كلية العلوم

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Subject: Basic Concepts
Class: 1St
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Lecture: (1)

Introduction

Probability and statistics are essential fields of mathematics that help us understand, analyze, and interpret data. These concepts are widely used in science, engineering, economics, and many other disciplines. This lecture introduces the foundational ideas in probability and statistics.

1. Probability Basics

1.1. Definitions

- **Experiment**: An activity or process that leads to an outcome. Example: Rolling a dice.
- **Sample Space (S)**: The set of all possible outcomes of an experiment. Example: For a dice, .
- **Event**: A subset of the sample space. Example: Rolling an even number ().

1.2. Probability of an Event

The probability of an event is given by:

- Example: Probability of rolling a 4 on a dice: .

1.3. Types of Events

- **Independent Events**: Two events are independent if the occurrence of one does not affect the other.
    - Example: Tossing two coins.
- **Mutually Exclusive Events**: Two events cannot occur simultaneously.
    - Example: Rolling a 3 and a 5 on a single dice roll.

1.4. Rules of Probability

1. **Addition Rule**:
    o   For mutually exclusive events: .
2. **Multiplication Rule**:

2. Statistics Basics

2.1. Types of Data

*   **Qualitative Data**: Non-numerical, categorical data (e.g., colors, types of fruits).
*   **Quantitative Data**: Numerical data (e.g., height, weight).
    o   Discrete: Countable values (e.g., number of students).
    o   Continuous: Measurable values (e.g., temperature).

2.2. Measures of Central Tendency

1. **Mean**: The average value of a dataset.

    where is the data points and is the number of points.

2. **Median**: The middle value when data is arranged in order.
    o   Example: For , the median is 3.
3. **Mode**: The value that appears most frequently.
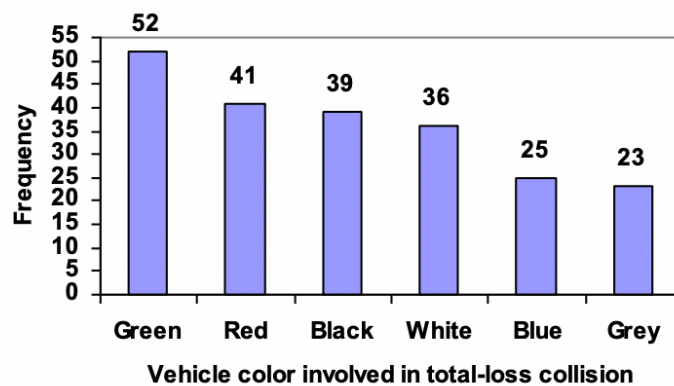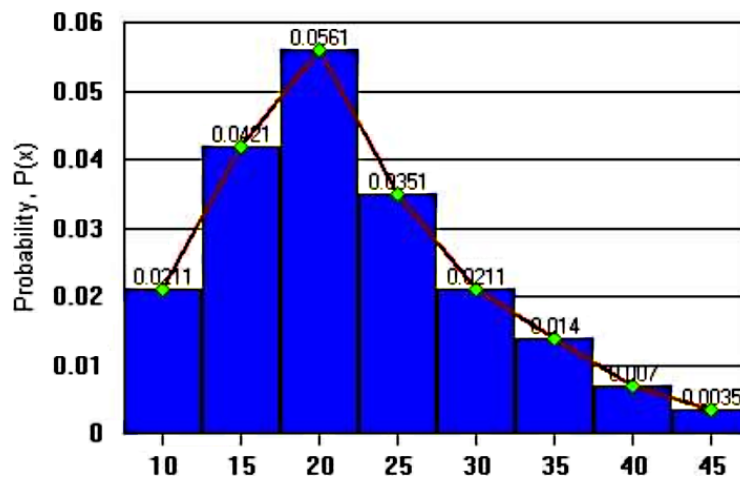   o   Example: For , the mode is 2.

2.3. Measures of Dispersion

1. **Range**: Difference between the maximum and minimum values.
2. **Variance**: Measures the spread of the data.
3. **Standard Deviation (SD)**: The square root of variance.

2.4. Data Representation
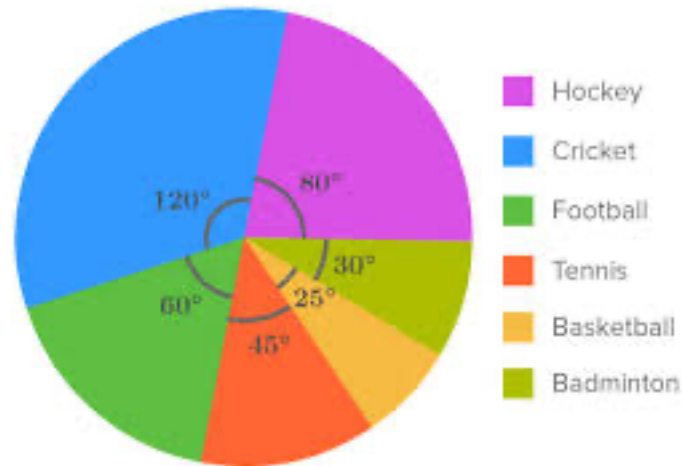
- **Bar Charts**: Used for categorical data.

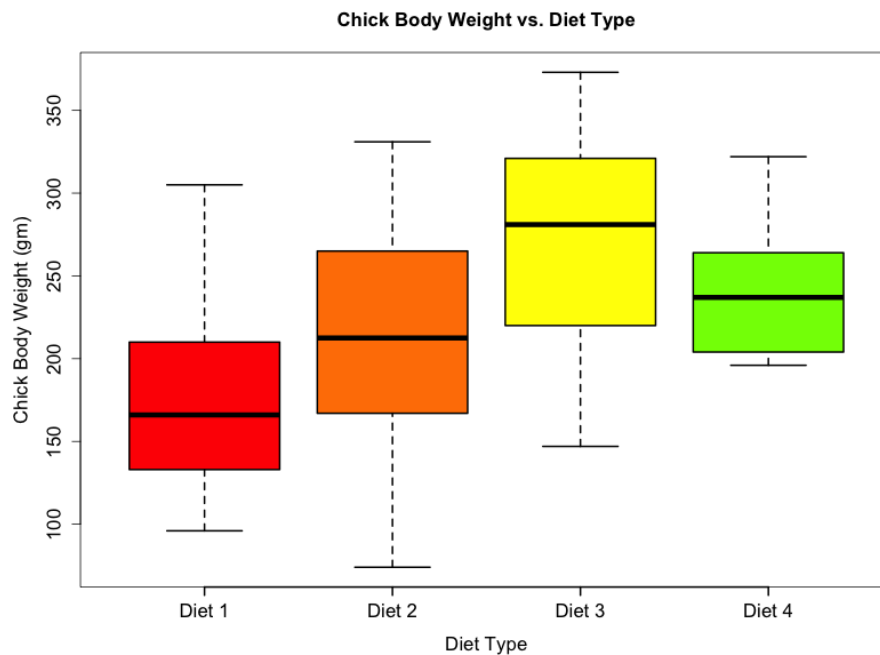- **Histograms**: Show frequency distribution of quantitative data.

- **Pie Charts**: Represent proportions of categories.

- **Box Plots**: Display data spread and identify outliers.

3. Relationship Between Probability and Statistics

- **Probability** helps predict the likelihood of future events based on theoretical models.
- **Statistics** uses data from past events to analyze trends and make conclusions.
  - Example: Using probability to estimate the chance of rain and statistics to analyze past weather patterns.

4. Applications of Probability and Statistics

1. **Medical Field**:
   - Probability: Calculating disease risk.
   - Statistics: Analyzing clinical trial data.
2. **Business**:
   - Probability: Risk assessment.
   - Statistics: Market trend analysis.

3. **Engineering**:
   - Probability: Reliability testing.
   - Statistics: Quality control.
4. **Daily Life**:
   - Probability: Games of chance.
   - Statistics: Analyzing personal expenses.

5. Key Terms to Remember

- Random Variable
- Probability Distribution (e.g., Normal Distribution)

- Outliers
- Hypothesis Testing
- Correlation and Regression

6. Exercises

1. A coin is tossed twice. What is the probability of getting at least one head?
2. Calculate the mean, median, and mode for the dataset .
3. A die is rolled. What is the probability of getting a number greater than 4?
4. Draw a histogram for the following data: .

7. Summary

- Probability provides the mathematical foundation for predicting outcomes.
- Statistics helps analyze data and draw conclusions.
- Together, they form the backbone of decision-making processes in various fields.