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Task_09

Mean, Median and Mode

① Mean:

1, 3, 5, 7, 9, 12, 14, 16, 18, 20

$$\text{Mean} = \frac{1+3+5+7+9+12+14+16+18+20}{10}$$

$$=$$

② Median:

Odd no. of observations:

$$\text{Median} = \left(\frac{n+1}{2}\right)^{th} \text{ term}$$

e.g: 14, 63, 55

in ascending order 14, 55, 63

$$\text{Median} = \left(\frac{3+1}{2}\right)^{th} \text{ term} = 2^{th} \text{ term}$$

so 55 is median

Even no. of observations:

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th} \text{ term} + \left(\frac{n}{2}+1\right)^{th} \text{ term}}{2}$$

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e.g: 10, 5, 4, 1, 11, 16

$$\text{Median} = \frac{\left(\frac{6}{2}\right)^{th} + \left(\frac{6}{2}+1\right)^{th}}{2}$$

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

$$\text{Median} = \frac{4}{2} + \frac{1}{2} = 2.5$$

Mode:

21, 19, 66, 21, 28, 41, 55, 21, 46
19, 20, 40, 50

Mode is the most frequent word

Mode = 21

Probability

"Probability is the chance on an event to occur."

Examples

Two coins are tossed 200 times, and we get

E_1: Two heads: 105 times

E_2: one head: 34 times

E_3: no head: 61 times

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Solution

$P(E_1) = \frac{105}{200} = 0.525$

$P(E_2) = \frac{34}{200} = 0.17$

$P(E_3) = \frac{61}{200} = 0.305$

The sum of all Probabilites should be 1.

$P(E_1) + P(E_2) + P(E_3)$

$= 0.525 + 0.17 + 0.305$

$= 1$

Variance and Standard deviation

Variance:

$$\frac{\Sigma (\text{score} - \text{mean})^2}{\text{score}}$$

Data / Score : 92 + 95 + 40 + 87 + 99 + 135

$$\text{Mean} = \frac{92 + 95 + 40 + 87 + 99 + 135}{6}$$

$$\text{Mean} = \frac{548}{6} = 91.333$$

$$\text{Variance } (\sigma^2) = \frac{(0.667)^2 + (3.667)^2 + (-51.333)^2 + (-4.333)^2 + (7.667)^2 + (43.667)^2}{6}$$

$$\sigma^2 = \frac{4633.33}{6} = 772.23$$

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Standard Derivation:

$$\sigma = \sqrt{772.23}$$

$$\sigma = 27.79$$

Normal Distribution:

"Applied to single variable continous data"

$$z = \frac{(x - \mu)}{\sigma}$$

The above formula is used to convert the raw (x) data into a standard score z.

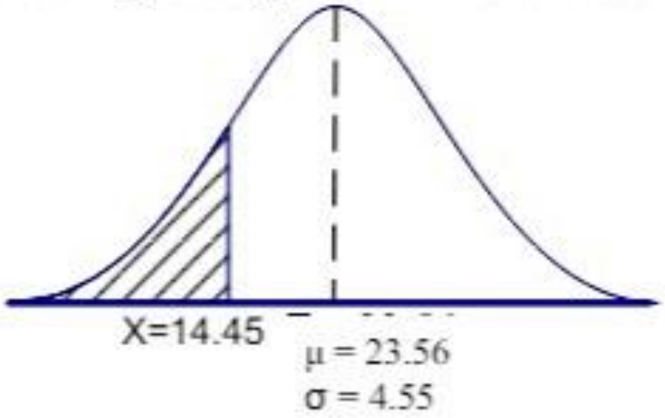
Example:

Example

Wool fibre breaking strengths are normally distributed with mean μ = 23.56 Newtons and standard deviation, σ = 4.55.

What proportion of fibres would have a breaking strength of 14.45 or less?

- **Draw a diagram, label and shade area required:**



Convert raw score (X) to a standard score (Z)

$$Z = \frac{14.45 - 23.56}{4.55}$$

$$Z = -2.0$$

Used table to find probability and adjust the result to required Probability.

$$P(X < 14.45) = P(Z < -2.0) = 0.5 - P(0 < Z < 2)$$

$$= 0.5 - 0.4772$$

$$= 0.0228$$

or 2.28%

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Binomial Distribution:

"Applied to single variable discrete data whose results are the numbers of "successfull outcomes" in a given scenario.

$$P(X = x) = {}^{n}C_x \cdot P^x \cdot q^{(n-x)}$$

$$q = (1 - P)$$

Example:

Example

An automatic camera records the number of cars running a red light at an intersection (that is, the cars were going through when the red light was against the car). Analysis of the data shows that on average 15% of light changes record a car running a red light. Assume that the data has a binomial distribution. What is the probability that in 20 light changes there will be exactly three (3) cars running a red light?

$P = 0.15$, $n = 20$, $X = 3$

$P(X = 3) = {}^{20}C_3 \times 0.15^3 \times (0.85)^{17}$

$= 0.243$

That is, the probability that in 20 light changes there will be three cars running a red light is 0.24 or 24%.

Poisson Distribution:

"This is often known as the distribution of rare events. Firstly, a Poisson process is where discrete event occurs in continuous but finite interval ~~of~~ or space."

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

Example:

Average number of accidents at a level-crossing every year is 5. Calculate the probability that there are exactly 3 accidents this years.

Solution:

$$\lambda = 5 \quad \text{and} \quad x = 3$$

$$P(X=3) = \frac{e^{-5} \times 5^3}{3!}$$

$$P(X=3) = 0.1404$$

There is 14% chance that there will be exactly 3 accidents this year.