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Probability Distributions

Module 1

- STANDARD DISTRIBUTIONS

In this module some important discrete distributions and continuous distributions are discussed

Discrete distributions

- Discrete distributions discussed in this module are the following:

1. Bernoulli
2. Binomial
3. Poisson
4. Geometric
5. Negative Binomial
6. Uniform

Bernoulli Distribution

Definition

A random variable X which takes two values 0 and 1 with probabilities q and p respectively ie,P(X=1)=p, P(X=0)=q, q=1-p is called a Bernoulli variate and is said to have a Bernoulli distribution.

In another way we can say:

A random variable X is said to follow Bernoulli distribution if its pdf is given by

$$f(x)=p^x(1-p)^{1-x} , x = 0,1$$
$$= 0 \text{ elsewhere}$$

Examples

1. An unbiased die is thrown once. Occurrence of 6 is considered as a success. Let X denote the number of successes. Here X takes the values 0 with probability $\frac{5}{6}$ and takes the value 1 with probability $\frac{1}{6}$.

2. An unbiased die is thrown once. Occurrence of 5 or 6 is considered as a success. Let X denote the number of successes. Here X takes the values 0 with probability $\frac{2}{3}$ and takes the value 1 with probability $\frac{1}{3}$.

3. An unbiased coin when tossed shows head or tail. If the outcome is head call it as success . Then X=0 or 1 according as outcome is tail or head .Here P(X=0)=P(X=1)= $\frac{1}{2}$

4.An unbiased die is thrown once. Occurrence of an even number is considered as a success. Let X denote the number of successes . Here X takes the values 0 and 1 with probability $\frac{1}{2}$

Moments of Bernoulli distribution

The rth moment about origin is

$$\mu_r' = E(X^r) = 0.q + 1.p = p, \quad r=1,2,....$$

- Mean $\quad$ =E(X)=p
- Variance=$E(X^2)$-$\{E(X)\}^2$

$$= p - p^2 = p(1-p)$$
$$= pq.$$

Moment Generating Function

- Mgf=E(e^{tX})

$$= e^{0}.q + e^{t}.p$$

$$= q + pe^{t}.$$

Problem

- X=0 or 1 according as an unbiased coin when tossed shows head or tail. Find the mgf.

Answer:

Pdf is given by

X	0	1
P_x	½	½

mgf is q+p$e^t = \frac{1}{2} + \frac{1}{2}\ e^t.$

Assignment

- X=0 or 1 according as an unbiased coin when tossed shows head or tail. Find the first four central moments.