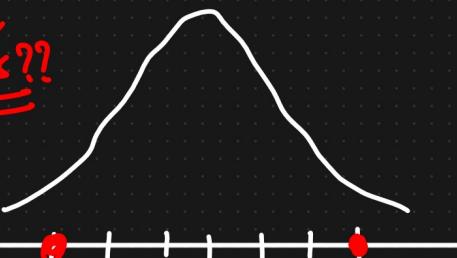


DAY 4 - STATS

- ① IQR - python ✓
- ② Probability ✓
- ③ Permutation And Combination ✓
- ④ Confidence Intervals ✓
- ⑤ P value ✓
- ⑥ Hypothesis Testing ✓

Aftr 3rd Sd outliers??



68
95
99.7%

$$Z\text{Score} = \frac{x_i - \mu}{\sigma}$$

④ Probability : Probability is a measure of the likelihood of an Event

Eg : Roll a dice $\{1, 2, 3, 4, 5, 6\}$

$Pr(\cdot 6) = \frac{\# \text{of way an event can occur}}{\# \text{of possible outcome}}$

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

Toss a coin $\{H, T\}$

$$\boxed{Pr(H) = \frac{1}{2}}$$

② Addition Rule (Probability, "or")

Mutual Exclusive Event

Two Events Are mutual exclusive if they cannot occur at the same time

Eg: Rolling a die $\{1, 2, 3, 4, 5, 6\}$
 $\{1, 2\}$

Tossing a coin $\{\text{H}, \text{T}\}$

Non Mutual Exclusive

Multiple events can occur at the same time

Eg: Deck of cards $\{\text{Q}, \text{K}\}$

① If I Toss a coin, what is the probability of the coin landing on heads or tails?

Ans) Mutual Exclusive Addition Rule

$$\begin{aligned} \Pr(A \text{ or } B) &= \Pr(A) + \Pr(B) \\ &= \frac{1}{2} + \frac{1}{2} \end{aligned}$$

$$\boxed{\Pr(A \text{ or } B) = 1}$$

Roll a die

$$\begin{aligned} \Pr(1 \text{ or } 3 \text{ or } 6) &= \Pr(1) + \Pr(3) + \Pr(6) \\ &= \frac{1}{6} + \frac{1}{6} + \frac{1}{6} \\ &= \frac{3}{6} = \frac{1}{2} = 0.5 \text{ or } 50\% \end{aligned}$$

Non Mutual Exclusive

You are picking a card randomly from a deck.
 What is the probability of choosing a card
 that is Queen or a heart?
 $\rightarrow (52)$

Ans) Non mutual Exclusive

$$P(Q) = \frac{4}{52} \quad P(\text{Heart}) = \frac{13}{52} \quad P(Q \text{ and Heart}) = \frac{1}{52}$$

Addition Rule for non mutual exclusive Events

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

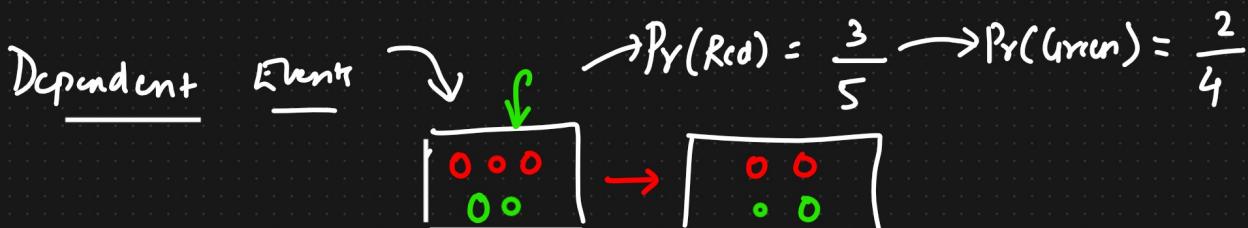
$$\begin{aligned} P(Q \text{ or Heart}) &= P(Q) + P(\text{Heart}) - P(Q \text{ and Heart}) \\ &= \frac{4}{52} + \frac{13}{52} - \frac{1}{52} \\ &= \frac{16}{52} \approx \frac{1}{3} \end{aligned}$$

③ Multiplication Rule

{Independent Events}

Eg: Rolling a dice $\{1, 2, 3, 4, 5, 6\}$

1, 1, 2, Each & Every are independent \rightarrow Red marble •



Naive Bayes {conditional probability}

Independent Events

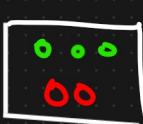
④ What is the probability of rolling a "5" and then a "4" in a dice?

Ans) Independent Event

Multiplication Rule

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

$$P(5 \text{ and } 4) = \frac{1}{6} * \frac{1}{6} = \frac{1}{36}$$



$$\frac{3}{5}$$

$$\frac{2}{4}$$

④ What is the probability of drawing a Queen and then a Ace from a deck of cards?

$$P(Q \text{ and } R) = P(Q) * P(R|Q)$$

Sunt
=

Ans) Dependent

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

conditional

probability

Baych theorem

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

$$= \frac{4}{52} * \frac{4}{51}$$



Permutation and Combination

Permutation (Arranging the objects or numbers in order)

School trip {Chocolate factory} → Dairy, 5 star, Milky bar, Eclairs, Crem,
 Student {Assignment} SITK

Student ↗
 →

$$\underline{6} \times \underline{5} \times \underline{4} = \underline{\underline{120}}$$

⑤

Dairy, Crem, Milky

$$n = 6$$

Milky, Crem, Dairy

$$r = 3$$

Permutation

$$\begin{aligned} n_p &= \frac{n!}{(n-r)!} = \frac{6!}{(6-3)!} \\ &= \frac{6 \times r \times 4 \times 3!}{3!} \\ &= \underline{\underline{120}} \end{aligned}$$

⑥ Combination

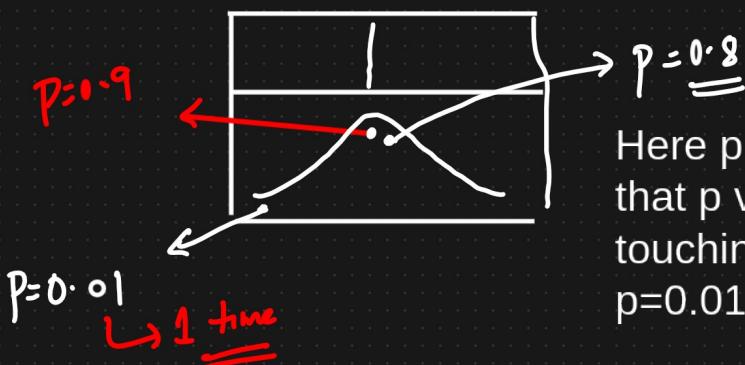
(These are the way of selecting the objects or numbers from a group of objects or collection, in such a way that the order of the objects does not matter)

Dairy Crem Eclair

— — —

$$\begin{aligned} n_c &= \frac{n!}{r!(n-r)!} = \frac{6!}{3!(6-3)!} \\ &= \frac{6^2 \times 5^2 \times 4 \times 3!}{3! \times 2 \times 1 \times 3!} \\ &= \underline{\underline{20}} \end{aligned}$$

① P value { many people get's confused)



Every 100 time I touch the mouse pad 80 times I touch this specific region

Here p value tells what is the probability wrt that p value for that instance. Probability of touching region with $p=0.8$ is 80% and for $p=0.01$ is 1%

Hypothesis testing, Confidence Interval, Significance Value, - - -

Let's say we are solving a problem, for a coin:

Coin \rightarrow Test whether this coin is a fair coin or not by performing

100 tosses

$$\boxed{P(H) = 0.5 \quad P(T) = 0.5}$$

100 (We are performing 100 tosses and we get:)

50 times Head (The coin is fair)

Hypothesis Testing

(In null hypothesis we put default question)

① Null Hypothesis : Coin is fair

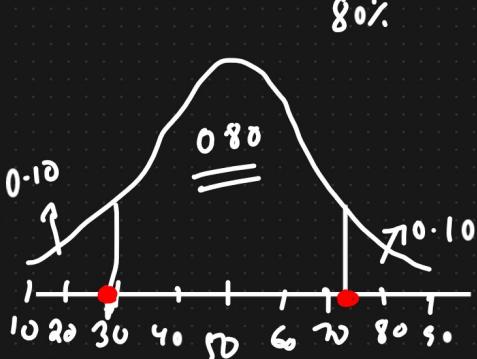
(opposite of null hypothesis is alternate hypothesis)

✓ ② Alternate Hypothesis : Coin is unfair

(Then we perform the experiment)

③ Experiment

④ Reject or Accept the Null Hypothesis



Shady coin $P(H) = 100\%$

Let's say In experiment we got:

30 Times Head

95 heads

100% - 5%

95%

[CI]

Significance value

$\alpha = 0.05$ { Domain Expert }

d = 0.20

d = 0.3

CI = 70%

1

- Our experiment result should be nearer to mean, so how far it can be from mean, here significance value comes

25

- Now this significance value is given by $\alpha = 0.05$ (i.e 5%) This is usually defined by domain expert. Now $100\% - 5\% = 95\%$; this is confidence interval.
- Now you can see in above curve, that 30 lies in 95%, so we can say coin is fair
- If we get 10 heads or 95 heads then it doesn't lie in range, so we can say coin is not fair.