Probability

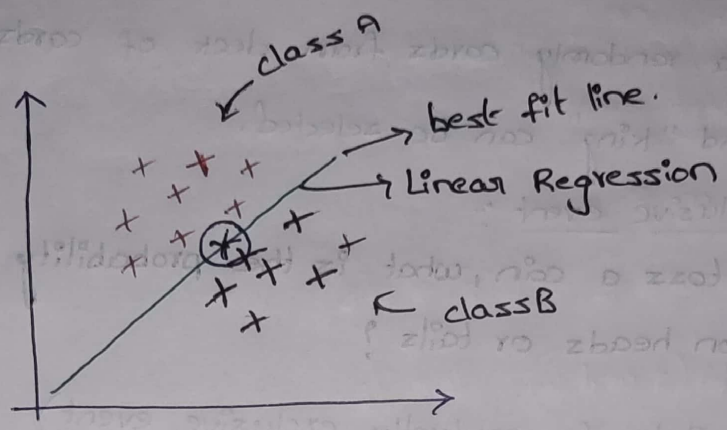


Fig:- Linear Regression

→ Here the point belongs to which class. (class A, class B)
→ In order to tell answer to this Question we will use probability.

probability:- probability is the branch of mathematics which is used to know the likelihood of an event.

Ex:- Roll a die $\{1, 2, 3, 4, 5, 6\}$

$$P(6) = \frac{\text{Number of ways an event can occur}}{\text{Number of possible outcomes.}}$$

Eg:- Toss a coin : {Head, Tail}

$pr(H) = 1/2$

Addition Rule

Mutual exclusive events:- Two events are mutually exclusive if they cannot occur at the same time.

Ex:- Tossing a coin{1,2} Ex2:- Rolling a dice ⇒ $\{1, 2, 3, 4, 5, 6\}$

→ We can't get head and tail at a time.

Non-mutual exclusive:-

→ Two events can occur at the same time

Ex:- picking a randomly cards from deck of cards, two events, "heart" and "king" can be selected.

A) Mutually exclusive event:

Q-1) If I toss a coin, what is the probability of the coin landing on heads or tails?

A) (Addition Rule for mutually exclusive event)

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

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

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

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

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

$$= 1/6 + 1/6 + 1/6$$

$$= 3/6$$

$$= 1/2$$

$$= 0.5$$

B) Non-mutually exclusive event:

Q-1) In a bag of marbles 10 Red, 6 Green, 3 (R & G) are there. When picking randomly from a bag of marbles. what is the probability of choosing a marble that is Red or green.

A) (Addition Rule for Non-mutually exclusive events:

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

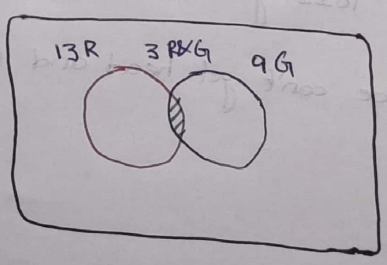
$$P(\text{Red}) = 13/19$$

$$P(\text{Green}) = 9/19$$

$$P(\text{Red \& Green}) = 3/19$$

$$P(\text{Red or Green}) = 13/19 + 9/19 - 3/19$$

$$= 19/19 = 1$$



Q-2) you are picking a card randomly from a deck, what is the probability of choosing a card that is queen or heart?

A) Non-mutual exclusive.

$P(Q) = 4/52$ $P(\heartsuit) = 13/52$ $P(Q \text{ and } \heartsuit) = 1/52$

Addition Rule for non mutual exclusive events.

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

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

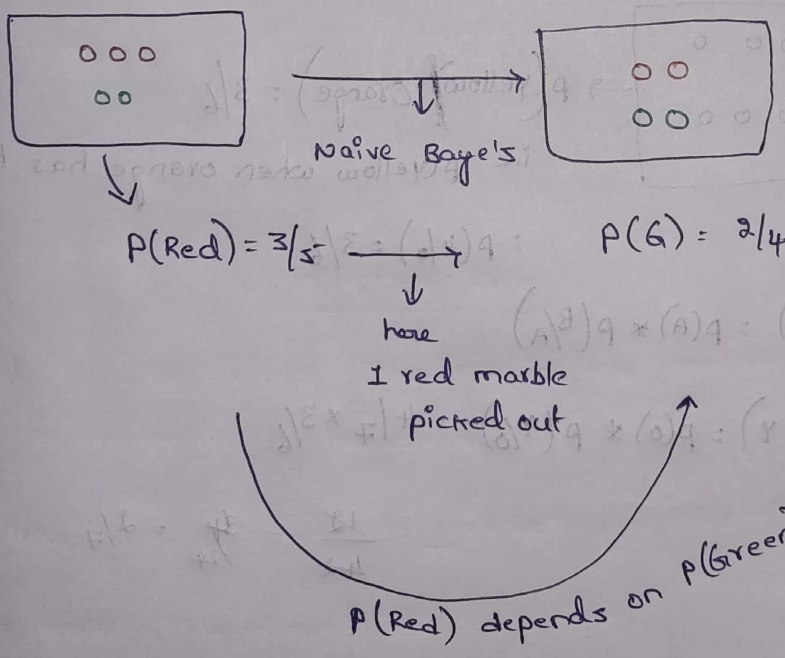
$$= \frac{16}{52} \Rightarrow \frac{4}{13}$$

Multiplication Rule:

Independent events:

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

Dependent event: Two events are dependent if they affect one another.



Q1) What is the probability of rolling a "5" and then a "4" in a dice?

A) Independent event

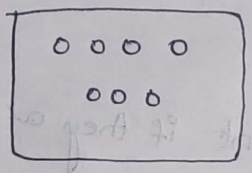
Multiplication Rule

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

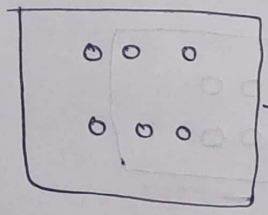
$$pr(5 \text{ and } 4) = 1/6 * 1/6$$

$$= 1/36.$$

Q2) A bag consists of 4 orange and 3 yellow marbles. what is the probability of drawing a "orange" and then a "yellow" marble from the bag:



$\rightarrow P(\text{orange}) = 4/7$



$\rightarrow P(\text{yellow} / \text{orange}) = 3/6$

i.e P(yellow when orange has happend)

$$= P(4/0) = 3/6$$

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

$$P(O \text{ and } Y) = P(O) * P(Y/O) = 4/7 \times 3/6$$

$$= \frac{12}{42} = 3/14 = 2/7$$

Permutation:

→ School trip {Chocolate factory} → Dairy, 5 star, Milky bar, Eclairs, Mango, coconut (Total 6 type of chocolates are there inside the factory)

→ students Assigned with a task to go in to the factory and write the first come first three names of chocolates.

→ * * * * * *

→ 6 * 5 * 4 = 120

Note: with permutations order matters, i.e All possible arrangements will be counted.

permutation = $^{n}P_{r}$

n = total no. of objects

r = No. of selections

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

n = 6 r = 3

$$\Rightarrow \text{permutations} = {}^{6}P_{3} = \frac{6!}{(6-3)!} = \frac{6\times5\times4\times\cancel{3!}}{\cancel{3!}} = 120.$$

Combination ($^{n}C_{r}$):

→ Repeatitions will not occur.

→ unique arrangements are only allowed.

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

∵ For above chocolate example

$$^{6}C_{3} = \frac{6!}{3!\,(6-3)!} = \frac{6\times5\times4\times\cancel{3!}}{3!\times\cancel{3!}} = \frac{6\times5\times4}{\cancel{3}\times\cancel{2}\times1} = 20$$