Binomial theory can be used when probability of sucess is very high

Binomial formula $b(x, n, P) = nC_x P^x (1-P)$

$nC_x \times P^x \times (1-P)^{n-x}$

b = binomial probability

x = total number of sucess

P = probability of a sucess in an individual trial

n = number of trials

$$nC_x = \frac{n!}{(n-x)!}$$

a coin is tossed 10 times what is probabily of getting 6 heads

Probability of sucess $P = 0.5$

probability of failure $= 1 - 0.5 = 0.5$

$n = 10 \quad x = 6$

$$P_6 = nC_x \times P^x \times (1-P)^{n-x}$$

$$P_6 = {}^{10}C_6 \times P^{0.5} \times (1-0.5)^{10-6}$$

$$= \frac{10!}{(10-6)! \times 6!} \times 0.5^6 \times 0.5^4$$

$$\frac{10!}{4! \times 6!} \times 0.5^6 \times 0.5^4$$

mean $= np = 10 \times 0.5 = 5$

Variance $= npq = 10 \times 0.5 \times 0.5 =$

Standard deviation $= \sqrt{npq} = \sqrt{10 \times 0.5 \times 0.5}$

POISSON DISTRIBUTION

occur when we have a rare event when probability of sucess is very low

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

where X = actual number of sucess that can result from

$e = 2.71828$

μ = mean of population

Properties

mean $= \mu$

Variant $= \mu$

standard deviation $= \sqrt{\mu}$

Average no of homes sold by solomon is 2 homes per day what is the probability of selling 3 homes tomorrow

Solution

$\mu = 2$

$x = 3$

$e =$

$$P(x, \mu) = \frac{(e^{-\mu})(\mu^x)}{x!} = \frac{e^{-2} \times 2^3}{3!}$$

HYPERGEOMETRIC DISTRIBUTION

If a population of size N contains K items of sucesses will have [N-K] failures, then the probability of hypergeometric random variables X,

The no of success in a random sample n

$$P(X=k) = \frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}} = \frac{\left({}^{K}C_{k}\right)\left({}^{N-K}C_{n-k}\right)}{{}^{N}C_{n}}$$

N = size ~~success~~ from population
n = size from sample
K = success from population
k = sucess from sample.

A deck of cards contain 20 cards, 6 red cards and 14 black cards. 5 cards are drawn randomly without replacement probability of exalt 4 red cards are drawn

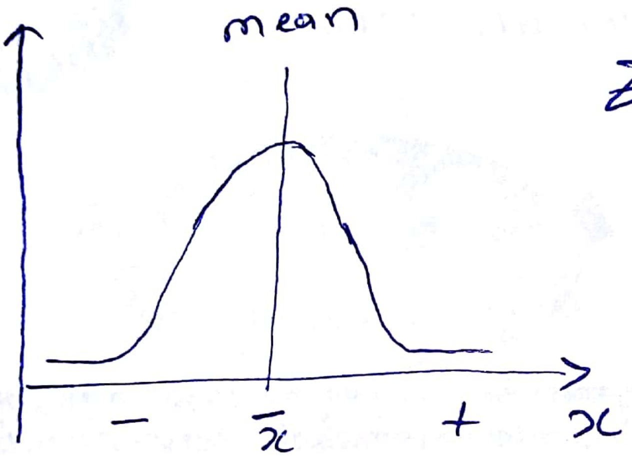
solution

Exactly = 4
N = 20
n = 5

N - K = 20 - 6 = 14
n - k = 5 - 4 = 1

$$\frac{\binom{6}{4}\binom{14}{1}}{\binom{20}{5}} = \frac{[{}^{6}C_{4}][{}^{14}C_{1}]}{{}^{20}C_{5}}$$

NORMAL DISTRIBUTION



$$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Z = Size

$\bar{x}$ = mean of sample

μ = mean of population

σ = Standard deviation of population

n = Size of sample

ABE 301

Course Content

Probability & Statistics.

Probability space, theories, conditional probability and independency, random variables, discrete and continuous distributions.

Mean and Variance, Binomial, Poisson hypergeometry.

Exponential and normal distribution and their characteristic

Center limit theorem.

Elementary sample theorem for normal population statistical inference on mean proportion and Variance.

- Simple linear regression & Engineering application
- Chi-square.

Probability & Statistic. Likelihood.

Probability is the measure of the ~~likelyhood~~ that a particular event will occur in any one trial or experiment carried out in a prescribed condition

Notation

P - Probability

The probability that a certain event of A will occur is denoted by P(A) or p(A). It is denoted by (P success)

Success or failure.

when an event occur in any one trial, it's called Success but when it fails it's called failure. In N of any trials there are x (successes) there will also be $(N-x)$ failure.

$$\frac{x}{N} = P(\text{success})$$

$$\frac{N-x}{(N-x)} = P(\text{failure}) \rightarrow \left(\frac{(N-x)}{N}\right)$$

$$\boxed{\frac{2}{120} = \frac{120-2}{120}}$$

$$P(A) + P(\text{Not } A) = 1$$

$$P(A) + P(\bar{A}) = 1$$

$$\frac{x}{N} + \frac{N-x}{N} = 1$$

Type of probability

Determination of probability may be undertaken from two processes:

1) Emperical or Experimental.
2) Classical or Theoritical.

Emperical or Experimental.

It's based on the ~~pernecious~~ previous known result.

→ Expectation. It's defined as the product of No of trials and probability that event A will occur in a number of trials.

Classical

The classical approach to probability is based on application of theoritical number of ways in which its possible for an event to occur.

Classical probability (P) of an event (A) occurring is defined by

$$P(A) = \frac{\text{Number of ways in which event A occur}}{\text{Total Number of all possible outcome.}}$$

2	2	2	2	2	2	
1	2	3	4	5	6.	$= 2/6$.
1	1	1	1	1	1	

<u>Mutually</u> <u>Exclusive</u> and <u>Mutually</u> <u>Non-Exclusive</u> <u>Event</u>.

<u>Mutually Exclusive Event</u> – This cannot occur together.

<u>Mutually Non Exclusive Event</u>'s are those which happen simultaneously e.g a pair of events like 2 dice casted.

or — Add
both — Multiplication

Additional Law of Probability

For a given event (A) and (B) are mutually Exclu-
sive either

If A and B are Mutually exclusive, probability will be either A or B but not both.

$$P(A \text{ or } B) = P(A) + P(B)$$

→ (Check)

Independent Event and Dependent Event

When the occurrence of one event doesn't affect the probability of occurrence of the second event —
⟹ Independent event (Replaced)

Event are dependent when the occurrence of one event affect the probability of occurrence of the second event (Not replaced)

Oranges

red orange = 12
White orange = 8
Blue orange = 10

Independent

dependent ⟹
White 2/8

$2/30 \to A$ $\frac{10}{30} \to B$

Conditional probability of an event (B) given occurring when given an event (A) has already taken place vice versa. but lineage of an event (B) stated above

$$P(B/A) = \frac{5/30}{2/30}$$

✓

$P(\text{Picking 2 white orange}) = 2/30$ (A)

$P(\text{Picking 5 blue orange}) = \frac{5}{30}$ (B)

} Independent.

$P(\text{Picking 5 red orange}) = \frac{5}{28}$ } dependent.

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Binomial Distribution.

Binomial theorem can be used when the probability of Success is very high.

Binomial formula:

$$b(x; n, P) = {}^nC_x \times p^x \times (1-P)^{n-x}.$$

Where

b = binomial Probability.

x = total No. of successes

P = Probability of success in an individual trial.

n = Number of trials.

$$^nC_x = \frac{n!}{(n-x)!\,x!}$$

Example: A coin is tossed 10 times what is the probability of getting exactly 6x?

$P = 0.5$

$q = 1 - 0.5 = 0.5$

$n = 10$

$x = 6$

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Not less than 6 - 6, 7, 8, 9, 10
Not more than 6 - 6, 5, 4, 3, 2, 1, 0.

$$P_6 = {}^nC_x \cdot p^x \cdot (1-p)^{n-x}$$

$$= {}^{10}C_6 \times p^6 \times (1-0.5)^{(10-6)}.$$

$$= \frac{10!}{(10-6)!\,6!} \times 0.5^6 \times 0.5^4$$

$$= \frac{10!}{4!\,6!} \times 0.5^6 \times 0.5^4$$

Mean $= np = 10 \times 0.5 = 5$
Variance $= npq = 10 \times 0.5 \times 0.5 = 2.5$
Standard deviation $= \sqrt{npq}$

Poisson Distribution

occur When we have a rear event, the probability of success is very low.

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

Where

X = actual number of successes that result from experiment.

$\bar{X}$ = means of sample.

s = standard deviation of sample.

σ = standard deviation of population

μ = mean of population.

$e = 2.71828$

Properties.

Mean $= \mu$

Variance $= \mu$

Standard deviation $= \sqrt{\mu}$

Example

Average number of homes sold by Solomon Company is 2 homes per day. what is the probability that exactly three (3) homes would be sold tomorrow.

Solution

$\mu = 2$, Since 2 homes are sold per day.

$x = 3$

$e = ?$

$$P(x; \mu) = \frac{(e^{-\mu})(\mu^{x})}{x!} = \frac{e^{-2} \times 2^{3}}{3!}$$

Ans = 0.180

A num from female from a population (male & female)
Success.

Hyper Geometric

When one takes a certain number from a sample drawn from a population.

If a Population of size "N" contains 'K' items of successes, failure will be $(N-K)$, then the probability of the hypergeometric random variable (X), the no of successes in a random sample of size (n) is

$$P(x=k) = \frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}$$

$$= \frac{\left({}^{K}C_{k}\right)\left({}^{N-K}C_{n-k}\right)}{{}^{N}C_{n}}$$

K – Population. (Success)

k = Sample. (Success)

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Examples

A deck of cards containing 20 cards, 6 red cards and 14 black cards. 5 cards are drawn at random without replacement. What is the probability that exactly 4 red cards are drawn?

Solution

Exactly $= 4$

$N = 20$

$n = 5$

$N - K = 20 - 6 = 14$

$n - K = 5 - 4 = 1$

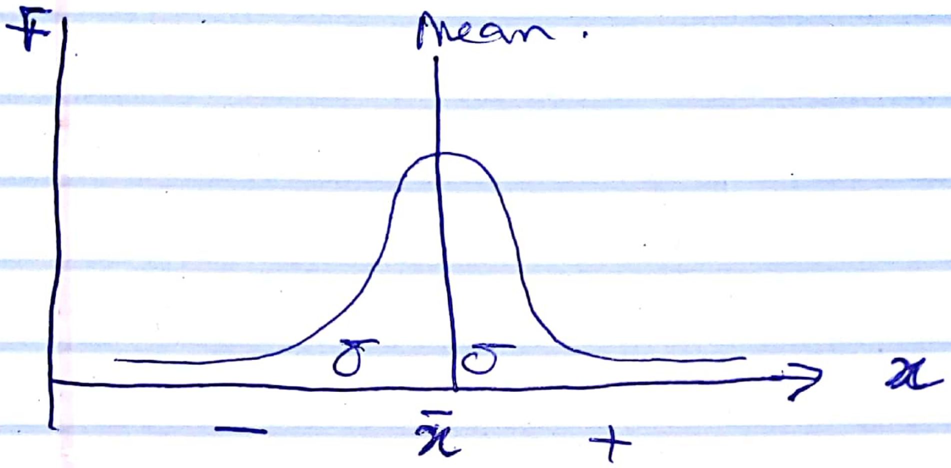
$$= \frac{\binom{6}{4}\binom{14}{1}}{\binom{20}{5}}$$

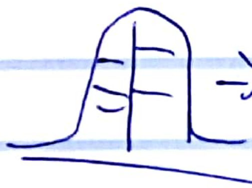
$$= \frac{({}^{6}C_{4})({}^{14}C_{1})}{({}^{20}C_{5})}$$

A

Approach a given point without touching it eg Sin 90.

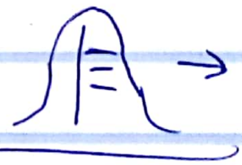
Normal Distribution





→ Two tail.

No subtraction



→ one tail.

↓

Substract from 0.05

Z = Size.

$\bar{X}$ = mean of sample.

σ = standard deviation of population.

n = size of sample.

μ = mean of population.

Normal distribution table

$$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

	Probability →
Number size ↓	