[Frequently Asked Questions]

Probability Distributions

Subject:	Business Economics
Course:	B. A. (Hons.), 1st Semester, Undergraduate
Paper No. & Title:	Paper – 102 Statistics for Business Economics
Unit No. & Title:	Unit – 5 Probability and Distribution
Lecture No. & Title:	Lecture – 2 Probability Distributions

Frequently Asked Questions

Q1. What is random variable?

A1. A variable whose value is determined by the outcomes of a random experiment is called a random variable. Which is a function defined over the sample space of an experiment. It is usually denoted by capital letters X,Y, Z etc.

Q2. Define mathematical expectation.

A2. Suppose X is a discrete random variable which assumes the possible values X_1, X_2,……. X_k with corresponding probabilities P_1, P_2,……, P_k , where $P_i=P(X= x_i)$, then mathematical expectation as a random variable X is defined as,

$$E(X)=\sum_{i=1}^{K} X_i P_i = X_1 P_1 + X_2P_2 +\ldots\ldots+ X_kP_k$$

Q3. If a discrete random variable X has the following probability distribution

x:	**0,**	**1,**	**2,**	**3,**	**4**
P(x):	**k**	**2k**	**3k**	**4k**	**5k**

Find the constant k.

A3. Here we must have total probability one. i.e. k+2k+3k+ 4k+5k = 1. Which implies 15k = 1. Therefore k = 1/15.

Q4. The probability distribution of a random variable X is given as:

x:	**-3**	**-2**	**0**	**2**	**3**
p(x):	**0.1**	**0.2**	**0.3**	**0.2**	**0.2**

Find its mean and variance.

A4. Here $E(X) = \sum xp(x)$

= (-3)(0.1) + (-2)(0.2) + 0 + 2(0.2) + 3(0.2) =0.3

$E(X^2) = \sum x^2 p(x)$

$= (-3)^2 (0.1) + (-2)^2(0.2) + 0 + 2^2(0.2) + 3^2(0.2)$

$= 0.9 + 0.8 + 0.8 + 1.8 = 4.3$

$V(X) = E(X^2) - (E(X))^2 = 4.3 - (0.3)^2 = 4.21$

Q5. State binomial distribution.

A5. If the Bernoulli trials are repeated n times and P be the probability of success then the probability of getting x success in n such trials is given by,

$$P(X) = \binom{n}{x} p^x q^{n-x}; \quad X=0,1,2\ldots\ldots,n; \quad 0 < P < 1; \quad q=1-p$$

is called binomial distribution.

Q6. State mean and variance of binomial distribution and relation between them.

A6. Mean = np, Variance = npq, $0 < p < 1$, $q = 1-p$. Here Mean > Variance.

Q7. State Poisson distribution.

A7. The Poisson distribution of happening of the event x times is given by

$$P(x) = \frac{e^{-\lambda}\lambda^x}{x!}, x = 0,1,2,\ldots.; \quad \lambda > 0.$$

Where λ = mean number of times the event happened.

Q8. In a police control room there are on an average 3 calls per 10 minute interval. What is the probability of receiving 4 calls in a 10 minute interval?

A8. P(x=4) = $\frac{e^{-3}3^4}{4!}$ = (27/8)(0.049787)=0.168