

Probability JEE Main Previous Year Questions with Solutions are available for students who are looking to solve questions from the Chapter - Probability. In this article, the engineering aspirants will get access to the previous year's questions on Probability including important concepts like Conditional Probability, Independent Events, the Theorem of Total Probability, Bayes' Theorem, Bernoulli Trials for JEE Main and Advanced exams.

**Question 1:** A doctor is called to see a sick child. The doctor knows (prior to the visit) that 90% of the sick children in that neighbourhood are sick with the flu, denoted by F, while 10% are sick with the measles, denoted by M. A well-known symptom of measles is a rash, denoted by R. The probability of having a rash for a child sick with the measles is 0.95. However, occasionally children with the flu also develop a rash, with conditional probability 0.08. Upon examination the child, the doctor finds a rash. Then what is the probability that the child has the measles?

**Solution:**

A: Doctor finds a rash

B1 : Child has measles

S: Sick children

$$P(S / F) = 0.9$$

$$B2 : \text{Child has flu} \Rightarrow P(B2) = 9 / 10$$

$$P(S / M) = 0.10$$

$$P(A / B1) = 0.95$$

$$P(R / M) = 0.95$$

$$P(A / B2) = 0.08$$

$$P(R / F) = 0.08$$

$$\begin{aligned} P(B1 / A) &= \frac{0.1 \times 0.95}{0.1 \times 0.95 + 0.9 \times 0.08} \\ &= [0.095] / [0.095 + 0.072] \\ &= 0.095 / 0.167 \\ &= 95 / 167 \end{aligned}$$

**Question 2:** If any four numbers are selected and they are multiplied, then the probability that the last digit will be 1, 3, 5 or 7 is \_\_\_\_\_.

**Solution:**

The total number of digits in any number at the units place is 10.

Therefore,  $n(S) = 10$

If the last digit is 1, 3, 5 or 7, then it is necessary that the last digit in each number must be 1, 3, 5 or 7.

Therefore,  $n(A) = 4$

$P(A) = 4 / 10 = 2 / 5$

Hence, the required probability is  $(2 / 5)^4 = 16 / 625$ .

**Question 3:** Forty teams play a tournament. Each team plays with every other team just once. Each game results in a win for one team. If each team has a 50% chance of winning each game, the probability that at the end of the tournament, every team has won a different number of games is \_\_\_\_\_.

**Solution:**

Team totals must be 0, 1, 2, 39.

Let the teams be  $T_1, T_2, \dots, T_{40}$ , so that  $T_i$  loses to  $T_j$  for  $i < j$ . In other words, this order uniquely determines the result of every game. There are  $40!$  such orders and 780 games, so  $2^{780}$  possible outcomes for the games.

Hence, the probability is  $40! / 2^{780}$ .

**Question 4:** If  $a$  is an integer lying in  $[-5, 30]$ , then the probability that the graph  $y = x^2 + 2(a + 4)x - 5a + 64$  is strictly above the  $x$ -axis is \_\_\_\_\_.

**Solution:**

$$x^2 + 2(a + 4)x - 5a + 64 \geq 0$$

If  $D \leq 0$ , then  $(a + 4)^2 - (-5a + 64) < 0$  Or

$$a^2 + 13a - 48 < 0 \text{ Or}$$

$$(a + 16)(a - 3) < 0$$

$$\Rightarrow -16 < a < 3 \Leftrightarrow -5 \leq a \leq 2$$

Then, the favourable cases are equal to the number of integers in the interval  $[-5, 2]$ , i.e., 8.

The total number of cases is equal to the number of integers in the interval  $[-5, 30]$ , i.e., 36.

Hence, the required probability is  $8 / 36 = 2 / 9$ .

**Question 5:** In a box of 10 electric bulbs, two are defective. Two bulbs are selected at random one after the other from the box. The first bulb after selection is being put back in the box before making the second selection. The probability that both the bulbs are without defect is \_\_\_\_\_.

**Solution:**

$$\text{Here } P(\text{without defect}) = 8 / 10 = 4 / 5 = p$$

$$P(\text{defected}) = 2 / 10 = 1 / 5 = q \text{ and } n = 2, r = 2$$

$$\text{Hence required probability} = {}^n C_r * p^r * q^{n-r}$$

$$= {}^2 C_2 * (4/5)^2 * (1/5)^0$$

$$= 16 / 25$$

**Question 6:** A bag contains 2 white and 4 black balls. A ball is drawn 5 times with replacement. The probability that at least 4 of the balls drawn are white is \_\_\_\_\_.

**Solution:**

$$\text{Probability for white ball} = 2 / 6 = 1 / 3$$

$$\text{Probability for black ball} = 4 / 6 = 2 / 3$$

$$\text{Required probability} = {}^5 C_5 * (1 / 3)^5 * (2 / 3)^0 + {}^5 C_4 * (1 / 3)^4 * (2 / 3)$$

$$= (1 / 3)^4 [(1 / 3) + 5 * (2 / 3)]$$

$$= 11 / 3^5$$

$$= 11 / 243.$$

**Question 7:** One coin is thrown 100 times. What is the probability of getting a tail as an odd number?

**Solution:**

$$\text{Let } p = \text{Probability of getting tail} = 1 / 2$$

$q = \text{Probability of getting head} = 1 / 2$

Also,  $p + q = 1$  and  $n = 100$

Required probability =  $P(X = 1) + P(X = 3) + \dots + P(X = 99)$

$$= {}^{100}C_1 * p * q^{99} + {}^{100}C_3 * p^3 * q^{97} + \dots + {}^{100}C_{99} * p^{99} * q^1$$

$$= [(p + q)^{100} - (p - q)^{100}] / [2]$$

$$= 1 / 2.$$

**Question 8:** In a bag, there are three tickets numbered 1, 2, 3. A ticket is drawn at random and put back and this is done four times. The probability that the sum of the numbers is even, is \_\_\_.

**Solution:**

The total number of ways of selecting 4 tickets =  $3^4 = 81$ .

The favourable number of ways = sum of coefficients of  $x^2, x^4, \dots$  in  $(x + x^2 + x^3)^4$

= sum of coefficients of  $x^2, x^4, \dots$  in  $x^4(1 + x + x^2)^4$ .

$$\text{Let } (1 + x + x^2)^4 = 1 + a_1x + a_2x^2 + \dots + a_8x^8.$$

$$\text{Then } 3^4 = 1 + a_1 + a_2 + \dots + a_8,$$

On putting  $x = 1$

$$1 = 1 + a_1 + a_2 + \dots + a_8,$$

On putting  $x = -1$

$$3^4 + 1 = 2 [1 + a_1 + a_2 + a_4 + a_6 + a_8]$$

$$\Rightarrow a_2 + a_4 + a_6 + a_8 = 41$$

Thus sum of the coefficients of  $x^2, x^4, \dots = 41$

Hence the required probability =  $41 / 81$ .

**Question 9:** For a biased die, the probabilities for different faces to turn up are

<b>Face</b>	1	2	3	4	5	6
<b>Probability</b>	0.2	0.22	0.11	0.25	0.05	0.17

The die is tossed and you are told that either face 4 or face 5 has turned up. The probability that it faces 4 is \_\_\_\_\_.

**Solution:**

Let A be the event that faces 4 turns up and B be the event that faces 5 turns up then

$$P(A) = 0.25, P(B) = 0.05.$$

Since A and B are mutually exclusive, so  $P(A \cup B) = P(A) + P(B) = 0.25 + 0.05 = 0.30$ .

We have to find  $P(A / A \cup B)$ , which is equal to

$$P[A \cap (A \cup B)] / P(A \cup B) = P(A) / P(A \cup B) = 0.25 / 0.30 = 5 / 6.$$

**Question 10:** Three ships A, B and C sail from England to India. If the ratio of their arriving safely are 2:5, 3:7 and 6:11 respectively then the probability of all the ships arriving safely is \_\_\_\_\_.

**Solution:**

We have the ratio of the ships A, B and C for arriving safely to be 2:5, 3:7 and 6:11 respectively.

The probability of ship A for arriving safely =  $2 / [2 + 5] = 2 / 7$

Similarly, for B =  $3 / [3 + 7] = 3 / 10$  and for C =  $6 / [6 + 11] = 6 / 17$

Probability of all the ships for arriving safely =  $2 / 7 \times 3 / 10 \times 6 / 17 = 18 / 595$ .

**Question 11:** If the probability of X to fail in the examination is 0.3 and that for Y is 0.2, then the probability that either X or Y failing in the examination is \_\_\_\_\_.

**Solution:**

Here  $P(X) = 0.3$ ;  $P(Y) = 0.2$

Now  $P(X \cup Y) = P(X) + P(Y) - P(X \cap Y)$

Since these are independent events, so  $P(X \cap Y) = P(X) * P(Y)$

Thus required probability =  $0.3 + 0.2 - 0.06 = 0.44$

**Question 12:** The probabilities that A and B will die within a year are p and q respectively, then the probability that only one of them will be alive at the end of the year is \_\_\_\_\_.

**Solution:**

Required probability is  $P[(A \text{ will die and } B \text{ alive}) \text{ or } (B \text{ will die and } A \text{ alive})]$

$$= P[(A \cap B') \cup (B \cap A')]$$

Since events are independent, so

$$\text{Required probability} = P(A) * P(B') + P(B) * P(A')$$

$$= p * (1 - q) + q * (1 - p)$$

$$= p + q - 2pq$$

**Question 13:** If A and B are two independent events such that  $P(A \cap B') = 3 / 25$  and  $P(A' \cap B) = 8 / 25$ , then  $P(A) =$  \_\_\_\_\_.

**Solution:**

Since events are independent.

$$\text{So, } P(A \cap B') = P(A) \times P(B') = 3 / 25$$

$$\Rightarrow P(A) \times \{1 - 2 P(B)\} = 3 / 25 \quad \dots(i)$$

$$\text{Similarly, } P(B) \times \{1 - P(A)\} = 8 / 25 \quad \dots(ii)$$

On solving (i) and (ii), we get

$$P(A) = 1/5 \text{ and } 3/5$$

**Question 14:** The probability that a man will be alive in 20 years is  $3 / 5$  and the probability that his wife will be alive in 20 years is  $2 / 3$ . Then what is the probability that at least one will be alive in 20 years?

**Solution:**

Let A be the event that the husband will be alive in 20 years and B be the event that the wife will be alive in 20 years. Clearly A and B are independent events.

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

$$\text{Given } P(A) = 3 / 5, P(B) = 2 / 3$$

The probability that at least of them will be alive in 20 years is

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

$$= 3 / 5 + 2 / 3 - [3 / 5] * [2 / 3]$$

$$= [9 + 10 - 6] / [15]$$

$$= 13 / 15$$

**Question 15:** One card is drawn randomly from a pack of 52 cards, then what is the probability that it is a king or spade?

**Solution:**

$$\text{Probability of king } P(A) = 4/52 = 1/13$$

$$\text{Probability of spade} = 13/52 = 1/4$$

$$P(\text{King or spade}) = P(\text{king}) + P(\text{spade}) - P(\text{King and spade})$$

$$= 1/13 + 1/4 - 1/52$$

$$= 16/52$$

$$= 4/13$$