DSS TUTORIAL

1)What is Probability Addition

**Ans) Probability Addition Rule** is used to find the probability that **at least one** of two events happens.

They are two types :

**A)Mutually Exclusive Events:**Two events are **mutually exclusive** if **they cannot happen at the same time**.

Example: Tossing a coin:Event A: Getting Heads,Event B: Getting Tails  
 A and B cannot both happen in the same toss.

#### 🐍 Java Code:

#### public class Mutually-exclusive {

#### public static void main(String[] args) {

#### double P\_heads = 0.5;

#### double P\_tails = 0.5;

#### double P\_heads\_or\_tails = P\_heads + P\_tails;

#### System.out.println("P(Heads or Tails): " + P\_heads\_or\_tails);

#### }

#### }

### ****B)Non-Mutually Exclusive Events:****Two events are **not mutually exclusive** if **they can happen at the same time**.

Example: Drawing a card from a deck

Event A: Red card,Event B: King  
Some red cards are kings, so A and B can both happen.

#### 🐍 Java Code:

public class Non-Mutually-Exclusive {

public static void main(String[] args) {

double P\_red = 26.0 / 52;

double P\_king = 4.0 / 52;

double P\_red\_and\_king = 2.0 / 52;

double P\_red\_or\_king = P\_red + P\_king - P\_red\_and\_king;

System.out.println("P(Red or King): " + P\_red\_or\_king);

}

}

1. What is Probability of Multiplication:

### Ans)The **Multiplication Rule** helps find the probability that **two events happen together** (i.e., both A and B occur).

1. **For Independent Events:**If two events **do not affect each other**, then:

P(A∩B)=P(A)×P(B)P(A \cap B) = P(A) \times P(B)

#### Example:Tossing a coin (Event A: Heads → 0.5),Rolling a die (Event B: Getting a 4 → 1/6)

#### Both are independent events.So, multiply probabilities of A and B.

#### Java Code:

public class IndependentEvents {

public static void main(String[] args) {

double P\_heads = 0.5;

double P\_four = 1.0 / 6;

double P\_heads\_and\_four = P\_heads \* P\_four;

System.out.println("P(Heads and 4): " + P\_heads\_and\_four);

}

}

2. **For Dependent Events:**If one event **affects the outcome** of the other:

P(A∩B)=P(A)×P(B∣A)P(A \cap B) = P(A) \times P(B|A)

#### Example:Drawing 2 cards from a deck **without replacement**

Event A: 1st card is King (4/52)

Event B: 2nd card is King given 1st is King (3/51)

You multiply the first probability by the second **conditional** one.

#### Java Code:

public class Dependent-events {

public static void main(String[] args) {

double P\_first-king = 4.0 / 52;

double P\_secondKing\_given\_firstKing = 3.0 / 51;

double P\_bothKings = P\_firstKing \* P\_secondKing\_given\_firstKing;

System.out.println("P(Both Kings without replacement): " + P\_bothKings);

}

}

### What is **Bayes’ Theorem**

### Ans)Bayes' Theorem allows us to find the **probability of an event A given event B has occurred**, especially when **direct calculation of conditional probability is hard**.

P(A∣B)=P(B∣A)⋅P(A)P(B)P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}

### **Example:**Let’s say,A person is tested for a disease.

Event A: The person has the disease. P(A)=0.01P(A) = 0.01 (1%)

Event B: The test is **positive**.

If a person **has** the disease, test is positive: P(B∣A)=0.99P(B|A) = 0.99,If a person **does not have** the disease, test is still positive 5% of the time: P(B∣¬A)=0.05P(B|¬A) = 0.05We want to find:What is the probability that a person **actually has the disease**, given that the test is positive? → P(A∣B)P(A|B)

### Java Code:

public class BayesTheorem {

public static void main(String[] args) {

double P\_A = 0.01;

double P\_notA = 1 - P\_A;

double P\_B\_given\_A = 0.99;

double P\_B\_given\_notA = 0.05;

double P\_B = (P\_B\_given\_A \* P\_A) + (P\_B\_given\_notA \* P\_notA);

double P\_A\_given\_B = (P\_B\_given\_A \* P\_A) / P\_B;

System.out.println(P\_A\_given\_B);

}

}

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