NPTEL

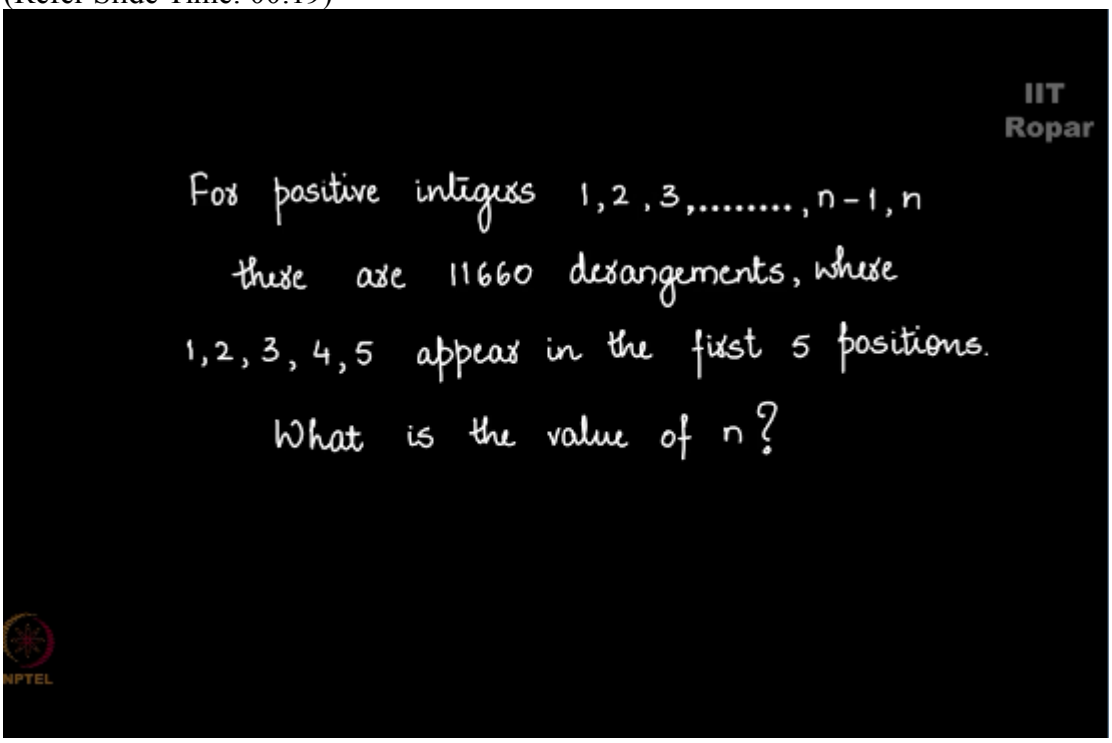
NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Principle of Inclusion and Exclusion

Example 18: Finding total number of items

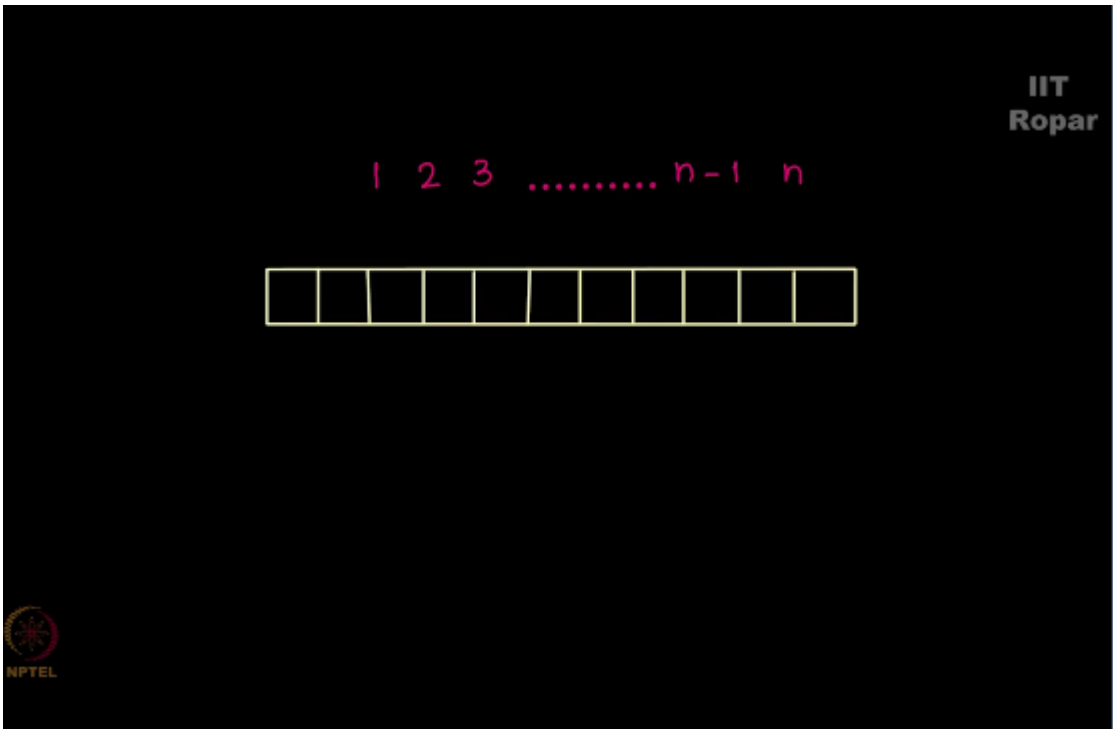
By
Prof. S.R.S Iyengar
Department of Computer Science
IIT Ropar

For positive integers 1, 2, 3 so on up to N-1 and N there are 11,660 derangements where 1, 2, 3 appear in the first 5 positions, what is the value of N?
(Refer Slide Time: 00:19)



Well let me explain the question first, there are n integers positive ones given to you, and there are 11,660 derangements for these N integers, what is the condition given? The condition is that 1, 2, 3, 4, 5 appear in the first 5 positions.

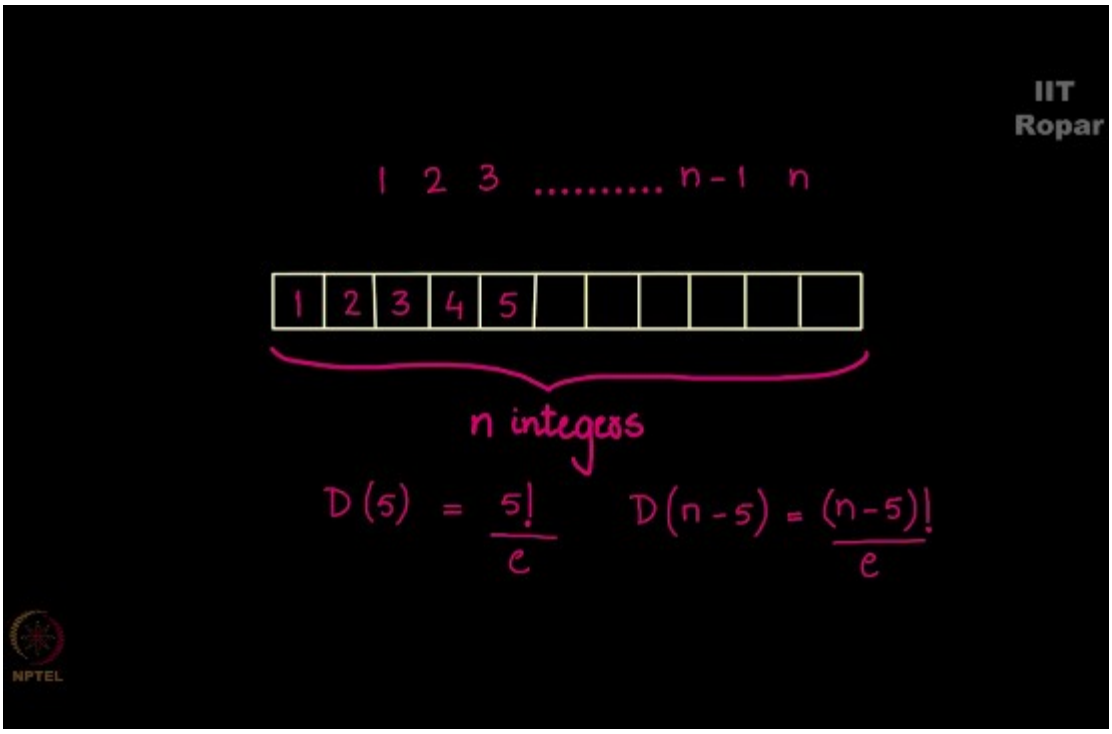
Now what is the value of this integer N? Let us see I have these N integers written as 1, 2, 3 so on N-1 and N, now I have these N slots here whatever the N is,
(Refer Slide Time: 01:08)



what is the condition given? It is given to us that 1, 2, 3, 4, 5 take the initial positions, right, now the rest of the positions are occupied by the N-5 integers, we have to find out what is this N, right these are the N integers, we have to find out this N.

Now derangements of these 5 integers is given to be 5 factorial/E you must be knowing that, why? Because D(n) where N is the integers, the integer derangement of N happen to be N factorial/E, now derangements of N-5 integers is N-5 factorial/E,

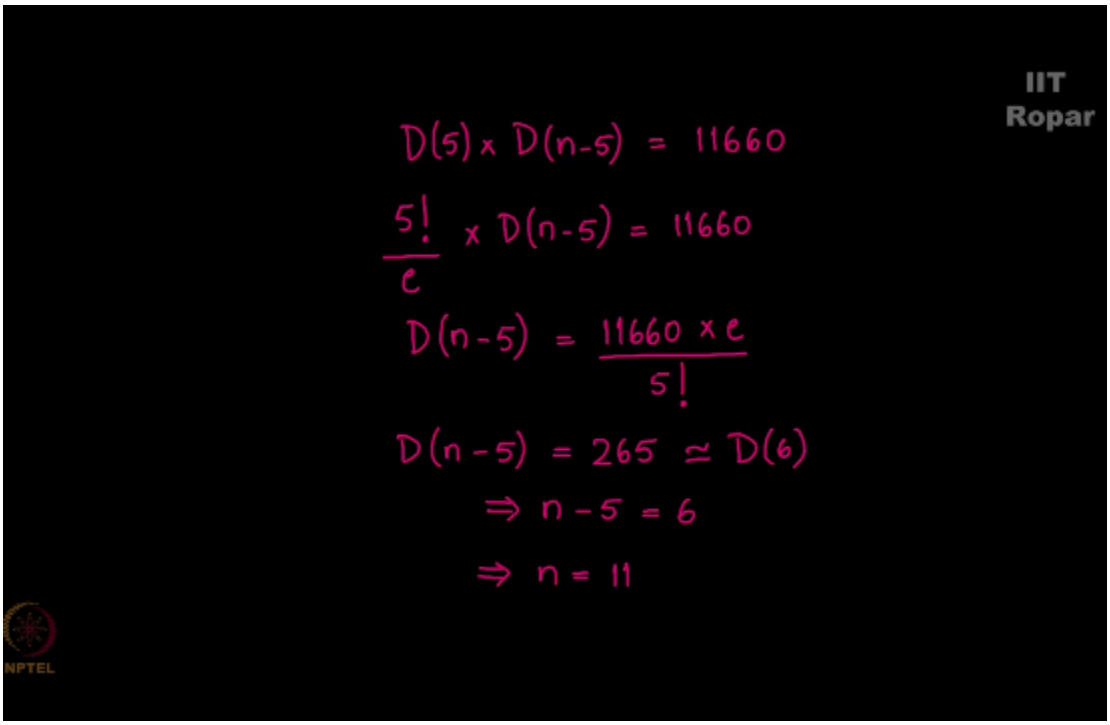
(Refer Slide Time: 02:03)



do you see that the total number of derangements which is 11,660 comes as a product of derangements of 5, the first 5 integers into the derangements of N-5 integers, their product gives 11,660 you might want to pause here and check it for smaller integers and verify it yourself.

Now derangements of 5 happens to be 5 factorial/E and into D(n-5) is 11,660, simple calculation I am going to do now, D(n-5) is 11660 x E/5 factorial, now calculating this I get D(n-5) as 265, well this comes very close to D(6) which happens to be 264, right, now what can I conclude? I can conclude that N-5 happens to be 6 which means N is 11, so the initial N which was given to us is 11,

(Refer Slide Time: 03:31)



and the derangements of 11 where 1, 2, 3, 4, 5 occupy the first 5 positions is 11,660.