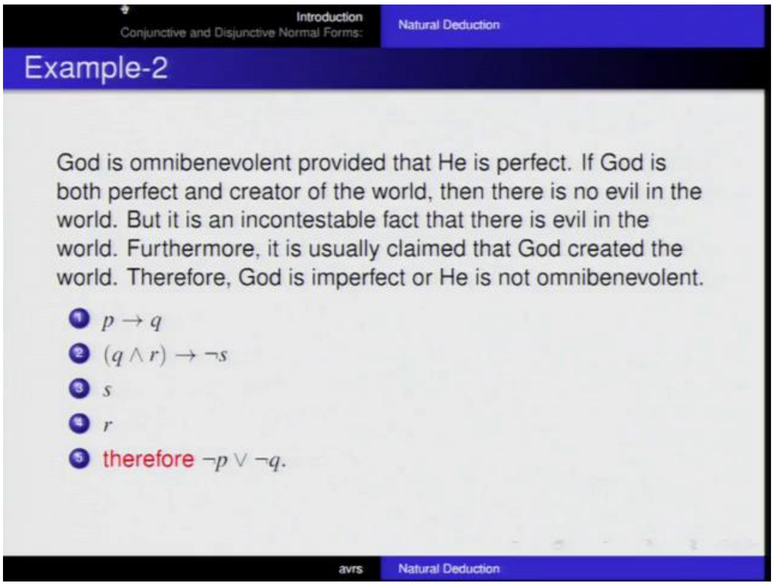
So, now this you can simplified its will become p and q using De Morgan’s laws; negation of negation of p is p and negation of conjunction disjunction and negation of negation of q is q. So, now, this can determines as p and q, this 6 simplification you will get this 1. So now, 1 and 7 like more respondents you will get q 1 and 7 you will get q here. So now, observe this particular kind of thing 2 and 3, so it is like x implies y and then not y.

So, it is a rule called as Modus Tollens rule, so if not y in this case is we need to denies x also. So, that is some Modus Tollens rule; that means, tenth 1 we have not a s and s; that means, we have denies the if you denies anticipant consequent, you have to denies the antecedent also. That means, is q and r, so how did we get this 1 from 3 2 and 3 Modus Tollens you got this 1. So, now this can be written as not q or not r. So now, so you have q here and not q here so this 9 and 11 disjunctive syllogism deeds to 11 is this 1 it leads to not r.

So, now under in the fourth step and all you have r is here I mean above. So now, we have going like this. So, now observe in the fourth step we have r here and in that twelveth step you came across not r; that means, it is r and not r. In the fourteenth step it is a contradiction x and not x it is contradiction. So, how did we generate this contradiction? In the fifteenth step what we will do here is that negation of not p or not q let to contradiction.

So, since it leads to contradiction that is x implies this contradiction the, it is not x. So that means, if that is a case if this whole thing will be considered as x x implies contradiction then it should be not of not of x. So, that is in the seventeenth step we can show that not of not p or not q is the case; that means, this is the conclusion that we are trying to achieve. So, this is the actual things which we follows and all that is the conclusion actual and what is the conclusion.

(Refer Slide Time: 27:00)

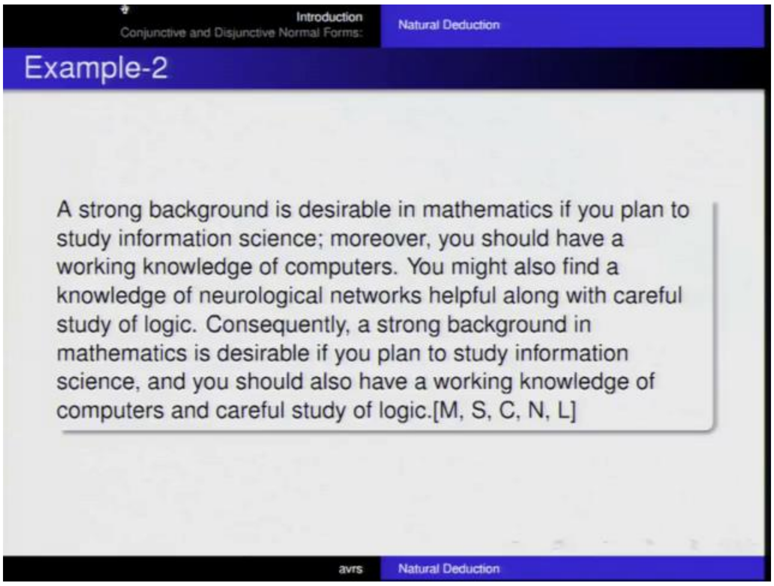


So, what is that we have achieve in this 1 simply these that we denied conclusion that is, we denied that it is not case at God is in perfect or he is not omnibenevolent. Now, we have to translate into the original argument and all. Then, we showed that it lead to contradiction I means, negation of x leads to contraction that means, x is a case. That means, the conclusion remains the same the conclusion holds provide a you follow this our conclusion follows from the premises.

That are take it here this called is how many violent provided that he is perfected extra. So, in this way we can translate the English language sentences appropriately into the language of propositional logic and you can apply is natural deduction method. But the problem here is that for example, of the conclusion does not follow from the premises in all. Then, suppose if you are using in RCP that rule then you will be working regress ultimately you may not be generate the conclusion that we are supposed to get.

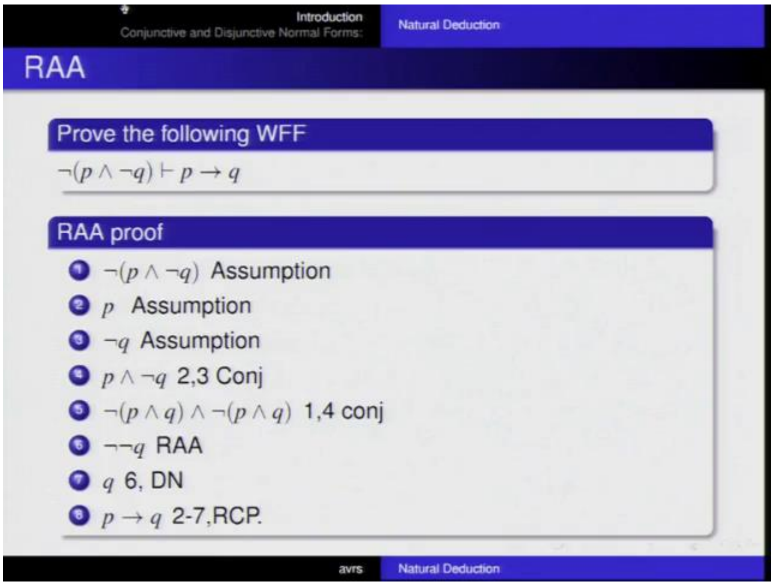
So, if in an invalid arguments this may not work there, you have to use semantic tableaux method are may be a reductio and absurdum method is the 1 which we need to employee. Sometimes proving a contradiction itself might find you might find it very very difficult and all. So, in that case complexity increases and all. So, in the 1 hand you are verifying it and the other hand, you have showing that something is not false and all. So, that is what we are trying to do in the reductio ad absurdum method.

(Refer Slide Time: 35:04)



So, like this we can talk about several examples, where we can employee a either a rule of conditional proofs or a reduction ad absurdum method.

(Refer Slide Time: 35:18)



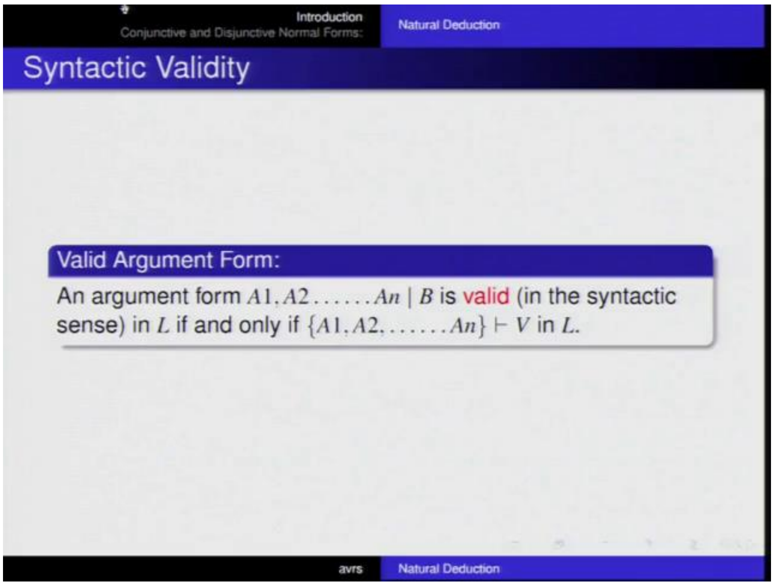
Suppose if we have trying to proof this particular kind of thing whether p implies q follows from not of p and not q. And here is a r a s proof reduction ad absurdum proofs this start with an assumption. So, that is not of p and not q that is assumption and then and you take the antecedent part of the consequent conditional that is p in the right hand side you will find that 1.

So, now, our assumption is that not q is our assumption. So, what essentially we are trying to do is we are considering a case in which you have true premises in a false conclusion. Now, if you take the 1st 1 not of p and not q as true, and then p implies q as false and then; that means, you have taken into consideration a counter example and all. So, that that creates a kind our counter examples. So, now, from this p and not q is our assumption already.

So, 2 and 3 if you use Law of Conjunction it will you will get p and not q. So, now we have from 1 and 4 and 1 hand we are not a p and not q and we have p not q. These 2 leads to contradiction so that means, we started with not q is our assumption that has to be false; that means, q has to be true. There is what we got it in a seventh step from the sixth step by using double negation rule you will get q.

So, now since you got from 2 you got 7. So, that is the q is obtain from p; that means, we can draw a line from p to q all the way from 2 to 7 and you say that p implies q then p reduce by using rule of conditional proof. In that what you will do is, you will discharge your assumption p q etcetera and all and you will start a talking about p implies q.

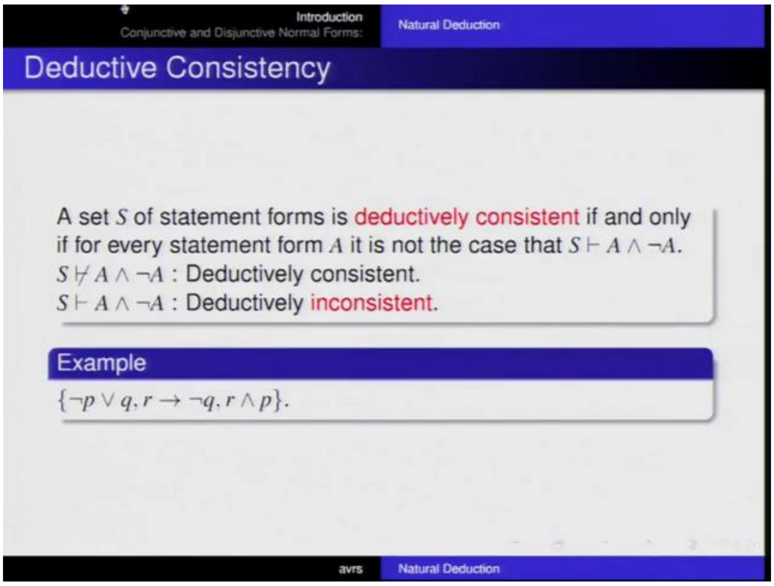
(Refer Slide Time: 37:15)



There are other notions which are important that is syntactic validity any argument A1, A2 to An and from that B follows is a valid in a syntactic especially when a conjunction of all the formulas A1 and A2 An is valid in a particular kind of language here. So, what is essentially we are trying to show is that when you show that all whatever you proved is also valid; that means, trued.

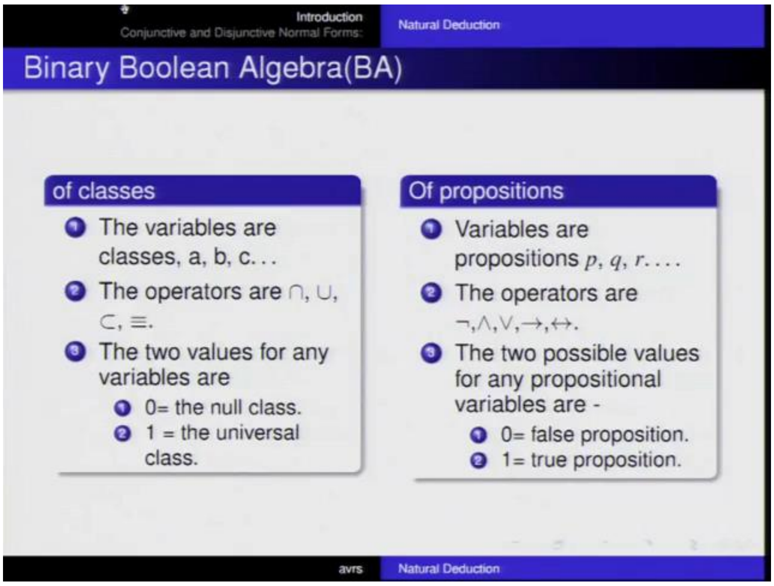
Tautology valid 1 hand the same in all; all the tautology are valid formulas and all valid formulas are; obviously, tautologies in all. So, if we show that on your proofs the theorems that is the last step of you proofs. So, that is valid formula is a tautology, then also you have said to have talked about we are talked about syntactic validity.

(Refer Slide Time: 38:17)



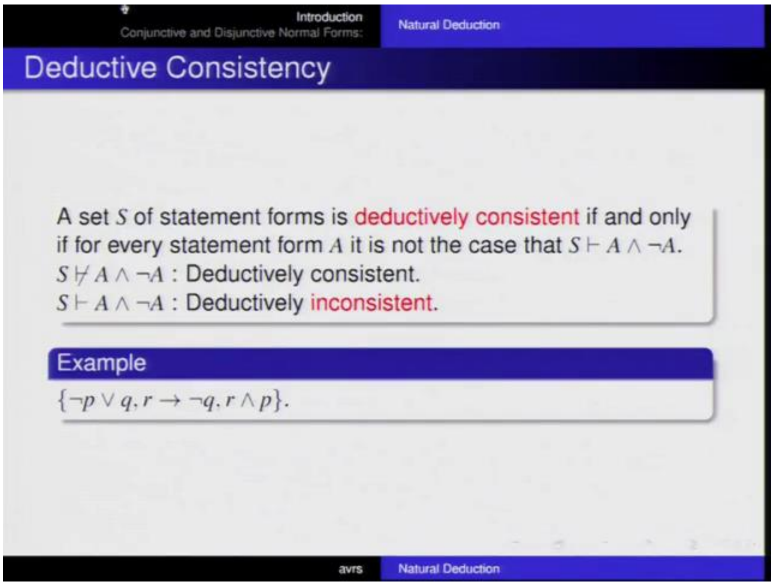
So, these are some of the important things you have deduction natural deduction system is also considered to be consistent; that means, you will not be able to deduct a both x and not x and all. So, it to derive that particular kind of thing x and not x then you are natural deduction system is in consistent.

(Refer Slide Time: 38:35)



So, with this we will and this particular kind of natural deduction method.

(Refer Slide Time: 38:17)



So, what essentially we did here is like just like some players are playing game and all. Suppose if you are playing a cricket etcetera you 1 must be in a position to know all the rules and all as per as possible many rules you may able to play without any faults and all. Suppose if you are playing a cricket and if you do not know what is no ball and what is a wide ball etcetera and all. And they will not be in a position to play without any faults.

In the same way natural deduction as per as possible very limited set assumes and all. That means, there are no self-evident rules etcetera to begin way, but we will start with some assumption which are also always considered to be true and then you added to that you have some basic principles which as Modus Tollens etcetera and all. All these rules are truth preserving rules; truth preserving a sense that a conclusion necessary from the premises and all.

And you will take those particular kind of truth preserving rules and then you will reduce some other theorems and all. So, what essentially we have we have trying to do in a natural deduction is, that all the valid formulas should find a proof at all. So, here it is formulas logical system which makes use of natural deduction; which is considered to be consistent, complete and even sound.

So, that takes care of our enquiry that all the valid formula should find a proof. So, here is a proof which we can produce it with the help of natural deduction system. So, in the next class we will be talking about another decision procedure method which is called as conjunction, conjunctive and disjunctive normal forms.