

* Explain Key statistical Concepts.

→ There are Many Key statistical Concepts are here.

- (i) Population and Sample
- (ii) Measures of Central Tendency
- (iii) Variance and Standard Deviation
- (iv) Probability and Correlation
- (v) Hypothesis testing
- (vi) Confidence Interval

→ (i) Population and Sample :-

→ Population is the entire group to care about.

ex :- If we want to study the average height of people in country, so the population is everyone in the country.

→ Sample is a smaller group taken from the population.

ex :- Instead of measuring everyone's height, we might measure 1000 people that is a sample.

→ (ii) Measures of Central Tendency :-

→ These tell us the centre of data, like,

- (1) Mean
- (2) Median
- (3) Mode

→ (1) Mean :- It is a average of a Number like Add all numbers, then divide by

how many numbers are there.

ex Num = {2, 4, 6} find Mean.

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{m} = \frac{2+4+6}{3} = 4.$$

→ (2) Median: It is a middle value of the sorted set of numbers.

ex For {2, 4, 6} → the median is 4.

→ (3) Mode: It is a most common value or the number that appears most often.

ex In {2, 2, 4, 6} the mode is 2.

→ (iii) Measures of Variance and standard deviation:

→ It tells us how spread out numbers are.

(i) Variance: It is average of how far each number is from the mean like square differences.

→ Formula is,

→ Variance of population,

$$\sigma^2 = \frac{\sum_{i=1}^N (x_i - \mu)^2}{N}$$

x_i = each data value
 μ = population mean
 N = population size

→ Variance of Sample,

$$s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}$$

\bar{x} = sample mean
 n = sample size

→ (2) Standard Deviation:

→ The square root of Variance. It's in the same units as the data.

→ Formulae,

$$\sigma = \sqrt{\sigma^2}$$

σ = Population standard deviation

σ^2 = Population Variance

s = Sample standard deviation

$$s = \sqrt{s^2}$$

s^2 = Sample Variance

→ (iv) Probability:

→ probability is the chance of something likely to happen.

→ The least probability write as 0 and the most probability write as 1.

→ Formula:

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

where, $P(E)$ is probability of event.

→ ex: Tossing a coin,

Probability of heads → 50% → 0.5

Probability of tails → 50% → 0.5

→ Probability, it helps us deal with Uncertainty.

→ (V) Correlation :

- Correlation shows if two things move together.
It ranges from -1 to +1.
 $+1$ = Positive Correlation.
 -1 = Negative Correlation.
 0 = No relationship.

→ Formulas Correlation with Pearson's r .

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2} \cdot \sqrt{\sum (y_i - \bar{y})^2}}$$

r = Correlation Coefficient

x_i = each Value of X

y_i = each Value of Y

\bar{x} = mean of X

\bar{y} = mean of Y

→ ex : If the Height and Weight usually have a positive correlation.

→ (vi) Hypothesis Testing :

→ It is a method used to decide if claim or assumption about population is true or false using Sample data.

→ There are two types of Hypothesis like.
(1) Null Hypothesis
(2) Alternate Hypothesis.

→ (1) Null Hypothesis : There is no effect or no difference in some particular situation.

ex : In hospital new medicine does not work better than the old one.

→ (2) Alternate Hypothesis : There is effect or difference in some particular situation.

ex : In hospital new medicine does work better than the old one.

→ (Vii) Confidence Interval :

→ It gives a range where we think the true value lies.

→ Formula of Confidence Interval is,

$$CI = \bar{x} \pm z \cdot \frac{\sigma}{\sqrt{n}}$$

CI = Confidence Interval

\bar{x} = Sample Mean

σ = Population standard deviation

n = Sample size.

→ ex : If a poll says a candidate has 52% support with a ±3% margin, we can be confident the real support is between 49% and 55%.