1. **What is marginal probability**

It is a probability of one event occurred calculation by ignoring all other variables.





1. **What are the probability axioms?**

It is called rules or principles of probability theory, has three rules





This calculation will used in **Naive Bayes** where naïve mean assumption, so in **Naive Bayes** is a **probabilistic classifier** based on **Bayes' Theorem** that assumes features are independent — it predicts the class with the highest probability.

1. **What is Conditional probability ?**

Conditional probability is the chance of event **A** happening **if** event **B** has already happened — like the chance it’s raining (**A**) given that it’s cloudy (**B**).

**Example**: If 30 out of 50 cloudy days are rainy, then  
**P(Rain | Cloudy) = 30 / 50 = 0.6**.

1. **What is Bayes’ Theorem and when is it used in data science?**

Bayes' Theorem helps us find the probability of a cause given an observed result. For example, if a person tests positive for a disease, Bayes' Theorem helps calculate how likely they truly have it, considering the test’s accuracy and disease rate. It's useful in areas like medical diagnosis, spam detection, and predictive modeling.

 Bayes' Theorem = Formula for conditional probability

 Naive Bayes = A classification model built using Bayes’ Theorem

Naive Bayes is widely used for spam detection, sentiment analysis, and text classification.

1. **Define variance and conditional variance.**

**Variance**: It shows how spread out numbers are from the average — for example, in the numbers [2, 4, 6], the variance is small because they’re close to the mean (4).

**Conditional Variance**: It’s the variance of a variable given some condition — for example, if we know it’s a rainy day, the variance of people carrying umbrellas may be less than on random days.