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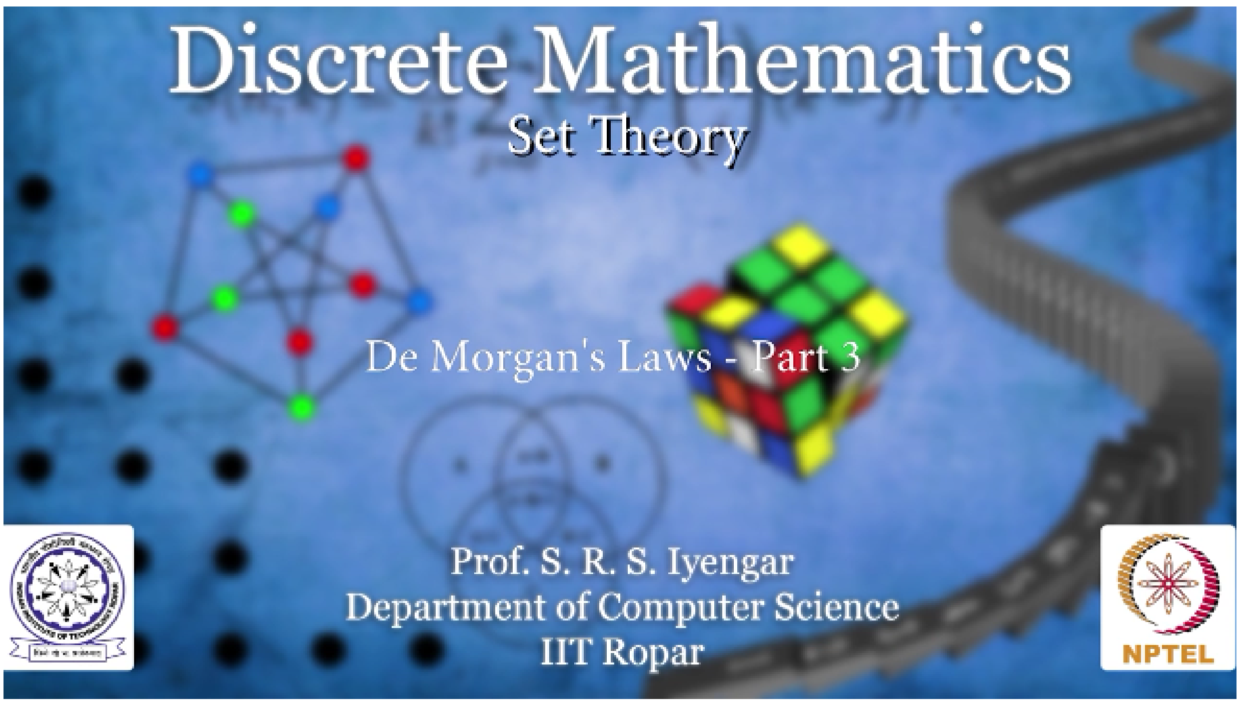
NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Set Theory

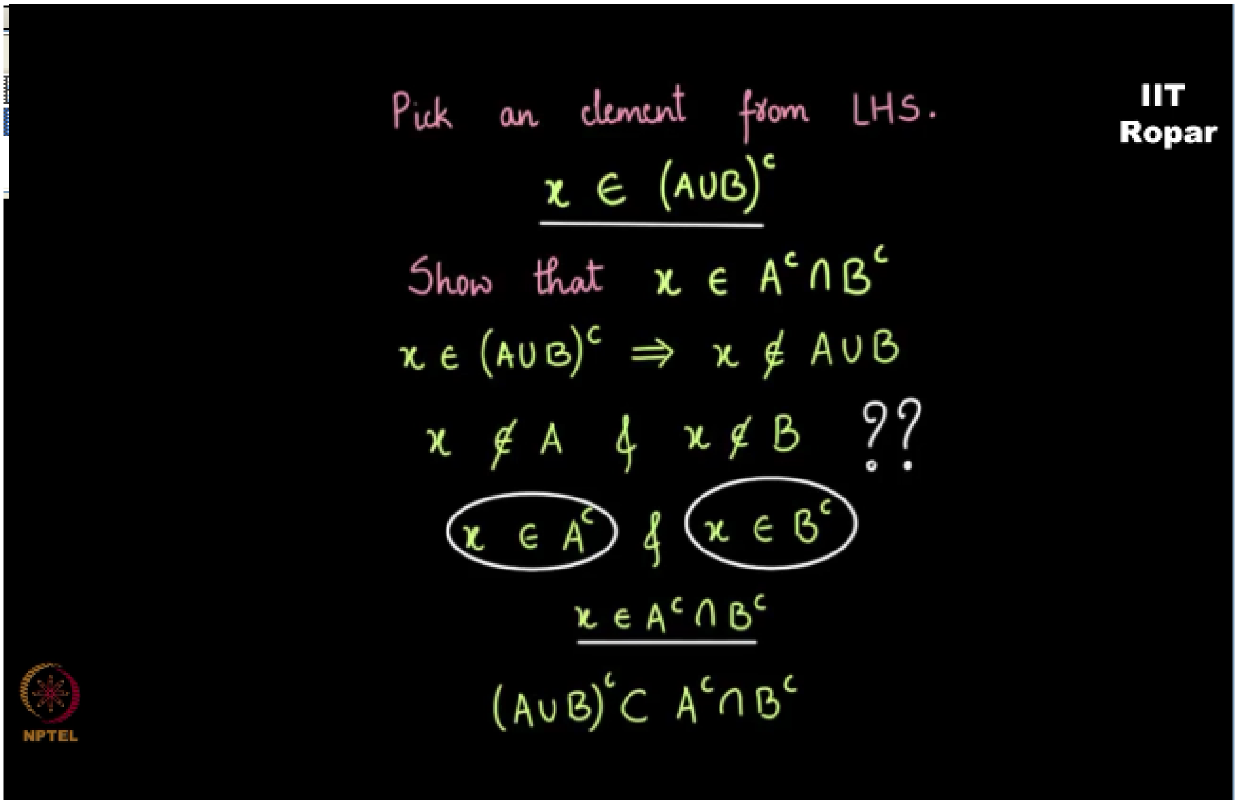
De Morgan's Laws – Part 3

With
Prof. S.R.S. Iyengar
Department of Computer Science
IIT Ropar

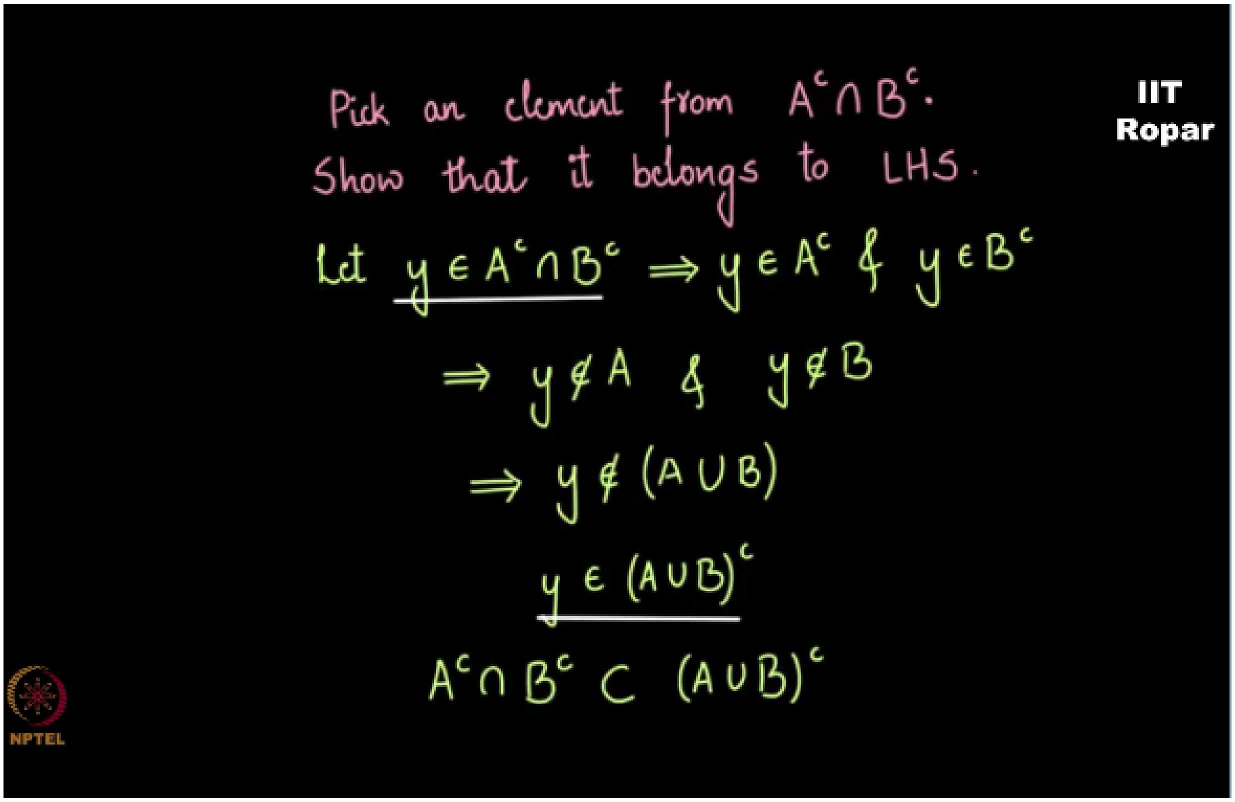


Pick an element from the left-hand side, it's a X belongs to A union B complement, and show that X also belongs to the right-hand side, which is A complement intersection B complement, so whenever X belongs to A union B complement it implies that X does not belong to A union B.

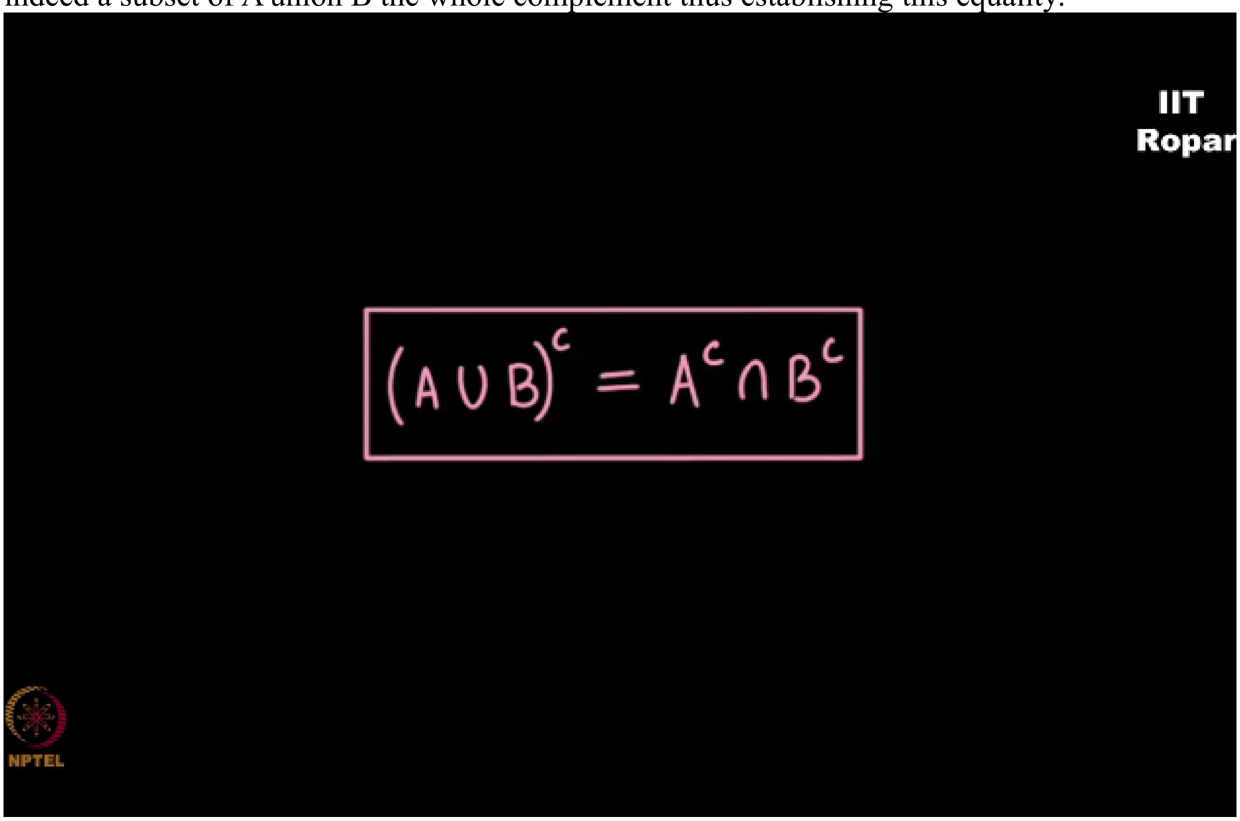
When will an element not belong to a set union another set, whenever that element does not belong to both of them, so X doesn't belong to A, and X does not belong to B. Now what does this mean? This means that X doesn't belong to A simply signifies that X actually belongs outside A, X belongs to A complement, and X belongs to B complement look at these two statements X belongs to a set as well as another set which means X should belong to a complement intersection B complement, pretty simple which implies look at this from where we started X belongs to A union B complement we ended up with X belongs to A complement intersection B complement thus proving that A union B the whole complement is a subset of A complement intersection B complement.



Now let us pick an element from A complement intersection B complement and show that also belongs to this left-hand side, how tough is it? It's pretty easy, why is that let's see. An element X rather let's say Y we used X already so let's say Y belongs to A complement intersection B complement, we will observe that our argument will simply be the reverse of what we saw here, Y belongs to A complement intersection B complement implies, Y belongs to A complement and Y belongs to B complement which in turn implies that Y does not belong to A, and Y does not belong to B, which means when Y neither belongs to A or B, Y certainly doesn't belong to A union B, correct, which means Y actually belongs to the complement of this set, so I start off



with Y belongs to A complement intersection B complement I ended up with Y belongs to A union B the whole complement which means A complement intersection B complement is indeed a subset of A union B the whole complement thus establishing this equality.



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