**Question 1:** A die is rolled. What is the probability of getting:

(a) An even number

(b) A number greater than 4

**Solution: -** (a) Probability of getting an even number

Even numbers on a die are: 2, 4, 6
Number of favorable outcomes = 3

$$\text{Probability} = \frac{3}{6} = \frac{1}{2}$$

**Answer:** The probability of getting an even number is **1/2**.

(b) Probability of getting a number greater than 4

Numbers greater than 4 are: 5, 6
Number of favorable outcomes = 2

$$\text{Probability} = \frac{2}{6} = \frac{1}{3}$$

**Answer:** The probability of getting a number greater than 4 is **1/3**.

**Question 2:** In a class of 50 students:20 like Mathematics (M) 15 like Science (S) 5 like both subjects

What is the probability that a student chosen at random likes Mathematics or Science?

**Solution: -** In a class of 50 students, 20 like Mathematics (M), 15 like Science (S), and 5 like both subjects

Number of students who like Mathematics or Science is calculated as:

$n(M \cup S) = n(M) + n(S) - n(M \cap S)$
$= 20 + 15 - 5$
$= 30$

Therefore, the probability that a student chosen at random likes Mathematics or Science is:

$$\text{Probability} = \frac{30}{50} = \frac{3}{5}$$

**Answer:** The required probability is **3/5**.

**Question 3:** A bag has 3 red and 2 blue balls. If one ball is drawn randomly and is red, what is the probability that the next ball is also red (without replacement)?

**Solution: -** A bag contains 3 red balls and 2 blue balls.

Since one red ball has already been drawn, the remaining balls in the bag are:

- Red balls = 2
- Blue balls = 2
- Total balls = 4

The probability that the next ball drawn is red is:

$$\text{Probability} = \frac{2}{4} = \frac{1}{2}$$

**Answer:** The probability that the next ball is also red is **1/2**.

**Question 4:** The population of a school is divided into 60% boys and 40% girls. If you want equal representation of both genders in the sample, which method should you use: Simple Random Sampling or Stratified Sampling? Why?

**Solution: -** The population of a school consists of 60% boys and 40% girls.

To get equal representation of both genders in the sample, **Stratified Sampling** should be Used.

**Reason:** In stratified sampling, the population is divided into groups (strata) such as boys and girls, and samples are taken from each group separately. This ensures that both boys and girls are Properly and fairly represented in the sample. Simple random sampling may not guarantee equal representation.

**Answer:** **Stratified Sampling** is the most suitable method because it ensures equal representation of both genders.

**Question 5:** The average height of 1000 students = 160 cm. A sample of 100 students shows an average height = 158 cm. Find the sampling error.

**Solution: -** The average height of 1000 students (population mean) is **160 cm**.

The average height of a sample of 100 students (sample mean) is **158 cm**.

**Sampling Error** is calculated as:

$$\text{Sampling Error} = \text{Sample Mean} - \text{Population Mean}$$
$$= 158 - 160 = -2 \text{ cm}$$

**Answer:** The sampling error is **–2 cm**, which means the sample average is **2 cm less** than the population average.

**Question 6:** The population mean salary is ₹50,000 with σ = ₹5,000. If we take a sample of 100 employees, what is the standard error of the mean (SEM)?

**Solution: -** The population mean salary is ₹50,000 and the population standard deviation (σ) is ₹5,000 The sample size is **n = 100**.

The **Standard Error of the Mean (SEM)** is calculated using the formula:

$$\text{SEM} = \frac{\sigma}{\sqrt{n}}$$
$$= \frac{5000}{\sqrt{100}} = \frac{5000}{10} = 500$$

**Answer:** The standard error of the mean (SEM) is **₹500**.

**Question 7:** In a group of 100 students: 40 like Cricket (C) 30 like Football (F) 10 like both Cricket and Football Find the probability that a student likes at least one sport.

**Solution: -** In a group of 100 students, 40 like Cricket (C), 30 like Football (F), and 10 like both sports.

Number of students who like **at least one sport** is:

$$n(C \cup F) = n(C) + n(F) - n(C \cap F)$$
$$= 40 + 30 - 10 = 60$$

The probability that a student likes at least one sport is:

$$\text{Probability} = \frac{60}{100} = \frac{3}{5}$$

**Answer:** The required probability is **3/5**.

**Question 8:** From a deck of 52 cards, two cards are drawn without replacement. What is the probability that both are Aces?

**Solution: -** A standard deck of cards has **52 cards**, out of which **4 are Aces**.

Probability that the **first card is an Ace**:

$$\frac{4}{52}$$

Since the card is not replaced, remaining cards = **51** and remaining Aces = **3**.

Probability that the **second card is also an Ace**:

$$\frac{3}{51}$$

Therefore, the probability that **both cards are Aces** is:

$$\frac{4}{52} \times \frac{3}{51} = \frac{12}{2652} = \frac{1}{221}$$

**Answer:** The probability that both cards drawn are Aces is **1/221**.

**Question 9:** A factory produces bulbs with 2% defective rate. If 5 bulbs are chosen at random, what is the probability that all are non-defective?

**Solution: -** The defective rate of bulbs is **2%**, so the probability that a bulb is **non-defective** is:

$$1 - 0.02 = 0.98$$

If **5 bulbs** are chosen at random, the probability that **all are non-defective** is:

$$(0.98)^5$$
$$= 0.9039 \text{ (approximately)}$$

**Answer:** The probability that all 5 bulbs are non-defective is **0.9039** (approximately).

Question 10: Differentiate between discrete and continuous random variables with examples.

**Solution: - Difference between Discrete and Continuous Random Variables**

A **random variable** is a variable whose value depends on the outcome of a random experiment.

**Discrete Random Variable**

A discrete random variable can take **countable values** (finite or countably infinite). The values are usually whole numbers.

**Examples:**

- Number of students present in a class
- Number of heads when a coin is tossed 5 times
- Number of defective items in a batch

**Continuous Random Variable**

A continuous random variable can take **any value within a given range**, including fractions and decimals. The values are not countable.

**Examples:**

- Height of students
- Weight of a person
- Time taken to complete an exam

**Conclusion**

Discrete random variables deal with **counting**, while continuous random variables deal with **measurement**.