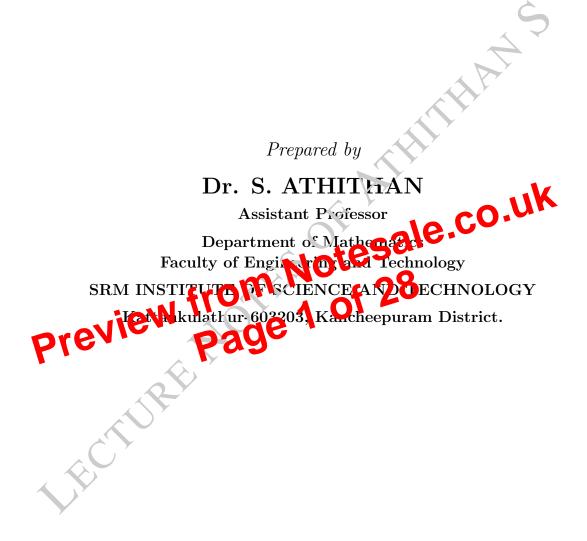
Lecture Notes 15MA301-Probability & Statistics





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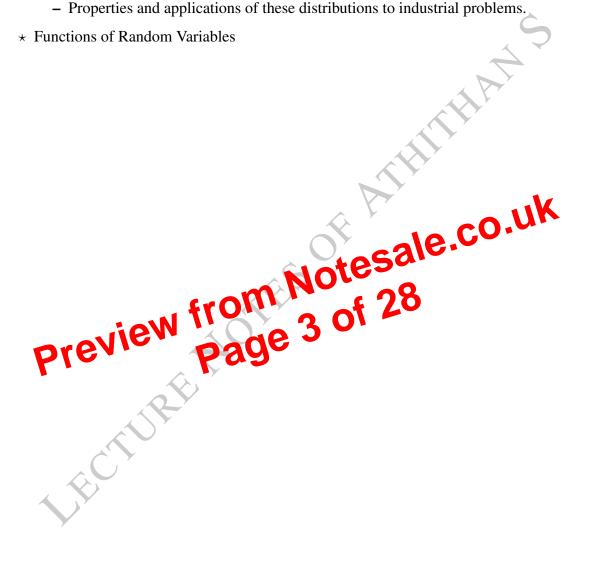
Kattankulathur-603203, Kancheepuram District.



Unit-2 **Probability Distributions**

TOPICS:

- * Some Special/Standard Probability Distributions
 - Discrete: Binomial, Poisson and Geometric
 - Continuous: Exponential and Normal
 - Properties and applications of these distributions to industrial problems.





Mean and Variance of Poisson Distribution 1.2.2

$$M_X(t) = e^{\lambda(e^t - 1)}$$

First Moment = Mean =
$$E(X) = M'_X(0)$$

 $M'_X(t) = \lambda e^t e^{\lambda(e^t - 1)}$
 $M'_X(0) = \lambda$

Second Moment = $E(X^2) = M''_X(0)$ $M''_X(t) = (\lambda e^t)^2 e^{\lambda(e^t - 1)} + \lambda e^t e^{\lambda(e^t - 1)}$ $M''_X(0) = \lambda^2 + \lambda$ $\neg (X^{2}) - [E(X)]^{2}$ $\lambda^{2} + \lambda - \lambda^{2} = \lambda$ riance= λ . NoteSale.co.uk

$$Var(X) = E(X^2) - [E(X)]^2$$
$$= \lambda^2 + \lambda - \lambda^2 = \lambda$$

Note that for Poisson Distribution, Mean=Variance= $\hat{\lambda}$.

Geometric Distribution 1.3

edition, if it assumes only non-negative A random variable X is still to values and its prol and by mass function

$$P(X = x) = q^{x}p, \ x = 0, 1, 2, \dots, \ 0$$

where q = 1 - p.

We can also write the pmf of the Geometric distribution as

$$P(X = x) = q^{x-1}p, \ x = 1, 2, 3, \dots, \ 0$$

where \hat{q}

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$$\therefore p = 1 - q = 1 - \frac{4}{5} = \frac{1}{5}$$
 and
 $\therefore (1) \Rightarrow n \cdot \frac{1}{5} = 20 \Rightarrow n = 100$
 \therefore the parameters are $\left(100, \frac{1}{5}\right)$.

Example: 5. Comment on the following "The mean of a binomial distribution is 3 and variance is 4".

Hints/Solution: Let (n,p) be the parameters of the binomial distribution, then mean =np and variance = npq.

Given np = 3 - - - - (1)and npq = 4 - - - - (2)Using (1) in (2), we get $(2) \Rightarrow 3q = 4 \Rightarrow q = \frac{4}{3} > 1$, which is not true, since the probability value can not be greater e.co.u than 1.

So, there is no binomial distribution with this data, the state

5 or 6 in a die. Let X denote the number of success when 6 Hints/Solution: Success is getting dice are thrown.

 $\therefore X$ is a binomial random variable with parameter (n, p). : $P(X = x) = {}^{n} C_{x} p^{x} q^{n-x}, x = 0, 1, 2, \cdots, n$

Given n = 6 and p =probability of getting 5 or $6 = \frac{2}{6} = \frac{1}{3}$

$$\therefore q = 1 - p = 1 - \frac{1}{3} = \frac{2}{3}$$

$$\therefore P(X = x) = {}^{6} C_{x} \left(\frac{1}{3}\right)^{x} \left(\frac{2}{3}\right)^{6-x}, x = 0, 1, 2, \cdots, 6$$

Example: 6. Six d

show a

o you expect atleast 3 dice to