Probability

Question1

A random experiment has five outcomes $\mathrm{w}_1, \mathrm{w}_2, \mathrm{w}_3, \mathrm{w}_4$ and w_5. The probabilities of the occurrence of the outcomes w_1, w_2, w_3, w_4 and w_5 are respectively $\frac{1}{6}, a, b$ and $\frac{1}{12}$ such that $12a + 12b - 1 = 0$. Then the probabilities of occurrence of the outcome w_3 is

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Options:

A. $\frac{2}{3}$

B. $\frac{1}{3}$

C. $\frac{1}{6}$

D. $\frac{1}{12}$

Answer: A

Solution:

$$\begin{aligned}
&\mathrm{p}(\mathrm{w}_1) = \tfrac{1}{6} \\
&\mathrm{p}(\mathrm{w}_2) = \mathrm{a} \quad \Rightarrow \tfrac{1}{6} + \mathrm{a} + \mathrm{b} + \mathrm{x} + \tfrac{1}{12} = 1 \\
&\mathrm{p}(\mathrm{w}_3) = \mathrm{b} \quad \Rightarrow 12(\mathrm{a} + \mathrm{b} + \mathrm{x}) = 9 \\
&\mathrm{p}(\mathrm{w}_4) = \mathrm{c} \quad \Rightarrow \mathrm{a} + \mathrm{b} + \mathrm{x} = \tfrac{3}{4} \\
&\mathrm{p}(\mathrm{w}_5) = \tfrac{1}{12} \quad \Rightarrow \tfrac{1}{12} + \mathrm{x} = \tfrac{3}{4} \Rightarrow \mathrm{x} = \tfrac{2}{3}
\end{aligned}$$

Question2

A die has two face each with number ' 1 ', three faces each with number ' 2 ' and one face with number ' 3 '. If the die is rolled once, then $\mathrm{P}(1 \text{ or } 3)$ is

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Options:

A. $\frac{2}{3}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\frac{1}{6}$

Answer: B

Solution:

To determine the probability of rolling a 1 or a 3 on this die, let's first outline the probability of each individual outcome:

Probability of rolling a 1, $\mathrm{P}(1)$: Since there are 2 faces showing the number 1, the probability is $\frac{2}{6}$.

Probability of rolling a 3, $\mathrm{P}(3)$: There is 1 face showing the number 3, so the probability is $\frac{1}{6}$.

To find the probability of rolling a 1 or a 3, we use the rule for the union of two mutually exclusive events:

$\mathrm{P}(1 \cup 3) = \mathrm{P}(1) + \mathrm{P}(3)$

Substituting the known probabilities:

$\mathrm{P}(1 \cup 3) = \frac{2}{6} + \frac{1}{6}$

$\mathrm{P}(1 \cup 3) = \frac{3}{6}$

Thus, the probability of rolling a 1 or a 3 is $\frac{1}{2}$.

Question3

Consider the following statements.

Statement (I): If E and F are two independent events, then E' and F' are also independent.

Statement (II): Two mutually exclusive events with non-zero probabilities of occurrence cannot be independent.

Which of the following is correct?

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Options:

A. Statement (I) is true and statement (II) is false

B. Statement (I) is false and statement (II) is true

C. Both the statements are true

D. Both the statements are false

Answer: C

Solution:

To enhance understanding of the statements, let's examine each one in detail:

Statement (I): If events E and F are independent, the complements of these events, E' and F', are also independent. This statement is true.

When two events, E and F, are independent, the occurrence of one does not affect the likelihood of the other occurring, mathematically expressed as $P(E \cap F) = P(E) \times P(F)$. Similarly, the complements of these events, E' and F', retain this independence property.

Statement (II): Two mutually exclusive events cannot be independent if they have non-zero probabilities. This statement holds true.

Mutually exclusive events are defined by $A \cap B = \emptyset$, which implies $P(A \cap B) = 0$. For these events to be independent, it would require $P(A \cap B) = P(A) \times P(B)$. However, if $P(A) \neq 0$ and $P(B) \neq 0$, then $P(A \cap B) \neq 0$, contradicting the independence condition. Thus, two non-zero mutually exclusive events cannot be independent.

Conclusively, **Statement I is true and Statement II is also true.**

Question4

If A and B are two non-mutually exclusive events such that $P(A \mid B)=P(B \mid A)$, then

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Options:

A. $A \subset B$ but $A \neq B$

B. $A=B$

C. $A \cap B=\phi$

D. $P(A)=P(B)$

Answer: D

Solution:

A and B are non mutually exclusive
$$P(A \mid B)=P(B \mid A)$$
$$\Rightarrow \frac{P(A \cap B)}{P(B)}=\frac{P(A \cap B)}{P(A)}$$
$$\Rightarrow P(B)=P(A)[\because P(A \cap B) \neq 0]$$

Question5

If A and B are two events such that $A \subset B$ and $P(B) \neq 0$, then which of the following is correct?

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Options:

A. $P(A \mid B)=\frac{P(B)}{P(A)}$

B. $P(A \mid B)<P(A)$

C. $P(A \mid B) \geq P(A)$

D. $P(A)=P(B)$

Answer: C

Solution:

$A \subset B \Rightarrow A \cap B = A$

$P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$

$= \dfrac{P(A)}{P(B)}$

$\Rightarrow P(A \mid B) P(B) = P(A) \Rightarrow P(A) \geq P(A \mid B)$

$[\because P(B) \neq 0]$

Question6

Meera visits only one of the two temples A and B in her locality. Probability that she visits temple A is $\frac{2}{5}$. If she visits temple A, $\frac{1}{3}$ is the probability that she meets her friend, whereas it is $\frac{2}{7}$ if she visits temple B. Meera met her friend at one of the two temples. The probability that she met her at temple B is

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Options:

A. $\frac{7}{16}$

B. $\frac{5}{16}$

C. $\frac{3}{16}$

D. $\frac{9}{16}$

Answer: D

Solution:

$P(A)=\frac{2}{5}$ F : The events of meera meets her friend.

$P(F/A)=\frac{1}{3}$

$P(F/B)=\frac{2}{7}$

$P(B)=1-P(A)$

$=1-\frac{2}{5}$

$=\frac{3}{5}$

The probability she meet her at temple B

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

$$=\frac{P(B)\times P(B/F)}{P(A)P(F/A)+P(B)P(B/F)}$$

$$=\frac{3/5\times 2/7}{(2/5\times 1/3)+(3/5\times 5/7)}=\frac{9}{16}$$

Question7

A die is thrown 10 times. The probability that an odd number will come up at least once is

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Options:

A. $\frac{11}{1024}$

B. $\frac{1013}{1024}$

C. $\frac{1023}{1024}$

D. $\frac{1}{1024}$

Answer: C

Solution:

Given, $n=10$

Probability of odd number, $p=\frac{1}{2}$

$\therefore \quad q=\frac{1}{2}$

$$\begin{aligned}\therefore \text{ Required probability } &= p(X \geq 1)\\ &= 1-p(X=0)\\ &= 1-{}^{10}C_0\left(\frac{1}{2}\right)^{10-0}\left(\frac{1}{2}\right)^0\\ &= 1-\frac{1}{2^{10}}\\ &= 1-\frac{1}{1024}=\frac{1023}{1024}\end{aligned}$$

Question8

A random variable X has the following probability distribution:

X	0	1	2
$P(X)$	25/36	k	1/36

If the mean of the random variable X is $1/3$, then the variance is

KCET 2024

Options:

A. $\frac{1}{18}$

B. $\frac{5}{18}$

C. $\frac{7}{18}$

D. $\frac{11}{18}$

Answer: B

Solution:

X	0	1	2
$P(X)$	$\frac{25}{36}$	k	$\frac{1}{36}$

$$\because \text{ Mean } = \sum_{i=1}^{n} x_i P(x_i)$$

$$\Rightarrow \quad \frac{1}{3} = 0 \times \frac{25}{36} + 1 \times k + 2 \times \frac{1}{36}$$

$$\Rightarrow \quad \frac{1}{3} = k + \frac{1}{18}$$

$$\therefore \quad k = \frac{1}{3} - \frac{1}{18} = \frac{6-1}{18} = \frac{5}{18}$$

$$\text{Now, variance } = \sum_{i=0}^{n} x_i^2 P_i(x) - (\text{ mean })^2$$

$$= (0)^2 \times \frac{25}{36} + (1)^2 \times k + (2)^2 \times \frac{1}{36} - \frac{1}{9}$$

$$= 0 + k + \frac{1}{9} - \frac{1}{9} = k = \frac{5}{18}$$

$$\text{Hence, variance } = \frac{5}{18}$$

Question9

If a random variable X follows the binomial distribution with parameters $n = 5, p$ and $P(X = 2) = 9P(X = 3)$, then p is equal to

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Options:

A. 10

B. $1/10$

C. 5

D. $1/5$

Answer: B

Solution:

$\because p(X=2) = 9 \times p(X=3)$ (where, $n=5$ and $q = 1-p$)

$$\Rightarrow \quad {}^5C_2 p^2 (1-p)^3 = 9 \cdot {}^5C_3 p^3 (1-p)^2$$

$$\Rightarrow \frac{5!}{2!3!} p^2 (1-p)^3 = 9 \cdot \frac{5!}{3!2!} p^3 (1-p)^2$$

$$\Rightarrow \quad \frac{p^2(1-p)^3}{p^3(1-p)^2} = 9 \Rightarrow \frac{1-p}{p} = 9$$

$$\Rightarrow \quad 9p + p = 1 \Rightarrow 10p = 1$$

$$\therefore \quad p = \frac{1}{10}$$

Question10

A bag contains $2n+1$ coins. It is known that n of these coins have head on both sides whereas, the other $n+1$ coins are fair. One coin is selected at random and tossed. If the probability that toss results in heads is $\frac{31}{42}$, then the value of n is

KCET 2023

Options:

A. 6

B. 8

C. 10

D. 5

Answer: C

Solution:

Given, n coins have head on both the sides and $(n+1)$ coins are fair coins.

Total coins $= 2n+1$

Let events E_1, E_2 be the following

$E_1 =$ Event that an unfair coin is selected

$E_2 =$ Event that a fair coin is selected

$\therefore \quad P(E_1) = \frac{n}{2n+1}$ and $P(E_2) = \frac{n+1}{2n+1}$

From the law of total probability,

$$\therefore \quad P(E) = P(E_1) \times P\left(\frac{E}{E_1}\right) + P(E_2) \times P\left(\frac{E}{E_2}\right)$$

$$\Rightarrow \quad \frac{31}{42} = \frac{n}{2n+1} \times 1 + \frac{n+1}{2n+1} \times \frac{1}{2}$$

$$\Rightarrow \quad \frac{31}{42} = \frac{2n+n+1}{2(2n+1)}$$

$$\Rightarrow \quad 31 \times 2(2n+1) = 42(3n+1)$$

$$\Rightarrow \quad 124n + 62 = 126n + 42$$

$$\Rightarrow \quad 2n = 20$$

$$\Rightarrow \quad n = 10$$

Question11

Let $A = \{x, y, z, u\}$ and $B = \{a, b\}$. A function $f : A \to B$ is selected randomly. The probability that the function is an onto function is

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Options:

A. $\frac{1}{8}$

B. $\frac{5}{8}$

C. $\frac{1}{35}$

D. $\frac{7}{8}$

Answer: D

Solution:

Total cases $= 2 \times 2 \times 2 \times 2 = 16$

We know that

Probability of onto $= 1-$ (Probability of not onto)

$$\text{Probability} = \frac{\text{Number of favorable event}}{\text{Total event}}$$

Probability of onto $= 1 - \frac{2}{16} = \frac{14}{16} = \frac{7}{8}$

Question12

If A and B are events, such that $P(A)=\frac{1}{4}, P(A/B)=\frac{1}{2}$ and $P(B/A)=\frac{2}{3}$, then $P(B)$ is

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Options:

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $\frac{1}{2}$

D. $\frac{1}{6}$

Answer: A

Solution:

Given, $P(A)=\frac{1}{4}, P\left(\frac{A}{B}\right)=\frac{1}{2}$ and $P\left(\frac{B}{A}\right)=\frac{2}{3}$

We know that, $P\left(\frac{E_1}{E_2}\right)=\frac{P(E_1\cap E_2)}{P(E_2)}$

$$\begin{aligned}
\therefore \quad & P\left(\frac{B}{A}\right)=\frac{P(B\cap A)}{P(A)} \\
\Rightarrow \quad & \frac{2}{3}=\frac{P(A\cap B)}{1/4} \quad [\because A\cap B=B\cap A] \\
\Rightarrow \quad & P(A\cap B)=\frac{2}{3}\times\frac{1}{4}=\frac{1}{6} \\
\because \quad & P\left(\frac{A}{B}\right)=\frac{1}{2} \\
\therefore \quad & \frac{P(A\cap B)}{P(B)}=\frac{1}{2} \\
\Rightarrow \quad & P(B)=2P(A\cap B)=2\times\frac{1}{6}=\frac{1}{3}
\end{aligned}$$

Question13

Find the mean number of heads in three tosses of a fair coin.

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Options:

A. 1.5

B. 4.5

C. 2.5

D. 3.5

Answer: A

Solution:

Given three coins are tossed.

Therefore, sample space,

$S=\{TTT, TTH, THT, HTT, HHT, HTH, THH, HHH\}$

$\therefore n(S)=8$

Let X represents 'number of heads'

$\because \quad X=0,1,2$ or 3.

Probability distribution of X is

X	0	1	2	3
$P(X)$	1/8	3/8	3/8	1/8

$$\begin{aligned}\text{Required mean } &= \Sigma X_i P_i \\ &= 0\left(\frac{1}{8}\right)+1\left(\frac{3}{8}\right)+2\left(\frac{3}{8}\right)+3\left(\frac{1}{8}\right) \\ &= 0+\frac{3}{8}+\frac{6}{8}+\frac{3}{8}=\frac{12}{8}=1.5\end{aligned}$$

Question14

If A and B are two events such that $P(A)=\frac{1}{2}, P(B)=\frac{1}{2}$ and $P(A \mid B)=\frac{1}{4}$, then $P\left(A^{\prime} \cap B^{\prime}\right)$ is

KCET 2022

Options:

A. $\frac{1}{8}$

B. $\frac{3}{16}$

C. $\frac{1}{12}$

D. $\frac{3}{4}$

Answer: A

Solution:

Given, $P(A)=\frac{1}{2}, P(B)=\frac{1}{2}$ and $P(A \mid B)=\frac{1}{4}$

$P(A \mid B)=\frac{P(A \cap B)}{P(B)} \Rightarrow \frac{1}{4}=\frac{P(A \cap B)}{1/2}$

$\Rightarrow P(A \cap B)=\frac{1}{4} \times \frac{1}{2}=\frac{1}{8}$

Now, $P\left(A' \cap B'\right)=P(A \cup B)'=1-P(A \cup B)$

$$=1-[P(A)+P(B)-P(A \cap B)]=1-\left[\frac{1}{2}+\frac{1}{2}-\frac{1}{8}\right]$$

$$=1-1+\frac{1}{8}=\frac{1}{8}$$

Question15

A pandemic has been spreading all over the world. The probabilities are 0.7 that there will be a lockdown, 0.8 that the pandemic is controlled in one month if there is a lockdown and 0.3 that it is controlled in one month if there is no lockdown. The probability that the pandemic will be controlled in one month is

KCET 2022

Options:

A. 0.65

B. 1.65

C. 1.46

D. 0.46

Answer: A

Solution:

Let event $E_1 =$ There is a lockdown,

Event $E_2 =$ There is no lockdown, and $A =$ Pandemic is controlled in one month

Now, $P(E_1) = 0.7, P(E_2) = 0.3$.

$P(A \mid E_1) = 0.8$ and $P(A \mid E_2) = 0.3$

$P(A) = 0.7(0.8) + 0.3(0.3) = 0.56 + 0.09 = 0.65$

Question16

If A and B are two independent events such that $P(\bar{A}) = 0.75, P(A \cup B) = 0.65$ and $P(B) = x$, then find the value of x.

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Options:

A. $\frac{5}{14}$

B. $\frac{8}{15}$

C. $\frac{9}{14}$

D. $\frac{7}{15}$

Answer: B

Solution:

Given, $P(\bar{A}) = 0.75, P(A \cup B) = 0.65\$and\$P(B) = x$

$P(A) = 1 - P(\bar{A}) = 1 - 0.75 = 0.25$

Also, A and B are independent.

$\Rightarrow P(A \cap B) = P(A) \cdot P(B) = 0.25x$

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

$\Rightarrow 0.65 = 0.25 + x - 0.25x \Rightarrow 0.40 = 0.75x$

$$\Rightarrow x = \frac{40}{75} = \frac{8}{15}$$

Question17

Given that, A and B are two events such that $P(B) = \frac{3}{5}, P\left(\frac{A}{B}\right) = \frac{1}{2}$ and $P(A \cup B) = \frac{4}{5}$, then $P(A)$ is equal to

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Options:

A. $\frac{3}{10}$

B. $\frac{1}{2}$

C. $\frac{1}{5}$

D. $\frac{3}{5}$

Answer: B

Solution:

Given, $P(B) = \frac{3}{5}, P\left(\frac{A}{B}\right) = \frac{1}{2}$ and $P(A \cup B) = \frac{4}{5}$

$\because \quad P\left(\frac{A}{B}\right) = \frac{1}{2}$

$\Rightarrow \quad \frac{P(A \cap B)}{P(B)} = \frac{1}{2}$

$\Rightarrow \quad P(A \cap B) = \frac{1}{2} \times \frac{3}{5} = \frac{3}{10}$

Now, $\quad P(A \cup B) = \frac{4}{5}$

$\Rightarrow \quad P(A) + P(B) - P(A \cap B) = \frac{4}{5}$

$\Rightarrow \quad P(A) + \frac{3}{5} - \frac{3}{10} = \frac{4}{5}$

$\Rightarrow \quad P(A) = \frac{4}{5} + \frac{3}{10} - \frac{3}{5}$

$= \frac{8+3-6}{10} = \frac{5}{10}$

$\therefore \quad P(A) = \frac{1}{2}$

Question18

If A, B and C are three independent events such that $P(A) = P(B) = P(C) = P$, then P (at least two of A, B and C occur) is equal to

KCET 2021

Options:

A. $P^3 - 3P$

B. $3P - 2P^2$

C. $3P^2 - 2P^3$

D. $3P^2$

Answer: C

Solution:

Given, $P(A) = P(B) = P(C) = P$

P (At least two of A, B, C occur)

$= (P \cap B \cap C') + P(A \cap B' \cap C) + P(A' \cap B \cap C) + P(A \cap B \cap C)$
$= P(A)P(B)P(C') + P(A)P(B')P(C) + P(A')P(B)P(C) + P(A)P(B)P(C)$
$= P(A)P(B)[1 - P(C)] + P(A)[1 - (B)]P(C) + [1 - P(A)]P(B)P(C) + P(A)P(B)P(C)$
$= P \times P \times (1 - P) + (1 - P) \times P \times P + P \times (1 - P) \times P + P \times P \times P$
$= P^2[(1 - P) + (1 - P) + (1 - P) + P]$
$= P^2[3 - 2P]$
$= 3P^2 - 2P^3$

P (At least two of A, B, C occur) is $3P^2 - 2P^3$.

Question19

Two dice are thrown. If it is known that the sum of numbers on the dice was less than 6 the probability of getting a sum as 3 is

KCET 2021

Options:

A. $\frac{1}{18}$

B. $\frac{5}{18}$

C. $\frac{1}{5}$

D. $\frac{2}{5}$

Answer: C

Solution:

Let $E_A =$ The event that the sum of numbers on the dice was less than 6.

$E_A = \{(1,4), (4,1), (2,3), (3,2), (2,2), (1,3), (3,1), (1,2), (2,1), (1,1)\}$
$\Rightarrow \quad n(E_A) = 10$

$E_B =$ The event that the sum of numbers on the dice is 3

$E_B = \{(1,2), (2,1)\}$
$\Rightarrow \quad n(E_2) = 2$
$\therefore$ Required probability $= \frac{2}{10} = \frac{1}{5}$

Question20

A car manufacturing factory has two plants X and Y. Plant X manufactures 70% of cars and plant Y manufactures 30% of cars. 80% of cars at plant X and 90 of cars at plant Y are rated as standard quality. A car is chosen at random and is found to be standard quality. The probability that it has come from plant X is :

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Options:

A. $\frac{56}{73}$

B. $\frac{56}{84}$

C. $\frac{56}{83}$

D. $\frac{56}{79}$

Answer: C

Solution:

Let $E =$ the event that the car is of standard quality.

Let $A_1 =$ the event that the car is manufactured in plant X.

and $A_2 =$ the event that the car is manufactured in plant Y.

Now, $P(A_1) = \frac{70}{100} = \frac{7}{10}, P(A_2) = \frac{30}{100} = \frac{3}{10}$

$P\left(\frac{E}{A_1}\right) =$ Probability that a standard quality car is manufactured in plant $X = \frac{80}{100} = \frac{8}{10}$

$P\left(\frac{E}{A_2}\right) =$ Probability that a standard quality car is manufactured in plant $Y = \frac{90}{100} = \frac{9}{10}$

$P\left(\frac{A_1}{E}\right) =$ Probability that a standard quality car has come from plant X

$$= \frac{P(A_1) \times P\left(\frac{E}{A_1}\right)}{P(A_1) \cdot P\left(\frac{E}{A_1}\right) + P(A_2) \cdot P\left(\frac{E}{A_2}\right)}$$

$$= \frac{\frac{7}{10} \times \frac{8}{10}}{\frac{7}{10} \times \frac{8}{10} + \frac{3}{10} \times \frac{9}{10}}$$

$$= \frac{7 \times 8}{7 \times 8 + 3 \times 9}$$
$$= \frac{56}{56 + 27} = \frac{56}{83}$$

Hence, the required probability is $\frac{56}{83}$.

Question21

If $P(A) = 0.59, P(B) = 0.30$ and $P(A \cap B) = 0.21$ then $P\left(A' \cap B'\right)$ is equal to

KCET 2021

Options:

A. 0.11

B. 0.38

C. 0.32

D. 0.35

Answer: C

Solution:

Given, $P(A) = 0.59, P(B) = 0.30$
and $P(A \cap B) = 0.21$

$$\begin{aligned} P\left(A' \cap B'\right) &= 1 - P(A \cup B) \quad [\therefore \text{ De Morgan's law }] \\ &= 1 - [P(A) + P(B) - P(A \cap B)] \\ &= 1 - [0.59 + 0.30 - 0.21] \\ &= 1 - [0.89 - 0.21] \\ &= 1 - 0.68 = 0.32 \end{aligned}$$

Question22

A die is thrown 10 times, the probability that an odd number will come up at least one time is

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Options:

A. $\frac{1}{1024}$

B. $\frac{1023}{1024}$

C. $\frac{11}{1024}$

D. $\frac{1013}{1024}$

Answer: B

Solution:

A die is thrown 10 times

Probability of success is an odd number

$\therefore \quad n = 10, p = \frac{1}{2}, q = \frac{1}{2}$

Number of success is atleast one

Required probability $P(x \geq 1) = 1 - P(x = 0)$

$$= 1 - {}^{10}C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^{10}$$
$$= 1 - \frac{1}{1024} = \frac{1023}{1024}$$

Question23

If A and B are two events such that $P(A) = \frac{1}{3}, P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{6}$, then $P\left(A'/B\right)$ is

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Options:

A. $\frac{2}{3}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. $\frac{1}{12}$

Answer: A

Solution:

$$\text{Given } P(A)=\frac{1}{3}, P(B)=\frac{1}{2} \text{ and } P(A\cap B)=\frac{1}{6}$$

$$P\left(A'/B\right)=\frac{P\left(A'\cap B\right)}{P(B)}=\frac{P(B)-P(A\cap B)}{P(B)}$$

$$=\frac{\frac{1}{2}-\frac{1}{6}}{1/2}=\frac{2}{3}$$

Question24

Events E_1 and E_2 from a partition of the sample space S. A is any event such that $P\left(E_1\right)=P\left(\dot{E}_2\right)=\frac{1}{2}, P\left(E_2/A\right)=\frac{1}{2}$ and $P\left(A/E_2\right)=\frac{2}{3}$, then $P\left(E_1/A\right)$ is

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Options:

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. 1

D. $\frac{1}{4}$

Answer: A

Solution:

$$\text{Given } P(E_1) = P(E_2) = \frac{1}{2}$$
$$P(E_2/A) = \frac{1}{2}, P(A/E_2) = \frac{2}{3}$$
$$P(E_1/A) = \frac{P(E_1) \times P(A/E_1)}{P(A)}$$
$$P(E_2/A) = \frac{P(E_2) \times P(A/E_2)}{P(A)}$$
$$P(E_1/A) + P(E_2/A) = 1$$
$$P(E_1/A) = 1 - P(E_2/A)$$
$$= 1 - \frac{1}{2} = \frac{1}{2}$$

Question25

The probability of solving a problem by three persons A, B and C independently is $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{3}$ respectively. Then the probability of the problem is solved by any two of them is

KCET 2020

Options:

A. $\frac{1}{12}$

B. $\frac{1}{4}$

C. $\frac{1}{24}$

D. $\frac{1}{8}$

Answer: B

Solution:

$$\text{Given, } P(A) = \frac{1}{2}, P(B) = \frac{1}{4}, P(C) = \frac{1}{3}$$
$$P(\bar{A}) = \frac{1}{2}, P(\bar{B}) = \frac{3}{4}, P(\bar{C}) = \frac{2}{3}$$

Required probability $= P(AB\bar{C}) + P(A\bar{B}C) + P(\bar{A}BC)$
$= \frac{1}{2} \times \frac{1}{4} \times \frac{2}{3} + \frac{1}{2} \times \frac{3}{4} \times \frac{1}{3} + \frac{1}{2} \times \frac{1}{4} \times \frac{1}{3}$
$= \frac{2+3+1}{24} = \frac{6}{24} = \frac{1}{4}$

Question26

If A, B, C are three mutually exclusive and exhaustive events of an experiment such that $P(A) = 2P(B) = 3P(C)$, then $P(B)$ is equal to

KCET 2020

Options:

A. $\frac{1}{11}$

B. $\frac{2}{11}$

C. $\frac{3}{11}$

D. $\frac{4}{11}$

Answer: C

Solution:

A, B, C are mutually exclusive and exhaustive events.

$\therefore \quad P(A \cap B) = P(B \cap C)$
$= P(A \cap C) = 0 = P(A \cap B \cap C)$
and $P(A) + P(B) + P(C) = 1$
$2P(B) + P(B) + \frac{2}{3}P(B) = 1$
$[\because P(A) = 2P(B), 2P(B) = 3P(C)]$
$= \frac{11P(B)}{3} = 1$
$P(B) = \frac{3}{11}$

Question27

Two letters are chosen from the letters of the word 'EQUATIONS'. The probability that one is vowel and the other is consonant is

KCET 2019

Options:

A. $\frac{3}{9}$

B. $\frac{8}{9}$

C. $\frac{5}{9}$

D. $\frac{4}{9}$

Answer: C

Solution:

Given, word EQUATIONS.

Here, consonants are Q, T, N, S and vowels are E, U, A, I, O

Number of ways of selecting two letters $= {}^9C_2$ and Number of ways of selecting one vowel and one consonants are ${}^5C_1 \times {}^4C_1$

$\therefore$ required probability $= \frac{{}^5C_1 \times {}^4C_1}{{}^9C_2} = \frac{5 \times 4}{\frac{9 \times 8}{2}} = \frac{5}{9}$

Question28

A random variable 'X' has the following probability distribution

x	1	2	3	4	5	6	7
$P(x)$	$k-1$	$3k$	k	$3k$	$3k^2$	k^2	k^2+k

Then the value of k is

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Options:

A. $\frac{2}{7}$

B. $\frac{1}{5}$

C. $\frac{1}{10}$

D. -2

Answer: A

Solution:

We know that, $\Sigma pi = 1$

$$\therefore (k-1)+3k+k+3k+3k^2+k^2+k^2+k=1$$
$$\Rightarrow \quad 5k^2+9k-2=0 \Rightarrow 5k^2+10k-k-2=0$$
$$\Rightarrow 5k(k+2)-1(k+2)=0 \Rightarrow (k+2)(5k-1)=0$$
$$\Rightarrow \quad k=\frac{1}{5}-2$$

Both values of k is not possible, since $P(X=1)=k-1$ will be negative.

Hence, Question is wrong.

Question29

If A and B are two events of a sample space S such that $P(A)=0.2, P(B)=0.6$ and $P(A \mid B)=0.5$ then $P\left(A' \mid B\right)=$

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Options:

A. $\frac{1}{2}$

B. $\frac{3}{10}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

Answer: A

Solution:

We have, $P\left(\frac{A}{B}\right)=0.5$

We know that, $P\left(\frac{A'}{B}\right)=1-P\left(\frac{A}{B}\right)$

$\therefore \quad P\left(\frac{A'}{B}\right)=1-0.5=0.5$

Question30

If 'X' has a binomial distribution with parameters $n=6, p$ and $P(X=2)=12, P(X=3)=5$ then $P=$

KCET 2019

Options:

A. $\frac{1}{2}$

B. $\frac{5}{12}$

C. $\frac{5}{16}$

D. $\frac{16}{21}$

Answer: A

Solution:

Since, $P(X=4)=12, P(X=3)=3$

Here, Both $P(X=2)$ and $P(X=3)$ have value greater than one which is not possible.

So, question is wrong.

Question31

A man speaks truth 2 out of 3 times. He picks one of the natural numbers in the set $S = \{1, 2, 3, 4, 5, 6, 7\}$ and reports that it is even. The probability that is actually even is

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Options:

A. $\frac{1}{10}$

B. $\frac{2}{5}$

C. $\frac{3}{5}$

D. $\frac{1}{5}$

Answer: C

Solution:

Let E_1 : the event that he picks even natural number

E_2 : the event that he pick odd natural numbers.

$\therefore \quad P(E_1) = \frac{3}{7}, P(E_2) = \frac{4}{7}$

E : the event that the man reports that it is an even number

$\therefore \quad P\left(\frac{E}{E_1}\right) = \frac{2}{3}, P\left(\frac{E}{E_2}\right) = \frac{1}{3}$

$\therefore$ required probability, $P\left(\frac{E_1}{A}\right)$

$$= \frac{P(E_1)P\left(\frac{E}{E_1}\right)}{P(E_1)P\left(\frac{E}{E_1}\right)+P(E_2)P\left(\frac{E}{E_2}\right)}$$

(by using Baye's theorem)

$$= \frac{\frac{3}{7}\times\frac{2}{3}}{\frac{3}{7}\times\frac{2}{3}+\frac{4}{7}\times\frac{1}{3}} = \frac{6}{10} = \frac{3}{5}$$

Question32

A bag contains 17 tickets numbered from 1 to 17. A ticket is drawn at random, then another ticket is drawn without replacing the first one. The probability that both the tickets may show even numbers is

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Options:

A. $\frac{7}{34}$

B. $\frac{8}{17}$

C. $\frac{7}{16}$

D. $\frac{7}{17}$

Answer: A

Solution:

Let's break down the problem step by step:

The tickets are numbered from 1 to 17.

The even numbers within this range are: 2, 4, 6, 8, 10, 12, 14, and 16. There are 8 even-numbered tickets.

Now, when drawing two tickets without replacement, the probability that both are even can be calculated as follows:

Probability of drawing an even ticket first:

$P(\text{first even}) = \frac{8}{17}$

Probability of drawing an even ticket second (after one even is already drawn):

Now there are 7 even tickets left out of 16 tickets total, so:

$P(\text{second even} \mid \text{first even}) = \frac{7}{16}$

Overall probability of both events happening:

Multiply the probabilities of the two independent events:

$P(\text{both even}) = \frac{8}{17} \times \frac{7}{16} = \frac{56}{272}$

Simplify the fraction:

Divide both numerator and denominator by 8:

$\frac{56 \div 8}{272 \div 8} = \frac{7}{34}$

Thus, the probability that both drawn tickets show even numbers is $\frac{7}{34}$.

This matches Option A.

Question33

A flashlight has 10 batteries out of which 4 are dead. If 3 batteries are selected without replacement and tested, then the probability that all 3 are dead is

KCET 2018

Options:

A. $\frac{1}{30}$

B. $\frac{2}{8}$

C. $\frac{1}{15}$

D. $\frac{1}{10}$

Answer: A

Solution:

To determine the probability that all 3 selected batteries are dead, we need to consider the following:

Total Batteries: There are 10 batteries in total, 4 of which are dead.

Selecting Dead Batteries: We are selecting 3 out of these 4 dead batteries, one after the other without replacement.

Calculate the probability step-by-step:

First Battery: The probability that the first battery selected is dead is $\frac{4}{10}$.

Second Battery: After removing one dead battery, there are now 3 dead batteries left out of 9 total batteries. Thus, the probability that the second battery is dead is $\frac{3}{9}$.

Third Battery: After selecting two dead batteries, there remain 2 dead batteries out of 8 total batteries. Therefore, the probability that the third battery is dead is $\frac{2}{8}$.

Multiplying these probabilities gives the overall probability that all three selected batteries are dead:

$\frac{4}{10} \times \frac{3}{9} \times \frac{2}{8} = \frac{1}{30}$

Question34

The probability of happening of an event A is 0.5 and that of B is 0.3 . If A and B are mutually exclusive events, then the probability of neither A nor B is

KCET 2018

Options:

A. 0.4

B. 0.5

C. 0.2

D. 0.9

Answer: C

Solution:

To find the probability of neither event A nor event B occurring, given that they are mutually exclusive, we start with the following information:

The probability of event A, $P(A)$, is 0.5.

The probability of event B, $P(B)$, is 0.3.

Since A and B are mutually exclusive, the probability of both events occurring simultaneously, $P(A \cap B)$, is 0.

Using these probabilities, we calculate the probability of the union of A and B, which is the probability of either event A or event B occurring. This is given by:

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

Substituting the values:

$P(A \cup B) = 0.5 + 0.3 - 0 = 0.8$

Thus, the probability of the union of events A and B is 0.8.

To find the probability that neither A nor B occurs, which we denote as $P(A' \cap B')$, we take the complement of $P(A \cup B)$:

$P(A' \cap B') = 1 - P(A \cup B)$

Calculating this gives:

$P(A' \cap B') = 1 - 0.8 = 0.2$

Therefore, the probability that neither event A nor event B occurs is 0.2.

Question35

In a simultaneous throw of a pair of dice, the probability of getting a total more than 7 is

KCET 2018

Options:

A. $\frac{7}{12}$

B. $\frac{5}{36}$

C. $\frac{5}{12}$

D. $\frac{7}{36}$

Answer: C

Solution:

Number of outcomes $= 6 \times 6 = 36$

getting a total more that $7 =$

$\{(2,6),(3,5),(3,6),(4,4),(4,5),(4,6),(5,3),$
$(5,4),(5,5),(5,6),(6,2),(6,3),(6,4),(6,5),(6,6)\}$

Required probability

$$= \frac{\text{Number of favourable outcomes}}{\text{Total outcomes}}$$
$$= \frac{15}{36} = \frac{5}{12}$$

Question36

If A and B are mutually exclusive events, given that $P(A) = \frac{3}{5}, P(B) = \frac{1}{5}$, then $P(A \text{ or } B)$ is

KCET 2018

Options:

A. 0.8

B. 0.6

C. 0.4

D. 0.2

Answer: A

Solution:

Since events A and B are mutually exclusive (they cannot occur at the same time), the probability of A or B occurring is simply the sum of their individual probabilities. Here's how we calculate it:

Write the formula for mutually exclusive events:

$P(A \text{ or } B) = P(A) + P(B)$

Substitute the given values:

$P(A \text{ or } B) = \frac{3}{5} + \frac{1}{5}$

Add the fractions:

$P(A \text{ or } B) = \frac{4}{5}$

Convert to decimal:

$\frac{4}{5} = 0.8$

Thus, the correct answer is Option A: 0.8.

Question37

A box has 100 pens of which 10 are defective. The probability that out of a sample of 5 pens drawn one by one with replacement and atmost one is defective, is

KCET 2017

Options:

A. $\frac{9}{10}$

B. $\frac{1}{2}\left(\frac{9}{10}\right)^4$

C. $\left(\frac{9}{10}\right)^5+\frac{1}{2}\left(\frac{9}{10}\right)^4$

D. $\frac{1}{2}\left(\frac{9}{10}\right)^5$

Answer: C

Solution:

We have

$p=$ probability that a bulb is defective $=\frac{10}{100}=\frac{1}{10}$

$\therefore \quad q=1-p=\frac{9}{10}$

Let X be the number of defective bulbs in a sample of 5 bulbs.

$\therefore$ Required probability

$$
\begin{aligned}
& =P(x=0)+P(x=1) \\
& ={ }^5 C_0\left(\frac{1}{10}\right)^0\left(\frac{9}{10}\right)^5+{ }^5 C_1\left(\frac{1}{10}\right)^1\left(\frac{9}{10}\right)^4 \\
& =\left(\frac{9}{10}\right)^5+5 \times \frac{1}{10}\left(\frac{9}{10}\right)^4 \\
& =\left(\frac{9}{10}\right)^5+\frac{1}{2}\left(\frac{9}{10}\right)^4
\end{aligned}
$$

Question38

The probability distribution of X is

X	0	1	2	3
$P(X)$	0.3	k	$2k$	$2k$

The value of k is

KCET 2017

Options:

A. 0.7

B. 0.3

C. 1

D. 0.14

Answer: D

Solution:

We have,

X	0	1	2	3
$P(X)$	0.3	K	$2K$	$2K$

We know that
$\Sigma P(x) = 1$

$\therefore \quad 0.3 + K + 2K + 2K = 1$
$\Rightarrow \quad 5K = 0.7$
$\Rightarrow \quad K = \frac{0.7}{5} = 0.14$

Question39

Two events A and B will be independent if

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Options:

A. $P(A' \cap B') = 1(1 - P(A))(1 - P(B))$

B. $P(A) + P(B) = 1$

C. $P(A) = P(B)$

D. A and B are mutually exclusive

Answer: A

Solution:

If events A and B are independent, the probability of both events occurring together is given by:

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

Moreover, if A and B are independent, their complements, A' and B', are also independent. This implies:

$$P(A' \cap B') = P(A') \cdot P(B')$$

Since the probability of a complement of an event is $1 - P$ of the event itself, we can express this as:

$$P(A' \cap B') = (1 - P(A)) \cdot (1 - P(B))$$

Furthermore, if A and B are mutually exclusive, it means they cannot happen at the same time, and thus:

$$P(A \cap B) = 0$$
