

NCERT Solutions Class 11 Maths

Chapter 14: Probability

EXERCISE 14.2

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Quick Summary: In NCERT Solutions Class 11 Maths Chapter 14 Exercise 14.2, students learn fundamental concepts of Events and the Addition Theorem of Probability through practical problems involving coins, dice, and cards. This exercise covers probability axioms, mutually exclusive events, and probability calculations which are essential for building a strong foundation in probability theory and scoring well in CBSE Class 11 exams.

Key Takeaways:

- Addition Theorem for mutually exclusive events: $P(A \cup B) = P(A) + P(B)$
- Basic probability axioms: $0 \leq P(E) \leq 1$ and sum of all probabilities equals 1
- Sample space identification and event probability calculation for coins, dice, and card problems
- Understanding mutually exclusive events where two events cannot occur simultaneously

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Question 1

QUESTION

Which of the following cannot be valid assignments of probabilities for outcomes of the sample space $S = \{\omega_1, \omega_2, \omega_3, \omega_4, \omega_5, \omega_6, \omega_7\}$?

Assignments:

(a) $P(\omega_1) = 0.1, P(\omega_2) = 0.01, P(\omega_3) = 0.05, P(\omega_4) = 0.03,$
 $P(\omega_5) = 0.01, P(\omega_6) = 0.2, P(\omega_7) = 0.6$

(b) $P(\omega_1) = P(\omega_2) = P(\omega_3) = P(\omega_4) = P(\omega_5) = P(\omega_6) =$
 $P(\omega_7) = 1/7$

(c) $P(\omega_1) = 0.1, P(\omega_2) = 0.2, P(\omega_3) = 0.3, P(\omega_4) = 0.4, P(\omega_5) =$
 $0.5, P(\omega_6) = 0.6, P(\omega_7) = 0.7$

(d) $P(\omega_1) = -0.1, P(\omega_2) = 0.2, P(\omega_3) = 0.3, P(\omega_4) = 0.4, P(\omega_5) =$
 $-0.2, P(\omega_6) = 0.1, P(\omega_7) = 0.3$

(e) $P(\omega_1) = 1/14, P(\omega_2) = 2/14, P(\omega_3) = 3/14, P(\omega_4) = 4/14,$
 $P(\omega_5) = 5/14, P(\omega_6) = 6/14, P(\omega_7) = 15/14$

SOLUTION

This question tests our understanding of the basic axioms of probability. Specifically, we need to check if the given assignments of probabilities satisfy two conditions: 1) Each probability must be between 0 and 1 (inclusive), and 2) The sum of all probabilities must equal 1.

(a)

Step 1: Check if each probability is between 0 and 1. All probabilities are between 0 and 1.

Step 2: Calculate the sum of the probabilities:

Since both conditions are met, this is a valid assignment of probabilities. **Answer: Yes**

(b)

Step 1: Check if each probability is between 0 and 1. is between 0 and 1.

Step 2: Calculate the sum of the probabilities:

Since both conditions are met, this is a valid assignment of probabilities. **Answer: Yes**

(c)

Step 1: Check if each probability is between 0 and 1. All probabilities are between 0 and 1.

Step 2: Calculate the sum of the probabilities:

Since the sum is not equal to 1, this is *not* a valid assignment of probabilities. **Answer: No**

(d)

Step 1: Check if each probability is between 0 and 1. We see that and , which are negative.

Since probabilities cannot be negative, this is *not* a valid assignment of probabilities. **Answer: No**

(e)

Step 1: Check if each probability is between 0 and 1. We see that , which is greater than 1.

Since probabilities cannot be greater than 1, this is *not* a valid assignment of probabilities. **Answer: No**

ANSWER

(a) Yes

(b) Yes

(c) No

(d) No

(e) No

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Question 2

QUESTION

A coin is tossed twice. What is the probability that at least one tail occurs?

SOLUTION

This question tests our understanding of basic probability, specifically calculating the probability of an event when tossing a coin multiple times.

Step 1: Define the sample space

When a coin is tossed twice, the possible outcomes are:

HH, HT, TH, TT

Here, H represents 'Heads' and T represents 'Tails'. The sample space, denoted by S, is:

The total number of possible outcomes is 4. We write this as .

Step 2: Define the event of interest

We want to find the probability of getting at least one tail. Let's call this event A.

The outcomes in event A are those with one or more tails:

The number of outcomes in event A is 3. We write this as .

Step 3: Calculate the probability

The probability of an event A is given by:

In our case:

Final Answer: The probability of getting at least one tail when a coin is tossed twice is .

ANSWER

3/4

Question 3

QUESTION

A die is thrown. Find the probability of the following events:

- (i) A prime number will appear.
- (ii) A number greater than or equal to 3 will appear.
- (iii) A number less than or equal to 1 will appear.
- (iv) A number more than 6 will appear.
- (v) A number less than 6 will appear.

SOLUTION

This question tests our understanding of basic probability, specifically calculating the probability of different events when a die is thrown.

(i) A prime number will appear.

Step 1: Define the sample space

When a die is thrown, the sample space is the set of all possible outcomes:

The total number of possible outcomes is .

Step 2: Define the event

Let be the event that a prime number appears. The prime numbers in the sample space are 2, 3, and 5.

The number of favorable outcomes is .

Step 3: Calculate the probability

The probability of event is given by:

(ii) A number greater than or equal to 3 will appear.

Step 1: Define the event

Let be the event that a number greater than or equal to 3 appears. The numbers in the sample space that satisfy this condition are 3, 4, 5, and 6.

The number of favorable outcomes is .

Step 2: Calculate the probability

The probability of event is given by:

(iii) A number less than or equal to 1 will appear.

Step 1: Define the event

Let E be the event that a number less than or equal to 1 appears. The only number in the sample space that satisfies this condition is 1.

The number of favorable outcomes is .

Step 2: Calculate the probability

The probability of event is given by:

(iv) **A number more than 6 will appear.**

Step 1: Define the event

Let E be the event that a number more than 6 appears. There are no numbers in the sample space that satisfy this condition.

The number of favorable outcomes is .

Step 2: Calculate the probability

The probability of event is given by:

(v) **A number less than 6 will appear.**

Step 1: Define the event

Let E be the event that a number less than 6 appears. The numbers in the sample space that satisfy this condition are 1, 2, 3, 4, and 5.

The number of favorable outcomes is .

Step 2: Calculate the probability

The probability of event is given by:

ANSWER

(i) $1/2$

(ii) $2/3$

(iii) $1/6$

(iv) 0

(v) $5/6$

Question 4

QUESTION

A card is selected from a pack of 52 cards.

- (a) How many points are there in the sample space?
- (b) Calculate the probability that the card is an ace of spades.
- (c) Calculate the probability that the card is (i) an ace (ii) a black card.

SOLUTION

This question explores basic probability concepts, including sample spaces and calculating probabilities of simple events when drawing a card from a standard deck of 52 cards.

(a) Determining the size of the sample space

The sample space consists of all possible outcomes of an experiment. In this case, the experiment is selecting a card from a pack of 52 cards. Each card represents a unique outcome.

Therefore, the number of points in the sample space is simply the total number of cards in the deck.

Answer: 52

(b) Probability of selecting the ace of spades

Step 1: Define the event

The event is selecting the ace of spades. There is only one ace of spades in a standard deck of cards.

Step 2: Calculate the probability

The probability of an event is calculated as:

In this case:

(since there's only one ace of spades)

(total number of cards)

Therefore, the probability of selecting the ace of spades is:

Answer: $1/52$

(c) (i) Probability of selecting an ace

Step 1: Define the event

The event is selecting an ace. There are four aces in a standard deck of cards (one for each suit: hearts, diamonds, clubs, spades).

Step 2: Calculate the probability

(four aces)

(total number of cards)

Therefore, the probability of selecting an ace is:

Answer: $1/13$

(c) (ii) Probability of selecting a black card

Step 1: Define the event

The event is selecting a black card. There are 26 black cards in a standard deck of cards (13 clubs and 13 spades).

Step 2: Calculate the probability

(26 black cards)

(total number of cards)

Therefore, the probability of selecting a black card is:

Answer: $1/2$

ANSWER

(a) 52

(b) $1/52$

(c) (i) $1/13$ (ii) $1/2$

Question 5

QUESTION

A fair coin with 1 marked on one face and 6 on the other and a fair die are both tossed. Find the probability that the sum of the numbers that turn up is

(i) 3

(ii) 12.

SOLUTION

This question tests our understanding of basic probability, specifically calculating probabilities of events involving a coin toss and a die roll.

(i) Probability of the sum being 3

Step 1: Define the sample space

When a coin with faces marked 1 and 6 is tossed, the possible outcomes are 1 and 6. When a die is rolled, the possible outcomes are 1, 2, 3, 4, 5, and 6. The sample space consists of all possible pairs of outcomes. The total number of outcomes is .

Step 2: List the possible outcomes

The sample space S is:

Step 3: Identify favorable outcomes

We want the sum of the numbers to be 3. The only outcome that satisfies this condition is (1, 2), since .

Step 4: Calculate the probability

The probability of the sum being 3 is the number of favorable outcomes divided by the total number of outcomes:

(ii) Probability of the sum being 12

Step 1: Refer to the sample space (same as in part i)

The sample space S is:

Step 2: Identify favorable outcomes

We want the sum of the numbers to be 12. The only outcome that satisfies this condition is (6, 6), since .

Step 3: Calculate the probability

The probability of the sum being 12 is the number of favorable outcomes divided by the total number of outcomes:

Final Answer:

(i) $\frac{1}{12}$

(ii) $\frac{1}{12}$

ANSWER

(i) $\frac{1}{12}$

(ii) $\frac{1}{12}$

Question 6

QUESTION

There are four men and six women on the city council. If one council member is selected for a committee at random, how likely is it that it is a woman?

SOLUTION

We are asked to find the probability of selecting a woman from a city council consisting of four men and six women.

Step 1: Determine the total number of council members

The total number of council members is the sum of the number of men and the number of women.

Step 2: Determine the number of favorable outcomes

We want to find the probability of selecting a woman. The number of women on the council represents the number of favorable outcomes.

Step 3: Calculate the probability

The probability of an event is calculated as the number of favorable outcomes divided by the total number of possible outcomes.

Step 4: Simplify the fraction

We can simplify the fraction by dividing both the numerator and the denominator by their greatest common divisor, which is 2.

Final Answer: The probability of selecting a woman is .

ANSWER

$\frac{3}{5}$

Question 7

QUESTION

A fair coin is tossed four times, and a person wins Rs 1 for each head and loses Rs 1.50 for each tail that turns up.

From the sample space, calculate how many different amounts of money you can have after four tosses and the probability of having each of these amounts.

SOLUTION

This question explores probability in the context of tossing a fair coin multiple times, where the outcomes affect monetary gains or losses. We need to determine the possible amounts of money one can have and the probability of each amount.

Step 1: Define the Sample Space

When a fair coin is tossed four times, the sample space has possible outcomes. We can represent these outcomes as sequences of H (Heads) and T (Tails). For example, HHTT means two heads followed by two tails.

Step 2: Calculate Monetary Outcomes for Each Sample Point

For each head (H), the person wins Rs 1. For each tail (T), the person loses Rs 1.50. We need to calculate the net gain or loss for each of the 16 outcomes.

Step 3: Determine Possible Amounts

Let's analyze the possible amounts:

- 4 Heads (HHHH): Rs 4.00 gain
- 3 Heads, 1 Tail: Rs 1.50 gain
- 2 Heads, 2 Tails: Rs -1.00 (Rs 1.00 loss)
- 1 Head, 3 Tails: Rs -3.50 (Rs 3.50 loss)
- 0 Heads, 4 Tails: Rs -6.00 (Rs 6.00 loss)

So, the possible amounts are: Rs 4.00 gain, Rs 1.50 gain, Rs 1.00 loss, Rs 3.50 loss, Rs 6.00 loss.

Step 4: Calculate Probabilities

- P(Winning Rs 4.00): Only 1 outcome (HHHH) out of 16. So,
- P(Winning Rs 1.50): 4 outcomes (HHHT, HHTH, HTHH, THHH). So,
- P(Losing Re 1.00): 6 outcomes (HHTT, HTHT, HTTH, THHT, THTH, TTHH). So,
- P(Losing Rs 3.50): 4 outcomes (HTTT, THTT, TTHT, TTTH). So,
- P(Losing Rs 6.00): Only 1 outcome (TTTT) out of 16. So,

Final Answer:

Possible amounts: Rs 4.00 gain, Rs 1.50 gain, Re 1.00 loss, Rs 3.50 loss, Rs 6.00 loss.

$P(\text{Winning Rs 4.00}) = 1/16$

$$P(\text{Winning Rs 1.50}) = 1/4$$

$$P(\text{Losing Re 1.00}) = 3/8$$

$$P(\text{Losing Rs 3.50}) = 1/4$$

$$P(\text{Losing Rs 6.00}) = 1/16$$

ANSWER

Possible amounts: Rs 4.00 gain, Rs 1.50 gain, Re 1.00 loss, Rs 3.50 loss, Rs 6.00 loss.

$$P(\text{Winning Rs 4.00}) = 1/16$$

$$P(\text{Winning Rs 1.50}) = 1/4$$

$$P(\text{Losing Re 1.00}) = 3/8$$

$$P(\text{Losing Rs 3.50}) = 1/4$$

$$P(\text{Losing Rs 6.00}) = 1/16$$

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Question 8

QUESTION

Three coins are tossed once. Find the probability of getting

- (i) 3 heads
- (ii) 2 heads
- (iii) at least 2 heads
- (iv) at most 2 heads
- (v) no head
- (vi) 3 tails
- (vii) exactly two tails
- (viii) no tail
- (ix) at most two tails.

SOLUTION

This question explores probability in the context of tossing three coins. We need to calculate the probabilities of various outcomes involving heads and tails.

Step 1: Determine the sample space

When three coins are tossed, the possible outcomes are:

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

The total number of possible outcomes is 8. Therefore, $n(S) = 8$.

(i) Probability of getting 3 heads

Step 2: Identify favorable outcomes

The event of getting 3 heads is $E = \{HHH\}$. The number of favorable outcomes is $n(E) = 1$.

Step 3: Calculate the probability

(ii) Probability of getting 2 heads

Step 4: Identify favorable outcomes

The event of getting 2 heads is $E = \{HHT, HTH, THH\}$. The number of favorable outcomes is $n(E) = 3$.

Step 5: Calculate the probability

(iii) Probability of getting at least 2 heads

Step 6: Identify favorable outcomes

The event of getting at least 2 heads is $E = \{HHT, HTH, THH, HHH\}$. The number of favorable outcomes is $n(E) = 4$.

Step 7: Calculate the probability

(iv) Probability of getting at most 2 heads

Step 8: Identify favorable outcomes

The event of getting at most 2 heads is $E = \{HHT, HTH, THH, HTT, THT, TTH, TTT\}$. The number of favorable outcomes is $n(E) = 7$.

Step 9: Calculate the probability

(v) Probability of getting no head

Step 10: Identify favorable outcomes

The event of getting no head is $E = \{TTT\}$. The number of favorable outcomes is $n(E) = 1$.

Step 11: Calculate the probability

(vi) Probability of getting 3 tails

Step 12: Identify favorable outcomes

The event of getting 3 tails is $E = \{TTT\}$. The number of favorable outcomes is $n(E) = 1$.

Step 13: Calculate the probability

(vii) Probability of getting exactly two tails

Step 14: Identify favorable outcomes

The event of getting exactly two tails is $E = \{HTT, THT, TTH\}$. The number of favorable outcomes is $n(E) = 3$.

Step 15: Calculate the probability

(viii) Probability of getting no tail

Step 16: Identify favorable outcomes

The event of getting no tail is $E = \{HHH\}$. The number of favorable outcomes is $n(E) = 1$.

Step 17: Calculate the probability

(ix) Probability of getting at most two tails

Step 18: Identify favorable outcomes

The event of getting at most two tails is $E = \{HHH, HHT, HTH, THH, HTT, THT, TTH\}$. The number of favorable outcomes is $n(E) = 7$.

Step 19: Calculate the probability

ANSWER

(i) $1/8$

(ii) $3/8$

(iii) $1/2$

(iv) $7/8$

(v) $1/8$

(vi) $1/8$

(vii) $3/8$

(viii) $1/8$

(ix) $7/8$

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Question 9

QUESTION

If $\frac{2}{11}$ is the probability of an event, what is the probability of the event 'not A'?

SOLUTION

This question tests our understanding of basic probability, specifically the concept of complementary events. The probability of an event 'not A' is the complement of the probability of event A.

Step 1: Define the given probability

We are given that the probability of event A, denoted as $P(A)$, is $\frac{2}{11}$. That is,

Step 2: Recall the complement rule

The probability of an event 'not A', denoted as $P(\text{not } A)$, is given by:

This is because the sum of the probabilities of an event and its complement must equal 1 (representing the entire sample space).

Step 3: Apply the complement rule

Substitute the given value of $P(A)$ into the formula:

Step 4: Calculate the probability

To subtract the fraction from 1, we rewrite 1 as a fraction with the same denominator:

Now we can subtract:

Final Answer: The probability of the event 'not A' is $\frac{9}{11}$.

Conclusion: The probability of an event not occurring is simply 1 minus the probability of the event occurring. This is a fundamental concept in probability theory.

ANSWER

$\frac{9}{11}$

Question 10

QUESTION

A letter is chosen at random from the word "ASSASSINATION". Find the probability that the letter chosen is

- (i) a vowel
- (ii) a consonant.

SOLUTION

This question tests our understanding of basic probability, specifically calculating the probability of selecting a vowel or a consonant from a given word.

Step 1: Count the total number of letters

The word "ASSASSINATION" has 13 letters. This will be the denominator in our probability calculations.

Step 2: Count the number of vowels

The vowels in the word are A, A, I, A, I, O. There are 6 vowels.

Step 3: Calculate the probability of selecting a vowel

(i) The probability of selecting a vowel is the number of vowels divided by the total number of letters:

Step 4: Count the number of consonants

The consonants in the word are S, S, S, S, N, T, N. There are 7 consonants.

Step 5: Calculate the probability of selecting a consonant

(ii) The probability of selecting a consonant is the number of consonants divided by the total number of letters:

Final Answer:

- (i) The probability of selecting a vowel is .
- (ii) The probability of selecting a consonant is .

Conclusion: The probabilities were calculated by finding the ratio of favorable outcomes (vowels or consonants) to the total possible outcomes (all letters in the word).

ANSWER

- (i) $\frac{6}{13}$
- (ii) $\frac{7}{13}$

Question 11

QUESTION

In a lottery, a person chooses six different natural numbers at random from 1 to 20 and if these six numbers match with the six numbers already fixed by the lottery committee, he wins the prize. What is the probability of winning the prize in the game? (Order of the numbers is not important.)

SOLUTION

This question tests our understanding of combinations and probability. We need to calculate the total possible outcomes and the favorable outcome to find the probability of winning the lottery.

Step 1: Determine the total number of possible outcomes

The person chooses six different numbers from a set of 20 natural numbers. The order in which the numbers are chosen does not matter. This is a combination problem. The total number of possible outcomes is the number of ways to choose 6 numbers from 20, which is given by .

We calculate this as:

So, there are 38760 possible combinations of six numbers.

Step 2: Determine the number of favorable outcomes

There is only one way to win the lottery: the person's chosen six numbers must exactly match the six numbers fixed by the lottery committee. Therefore, there is only 1 favorable outcome.

Step 3: Calculate the probability of winning

The probability of winning is the ratio of the number of favorable outcomes to the total number of possible outcomes:

Final Answer: The probability of winning the prize in the game is .

ANSWER

$\frac{1}{38760}$

Question 12

QUESTION

Check whether the following probabilities $P(A)$ and $P(B)$ are consistently defined:

- (i) $P(A) = 0.5$, $P(B) = 0.7$, $P(A \cap B) = 0.6$
- (ii) $P(A) = 0.5$, $P(B) = 0.4$, $P(A \cup B) = 0.8$

SOLUTION

This question tests our understanding of the basic properties of probability, specifically the relationships between $P(A)$, $P(B)$, $P(A \cap B)$, and $P(A \cup B)$.

(i) $P(A) = 0.5$, $P(B) = 0.7$, $P(A \cap B) = 0.6$

Step 1: Recall the properties of probability

For any two events A and B , the probability of their intersection, $P(A \cap B)$, must be less than or equal to the probability of each individual event, $P(A)$ and $P(B)$. This is because the intersection represents the outcomes that are common to both A and B , so it cannot be more probable than either A or B alone.

Mathematically, this means:

and

Step 2: Check the given values against the property

We are given $P(A) = 0.5$, $P(B) = 0.7$, and $P(A \cap B) = 0.6$.

Let's check if the condition holds:

which is false.

Let's check if the condition holds:

which is true.

Step 3: Conclude

Since 0.6 is not less than or equal to 0.5 , the given probabilities are not consistently defined.

(ii) $P(A) = 0.5$, $P(B) = 0.4$, $P(A \cup B) = 0.8$

Step 1: Recall the addition rule of probability

The addition rule states that for any two events A and B :

Step 2: Rearrange the formula to find $P(A \cap B)$

We can rearrange the formula to solve for :

Step 3: Substitute the given values

Substituting the given values, we get:

Step 4: Check if the calculated $P(A \cap B)$ is valid

We need to ensure that , and .

In our case, . We can see that:

is true.

is true.

is true.

Step 5: Conclude

Since the calculated is valid and satisfies all the necessary conditions, the given probabilities are consistently defined.

ANSWER

(i) No, because $P(A \cap B)$ must be less than or equal to $P(A)$ and $P(B)$.

(ii) Yes

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Question 13

QUESTION

Fill in the blanks in the following table:

$P(A)$, $P(B)$, $P(A \cap B)$, $P(A \cup B)$:

(i) $P(A) = 1/3$, $P(B) = 1/5$, $P(A \cap B) = 1/15$, $P(A \cup B) = ?$

(ii) $P(A) = 0.35$, $P(B) = ?$, $P(A \cap B) = 0.25$, $P(A \cup B) = 0.6$

(iii) $P(A) = 0.5$, $P(B) = 0.35$, $P(A \cap B) = ?$, $P(A \cup B) = 0.7$

SOLUTION

This question tests our understanding of the relationship between the probabilities of events A, B, their intersection ($A \cap B$), and their union ($A \cup B$). We will use the formula: to find the missing probabilities.

(i) We are given , , and . We need to find .

Step 1: Apply the formula

We use the formula for the probability of the union of two events:

Step 2: Substitute the given values

Substitute the given probabilities into the formula:

Step 3: Find a common denominator and simplify

The least common denominator for 3, 5, and 15 is 15. So, we rewrite the fractions with the common denominator:

Step 4: Calculate the result

Answer:

(ii) We are given , , and . We need to find .

Step 1: Apply the formula

We use the formula for the probability of the union of two events:

Step 2: Rearrange the formula to solve for $P(B)$

We want to find , so we rearrange the formula:

Step 3: Substitute the given values

Substitute the given probabilities into the formula:

Step 4: Calculate the result

Answer:

(iii) We are given , , and . We need to find .

Step 1: Apply the formula

We use the formula for the probability of the union of two events:

Step 2: Rearrange the formula to solve for $P(A \cap B)$

We want to find , so we rearrange the formula:

Step 3: Substitute the given values

Substitute the given probabilities into the formula:

Step 4: Calculate the result

Answer:

ANSWER

(i) $7/15$

(ii) 0.5

(iii) 0.15

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Question 14

QUESTION

Given $P(A) = 3/5$ and $P(B) = 1/5$. Find $P(A \text{ or } B)$, if A and B are mutually exclusive events.

SOLUTION

This question tests our understanding of probability, specifically the addition rule for mutually exclusive events.

Step 1: Recall the definition of mutually exclusive events

Two events, A and B, are mutually exclusive if they cannot occur at the same time. In other words, their intersection is empty: .

Step 2: State the addition rule for mutually exclusive events

If A and B are mutually exclusive events, then the probability of A or B occurring (denoted as or) is the sum of their individual probabilities:

Step 3: Apply the given values

We are given:

Since A and B are mutually exclusive, we can directly apply the addition rule:

Step 4: Calculate the sum

Final Answer:

ANSWER

4/5

Question 15

QUESTION

If E and F are events such that $P(E) = 1/4$, $P(F) = 1/2$ and $P(E \text{ and } F) = 1/8$, find

- (i) $P(E \text{ or } F)$
- (ii) $P(\text{not } E \text{ and not } F)$.

SOLUTION

This question tests our understanding of basic probability rules, specifically the addition rule and De Morgan's law.

(i) Finding $P(E \text{ or } F)$

Step 1: Recall the addition rule of probability

The probability of E or F occurring is given by:

Where is the probability of E or F, is the probability of E, is the probability of F, and is the probability of E and F.

Step 2: Substitute the given values

We are given , , and .

Substituting these values into the addition rule, we get:

Step 3: Simplify the expression

To add the fractions, we need a common denominator, which is 8.

Therefore,

(ii) Finding $P(\text{not } E \text{ and not } F)$

Step 1: Apply De Morgan's Law

De Morgan's Law states that the probability of (not E) and (not F) is equal to the probability of not (E or F):

Step 2: Use the complement rule

The probability of an event not occurring is 1 minus the probability of the event occurring:

Step 3: Substitute the value of

We found that in part (i).

Therefore,

Step 4: Simplify the expression

Therefore,

Final Answer:

(i)

(ii)

ANSWER

(i) $\frac{5}{8}$

(ii) $\frac{3}{8}$

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Question 16

QUESTION

Events E and F are such that $P(\text{not } E \text{ or not } F) = 0.25$. State whether E and F are mutually exclusive.

SOLUTION

This question tests our understanding of probability, specifically the concepts of mutually exclusive events and De Morgan's Law.

Step 1: Understand the given information

We are given that . This can be written as , where and represent the complements of events and respectively.

Step 2: Apply De Morgan's Law

De Morgan's Law states that the complement of a union is the intersection of the complements. In probability terms:

Therefore, we have .

Step 3: Find the probability of the intersection

Since , we can find the probability of the intersection of and using the complement rule:

Step 4: Determine if the events are mutually exclusive

Two events are mutually exclusive if they cannot occur at the same time. Mathematically, this means .

Step 5: Conclude

Since and not 0, events and are *not* mutually exclusive. They have a non-zero probability of occurring together.

Final Answer: No

ANSWER

No

Question 17

QUESTION

A and B are events such that $P(A) = 0.42$, $P(B) = 0.48$ and $P(A \text{ and } B) = 0.16$. Determine

- (i) $P(\text{not } A)$
- (ii) $P(\text{not } B)$
- (iii) $P(A \text{ or } B)$.

SOLUTION

This question tests our understanding of basic probability rules, including the complement rule and the addition rule.

(i) Finding $P(\text{not } A)$

We are given . We need to find the probability of the event "not A", which is the complement of A.

The complement rule states that .

Therefore, .

Answer:

(ii) Finding $P(\text{not } B)$

We are given . We need to find the probability of the event "not B", which is the complement of B.

Using the complement rule, .

Therefore, .

Answer:

(iii) Finding $P(A \text{ or } B)$

We are given , , and . We need to find the probability of the event "A or B".

The addition rule states that .

Substituting the given values, we get .

Calculating, .

Answer:

ANSWER

- (i) 0.58

(ii) 0.52

(iii) 0.74

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Question 18

QUESTION

In Class XI of a school, 40% of the students study Mathematics and 30% study Biology. 10% of the class study both Mathematics and Biology. If a student is selected at random from the class, find the probability that the student will be studying Mathematics or Biology.

SOLUTION

This question tests our understanding of basic probability, specifically the concept of the union of two events.

Step 1: Define the events

Let A be the event that a student studies Mathematics.

Let B be the event that a student studies Biology.

Step 2: Write down the given probabilities

We are given:

(Probability of studying Mathematics)

(Probability of studying Biology)

(Probability of studying both Mathematics and Biology)

Step 3: Identify what we need to find

We need to find the probability that a student studies Mathematics or Biology, which is $P(A \cup B)$.

Step 4: Apply the formula for the union of two events

The formula for the probability of the union of two events is:

This formula accounts for the fact that if we simply add $P(A)$ and $P(B)$, we would be double-counting the students who study *both* subjects. Therefore, we subtract $P(A \cap B)$.

Step 5: Substitute the given values into the formula

Step 6: Calculate the result

Final Answer: The probability that the student will be studying Mathematics or Biology is 0.6.

ANSWER

0.6

Question 19

QUESTION

In an entrance test graded on the basis of two examinations, the probability of a randomly chosen student passing the first examination is 0.8 and the probability of passing the second examination is 0.7. The probability of passing at least one of them is 0.95. What is the probability of passing both?

SOLUTION

This question tests our understanding of probability, specifically the concepts of union and intersection of events.

Step 1: Define the events

Let A be the event that a student passes the first examination, and B be the event that a student passes the second examination.

Step 2: Write down the given probabilities

We are given:

$P(A \cup B)$ (probability of passing at least one examination)

Step 3: Use the formula for the union of two events

The probability of the union of two events is given by:

$P(A \cap B)$ Where is the probability of both events and occurring (passing both examinations).

Step 4: Substitute the given values into the formula

We have:

Step 5: Solve for

Final Answer: The probability of passing both examinations is 0.55.

ANSWER

0.55

Question 20

QUESTION

The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1. If the probability of passing the English examination is 0.75, what is the probability of passing the Hindi examination?

SOLUTION

This question involves understanding and applying the concepts of probability, specifically dealing with events related to passing examinations in English and Hindi. We'll use the properties of probabilities and set theory to find the probability of passing the Hindi examination.

Step 1: Define the events

Let E be the event that the student passes the English examination, and H be the event that the student passes the Hindi examination.

Step 2: Write down the given probabilities

We are given:

(Probability of passing both English and Hindi)

(Probability of passing neither)

(Probability of passing English)

Step 3: Use De Morgan's Law

We know that $P(\overline{E \cap H}) = P(\overline{E} \cup \overline{H})$. Therefore,

This implies that

Step 4: Apply the formula for the probability of the union of two events

We have the formula:

Step 5: Substitute the known values and solve for

Substituting the values we have:

Final Answer: The probability of passing the Hindi examination is 0.65.

ANSWER

0.65

Question 21

QUESTION

In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that

- (i) the student opted for NCC or NSS
- (ii) the student has opted neither NCC nor NSS
- (iii) the student has opted NSS but not NCC.

SOLUTION

This question involves calculating probabilities related to students opting for NCC and NSS. We'll use the concepts of union, intersection, and complements of sets to find the required probabilities.

Step 1: Define the events and their probabilities

Let A be the event that a student opted for NCC, and B be the event that a student opted for NSS.

We are given:

$n(A) = 30$, $n(B) = 32$, and the total number of students $n(S) = 60$.

Therefore:

(i) Probability that the student opted for NCC or NSS

We need to find $P(A \cup B)$. Using the formula:

Answer:

(ii) Probability that the student has opted neither NCC nor NSS

We need to find $P(\overline{A \cup B})$, which is the complement of $P(A \cup B)$.

Answer:

(iii) Probability that the student has opted NSS but not NCC

We need to find $P(B - A)$, which means the student opted for NSS but not NCC.

Answer:

ANSWER

- (i) $19/30$
- (ii) $11/30$

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Key Formulas

Important Formulas for Exercise 14.2

Formula / Concept	Description
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	This is the Addition Theorem of Probability . It gives the probability of the occurrence of at least one of two events A or B. The term $P(A \cap B)$ is subtracted to avoid double-counting the outcomes that are common to both A and B.
Mutually Exclusive Events	Two or more events are considered mutually exclusive if they cannot happen at the same time. For example, when tossing a coin, the outcomes of getting a head and a tail are mutually exclusive.
$P(A \cap B) = 0$	For mutually exclusive events, the probability of both events occurring simultaneously is zero.
$P(A \cup B) = P(A) + P(B)$	This is a simplified version of the Addition Theorem for mutually exclusive events . Since the events cannot occur together, the probability of their intersection is zero.
Event 'A or B'	This corresponds to the union of two sets, denoted as $A \cup B$. It represents the outcomes where either event A occurs, or event B occurs, or both occur.
Event 'A and B'	This corresponds to the intersection of two sets, denoted as $A \cap B$. It represents the outcomes where both event A and event B occur simultaneously.
Event 'not A'	This is the complement of event A, often denoted as A' or A^c . It represents all the outcomes in the sample space where event A does not occur.

Formula / Concept	Description
$P(\text{not } A) = 1 - P(A)$	The probability of the complement of an event A is equal to 1 minus the probability of event A.
Impossible Event	An event that cannot happen is called an impossible event. The probability of an impossible event is 0. For example, getting a 7 when rolling a standard six-sided die is an impossible event.
Sure Event	An event that is certain to happen is called a sure event. The probability of a sure event is 1. For example, getting a number less than 7 when rolling a standard six-sided die is a sure event.

7 Top FAQs

Q1. How many questions are included in NCERT Solutions for Class 11 Maths Chapter 14 Probability Exercise 14.2?

NCERT Solutions for Class 11 Maths Chapter 14 Probability Exercise 14.2 contains exactly 21 questions. These questions cover important concepts like Addition Theorem of Probability and Mutually Exclusive Events, which are crucial for CBSE board exam 2025-26 preparation.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 14 Probability Exercise 14.2 with step by step solutions?

You can download free PDF of NCERT Solutions for Class 11 Maths Chapter 14 Probability Exercise 14.2 from official NCERT website and various educational platforms. These PDFs include detailed step by step solutions for all 21 questions, updated as per CBSE syllabus 2025-26.

Q3. How many marks does Probability Chapter 14 Exercise 14.2 carry in CBSE Class 11 board exam 2025-26?

In CBSE Class 11 board exam 2025-26, the entire Unit V (Statistics and Probability) carries 10 marks weightage, with Chapter 14 Probability contributing approximately 6 marks. Exercise 14.2 focusing on Addition Theorem of Probability is an important part of this weightage.

Q4. Which is the most difficult question in NCERT Solutions Class 11 Maths Chapter 14 Probability Exercise 14.2 for CBSE board exam preparation?

Questions 18-21 in NCERT Solutions Class 11 Maths Chapter 14 Probability Exercise 14.2 are considered most challenging as they involve complex applications of Addition Theorem and Mutually Exclusive Events. These questions require strong conceptual understanding and step by step problem-solving approach for CBSE board exam 2025-26.

Q5. What is Addition Theorem of Probability explained in NCERT Solutions for Class 11 Maths Chapter 14 Exercise 14.2?

Addition Theorem of Probability in NCERT Solutions Class 11 Maths Chapter 14 Exercise 14.2 states that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ for any two events A and B. For mutually exclusive events, $P(A \cap B) = 0$, so the formula simplifies to $P(A \cup B) = P(A) + P(B)$, which is extensively used in Exercise 14.2 questions.

More Exercises

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