# Discrete Mathematics Scribed Notes- 26

Roll No:-
202212001
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## Formal Power Series / Generating Functions

A generating function is a way of encoding an infinite sequence of numbers ($a_n$) by treating them as the coefficients of a formal power series. This series is called the generating function of the sequence.

**Q- In how many ways 3 people can eat 11 chocolates.**

Sol:-
If a is the person 1
b is the person 2
C is the person 3

Counting using Binomial theorem
a<=3, b<=5,c<=7

$$\rightarrow (x^0 + x^1 + x^2 + x^3)(x^0 + x^1 + x^2 + x^3 + x^4 + x^5)$$
$$(x^0 + x^1 + x^2 + x^3 + x^4 + x^5 + x^6 + x^7)$$

$$\rightarrow C_0 x^0 + C_1 x^1 + C_2 x^2 + \cdots C_{11} x^{11} + C_{12} x^{12} + \cdots$$
$$+ C_{15} x^{15}$$

To find how many times total 11 chocolates are eaten-
=Coefficient of x^11
= C11.

$$max = \quad 3 \qquad 5 \qquad 7$$

$$2\begin{bmatrix} 0 & 4 & 7 \\ 0 & 5 & 6 \end{bmatrix}$$

$$3\begin{bmatrix} 1 & 3 & 7 \\ 1 & 4 & 6 \\ 1 & 5 & 5 \end{bmatrix}$$

$$4\begin{bmatrix} 2 & 2 & 7 \\ 2 & 3 & 6 \\ 2 & 4 & 5 \\ 2 & 4 & 4 \end{bmatrix}$$

$$5\begin{bmatrix} 3 & 1 & 7 \\ 3 & 2 & 6 \\ 3 & 3 & 5 \\ 3 & 4 & 4 \\ 3 & 5 & 3 \end{bmatrix}$$

$$2 + 3 + 4 + 5$$
$$= \boxed{14}$$

**Geometric Distribution**

Geometric distribution is a type of discrete probability distribution that represents the probability of the number of successive failures before a success is obtained in a Bernoulli trial. A Bernoulli trial is an experiment that can have only two possible outcomes, ie., success or failure. In other words, in a geometric distribution, a Bernoulli trial is repeated until a success is obtained and then stopped.

For example
Suppose a dice is repeatedly rolled until "3" is obtained. Then the probability of getting "3" is p = 1 / 6 and the random variable, X, can take on a value of 1, 2, 3, ...., until the first success is obtained. This is an example of a geometric distribution with p = 1 / 6.

**Binomial Distribution**

The binomial distribution is the discrete probability distribution that gives only two possible results in an experiment, either success or failure. It means how many success in N trails