NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Principle of Inclusion and Exclusion

Example 8 – Brownies, Muffins and Cookies

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Consider a set of 100 people where 35 like muffins, 30 like brownie, 30 like cookies, 9 like muffins and brownies, 11 like brownies and cookies, 10 like muffins and cookies, and 5 like all 3, now the question is how many do not like either?
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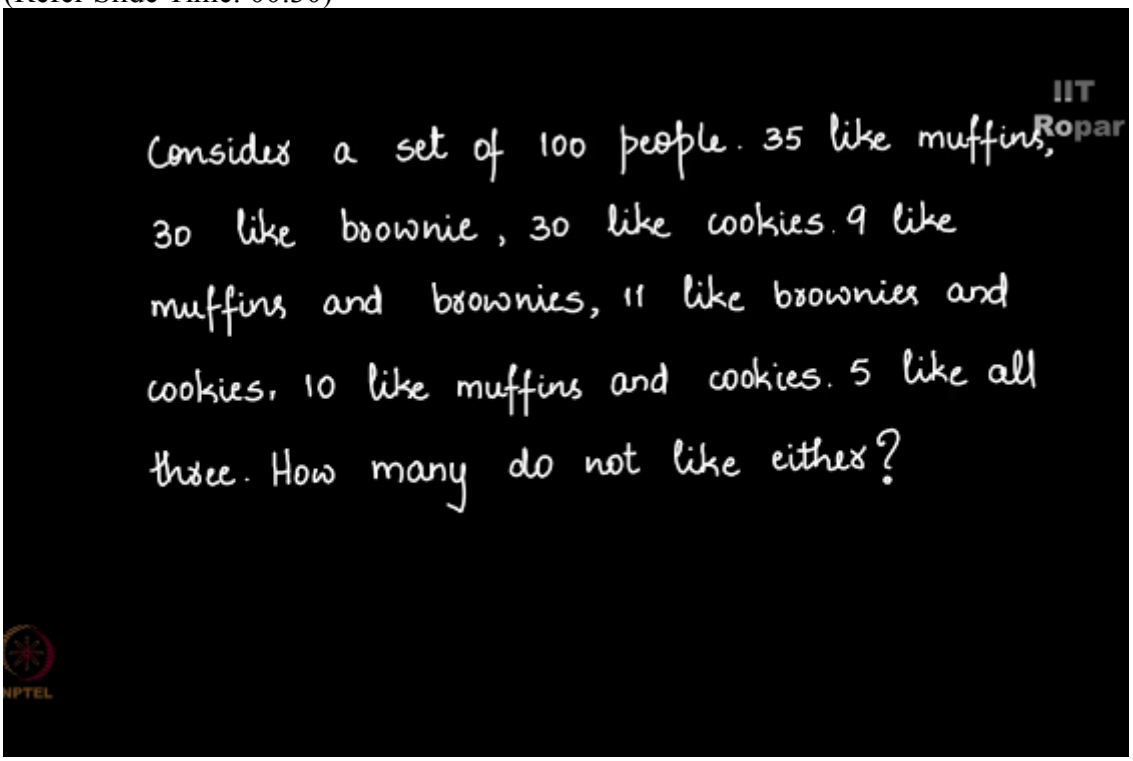

that is how many people do not like either brownie, cookies or muffins we have to find out. Now consider this as the set of 100 people, right, now let this represent C1 the condition where a person likes muffins,
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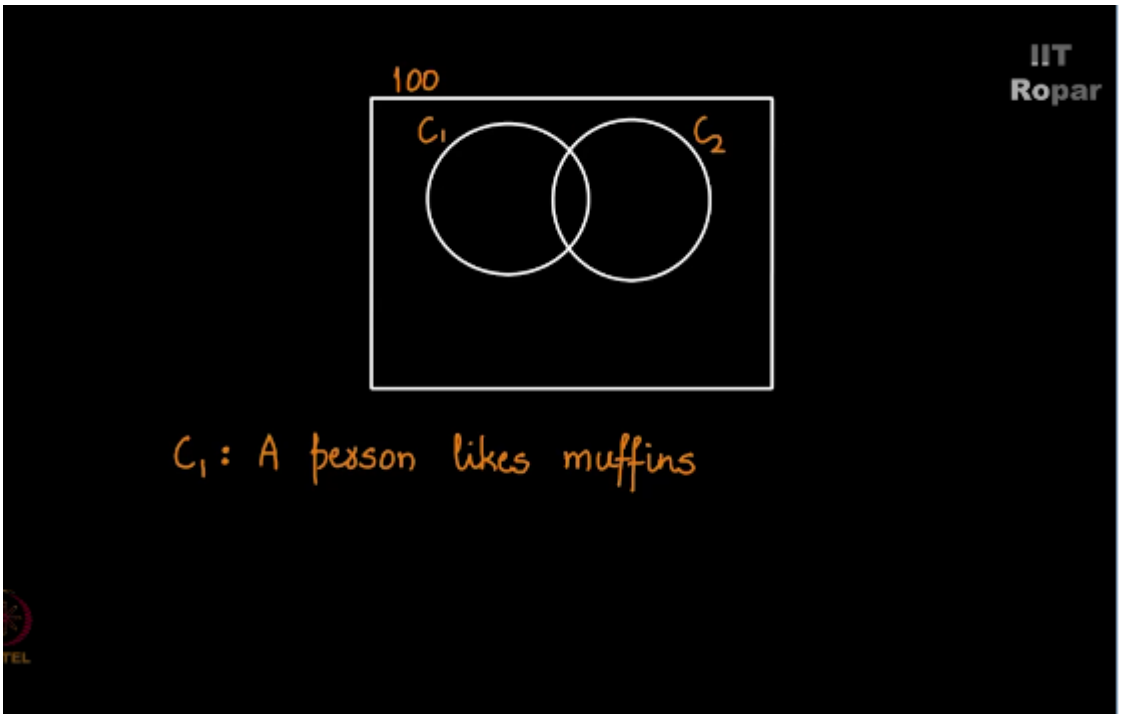

let this circle represent C2 conditions where a person likes brownies,

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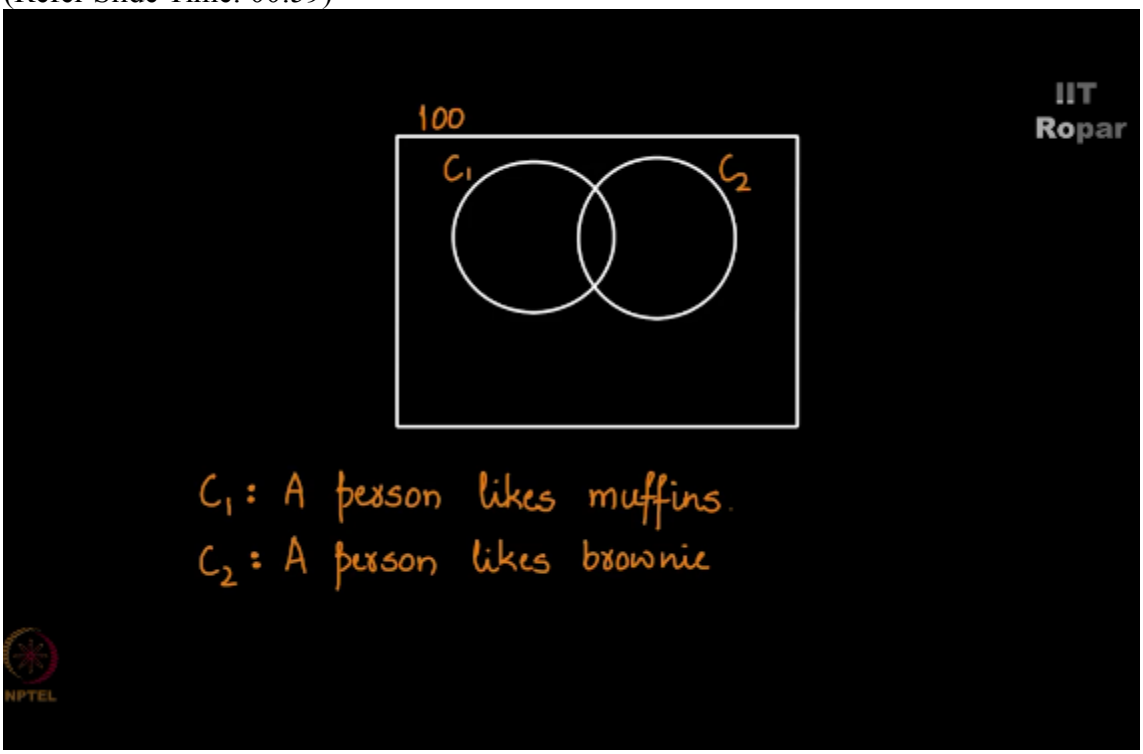

and let this represents C3 where it is a condition where a person likes cookies,

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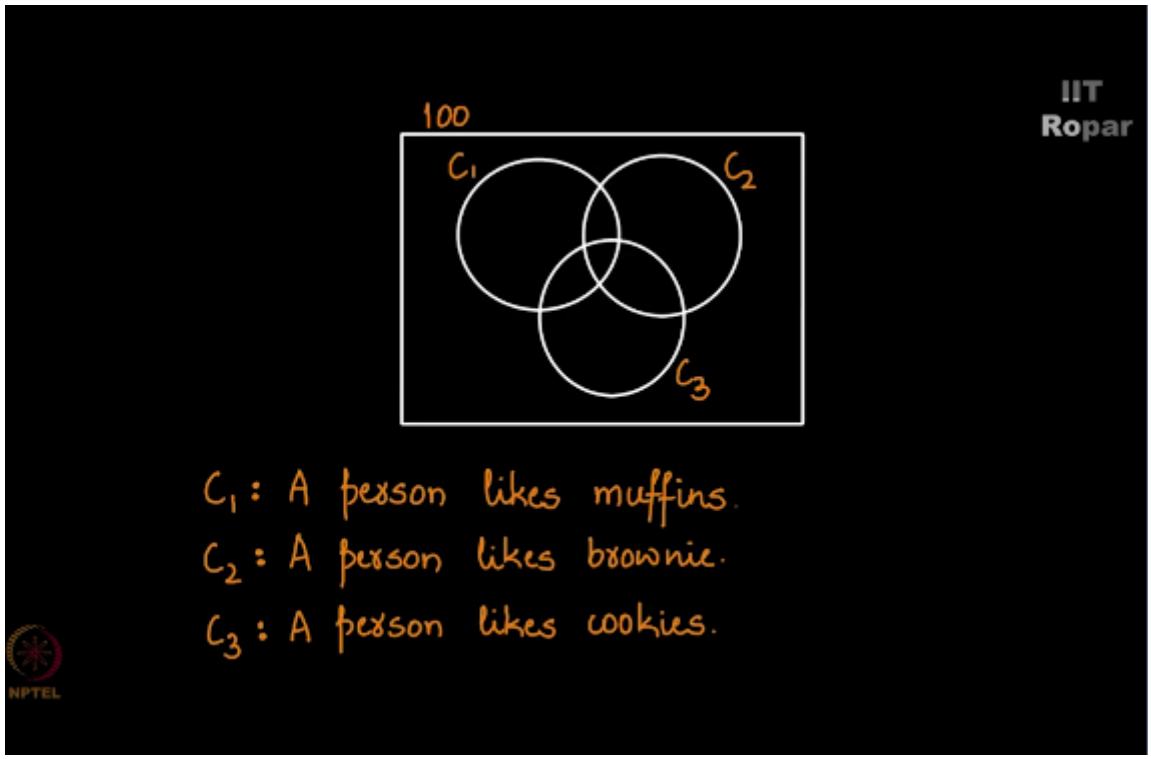

so we have 3 conditions here C1, C2 and C3 according to the likings of the person.

Now let us see the values given to us in the ovals,
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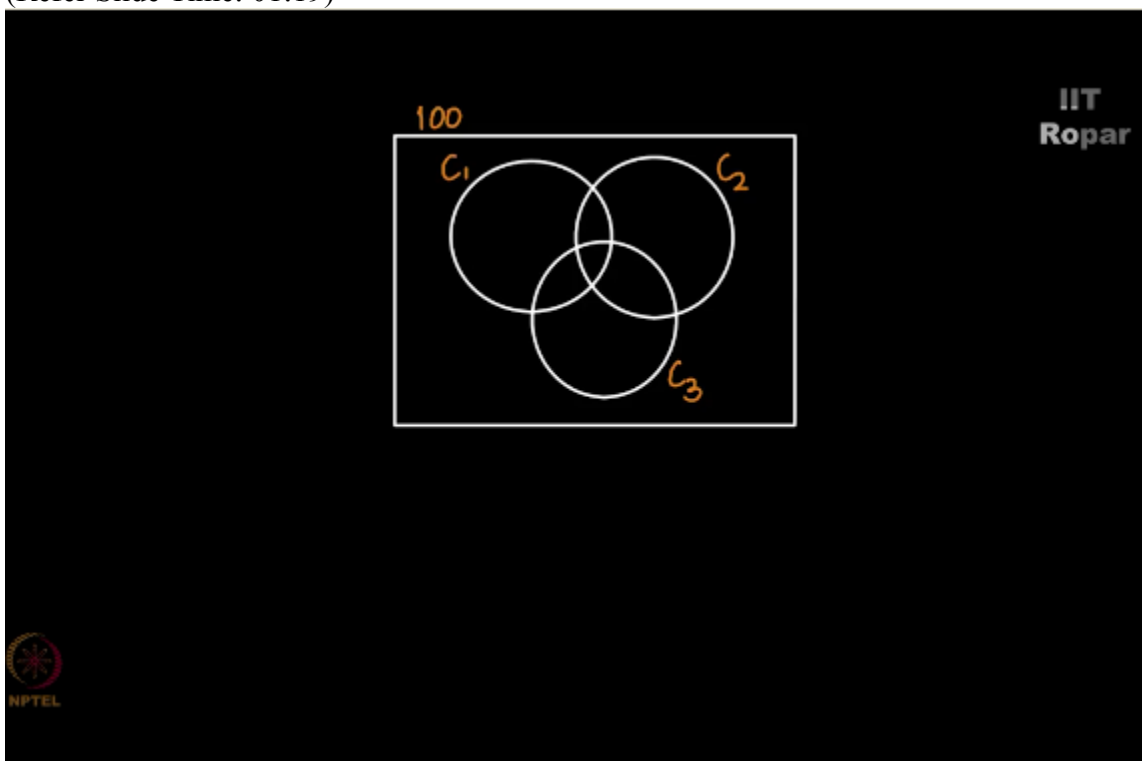

there are 100 people and we have 3 conditions, it has given that 35 like muffins so N(C1) happens to be 35, 30 people like brownie which means N(C2) happens to be 30, 30 people like cookies which means N(C3) is 30,
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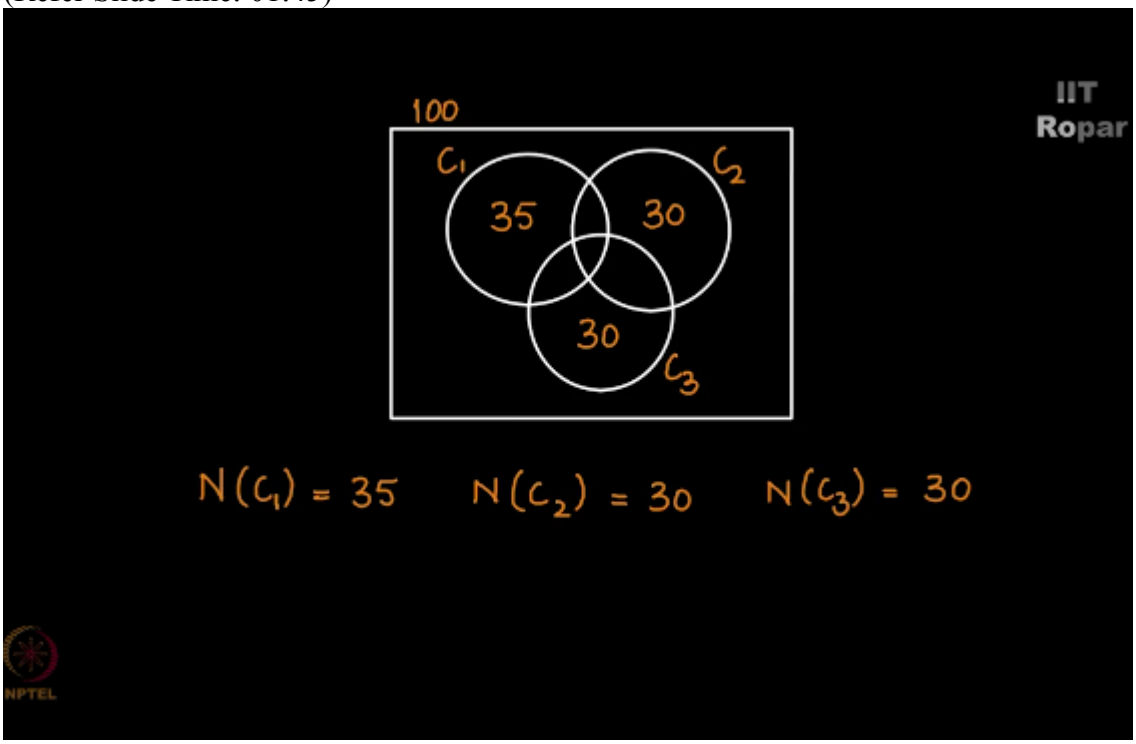

now there are more things given to us, 9 people like muffins and brownie which means N(C1, C2) is 9,
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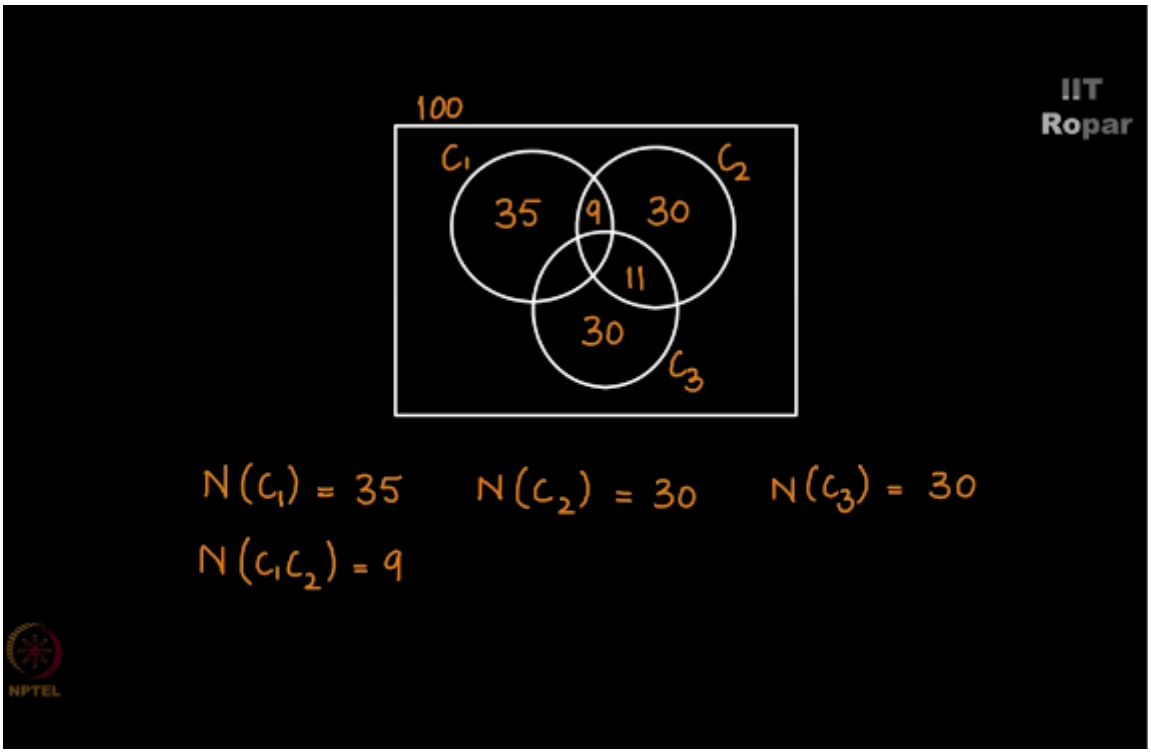

11 people like brownie and cookies which means N(C2,C3) is 11, 10 people like muffins and cookies which means N(C2, C3, C1) is 10 right,

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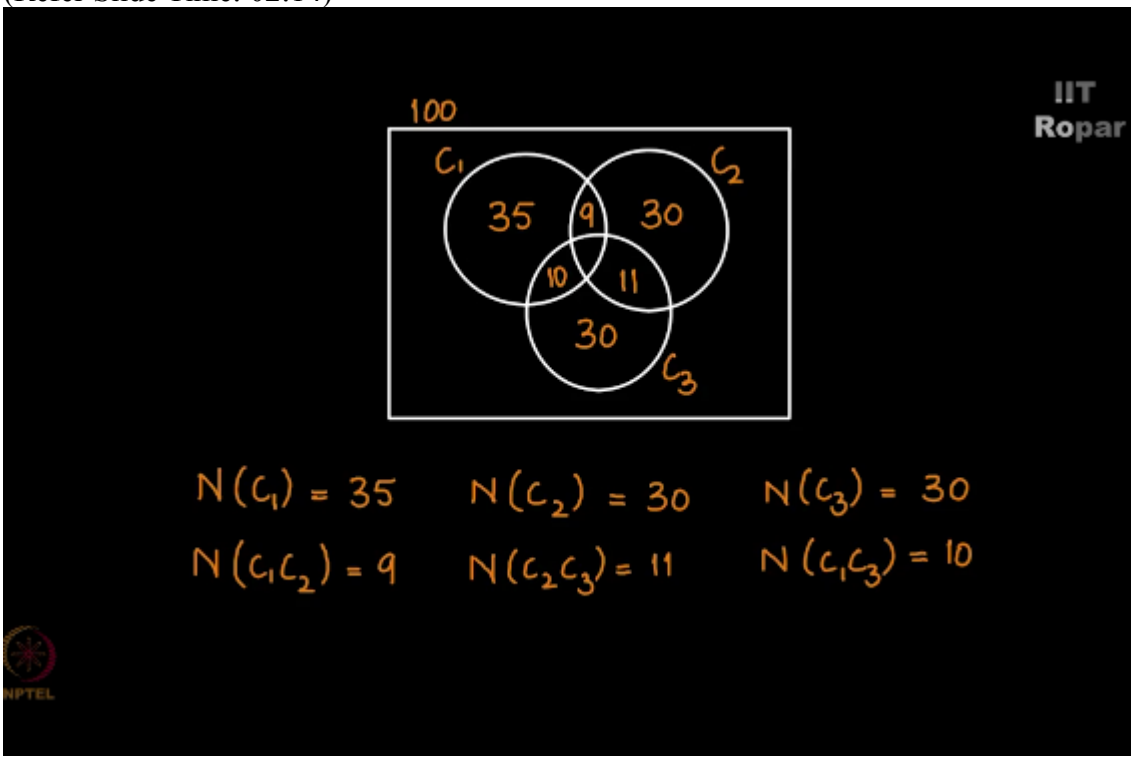

now the intersection of all the 3 conditions is 5 which means N(C1,C2,C3) is 5,

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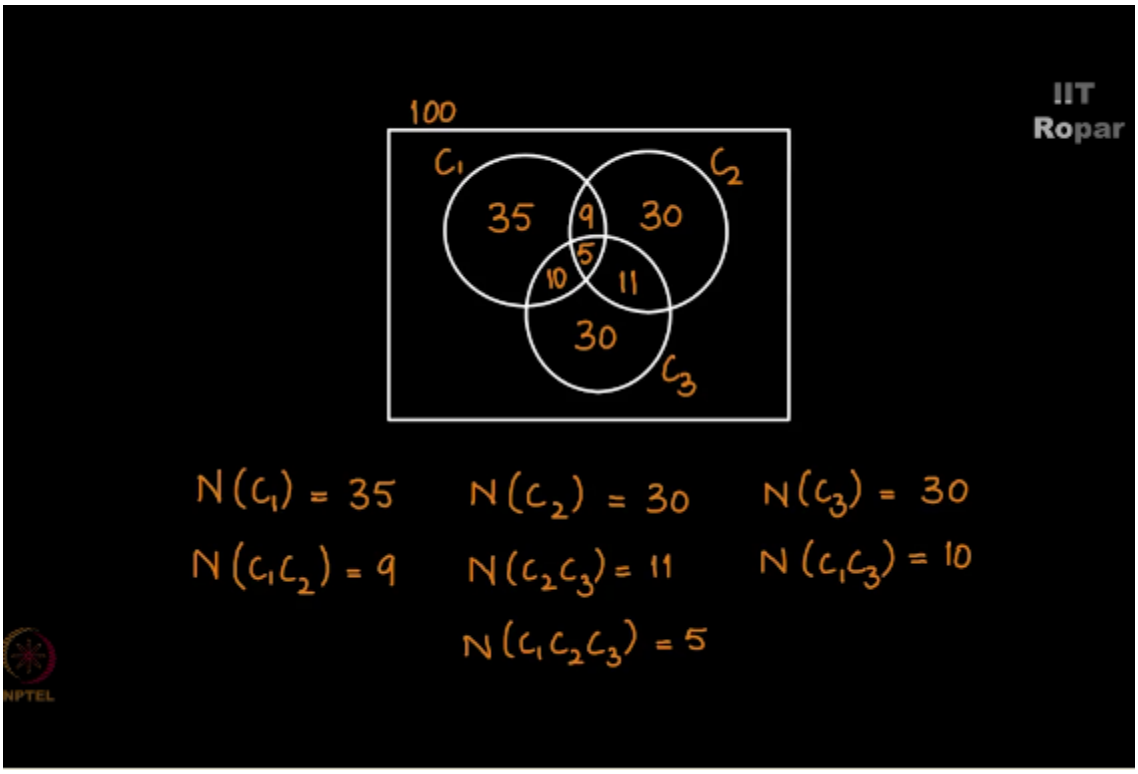

right so we have 5 people who like all the 3, but what is the question we have to find out those people who do not like anything, that is those people who lie here,

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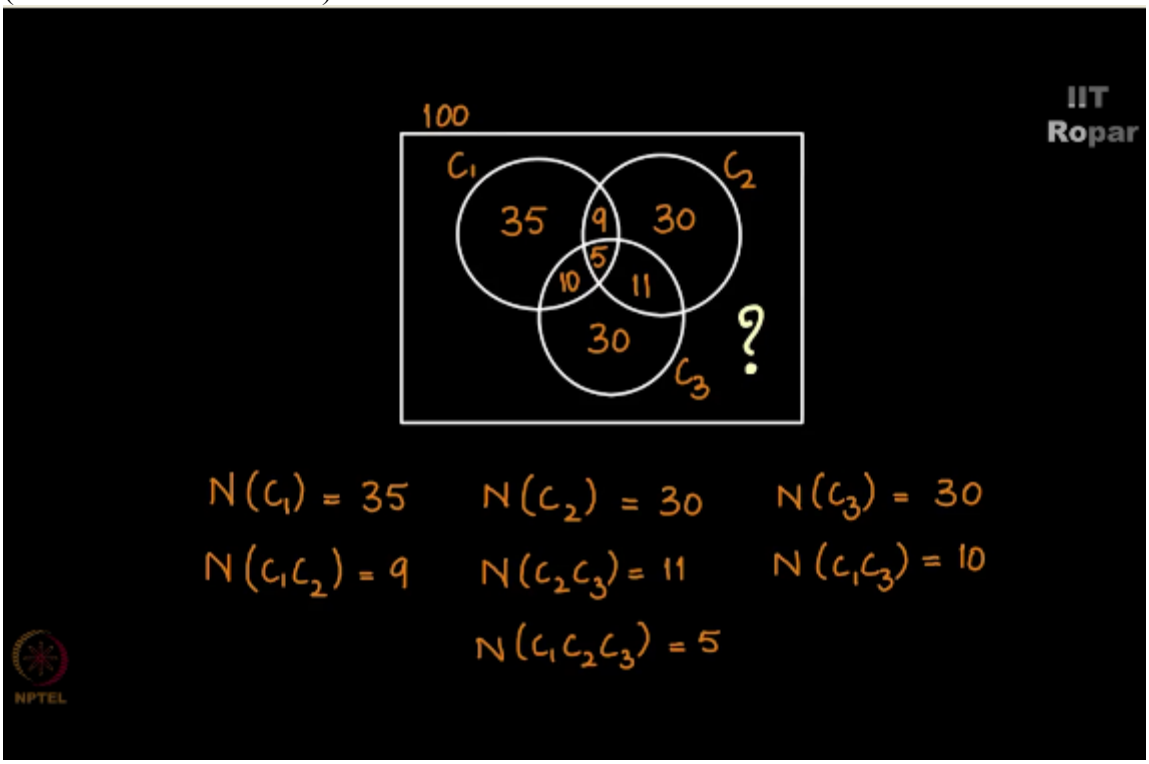

right, now which means the question is precisely you have to find out what is N(C1 bar, C2 bar and C3 bar), N(C1 bar, C2 bar, C3 bar) as we know is N all possible likings that is all people in

the set, that is 100 right -S1 + S2 + rather -S3, S1 is what? N(C1) + N(C2) + N(C3) right, now let me write down everything this is equal to 100 all possible elements in the set which is 100 people - 35 + 30 + 30 this is nothing but N(C1) + N(C2) + N(C3) + 9 + 10 + 11 this represents N(C1,C2) + N(C2+C3) + N(C1,C3) -5, the last one which represents N(C1,C2, C3), so according to the formula we have written everything,

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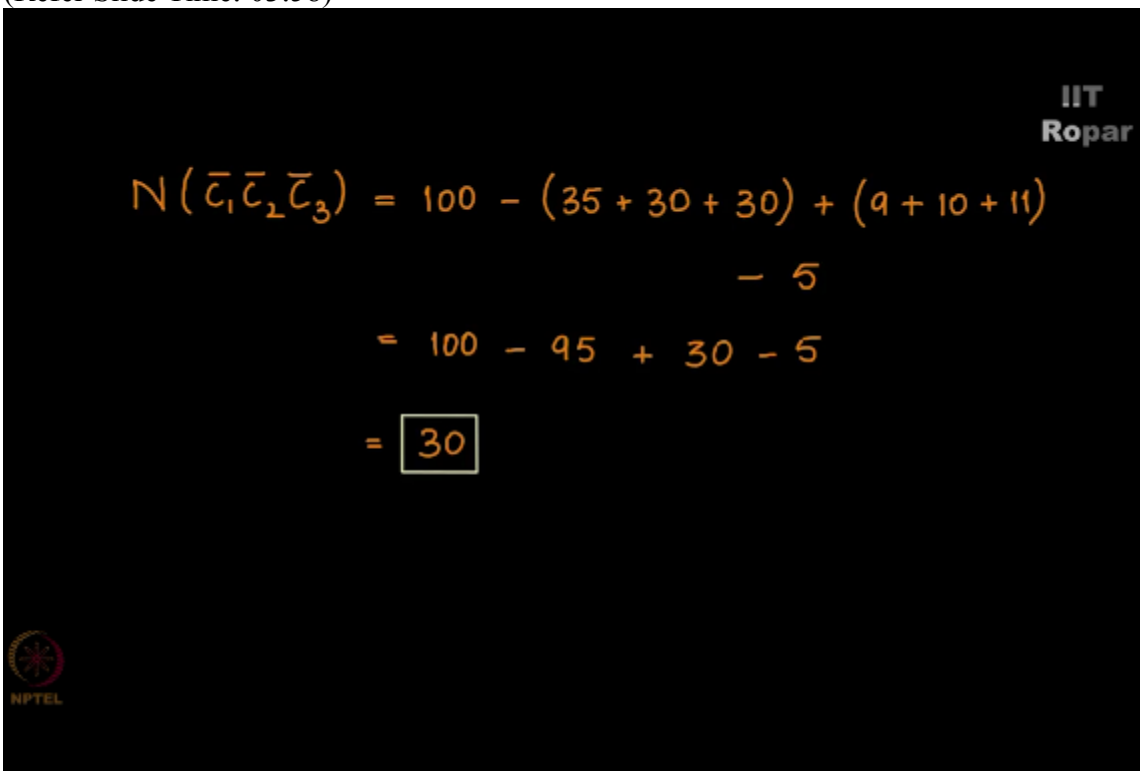

now this gives 100 - 95 + 30 – 5, on calculation the answer happens to be 30 which means there are 30 people in the set who do not like brownie, muffins or cookies, neither of them they like so there are 30 such people here, we found it out you using the principle of inclusion and exclusion.