NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Principle of Inclusion and Exclusion

Introduction to Advanced Counting

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Most of us know what is this topic the moment we see this diagram,
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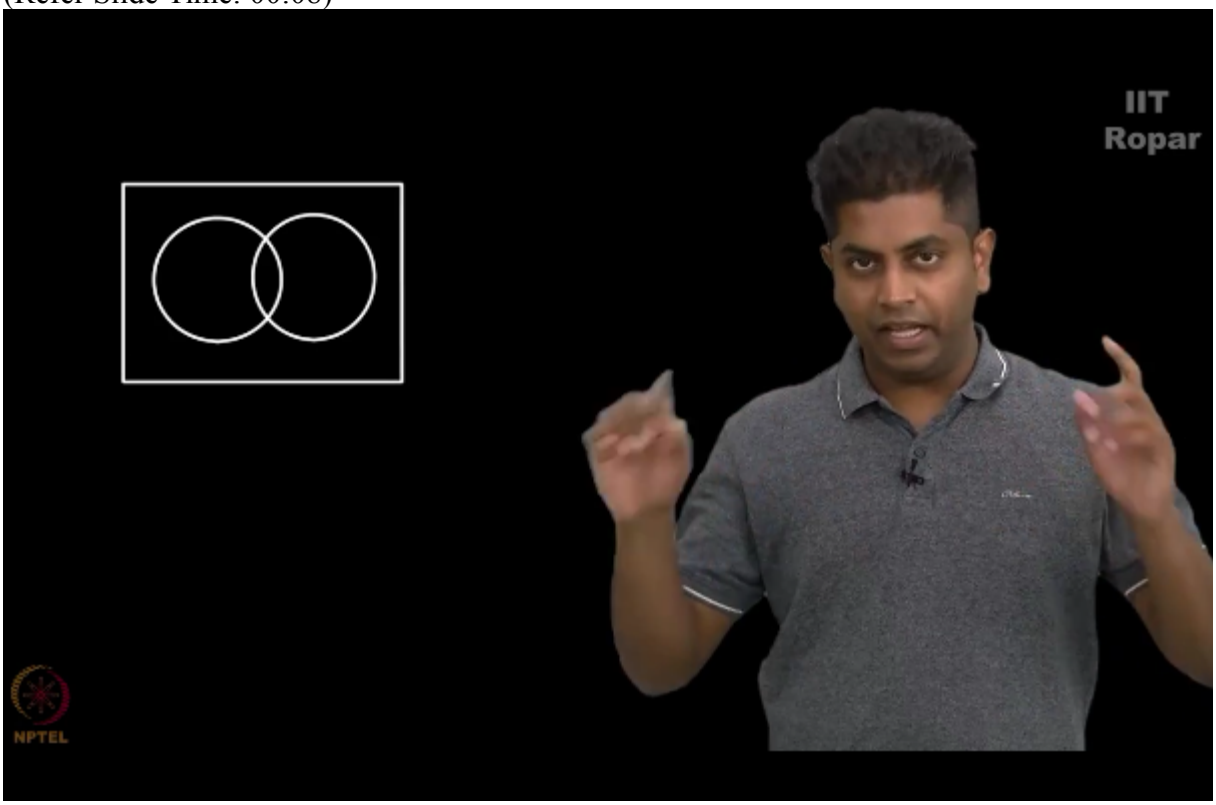

a rectangle and two circles overlapping, this is popularly called the Venn diagram, which is generally used to illustrate how could one compute A union B, given 2 sets A and B you may have some elements in common, so when you take the union of these two things it is not necessarily number of elements in A and number of elements in B which comprise of, this is not what A union B comprises of,
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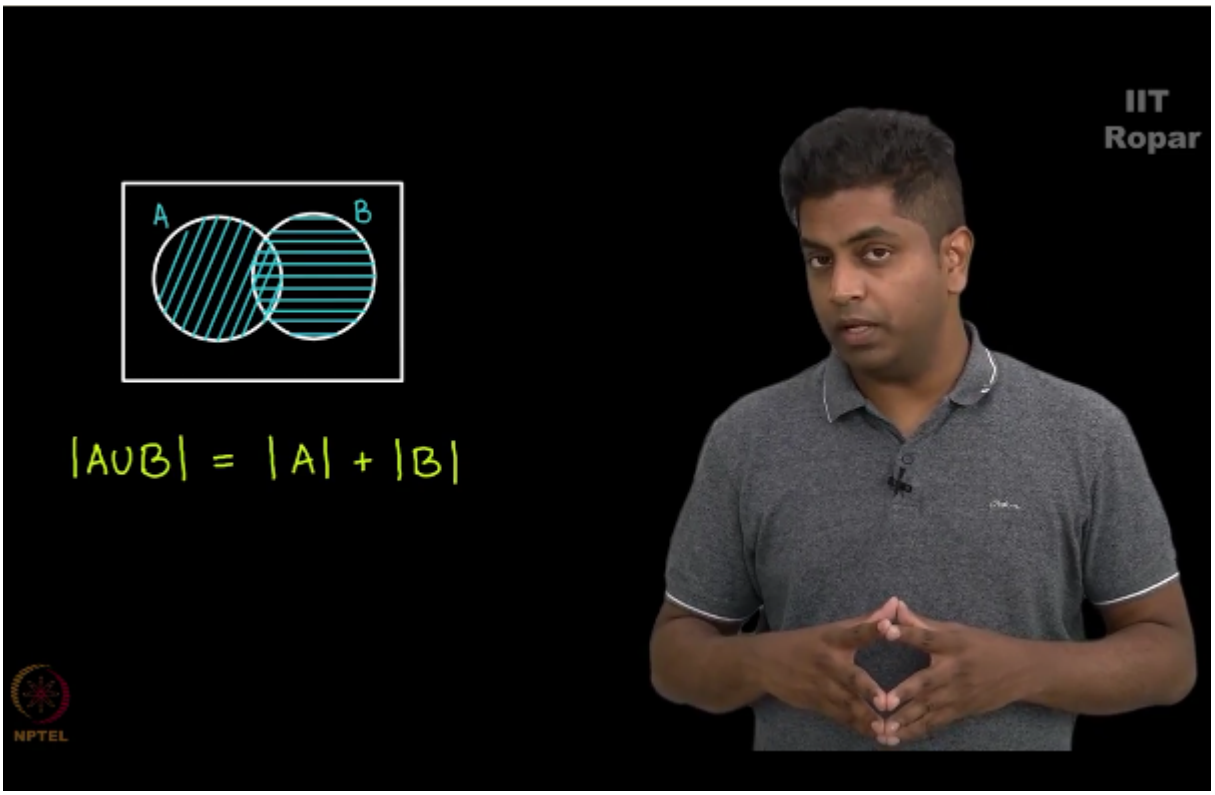

so what's the formula? The number of elements in A union B is number of elements in A, and number of elements in B, wait a minute we just included a few elements here twice, so we should subtract it once, so what we do? Is we do a -A intersection B,
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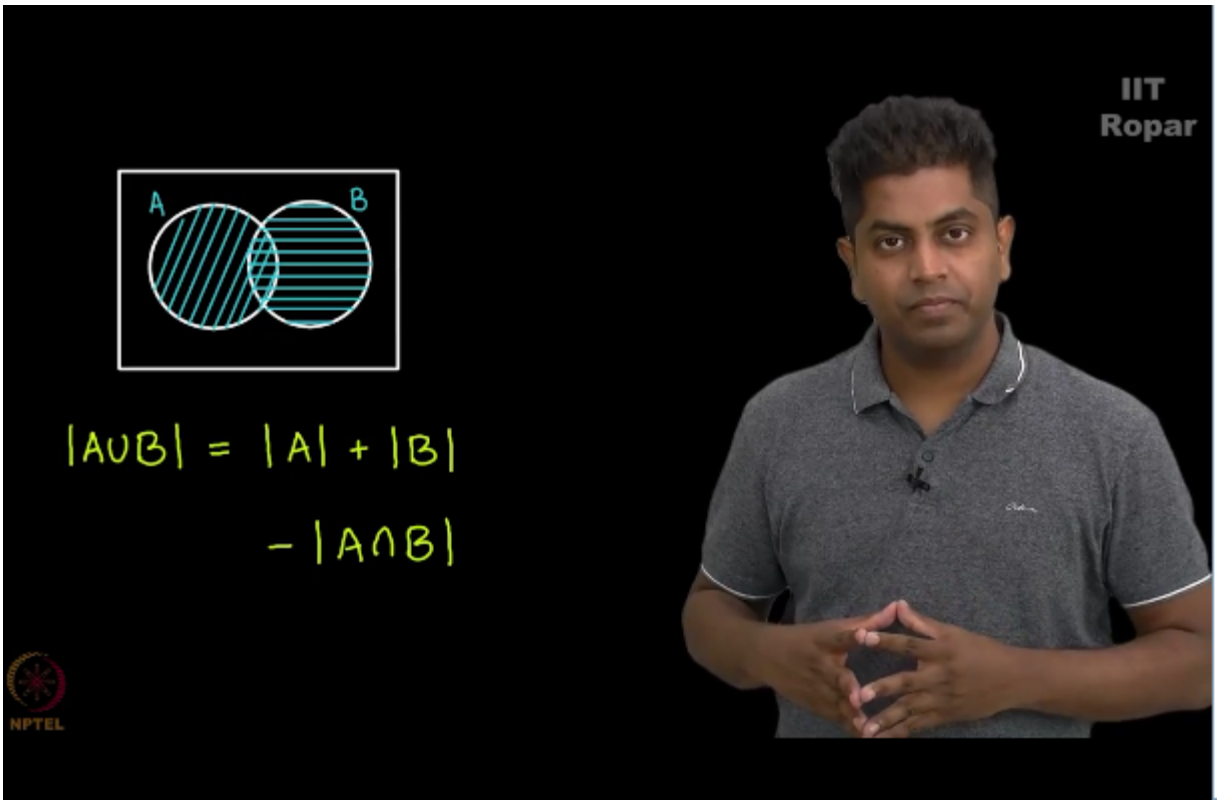

right that gives us what is inside A union B, correct, for 3 sets the formula becomes a little complicated,

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so what you do is the number of elements in A union B union C is number of elements in A + number of elements in B + number of elements in C you did a whole lot of counting twice of some entities here it's only obvious from the diagram,
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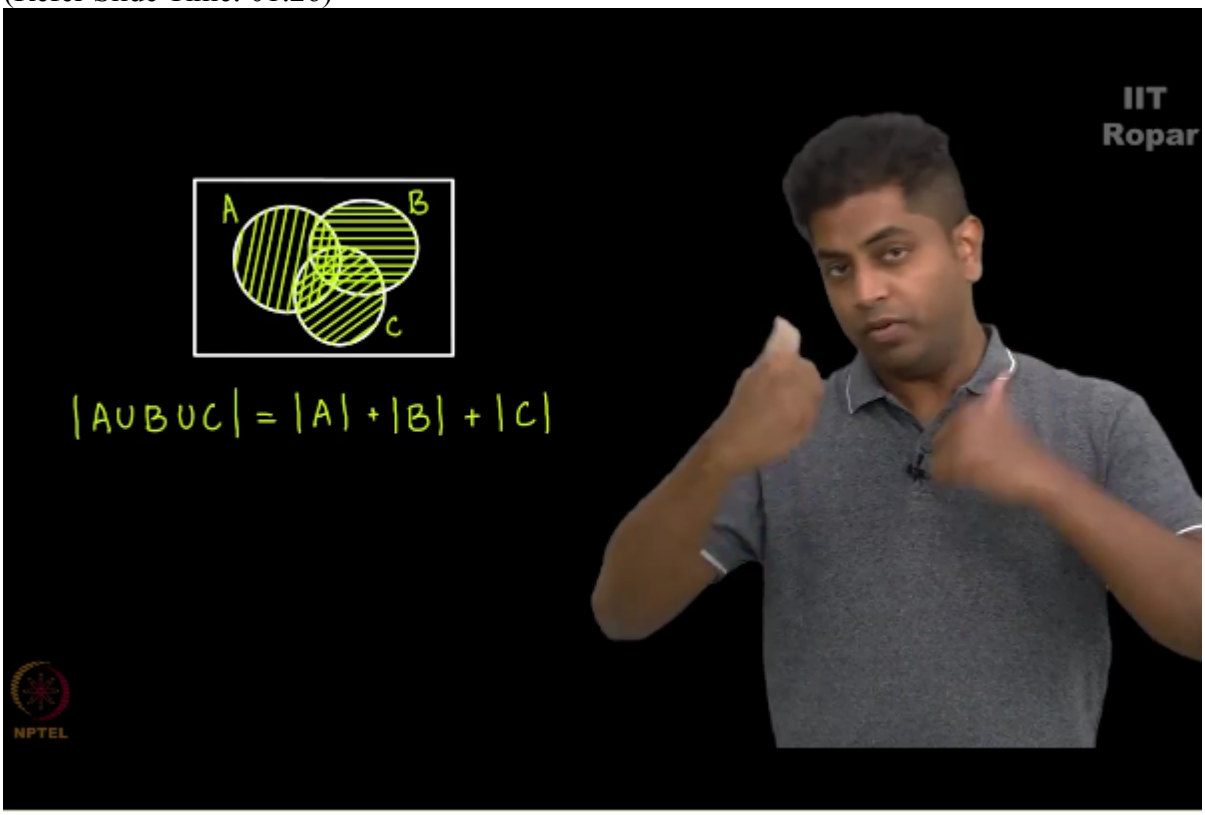

so what you do? You counter it, you subtract it with A union B, subtract A union C, and subtract B union C,
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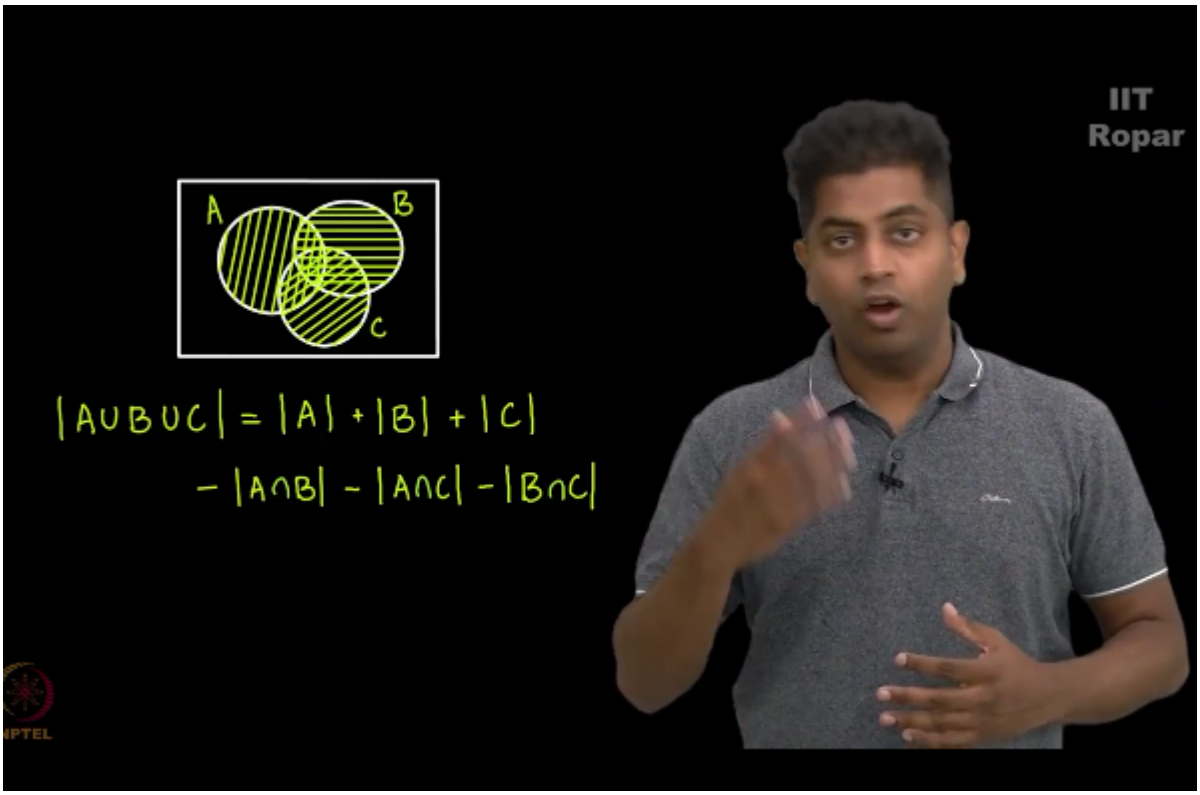

and then you will say oh my god wait a minute, in the pretext of removing some elements I have over removed you see initially you over added to compensate you removed, now you over removed, to compensate you have to add something, what should you add? Bit of observation tells you that you must add A intersection B intersection C,

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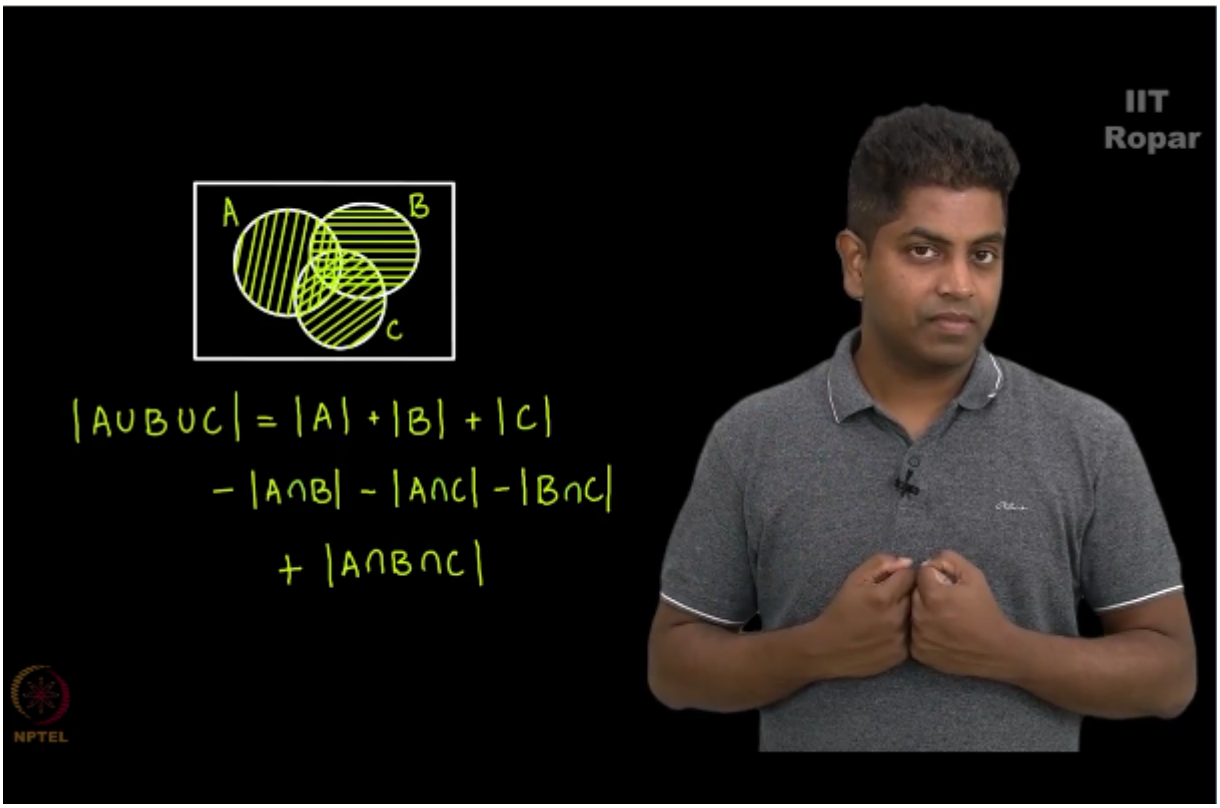

let us see this with a few examples, so it becomes very clear to all of us.

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