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

When a fair die is rolled, the possible outcomes are:
{1, 2, 3, 4, 5, 6}

(a) Probability of getting an even number

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

$$P(\text{even number}) = \frac{3}{6} = \frac{1}{2}$$

(b) Probability of getting a number greater than 4

Numbers greater than 4 are: {5, 6}
Number of favorable outcomes = 2
Total possible outcomes = 6

$$P(\text{number greater than 4}) = \frac{2}{6} = \frac{1}{3}$$

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?

Let:

- Total students = 50
- Students who like Mathematics (M) = 20
- Students who like Science (S) = 15
- Students who like both (M ∩ S) = 5

Using the formula: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

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

$$P(M \text{ or } S) = \frac{30}{50} = \frac{3}{5}$$

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)?

A bag has 3 red and 2 blue balls (total = 5).

Since one red ball has already been drawn and not replaced:

- Remaining red balls = 2
- Remaining total balls = 4

Probability that the next ball is red:

$$P(\text{next ball is red}) = \frac{2}{4} = \frac{1}{2}$$

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?

Use stratified sampling.

Why:
The school has two groups—boys and girls. If you want both groups to be equally represented, you should first separate students into boys and girls, and then select the same number from each group.

Simple random sampling might pick more boys than girls (or vice versa), so it does not guarantee equal representation.

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.

Given:

- Population mean height = **160 cm**
- Sample mean height = **158 cm**

Sampling Error Formula:

$$\text{Sampling Error} = \text{Population Mean} - \text{Sample Mean}$$

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

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)?

Given:

- Population standard deviation (σ) = ₹5,000
- Sample size (n) = 100

Formula used:

$$\text{SEM} = \frac{\sigma}{\sqrt{n}}$$

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

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.

Given:

- Total students = 100
- Like Cricket (C) = 40
- Like Football (F) = 30
- Like both (C ∩ F) = 10

Step 1: Students who like at least one sport

(Using the Addition Law of Probability)

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

Step 2: Find the probability

$$P(\text{at least one sport}) = \frac{60}{100} = \frac{3}{5}$$

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

A standard deck has 52 cards, out of which 4 are Aces.

Since the cards are drawn without replacement:

Step 1: Probability that the first card is an Ace

$$P(\text{first Ace}) = \frac{4}{52}$$

Step 2: Probability that the second card is an Ace

(After one Ace is already drawn)

- Remaining Aces = 3
- Remaining cards = 51

$$P(\text{second Ace}) = \frac{3}{51}$$

Step 3: Multiply the probabilities

$$P(\text{both Aces}) = \frac{4}{52} \times \frac{3}{51}$$
$$= \frac{12}{2652} = \frac{1}{221}$$

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?

Given:

- Defective rate = 2%
- So, Non-defective rate = 98% = 0.98
- Number of bulbs chosen = 5

Probability that all 5 bulbs are non-defective:

$$P = (0.98)^5$$

$$(0.98)^5 \approx 0.9039$$

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

Discrete Random Variable	**Continuous Random Variable**
Takes **countable values** (finite or countably infinite)	Takes **uncountable values** (can take any value in a range)
Values are usually **whole numbers**	Values can be **fractions or decimals**
Obtained by **counting**	Obtained by **measuring**
Probability is assigned to **specific values**	Probability is assigned to an **interval of values**
Represented using a **probability mass function (PMF)**	Represented using a **probability density function (PDF)**