MEAN

FORMULA :-

$$\text{mean} = \frac{\text{sum of data}}{\text{no. of data points}} = \frac{\sum x_i}{n}$$

EXAMPLE : 01

Find the mean of this data

1, 2, 4, 5

$$\text{mean} = \frac{1+2+4+5}{4}$$

$$= \frac{12}{4} \Rightarrow 3$$

mean is 3

EXAMPLE : 02

When data is present in tabular form we find mean as,

$$\text{mean } \bar{x} = \frac{(x_1 f_1 + x_2 f_2 + \dots + x_n f_n)}{f_1 + f_2 + \dots + f_n}$$

Example : Find mean of following distribution

x	4	6	9	10	15
f	5	10	10	7	8

Solution:

Calculation table for arithematic mean:

x_i	f_i	$x_i f_i$
4	5	20
6	10	60
9	10	90
10	7	70
15	8	120
	$\Sigma f_i = 40$	$\Sigma x_i f_i = 360$

$$\text{Mean } \bar{x} = \frac{\Sigma x_i f_i}{\Sigma f_i}$$

$$= \frac{360}{40} \Rightarrow 9$$

Mean is 9

MEDIAN

Note :- Always arrange the data in ascending order first.

If n is Even :

- Median $= \dfrac{[(n/2)^{th} \text{ term} + (n/2+1)^{th} \text{ term}]}{2}$

If n is Odd :

- Median $= \dfrac{n+1}{2}$

EXAMPLE 1 :

Let's consider the data : 56, 67, 54, 34, 78, 43, 23 . What is median?

Solution :-

Arranging is ascending order we get
23, 34, 43, 54, 56, 67, 78.

Here n (no. of observations) $= 7$

So $\dfrac{7+1}{2} = 4$

Median will be the 4th observation

Median = 54

EXAMPLE 2:

Let's Consider data 50, 67, 24, 34, 78, 43.

What is the median?

Solution:-

Arranging in ascending order we get

24, 34, 43, 50, 87, 78.

Here $n = 6$

$$\frac{6}{2} = 3$$

Using Formula

$$\text{Median} = \frac{3\text{rd observation} + 4\text{th observation}}{2}$$

$$= \frac{43+50}{2}$$

Median = 46.5

MODE

'Term with the highest frequency'

EXAMPLE : 1

Ms. Noris asked students in her class how many siblings each had.
Find the mode of data :

0, 0, 1, 1, 1, 1, 1, 2, 2, 2, 3, 5

The mode is '1' sibling.

EXAMPLE : 02

Find the mode of data :

0, 1, 1, 1, 2, 2, 2, 3, 4, 3

Their is a tie for value that occurs most.
So the modes are 1 and 2.

PROBABILITY DISTRIBUTION

TYPES

1. NORMAL Distribution
2. UNIFORM DISTRIBUTION
3. BINOMIAL DISTRIBUTION
4. POISSON DISTRIBUTION

NORMAL DISTRIBUTION

&

FORMULA :-

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[\frac{-1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right]$$

Where

x is the variable

μ is the mean

σ standard deviation

EXAMPLE :-

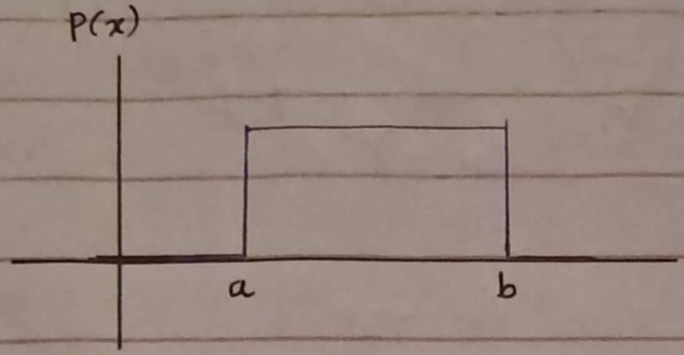
Find the probability density function for normal distribution where mean is 4, standard deviation is 2 & $x = 3$.

Solution :-

$$f(x) = \frac{1}{2\sqrt{2\pi}} \exp\left[\frac{-1}{2}\left[\frac{3-4}{2}\right]^2\right]$$

$$f(x) = 0.17603$$

UNIFORM DISTRIBUTION



$$P(a \leq x \leq b) \Rightarrow \text{height} = \frac{1}{b-a}$$

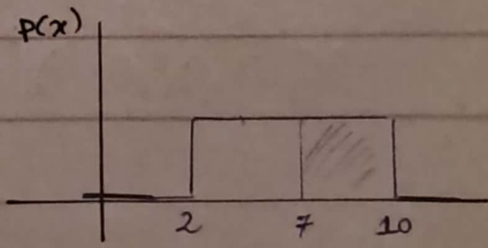
$$\text{Mean} = \mu = \frac{a+b}{2}$$

$$\text{Standard deviation, } \sigma = \sqrt{\frac{(b-a)^2}{12}}$$

EXAMPLE :-

Bus is uniformly late b/w 2 & 10 minutes. How long can you expect to wait? with what S.D? if it's 7 min late, you'll be late for work. What's the prob. of you being late?

$$\mu = \frac{2+10}{2} = 6 \text{ mins}$$



$$\sigma = \sqrt{\frac{(10-2)^2}{12}} = 2.31 \text{ mins}$$

$$P(7 \leq x \leq 10) = \frac{10-7}{10-2} = 0.375$$

BINOMIAL DISTRIBUTION

FORMULA :-

$$P(x) = \binom{n}{x} p^x q^{n-x} = \frac{n!}{(n-x)!\,x!} p^x q^{n-x}$$

where n: no. of trials (or samples)

x : the no. of successes desired

q: probability of getting success in one trial.

p: probability of getting failure in one trial.

Example 1: If coin is tossed 5 times, using binomial distribution find probability of:

- exactly 2 heads.

No. of trials $n = 5$

Probability of head $p = 1/2$

Probability of tail $q = 1/2$

Exactly 2 heads $x = 2$

$$^nC_x\, p^x (q)^{n-x}$$

$$^5C_2 (1/2)^2 (1/2)^3 = \frac{5!}{2!\,3!}$$

$$P = \frac{5}{16}$$

EXAMPLE :- 60% of people who purchase sports car are men. Find prob. that exactly 7 are men if 10 sports car owners r selected randomly.

The number of sports car owners $n = 10$ & no. to find probability is $X = 7$.

$p = 60\%$ or 0.6

Probability of failure $q = 1 - 0.6 = 0.4$

$$P(x) = \frac{n!}{(n-x)!\,x!} p^{x} q^{n-x}$$

$$= \frac{10!}{(10-7)!\,7!} (0.6)^{7} (0.4)^{3}$$

$$P(x) = 0.215$$

POISSON DISTRIBUTION

FORMULAS:-

$$f(x) = \frac{e^{-\lambda} \lambda^{k}}{k!}$$

Example :1 If random variable X follows a Poisson distribution with a mean of 3.4 find $P(X=6)$?

$$P(X=6) = \frac{e^{-3.4} \, 3.4^{6}}{6!}$$

$= 0.072$

EXAMPLE :2

In a cafe, the customer arrives at a mean rate of 2 per min. Find probability of arrival of 5 customers in 1 min.

Given $\lambda = 2$ & $x = 5$

$$P = \frac{e^{-2} \, 2^{5}}{5!}$$

$$\boxed{P = 0.036}$$