WELCOME TO

TECH I.S.

Discrete Random Variables

Random Variable

Random Variable: A random variable is one whose value is not known ahead of time.
Example: Your final grade, tomorrow's temperature.

Discrete Random Variable: →

- Data that you Count.
- Has separate, indivisible categories
- Example: Number of childrens in a family

For a random variable X, $P(X)$ is the probability distribution function or pdf.

Probability Mass Function - PMF

The probability distribution of a discrete random variable is called a <u>probability mass function (PMF).</u>

$$p(x) = P(X = x)$$

The probability of x = the probability(X = one specific x)

F(x)	$\sum_{i=1}^{n} p_i = 1$
Mean μ	$\sum_{i=1}^{n} x_i p_i$
Variance σ²	$\sum_{i=1}^{n} (x_i - \mu)^2 p_i$

Bernoulli Distribution

When trial is performed once & Only 2 possible outcomes (Success, Failure).

Probability of success in a trial is p

$$P(X = k) = \begin{cases} p & \text{if k=1} \\ q = 1 - p & \text{if k=0} \end{cases}$$

$\mu = p$

$\sigma^2 = p(1-p) = pq$

Example: A basket player makes 70% of free throws. One shot is taken.

p = P(success) = 0.70
q = P(failure) = 1-p = 0.30

		Mean		Expected Value	Variance
x	P(x)	xP(x)	$(x-\mu)$	$(x-\mu)^2$	$(x-\mu)^2P(x)$
0	0.30	0	-0.70	0.49	0.147
1	0.70	0.70	0.30	0.09	0.063
Total	**1.0**	**μ=0.70=p**			**σ^2=0.21=pq**

Binomial Distribution

It is an extension of the Bernoulli distribution, where the number of trials allowed for each outcome is now more than one.

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

$$\mu = E(X) = np$$

$$\sigma^2 = Var(X) = np(1-p)$$

Example: A basket player makes 70% of free throws. three shots are taken. Find the probability of making exactly 2 Shots

p = P(Success) = 0.70
q = P(Failure) = 1-p = 0.30
n = number of independent trials =3

P(SSF) = P(S)P(S)P(F) = (0.70)(0.70)(0.30) = 0.147
P(SFS) = P(S)P(F)P(S) = (0.70)(0.30)(0.70) = 0.147
P(FSS) = P(F)P(S)P(S) = (0.30)(0.70)(0.70) = 0.147

P(X=2) = 3(0.147)= 0.441

Poisson Distribution

The Poisson distribution deals with the frequency with which an event occurs in a specific interval of time, given that the probability of the event occurring is constant.

$$P(x) = \frac{e^{-\mu}\mu^{x}}{x!}$$

$$\mu = \mu$$
$$\sigma = \sqrt{\mu}$$

<u>Example</u>:
Earthquakes of Richter magnitude 3 or greater occur on a certain fault at a rate of twice(2) every year.

<u>Find the probability of at least one earthquake of RM 3 or greater in the next year.</u>

$$P(X > 0) = 1 - P(0)$$
$$= 1 - \frac{e^{-2}2^{0}}{0!}$$
$$= 1 - e^{-2} \approx .8647$$

<u>Find the probability of exactly 6 earthquakes of RM 3 or greater in the next 2 years.</u>

$$\mu = 2(2) = 4$$
$$P(X = 6) = \frac{e^{-4}4^{6}}{6!} \approx .1042$$

Much obliged.

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