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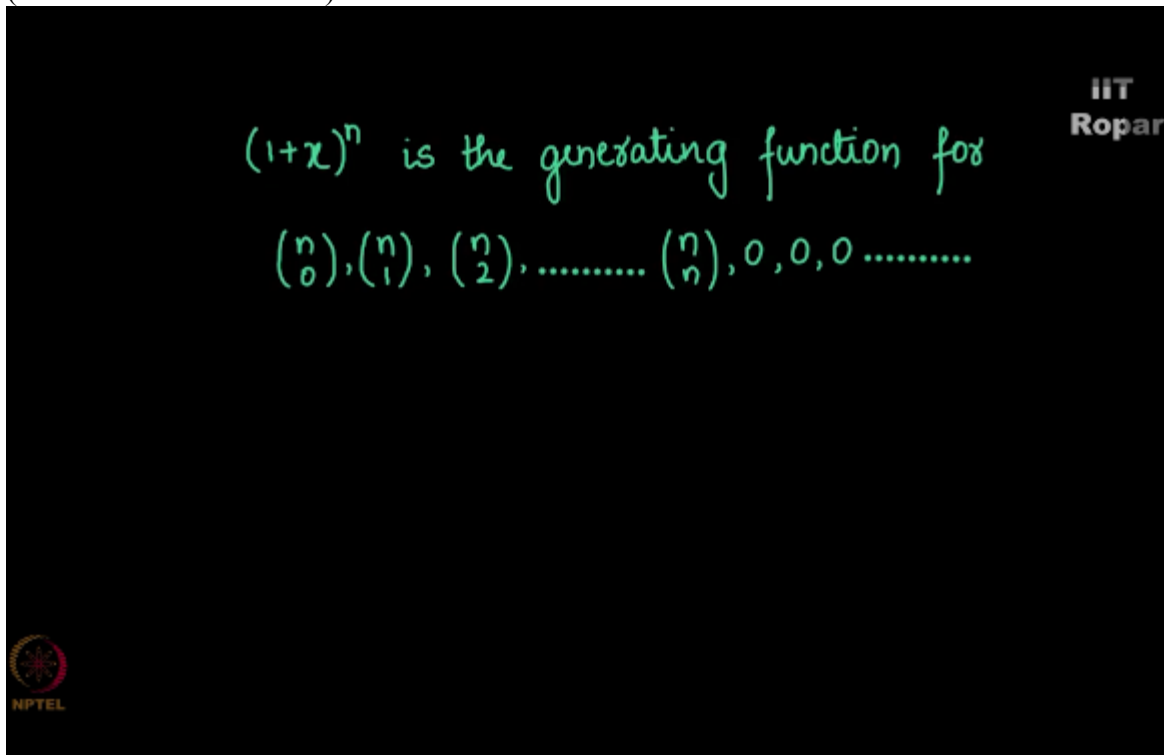
NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics  
Graph Theory – 3 &  
Generating Functions

Binomial expansion - Explained

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The professor told that  $1 + X$  to the  $N$  is the generating function for the sequence, and choose 0 and choose 1 and choose 2 up to  $N$  choose  $N$ , and then 0, 0, 0, if you're thinking why, (Refer Slide Time: 00:21)



I hope you had figured it out, if not let me tell you the answer, we know that  $1 + X$  to the  $N$  is the binomial expansion which gives  $N$  choose 0 into  $X$  to the 0 +  $N$  choose 1 into  $X$  +  $N$  choose 2 into  $X$  square +  $N$  choose 3 into  $X$  cube, so on +  $N$  choose  $N$  into  $X$  to the  $N$ , (Refer Slide Time: 00:47)

$(1+x)^n$  is the generating function for

$\binom{n}{0}, \binom{n}{1}, \binom{n}{2}, \dots, \binom{n}{n}, 0, 0, 0, \dots$

$$(1+x)^n = \binom{n}{0}x^0 + \binom{n}{1}x + \binom{n}{2}x^2 + \binom{n}{3}x^3 + \dots + \binom{n}{n}x^n$$



so now do you see that it is nothing but  $N$  choose  $0$  into  $1 + N$  choose  $1$  into  $X$ , so on up to  $N$  choose  $N$  into  $X$  to the  $N$ , do you see that the coefficients are  $N$  choose  $K$ , where  $K$  is from  $0$  to  $N$ ,

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$(1+x)^n$  is the generating function for

$\binom{n}{0}, \binom{n}{1}, \binom{n}{2}, \dots, \binom{n}{n}, 0, 0, 0, \dots$

$$(1+x)^n = \boxed{\binom{n}{0}}x^0 + \boxed{\binom{n}{1}}x + \boxed{\binom{n}{2}}x^2 + \boxed{\binom{n}{3}}x^3 + \dots + \boxed{\binom{n}{n}}x^n$$

$$\binom{n}{k} \quad 0 \leq k \leq n$$



that's why the professor mentioned that  $1 + X$  to the  $N$  is the function which generates the sequence,  $N$  choose 0,  $N$  choose 1,  $N$  choose 2,  $N$  choose 3 so on up to  $N$  choose  $N$ , and then 0, 0, 0, 0, so on.

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