NAIVE BAYES CLASSIFIER IN MACHINE LEARNING

What is Naive Bayes?

Naive Bayes Classifier works on the principles of **Conditional Probability** as given by **Baye's Theorem.**

It is based on **Supervised Machine Learning.**

It is a **probabilistic classifier**, which means it predicts on the basis of the **probability** of an object.

What is Independent Event?

Rolling a Die

Rolling a Die: {1, 2, 3, 4, 5, 6}

Prob(1): 1/6

Prob(2): 1/6

Prob(3): 1/6

What is Independent Event?

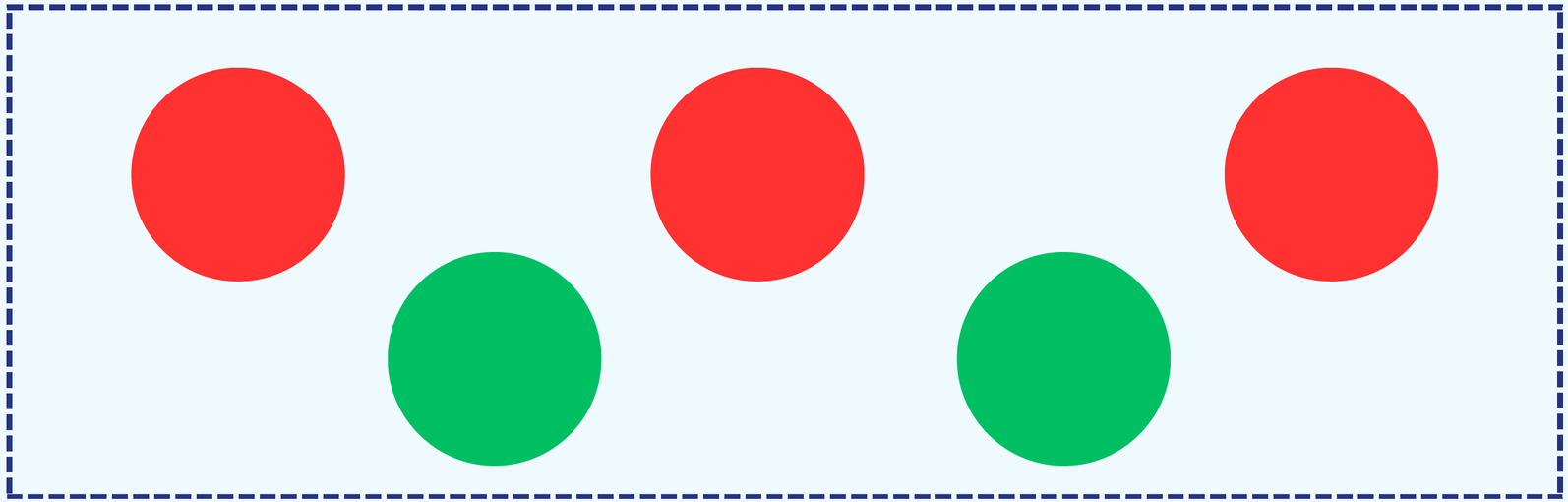
Tossing a coin: {H, T}

Prob(H): 1/2

Prob(T): 1/2

Tossing a coin

What is Dependent Event?

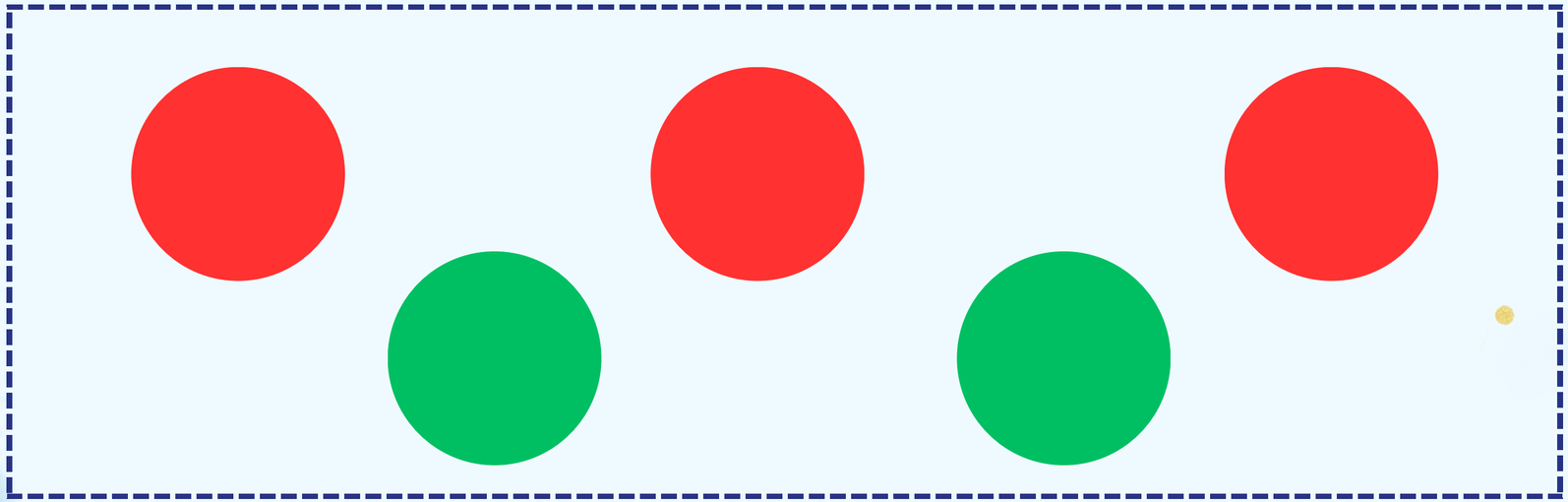


There is a Box. In this Box there are 3 Red Ball and 2 Green Ball.

What is Dependent Event?

Event: We choose a Red Ball.

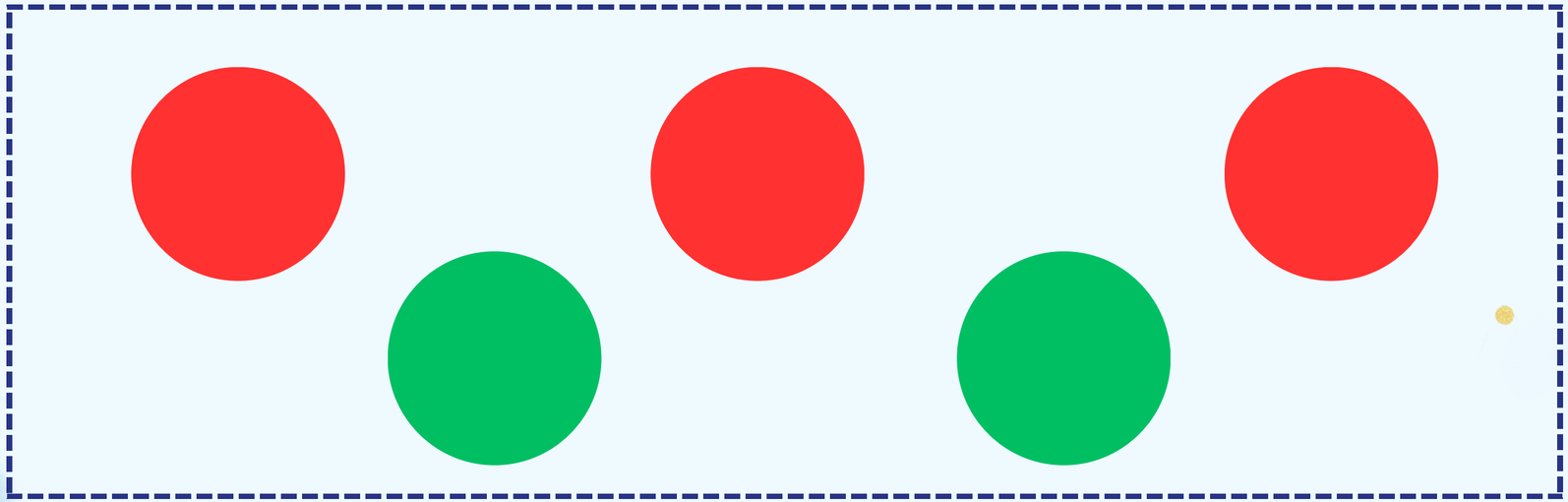
Probability: Prob(Red)=3/5



What is Dependent Event?

Event: Now We choose a Green Ball.

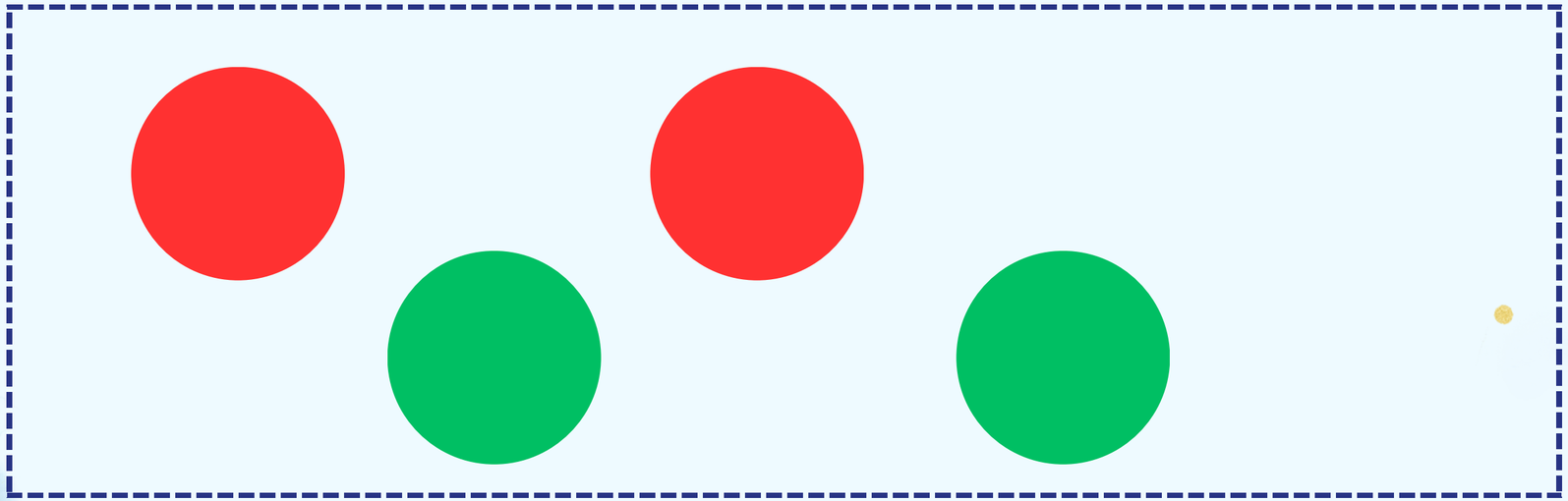
Probability: ????



What is Dependent Event?

Remaining Red Ball: 2

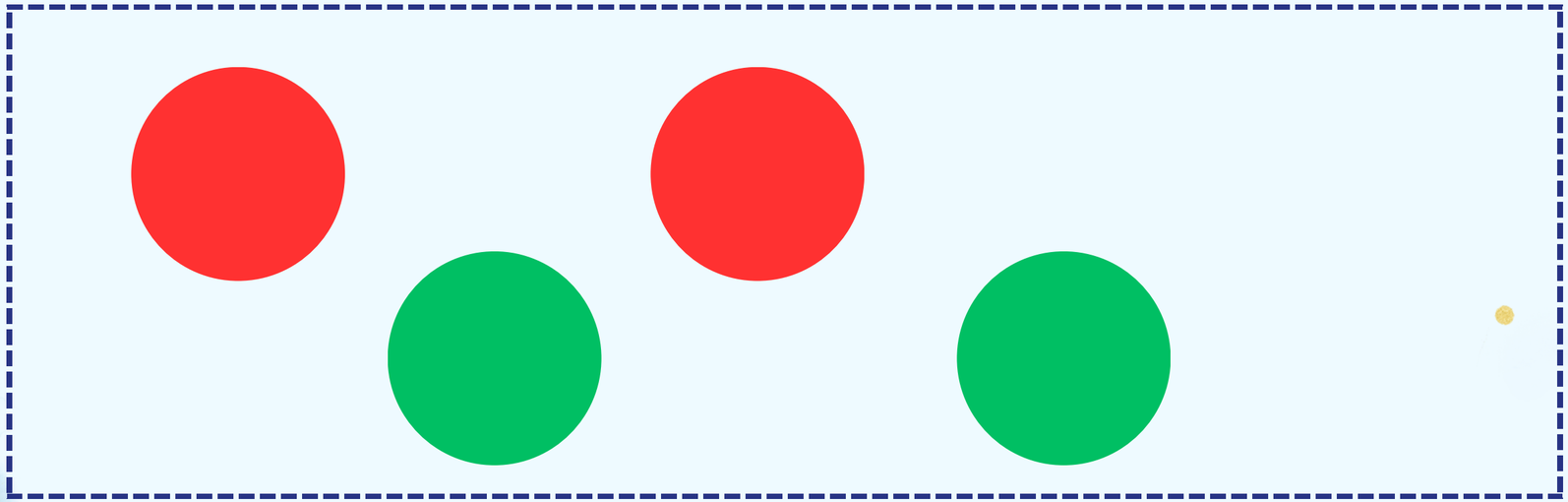
Remaining Green Ball: 2



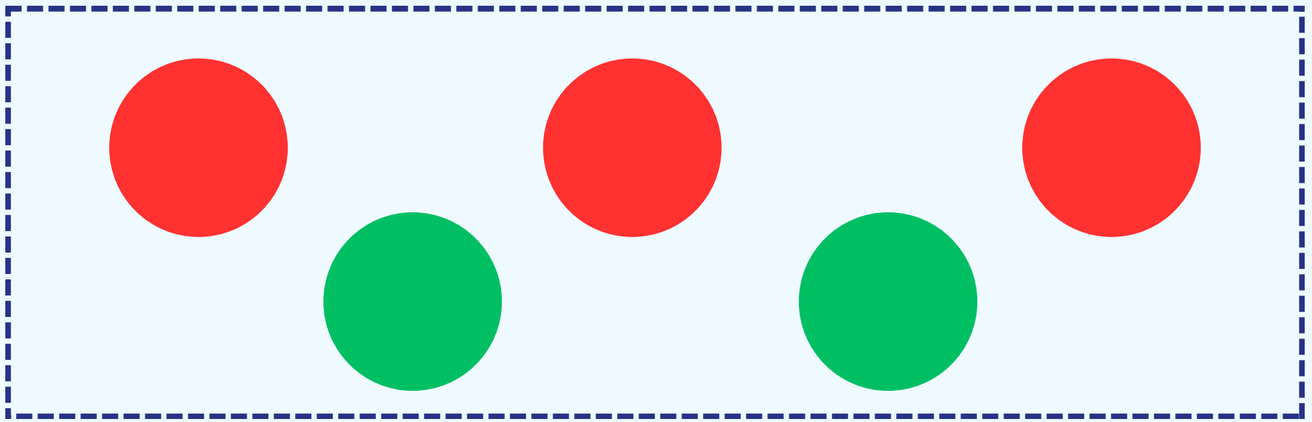
What is Dependent Event?

Event: Now We choose a Green Ball.

Probability: Prob(Green)=2/4



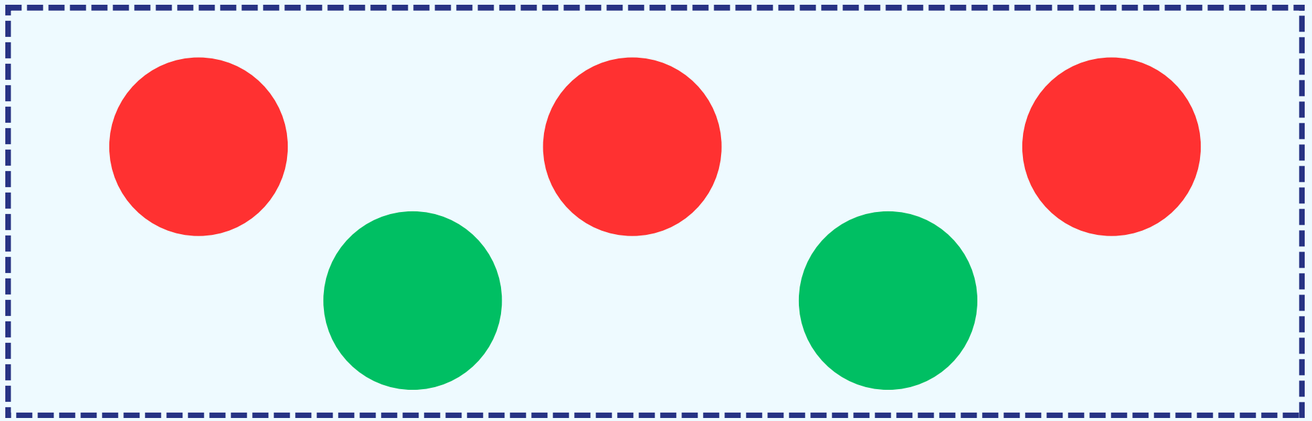
What is Dependent Event?



First we choose a Red Ball and after that a Green Ball.

Prob (R and G): Prob(R) * Prob (G/ R)

What is Dependent Event?



First we choose a Red Ball and after that a Green Ball.

Prob (R and G): Prob(R) * Prob (G/ R)

Conditional Probability

Baye's Theorem

Prob (R and G): Prob(R) * Prob (G/ R)

Prob (A and B): Prob(A) * Prob (B/ A)

Prob (Band A): Prob(B) * Prob (A/ B)

Baye's Theorem

Prob (A and B) = Prob (Band A)

Prob(A) * Prob (B/ A) = Prob(B) * Prob (A/ B)

$$\text{Prob (B/ A)} = \frac{\text{Prob(B) * Prob (A/ B)}}{\text{Prob(A)}}$$

Probability of B when A is given.

Baye's Theorem

x1	x2	x3	y
—	—	—	NO
—	—	—	YES
—	—	—	YES

What will be the Probability of y?

Baye's Theorem

$$\text{Prob}(B/A) = \frac{\text{Prob}(B) * \text{Prob}(A/B)}{\text{Prob}(A)}$$

$$\text{Prob}(\text{Yes}/x1,x2,x3) = \frac{\text{Prob}(\text{Yes}) * \text{Prob}(x1,x2,x3/\text{Yes})}{\text{Prob}(x1,x2,x3)}$$

$$\text{Prob}(\text{No}/x1,x2,x3) = \frac{\text{Prob}(\text{No}) * \text{Prob}(x1,x2,x3/\text{No})}{\text{Prob}(x1,x2,x3)}$$

Baye's Theorem

$$\text{Prob}(\text{Yes}/\ x1,x2,x3) = \frac{\text{Prob}(\text{Yes}) * \text{Prob}(x1,x2,x3/\ \text{Yes})}{\text{Prob}(x1,x2,x3)}$$

Constant

$$\text{Prob}(\text{No}/\ x1,x2,x3) = \frac{\text{Prob}(\text{No}) * \text{Prob}(x1,x2,x3/\ \text{No})}{\text{Prob}(x1,x2,x3)}$$

Constant

Baye's Theorem

$$Prob(Yes/ x1,x2,x3) = Prob(Yes) * Prob(x1,x2,x3/ Yes)$$

$$Prob(Yes/ x1,x2,x3) = Prob(Yes) * Prob(x1/Yes) * Prob(x2/Yes) * Prob(x3/Yes)$$

$$Prob(No/ x1,x2,x3) = Prob(No) * Prob(x1,x2,x3/ No)$$

$$Prob(No/ x1,x2,x3) = Prob(No) * Prob(x1/No) * Prob(x2/No) * Prob(x3/YNo)$$

Naive Baye's Problem -1

Day	Weather	Temperature	Humidity	Wind	Play Football?
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Cloudy	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	Yes
5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Cloudy	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Cloudy	Mild	High	Strong	Yes
13	Cloudy	Hot	Normal	Weak	Yes
14	Rain	Mild	High	Strong	No

If the Weather is Sunny and Wind is Weak then what will happen?

Naive Baye's Problem -1

Day	Weather	Temperature	Humidity	Wind	Play Football?
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Cloudy	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	Yes
5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Cloudy	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Cloudy	Mild	High	Strong	Yes
13	Cloudy	Hot	Normal	Weak	Yes
14	Rain	Mild	High	Strong	No

Prob (Yes/ Sunny,Weak) = ???????????

Prob (No/ Sunny,Weak) = ???????????