

## **PROBABILITY ASSIGNMENT**

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

- (a) An even number (b) A number greater than 4

Ans : A **fair die** has 6 equally likely outcomes:

(1,2,3,4,5,6)

- (a) Even numbers on a die are:

(2,4,6)

- Favorable outcomes = 3
- Total outcomes = 6

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

(B) Numbers greater than 4 are :

{5,6}

Favourable outcomes = 2

Total outcomes = 6

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

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?

Ans : Given :

Total students = **50**

Like Mathematics,  $n(M) = 20$

Like Science,  $n(S) = 15$

Like both,  $n(M \cap S) = 5$

Now, we'll find, who like mathematics or science,

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

Now,  $P(M \text{ or } S) = n(M \cup S) / \text{Total students} = 30/50 = 3/5 \text{ or } 0.6$

So, finally, the probability that a student chosen at random likes mathematics or science is  $3/5$  or  $0.6$ .

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)?

Ans :

Red ball = 3

Blue ball = 2

One red ball withdrawn, the left red ball = 2

So, favourable outcomes = 2

Total balls left = 4

So the  $P(\text{probability that the next ball is red}) = 2/4 = 1/2$ .

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?

Ans : First of all, let us know that what simple random sampling and stratified sampling :

- **Simple Random Sampling** : everyone has an equal chance, but we cannot control how many boys or girls get selected.
- **Stratified Sampling** → the population is divided into groups (strata) like boys and girls, and you choose from each group deliberately.  
Cause we want to do equal representation, that's why we would use stratified sampling technique.

Ans :

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

$$\text{Sampling error} = \text{population mean} - \text{sample mean}$$

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

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

**Answer:**

Standard Error of the Mean (SEM) is calculated as:

$$\text{SEM}(\text{standard error of mean}) = \frac{\sigma}{\sqrt{n}} = \frac{5000}{\sqrt{100}} = \frac{5000}{10} = ₹500$$

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.

Total students = 100

Like Cricket (C) = 40

Like Football (F) = 30

Like both Cricket and Football = 10

To find the number of students who like **at least one sport**, use the **inclusion-exclusion principle**:

$$n(C \cup F) = n(C) + n(F) - n(C \cap F)$$

Substitute the values:

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

So, **60 students like at least one sport.**

Now probability that a student likes at least one sport:

$$P(\text{at least one sport}) = \frac{60}{100} = \boxed{0.60}$$

(So, the probability is 0.60 or 60%).)

Question 8: From a deck of 52 cards, two cards are drawn without replacement.

What is the probability that both are Aces?

**Total cards in a deck: 52**

**Number of Aces: 4**

**Two cards drawn without replacement**

**Step 1: Probability of first Ace**

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

**Step 2: Probability of second Ace (after one Ace is drawn)**

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

**Step 3: Probability both are Aces** (multiply probabilities for successive events without replacement):

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

So, the final answer is  $\frac{1}{221}$

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?

Ans : **Given:**

- Defective rate = 2% → Probability a bulb is defective = 0.02
- Probability a bulb is **non-defective** =  $1 - 0.02 = 0.98$
- Number of bulbs chosen = 5
- Event: **all 5 bulbs are non-defective**

### **Step 1: Probability of each bulb being non-defective**

Since the bulbs are chosen independently:

$$P(\text{all 5 non-defective}) = 0.98 \times 0.98 \times 0.98 \times 0.98 \times 0.98$$

### **Step 2: Using exponent notation**

$$P(\text{all 5 non-defective}) = (0.98)^5$$

### **Step 3: Calculate**

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

So, final answer is 0.904 (approximately)

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

Ans :

- **Discrete random variable:** takes **countable values** (like 0, 1, 2...).  
*Example:* Number of students in a class.
- **Continuous random variable:** takes **any value in a range** (can have decimals).  
*Example:* Height of students.

Thank You !