CBSE 2025-26

Class 12 - Mathematics

Probability

Important Question

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1. The probability of choosing an integer k, randomly from the integers 1, 2, 3, ..., 2n is proportional to log k. The conditional probability of choosing integer 2, given that an even integer is chosen, is:
   a. $\frac{1}{\log(n!)}$
   b. $\frac{\log n}{n\log 2+\log(n!)}$
   c. $\frac{\log 2}{n\log 2+\log(n!)}$
   d. $\frac{\log 2}{\log 2+\log(n!)}$
2. If E and F are events with $P(E) \leq P(F)$ and $P(E\cap F) > 0$, then which one is not correct?
   a. occurrence of E $\Rightarrow$ occurrence of F
   b. non-occurrence of E $\Rightarrow$ non-occurrence of F
   c. None of these
   d. occurrence of F $\Rightarrow$ occurrence of E
3. Let A and B be independent events with P(A) = 0.3 and P(B) = 0.4. Find P(A ∪ B).
   a. 0.62
   b. 0.58
   c. 0.51
   d. 0.55

4. If P(A) = 0.4, P(B) = 0.8 and P(B | A) = 0.6, then P(A ∪ B) is equal to
   a. 0.48
   b. 0.96
   c. 0.3
   d. 0.24
5. State True or False:
   i. If two events are independent, then the sum of their probabilities must be equal to 1.
   ii. If A and B are two independent events then P(A and B) = P(A).P(B).
6. Fill in the blanks:
   a. If A and B be two events and P(A | B) = P (A), then A is ________ of B.
   b. If the events A and B are independent, then P(A ∩ B) is equal to ________.
7. A bag contains 3 red and 2 black balls. One ball is drawn from it at random. Its colour is noted and then it is put back in the bag. A second draw is made and the same procedure is repeated. Find the probability of drawing two red balls.
8. Three cards are drawn with replacement from a well-shuffled pack of 52 cards. Find the probability that the cards are drawn are king, queen and jack.
9. If P(A) = $\frac{6}{11}$, P(B) = $\frac{5}{11}$ and $\mathrm{P(A\cup B)} = \frac{7}{11}$, find $\mathrm{P(A\cap B)}$
10. Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that:
    i. the problem is solved.
    ii. exactly one of them solves the problem.
11. In a class, 40% students study mathematics; 25% study biology and 15% study both mathematics and biology. One student is selected at random. Find the probability that he studies mathematics if it is known that he studies biology.

12. A black and a red die are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5.
13. There are three identical boxes I, II and III, each containing two coins. In box I, both coins are gold coins, in box II, both are silver coins and in box III, there is one gold and one silver coin. A person chooses a box at random and take out a coin. If the coin is of gold, then what is the probability that the other coin in box is also of gold?
14. A pharmaceutical company wants to advertise a new product on T.V., where the product is specially designed for women. For that an advertising executive is hired to study television-viewing habits of married couples during prime time hours. Based on past viewing records he has determined that during prime time husbands are watching television 70% of the time. It has also been determined that when the husband is watching television, 30% of the time the wife is also watching. When the husband is not watching television, 40% of the time the wife is watching television.

Based on the above information, answer the following questions:

i. The probability that the husband is not watching television during prime time, is
   a. 0.6
   b. 0.3
   c. 0.4
   d. 0.5

ii. If the wife is watching television, the probability that the husband is also watching television is:
   a. $\frac{2}{11}$
   b. $\frac{7}{11}$
   c. $\frac{5}{11}$
   d. $\frac{8}{11}$

iii. The probability that both husband and wife are watching television during prime time is:
   a. 0.21
   b. 0.5
   c. 0.3
   d. 0.4

iv. The probability that the wife is watching television during prime time is:
   a. 0.24
   b. 0.33
   c. 0.3
   d. 0.4

v. If the wife is watching television, then the probability that the husband is not watching television is
   a. $\frac{2}{11}$
   b. $\frac{4}{11}$
   c. $\frac{1}{11}$
   d. $\frac{5}{11}$

Solution

1. (c) $\frac{\log 2}{n\log 2+\log(n!)}$

Explanation: Let E_i be the event when integer 2i is chosen, where i = 1, 2, 3, ..., n

Let A be the event that an even number is chosen. Then,

A = $E_1 \cup E_2 \cup E_3 \cup \ldots \cup E_n$

All E_I's are mutually exclusive

$\Rightarrow$ P(A) = P(E_1) + P(E_2) + ... + P(E_n)

(Given P (E_I) = c log 2i)

$\Rightarrow$ P(A) = c log 2 + c log 4 + c log 6 + ... + c log 2n

= c log (2.4.6 ... 2n)

= c log (2^n. 1 .2 .3 ... n)

= c(n log 2 + log n!)

Let B be the event that integer 2 is chosen.

P(B|A) = $\frac{P(A\cap B)}{P(A)} = \frac{P(E_1)}{P(A)}$

= $\frac{c\log 2}{c(n\log 2+\log n!)} = \frac{\log 2}{n\log 2+\log(n!)}$

2. (b) non-occurrence of E $\Rightarrow$ non-occurrence of F

Explanation: It is given that, $P(E) \leq P(F) \Rightarrow E \subseteq F$ ...(i)

and $P(E \cap F) > 0 \Rightarrow E \subset F$ ...(ii)

(a) occurrence of E $\Rightarrow$occurrence of F [from Eq. (i)]

(b) occurrence of F $\Rightarrow$occurrence of E [from Eq. (ii)]

(c) non-occurrence of E $\Rightarrow$occurrence of F

Hence, option (c) is not correct. [from Eq. (i)]

3. (b) 0.58

Explanation: Let A and B be independent events with P (A) = 0.3 and P(B) = 0.4

Since the events are independent, P(A ∩ B) = P(A)·P(B)

Therefore P(A ∪ B) = P(A) + P(B) = 0.3 + 0.4 - 0.12 = 0.58

4. (b) 0.96

Explanation: Here, $P(A) = 0.4, P(B) = 0.8$ and $P(B|A) = 0.6$

$\because P(B/A) = \frac{P(B\cap A)}{P(A)}$

$\Rightarrow P(B\cap A) = P(B/A)\cdot P(A)$

= 0.6 $\times$ 0.4 = 0.24

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

= 0.4 + 0.8 - 0.24

= 1.2 - 0.24 = 0.96

5. State True or False:

i. (b) False

   Explanation: False

ii. (a) True

   Explanation: True

6. Fill in the blanks:
   a. Independent
   b. P(A).P(B)
7. Given: Bag contains 3 red and 2 black balls.

   Let three red balls be R_1, R_2 and R_3 and 2 black balls be B_1 and B_2.

   Sample space:

   (R_1,R_2), (R_1,R_3), (R_1,B_1), (R_1,B_2), (R_1,B_3), (R_2,R_3), (R_2,B_1), (R_2,B_2),(R_3,R_3)

   P(drawing two red balls) = P(red ball in first draw and red ball second draw)

   $= \frac{3}{5} \times \frac{3}{5}$

   $= \frac{9}{25}$
8. P(king) = $\frac{4}{52}$

   P(queen) = $\frac{4}{52}$

   P(jack) = $\frac{4}{52}$

   These cards can be drawn in $^3P_3$ ways.

   Therefore, required probability is given by,

   P(king, queen and jack) = $\frac{4}{52} \times \frac{4}{52} \times \frac{4}{52} \times ^3P_3$

   $= \frac{3!}{2197}$

   $= \frac{6}{2197}$
9. Given that P(A) = $\frac{6}{11}$, P(B) = $\frac{5}{11}$, P$(A \cup B) = \frac{7}{11}$

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

   $\Rightarrow P(A \cap B) = \frac{6}{11} + \frac{5}{11} - \frac{7}{11} = \frac{11-7}{11}$

   $\Rightarrow P(A \cap B) = \frac{4}{11}$
10. P (A) = $\frac{1}{2}$, P (B) = $\frac{1}{3}$,$P\left(\bar{A}\right) = 1 - \frac{1}{2} = \frac{1}{2}$ and $P\left(\bar{B}\right) = 1 - \frac{1}{3} = \frac{2}{3}$

    i. P (the problem is solved) = 1 – P (the problem is not solved)

    $= 1 - P\left(\bar{A}\, and\, \bar{B}\right)$

    $= 1 - P\left(\bar{A}\right).P\left(\bar{B}\right)$

    $= 1 - \frac{1}{2} \times \frac{2}{3} = 1 - \frac{2}{6} = \frac{4}{6} = \frac{2}{3}$

    ii. P (exactly one of them solves the problem) = P (A). $P\left(\bar{B}\right) + P\left(\bar{A}\right)$. P (B)

    $= \frac{1}{2} \times \frac{2}{3} + \frac{1}{2} \times \frac{1}{3} + \frac{1}{6} \times \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$
11. Let P(A) be the probability of students studying mathematics

    ∴ P(A) = 0.40

    Let P(B) be the probability of students studying biology

    ∴ P(B) = 0.25

    Let P(A ∩ B) be the probability of students studying both mathematics and biology

    ∴ P(A ∩ B) = 0.15

    One student is selected at random

    The probability that he studies mathematics given that he studies biology: P(A/B)

    $= \frac{P(A \cap B)}{P(B)}$

$= \frac{0.15}{0.25}$
$= \frac{3}{5}$

12. Let the first observation be from the black die and second from the red die.
    When two dice (one black die and another red) are rolled, the sample space S has 6×6 = 36 number of elements.
    Let A : obtaining a sum greater than 9 = {(4,6),(5,5),(5,6),(6,4),(6,5),(6,6)}
    and B: black die resulted in a 5 = {(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)}
    $\therefore A \cap B$ = {(5,5),(5,6)}
    The conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5, is given by P(A/B)
    $\therefore P(A/B) = \frac{P(A\cap B)}{P(B)} = \frac{\frac{2}{36}}{\frac{6}{36}} = \frac{2}{6} = \frac{1}{3}$

13. There are three identical boxes I, II and III, each containing two coins. In box I, both coins are gold coins, in box II, both are silver coins and in box III, there is one gold and one silver coin. A person chooses a box at random and take out a coin. If the coin is of gold, then we have to find the probability that the other coin in box is also of gold.
    Let us define the events as
    E_1: Box I is selected
    E_2: Box II is selected
    E_3 · Box III is selected
    A: The drawn coin is a gold coin
    Since events E_1, E_2 and E_3 are mutually exclusive and exhaustive events.
    $\therefore P(E_1) = P(E_2) = P(E_3) = \frac{1}{3}$

    Now, $P(A/E_1)$
    = Probability that a gold coin is drawn from box I
    $= \frac{2}{2} = 1$ [$\because$ box I contain both gold coins]
    $P(A/E_2) =$ Probability that a gold coin is drawn from box II=0[$\because$ box II has both silver coins]
    and $P(A/E_3)$ = Probability that a gold coin is
    drawn from box III $= \frac{1}{2}$
    [$\because$ box III contains 1 gold and 1 silver coin]
    The probability that other coin in box is also of
    gold = The probability that the drawing gold coin
    from bag I
    $= P(E_1/A) = \frac{P(E_1)\cdot P(A/E_1)}{[P(E_1)P(A/E_1)+P(E_2)P(A/E_2)]}$
    [by Baye' s theorem]
    $= \frac{\frac{1}{3}\times 1}{\left(\frac{1}{3}\times 1\right)+\left(\frac{1}{3}\times 0\right)+\left(\frac{1}{3}\times\frac{1}{2}\right)}$
    $= \frac{1}{1+0+\frac{1}{2}} = \frac{1}{3/2} = \frac{2}{3}$
    Hence, the required probability is $\frac{2}{3}$.

14. i. (b) Since, it is given that during prime time the husband is watching T.V. 70% of the time
    Required probability = 1 - P(husband is watching television during prime time)
    = 1 - 0.7 = 0.3

ii. (b) Let H be the event that husband is watching T.V., W be the event that wife is watching T.V. Then, P(H) = 0.7, $P(\bar{H})$ = 0.3

P(W|H) = 0.3 and $P(W|\bar{H})$ = 0.4

∴ Required probability = P(H|W)

= $\frac{P(H)\cdot P(W|H)}{P(H)\cdot P(W|H)+P(\overline{H})P(W|\overline{H})}$

= $\frac{0.7\times 0.3}{0.7\times 0.3+0.4\times 0.3} = \frac{0.21}{0.33} = \frac{7}{11}$

iii. (a) Required probability = P(H ∩ W) = P(H)P(W | H) = 0.7 $\times$ 0.3 = 0.21

iv. (b) Required probability = P(W) = $\frac{P(H\cap W)}{P(H|W)}$

= $\frac{0.21}{7/11} = \frac{21}{100} \times \frac{11}{7} = \frac{33}{100}$ = 0.33

v. (b) Required probability = $P(\bar{H}|W)$

= 1 - P(H | W) = 1 - $\frac{7}{11}$ = $\frac{4}{11}$