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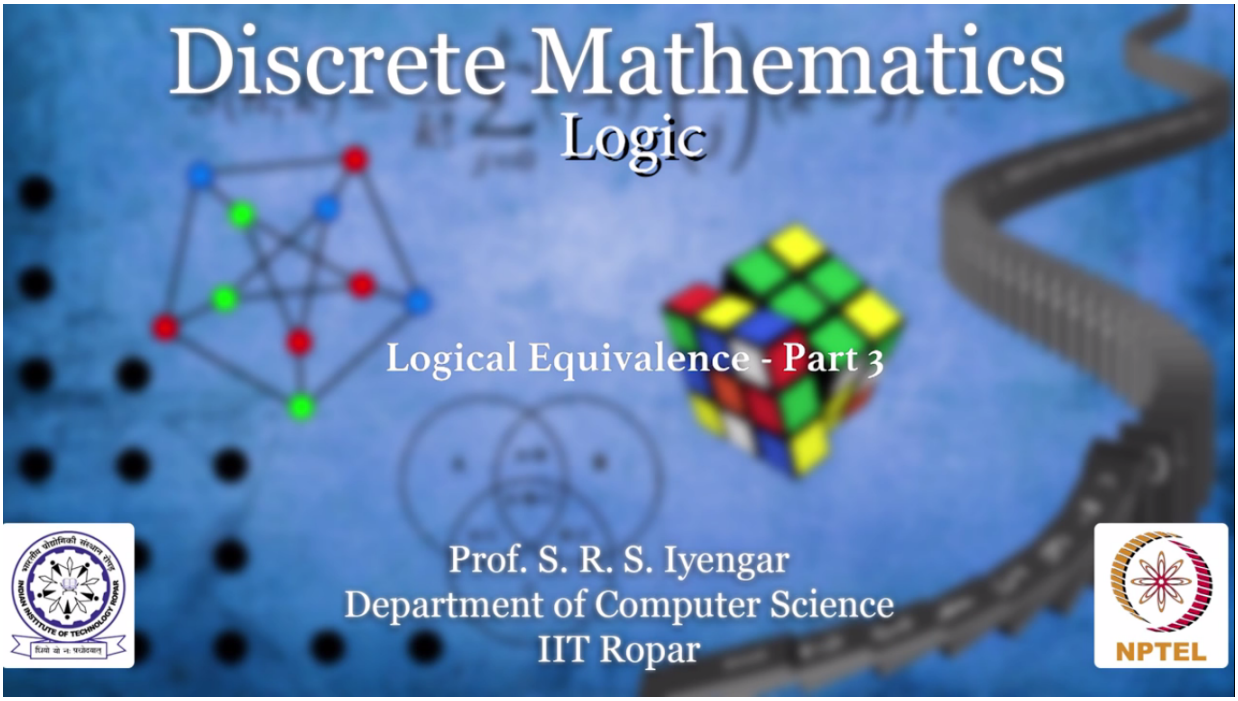


Discrete Mathematics
Logic
Logical Equivalence - Part 3
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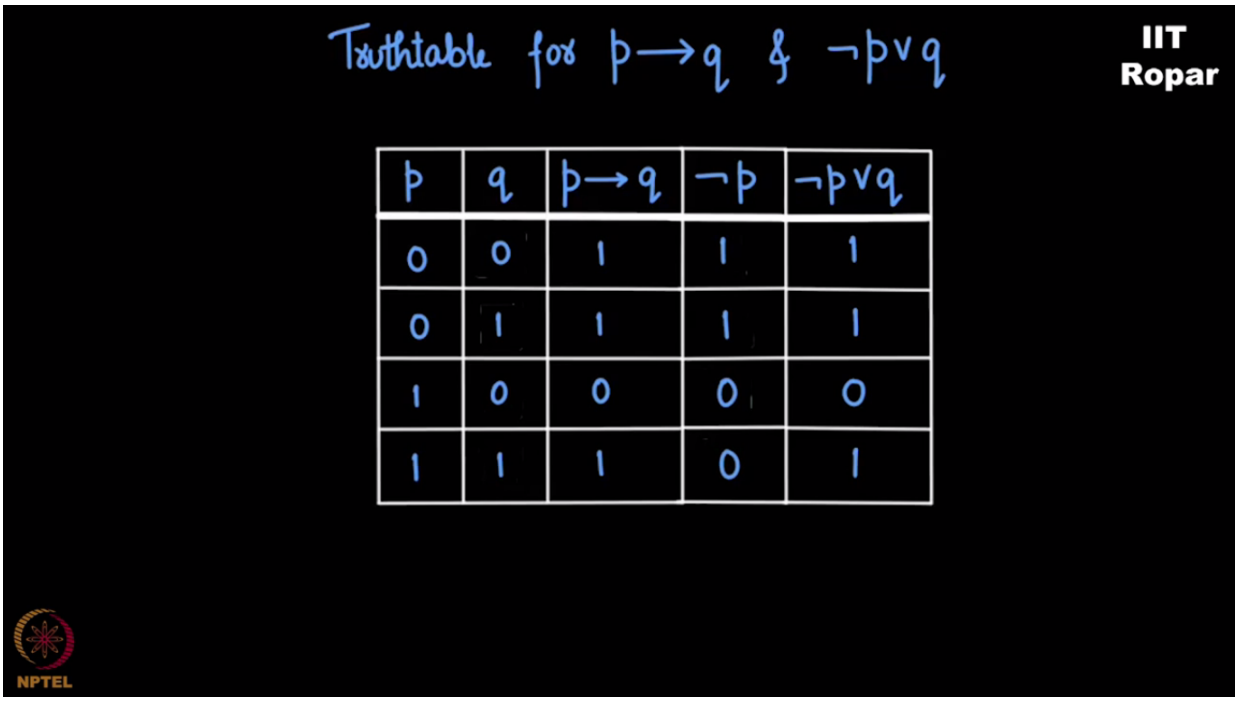
I will not write a truthtable for two different Boolean expressions. The familiar P implies Q and another Boolean expression not P OR Q. Why am I doing this? You will get to know in a minutes time. So let me look at the truthtables of these two expressions. So P and Q as and always and then what is P implies Q? We know it is 1, 1, 0, 1. Okay. We have not P OR Q here so I will write down not P for my reference. Not P would be 1, 1, 0, 0. So I should now write down not P OR Q. 1 or 0 is 1. 1 or 1 is 1. 0 or 0 is 0. 0 or 1 is 1. Now pause and observe.




Don't you think these two entries are precisely the same. Yes they are. Okay. Whenever two columns are precisely the same, their corresponding Boolean expressions are equivalent. What do I mean by equivalent? Look here is a Boolean expression. Some let's say Boolean expression B. here is another Boolean expression let's say B dash. And then entire column is the same which means no matter what input you give for this Boolean circuit or Boolean expression they agree always. When they agree always we should say they both are exactly the same. They might appear different. So my P implies Q here and my not P OR Q here are exactly the same but they appear different. Such expressions are called equivalent Boolean expressions. Here is an interesting question. P implies and implied by Q and look at this expression. P AND Q OR not P AND not Q. Let us write the truthtable of both of these expressions. P implies and implied by Q has the values 1, 0, 0, 1. And let's try writing the truthtable of this which involves writing the truthtable of P AND Q which is this and then the truthtable of not P AND not Q which is this and OR of these two which is this. What do you observe? I observe that these entries are same as the entries for P implies and implied by Q which means these two expressions are equivalent.