

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:
 $P(A \cap B) = P(A) \times P(B)$ $P(A \cap B) = P(A) \times P(B)$

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

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:
 $P(A \cap B) = P(A) \times P(B|A)$ $P(A \cap B) = P(A) \times P(B|A)$

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);
    }
}

```

2) 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.

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Example: Let's say, A person is tested for a disease.

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

Event B: The test is positive.

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

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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