NPTEL

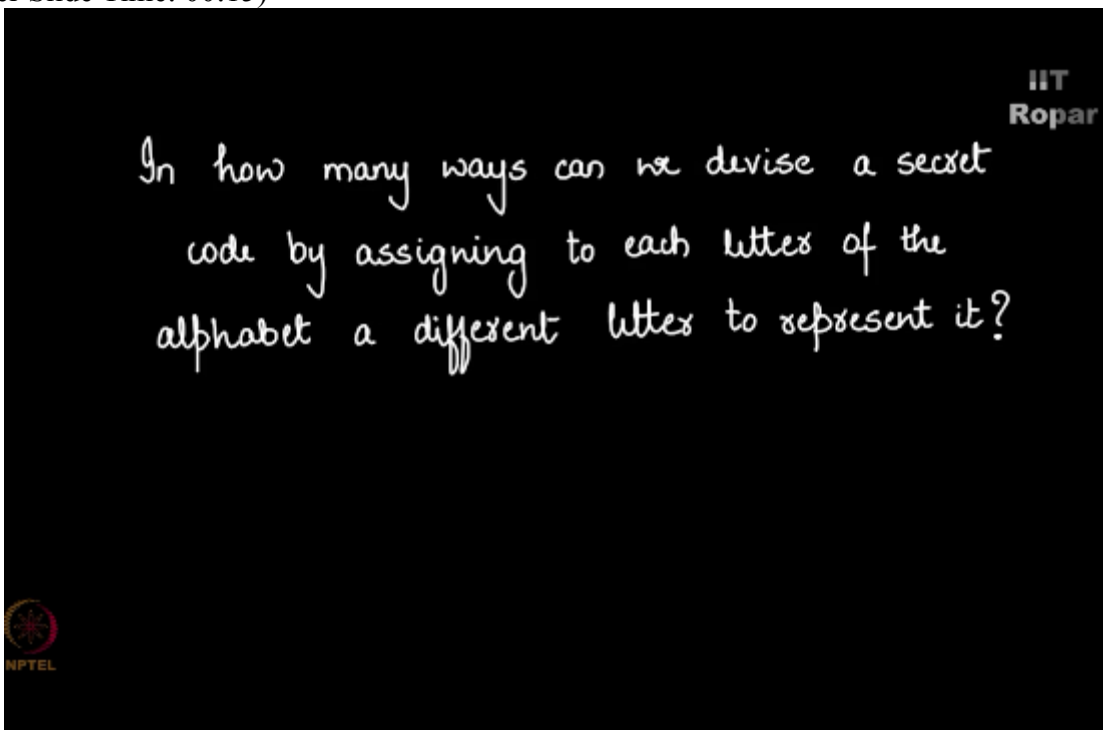
NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Principle of Inclusion and Exclusion

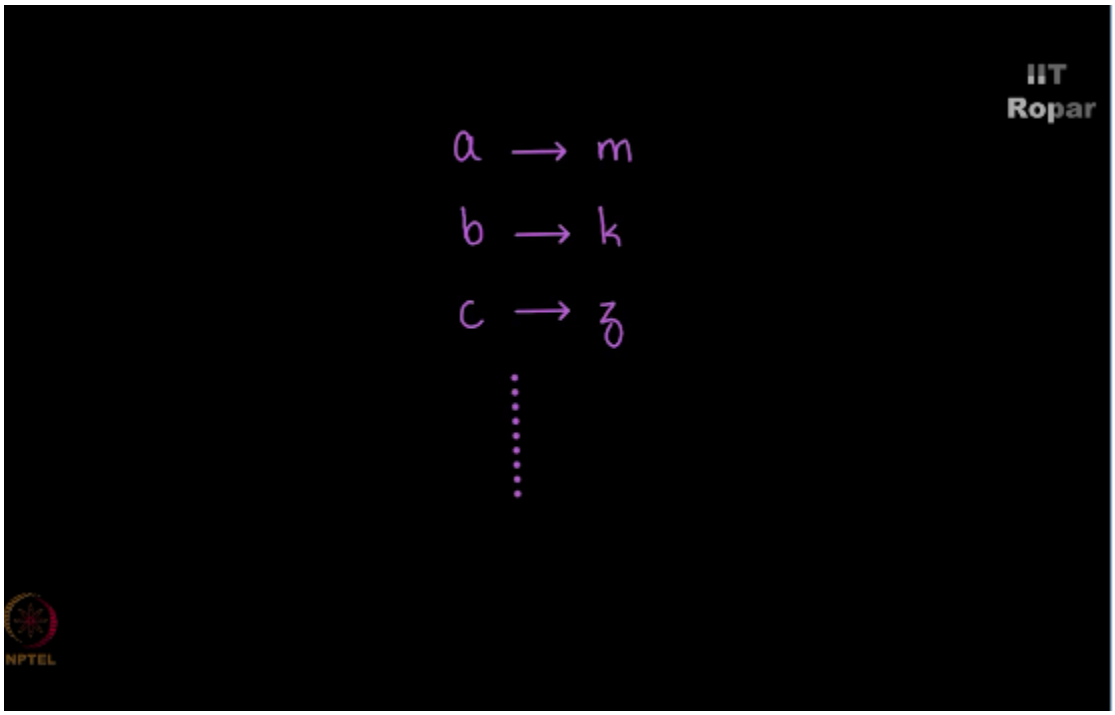
Example 19: Devising a secret code

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

In how many ways can we devise a secret code by assigning to each letter of the alphabet a different letter to represent it?
(Refer Slide Time: 00:15)



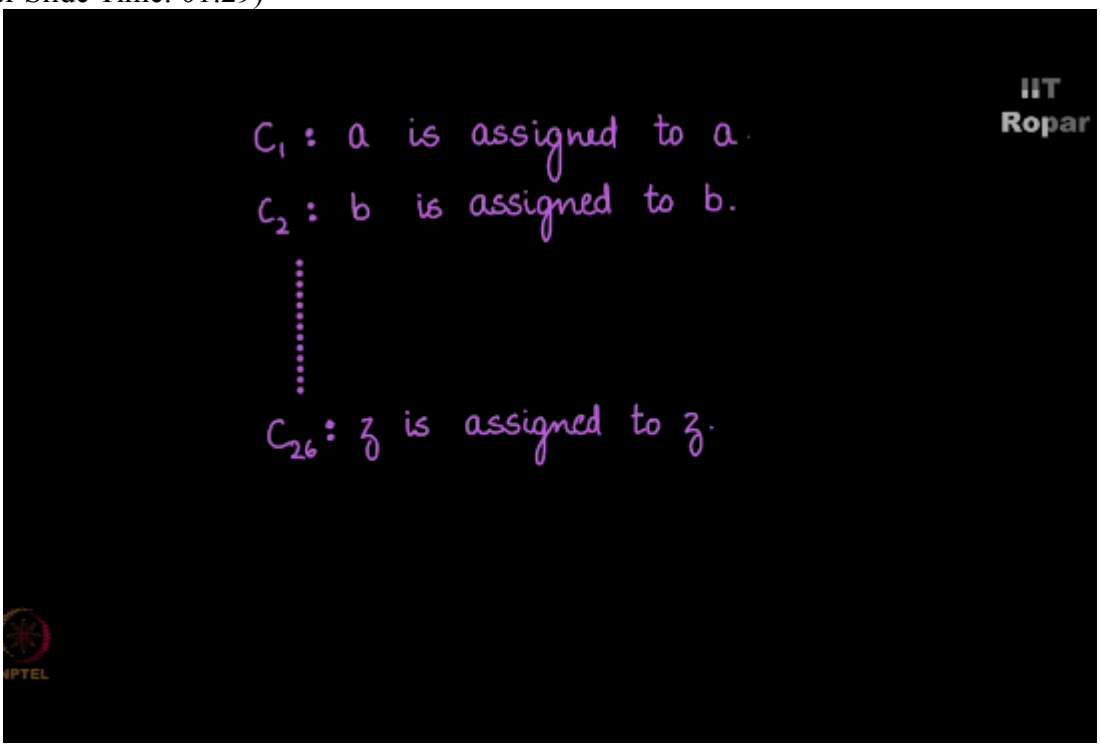
So we need to devise a secret code, how do we do it? We assign to each letter a different letter, for example I cannot assign A to A, right, I can assign rather A to say M, I can assign B to say K, C to say Z so on, the basic principle is A cannot take the letter A, B cannot take B, C cannot take C and so on,
(Refer Slide Time: 00:53)



right, you can have anything other than the letter itself.

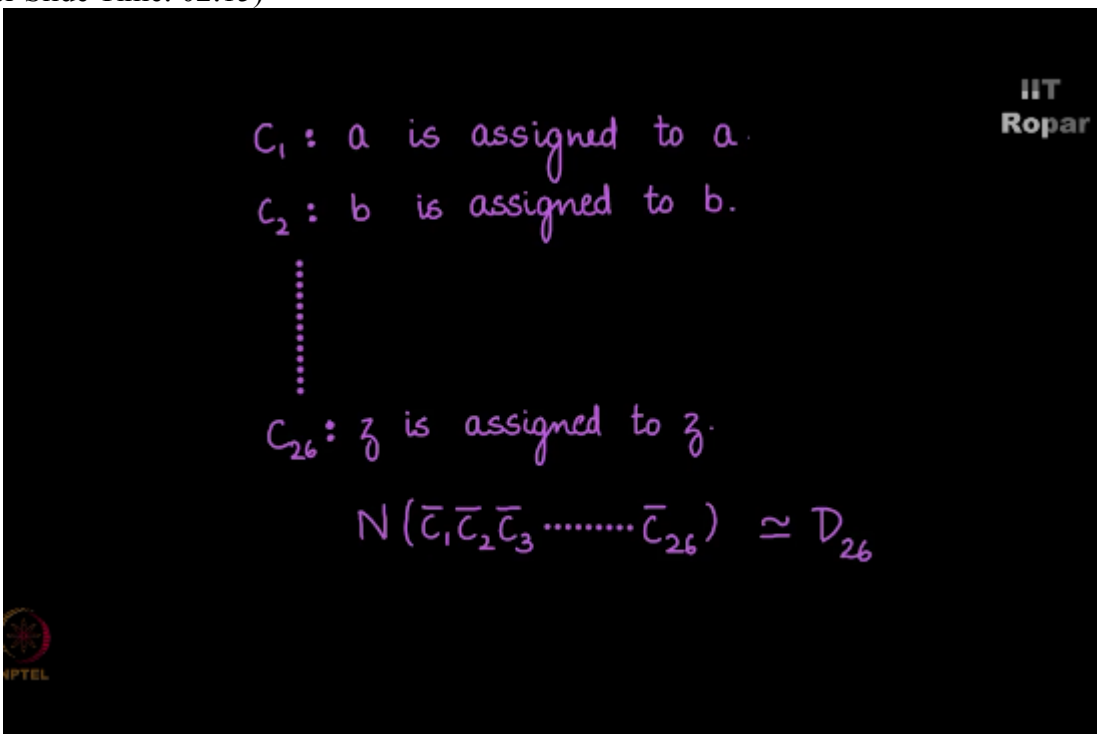
Now the question is what is N(C1 bar, C2 bar) and so on, will what a C1, C2 then here let us see, the condition 1 happens to be A is assigned to the letter A, C2 happens to be B is assigned to letter B, C3 will be C is assigned to letter C and so on up to C26, which says that Z is assigned to the alphabet Z, right, these are the conditions here.

(Refer Slide Time: 01:29)



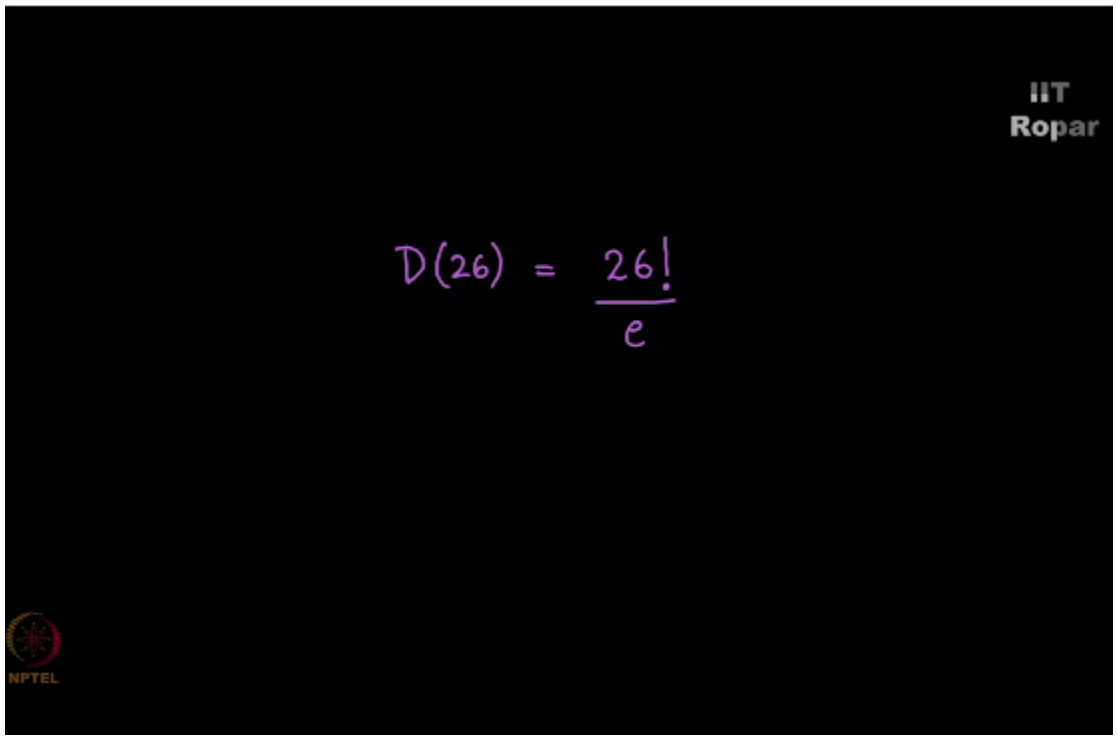
Now we have to find out what is N(C1 bar, C2 bar, C3 bar) so on up to C26 bar, because it is given that an alphabet cannot be assigned to itself. Now you see D26 represents derangements of 26 numbers which says that you cannot have ith number in the ith position, isn't this very similar to that? Yes, it is, now we can write D26 like this or like this, so it is equivalent to finding out derangements of 26,

(Refer Slide Time: 02:15)



derangements of 26 numbers, so we know that D(n) is N factorial/E and hence D26 happens to be 26 factorial/E.

(Refer Slide Time: 02:45)



Now in these many ways you can devise a secret code by assigning to each letter a different letter, you can probably find out yourself what is the exact value?

IIT MADRAS PRODUCTION

Founded by
Department of Higher Education
Ministry of Human Resources Development
Government of India

www.nptel.iitm.ac.in