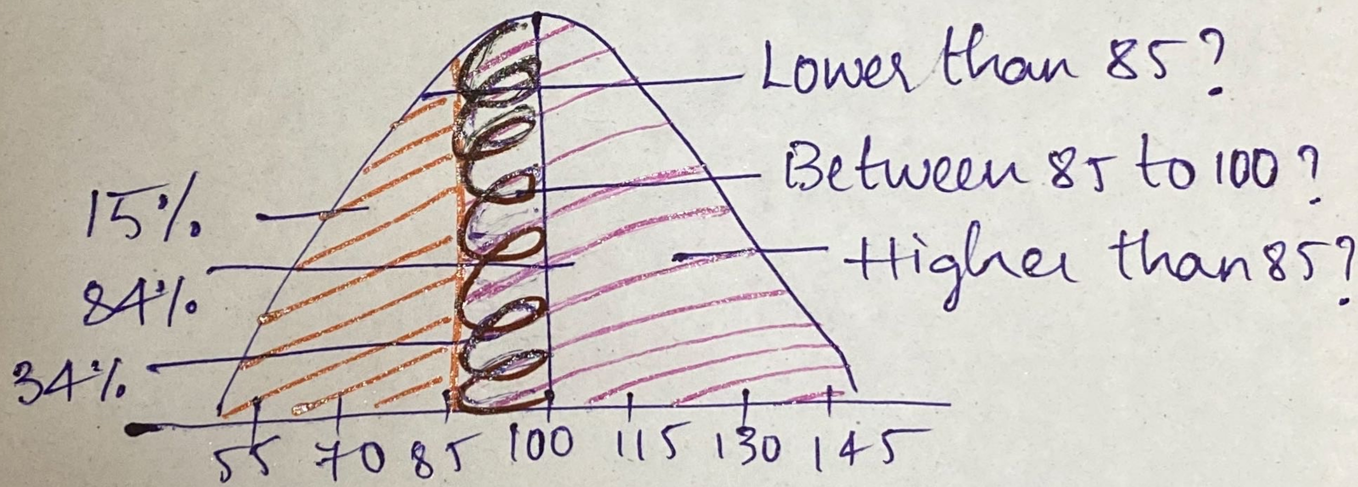
DAY-4

Problem Statement: In india the Average IQ is 100 with σ of 15. What is the percentage of population would you expect to have a IQ of;

i) lower than 85 =

ii) higher than 85 =

iii) Between 85 to 100 =



Solution: $Z\text{-score} = \dfrac{x_i - \mu}{\sigma}$

i) $\dfrac{85-100}{15} = -1$ using Z-table = 15.87

ii) $1 - 0.1587 = 0.8413$

iii) $0.5 - 0.1587 = 03413$

1) Central limit theorm: The central limit theorm states that if you have a population with mean (μ) and standard deviation (σ) and take sufficiently large random samples from the population with replacement, then the distribution of the sample means will be approximately normally distributed.

$\boxed{n \geq 30}$

the more sample data is collected the more accurate result we will have.

n = sample data

m = no. of data.

Wheather the population data is normally distributed, log normal distributed or any other distribution, if we take the sample data (n) which should be $n \geq 30$ will get the mean ($\bar{x}$), if we plot the graph using those values we will be getting normaly Distributed Graph.

2) probability: It is a measure of the likelyhood of an event.

Eg1: Tossing a fair coin.

whenver we toss a coin probability of getting Heads is 0.5 & Tail is also 0.5

$$P(H) = 0.5 \quad , \quad P(T) = 0.5 = (1/2)$$

Eg2: Rolling a dice.

probability of getting 1 is $P(1) = \frac{1}{6}$, 2 is $P(2) = \frac{2}{6}$ --- etc.

1) Mutual Exclusive Event: Two events are mutually exclusive if they cannot occur at the same time.

Eg: Tossing coin, winter-summer

Heads & Tails cannot be occur at same time

Both seasons cannot occur at same time

2) Non-Mutual Exclusive Event: Two events are non-mutual Exclusive if they can occur at the same time.

Eg: picking randomly a card from a desk of cards, two events heart & King canbe selected

Problem for Mutual Exclusive Events:

1) What is the probability of landing a coin on land on heads (or) tails?

⇒ Additional rule for M.E.E.

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

$= \frac{1}{2} + \frac{1}{2} = 1$

2) What is the probability of getting 1 or 6 or 3 while rolling a dice?

$P(1 \text{ or } 6 \text{ or } 3) = P(1) + P(6) + P(3)$

$= \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{1}{2}$

Problem for non-mutual Exclusive Event:

Bag of marbles : 10 Red, 6 Green, 3(R & G)

1) When picking randomly from a bag of marbles what is the probability of choosing a marble that is Red or green?

⇒ Addition rule for N.M.E.E.

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

$= \frac{13}{19} + \frac{9}{19} - \frac{3}{19} = \frac{19}{19} = 1$

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

$$= \frac{13}{19} + \frac{9}{19} - \frac{3}{19} = \frac{19}{9} = 1$$

2) from deck of cards what is the probability of choosing ♡ (or) Queen ?

$P(♡ \text{ or Queen}) = P(♡) + P(\text{Queen}) - P(♡ \text{ and queen})$

$$= \frac{13}{52} + \frac{4}{52} - \frac{1}{52}$$

$$= \frac{16}{52}$$

* Multiplication Rule :

1) Dependent Events : Two events are dependent if they effect one another

Eg: Bag of marbles [4 white, 3 yellow]

$P(W) = \frac{4}{7}$, So the probability of marble white is 4/7, if we pick up one white marble and next if I want to pickup other yellow marble the probability will be as $P(Y) = \frac{3}{6}$.

Now, we can confirm that there is a change in yellow marble with respective to the white marble which is called as <u>conditional probability</u>.

<u>Problem</u>: What is the probability of rolling a "5" and a "3" with a normal 6 sided dice?

<u>Sol</u>: Multiplication rule for Independent Events.

$$P(A \text{ and } B) = P(A) * P(B)$$

$$= \frac{1}{6} \times \frac{1}{6} = \underline{\underline{\frac{1}{36}}}$$

3) <u>Permutation</u>: It is an arrangement of objects in a definite order.

<u>Eg</u>: If a child is asked to pickup 3 chocolate names from {Dairymilk, 5-star, Munch, perk, kitkat, silk}

a child can pickup in $\underline{\underline{6}}$ ways

formula = ~~^nP~~ $_r$

n = Total no of objects

r = no. of selections

$$^nP_r = \frac{n!}{(n-r)}$$

$$^{n}P_r = \frac{n!}{(n-r)!} = \frac{5!}{(5-3)!} \quad (! = \text{factorial})$$

$$= \frac{5 \times 4 \times 3 \times 2!}{2!} = \underline{\underline{60}}$$

<u>Combination</u>: Repeation will not occur.

<u>Eg</u>: {Dairy Milk, Munch, Perk}

{Perk, Munch, Dairy Milk} ✗

only unique combination is possible

$$^{n}C_r = \frac{n!}{r!(n-r)!} = \frac{5!}{3!(2)!} = \frac{5 \times 4^{2} \cancel{\times 3 \times 2 \times 1}}{\cancel{3!} \times 2}$$

$$= \underline{\underline{10}}$$

4) <u>Covariance</u>: It is used to determine the Relation between the movement of two random variables.

$$\text{cov}(x, y) = \frac{\Sigma (x_i - \bar{x}) * (y_i - \bar{y})}{n-1}$$

$$\text{Variance } \sigma^2 = \frac{\Sigma (x_i - \bar{x})}{n-1}$$

$$\sigma^2 = \frac{\Sigma (x_i - \bar{x}) * (x_i - \bar{x})}{n-1} \Rightarrow \text{Cov}(x, x)$$