1. Probability Basics

- **Definition**: Probability as a measure of the likelihood of an event occurring.
- **Types of Probability**:
  - **Classical Probability**: Based on equally likely outcomes, using the formula:
    $\mathrm{P}(E) = \frac{\text{Number of favorable outcomes}}{\text{Total number of possible outcomes}}$
  - **Empirical Probability**: Based on observed frequencies.
    $\mathrm{P}(E) = \frac{\text{Number of times event E occurs}}{\text{Total number of observations}}$
  - **Axiomatic Probability**: Based on a set of axioms with fundamental rules like:

$$P(S) = 1, \quad 0 \leq P(E) \leq 1, \quad P(E_1 \cap E_2) = P(E_1) \cdot P(E_2)$$

2. Probability Rules and Concepts

- **Complementary Events**:
  - If A is an event, then the complement of A, denoted A^C, represents all outcomes not in A.
  - **Formula**:

$$P(A^C) = 1 - P(A)$$

- **Union of Events**:
  - The union of two events A and B is the event that either A, B, or both occur.
  - **Formula**:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

- **Independent Events**:
  - Events A and B are independent if the occurrence of one does not affect the occurrence of the other.
  - **Formula**:

$$P(A \cap B) = P(A) \cdot P(B)$$

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

$$P(A \cap B) = 0$$

3. Conditional Probability

- **Definition**: The probability of an event A occurring given that event B has occurred.
- **Formula**:

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

where $P(B) > 0$.

4. Combinations and Permutations

- **Permutations**: When the order matters in selecting items from a set.
  - **Formula**:

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

- **Combinations**: When the order does not matter in selecting items from a set.
  - **Formula**:

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

5. Real-Life Applications of Probability

- **Survey Problems**: Calculating the probability of selecting different types of accounts (loan, savings, current).
- **Dice Rolling**: Analyzing the probability of various sums when two dice are thrown.
- **Committee Selection**: Using combinations to determine the probability of selecting a group with certain gender distributions.

6. Key Formulas for Calculations

- **Complementary Probability**:

$$P(A^C) = 1 - P(A)$$

- **Addition Rule** (for non-mutually exclusive events):

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

- **Multiplication Rule** (for independent events):

$$P(A \cap B) = P(A) \cdot P(B)$$

Notable Example Problems Covered

- **Dice Rolling**: Probabilities of sums greater than 8, less than 6, and neither 7 nor 11.
- **Bank Survey**: Calculating probabilities of different account types, including loan and current accounts.
- **Committee Selection**: Using combinations to determine probabilities of a majority of women being selected for a committee.
- **Survey/Inventory Problems**: Analyzing probabilities based on sample space and given data, such as in Example 8 (about laptops and desktops).

Conclusion

The session covered important foundational concepts in probability, including basic definitions, rules, and methods for calculating various probabilities. Key practical applications and example problems helped reinforce these concepts. Understanding the relationship between complementary events, independent and mutually exclusive events, and conditional probability are essential for further study in statistical methods and data analysis.