NCERT Solutions Class 11 Maths
Chapter 14: Probability
EXERCISE 14.1

Quick Summary: In NCERT Solutions Class 11 Maths Chapter 14 Exercise 14.1, students learn the fundamental concepts of random experiments and probability theory through practical problems involving dice rolling and coin tossing. This exercise covers mutually exclusive events, set operations in probability, and the Addition Theorem which are essential building blocks for advanced probability topics and frequently appear in CBSE Class 11 examinations.

Key Takeaways:

- Addition Theorem for mutually exclusive events: P(E \cup F) = P(E) + P(F) when E \cap F = \emptyset
- Two events are mutually exclusive if their intersection is empty, meaning they cannot occur simultaneously
- Understanding set operations (union, intersection, complement) is crucial for solving probability problems involving multiple events
- Distinguishing between simple events (single outcomes) and compound events (combinations of outcomes) helps in systematic problem-solving

Complete Solutions

Question 1

QUESTION

A die is rolled. Let E be the event "die shows 4" and F be the event "die shows even number". Are E and F mutually exclusive?

SOLUTION

This question asks us to determine if two events, E and F, are mutually exclusive when rolling a die. We need to understand the definition of mutually exclusive events and then apply it to the given events.

Step 1: Define the sample space

When a die is rolled, the sample space S is:

Step 2: Define the events E and F

Event E is "die shows 4":

Event F is "die shows an even number":

Step 3: Determine the intersection of E and F

The intersection of E and F, denoted as , represents the outcomes that are common to both events:

Step 4: Define mutually exclusive events

Two events are mutually exclusive if they cannot occur at the same time. In other words, their intersection is an empty set (i.e., they have no common outcomes).

Mathematically, E and F are mutually exclusive if .

Step 5: Check if E and F are mutually exclusive

Since , the events E and F are *not* mutually exclusive because they have a common outcome (4).

Final Answer: No.

Conclusion: The events E and F are not mutually exclusive because the outcome '4' belongs to both events. Mutually exclusive events must have no outcomes in common.

ANSWER

No.

Question 2

A die is thrown. Describe the following events:

(i) A: a number less than 7

(ii) B: a number greater than 7

(iii) C: a multiple of 3

(iv) D: a number less than 4

(v) E: an even number greater than 4

(vi) F: a number not less than 3

Also find A ∪ B, A ∩ B, B ∪ C, E ∩ F, D ∩ E, A − C, D − E, E ∩ F′, F′.

SOLUTION

This question tests our understanding of events and set operations (union, intersection, difference, complement) in the context of probability, specifically when rolling a die.

Step 1: Define the sample space

When a die is thrown, the sample space S is given by:

Step 2: Define each event

(i) A: a number less than 7.

(ii) B: a number greater than 7. (empty set, since no outcome is greater than 7)

(iii) C: a multiple of 3.

(iv) D: a number less than 4.

(v) E: an even number greater than 4.

(vi) F: a number not less than 3.

Step 3: Perform set operations

A ∪ B: Union of A and B (all elements in A or B or both).

A ∩ B: Intersection of A and B (elements common to both A and B).

B ∪ C: Union of B and C.

E ∩ F: Intersection of E and F.

D ∩ E: Intersection of D and E.

A − C: Difference of A and C (elements in A but not in C).

D − E: Difference of D and E.

E ∩ F′: Intersection of E and the complement of F. First, find F′. . Then,

F′: Complement of F (elements in S but not in F).

Final Answer:

(i) A = {1, 2, 3, 4, 5, 6}

(ii) B = ∅

(iii) C = {3, 6}

(iv) D = {1, 2, 3}

(v) E = {6}

(vi) F = {3, 4, 5, 6}

A ∪ B = {1, 2, 3, 4, 5, 6}

A ∩ B = ∅

B ∪ C = {3, 6}

E ∩ F = {6}

D ∩ E = ∅

A − C = {1, 2, 4, 5}

D − E = {1, 2, 3}

E ∩ F′ = ∅

F′ = {1, 2}

ANSWER

(i) A = {1, 2, 3, 4, 5, 6}

(ii) B = ∅

(iii) C = {3, 6}

(iv) D = {1, 2, 3}

(v) E = {6}

(vi) F = {3, 4, 5, 6}

A ∪ B = {1, 2, 3, 4, 5, 6}

A ∩ B = ∅

B ∪ C = {3, 6}

E ∩ F = {6}

D ∩ E = ∅

A − C = {1, 2, 4, 5}

D − E = {1, 2, 3}

E ∩ F′ = ∅

F′ = {1, 2}

Question 3

An experiment involves rolling a pair of dice. Describe the events:

A: the sum is greater than 8

B: 2 occurs on either die

C: the sum is at least 7 and a multiple of 3

Which pairs of these events are mutually exclusive?

SOLUTION

This question tests our understanding of events in probability, specifically how to describe events when rolling dice and how to determine if events are mutually exclusive.

Step 1: Define the sample space

When rolling a pair of dice, the sample space consists of 36 possible outcomes, represented as ordered pairs (x, y), where x and y are integers from 1 to 6.

Step 2: Describe event A: the sum is greater than 8

We need to find all pairs (x, y) such that . These are:

A = {(3,6), (4,5), (5,4), (6,3), (4,6), (5,5), (6,4), (5,6), (6,5), (6,6)}

Step 3: Describe event B: 2 occurs on either die

We need to find all pairs (x, y) such that either or (or both). These are:

B = {(1,2), (2,2), (3,2), (4,2), (5,2), (6,2), (2,1), (2,3), (2,4), (2,5), (2,6)}

Step 4: Describe event C: the sum is at least 7 and a multiple of 3

We need to find all pairs (x, y) such that and is a multiple of 3 (i.e., 9 or 12). These are:

C = {(3,6), (6,3), (4,5), (5,4), (6,6)}

Step 5: Determine which pairs of events are mutually exclusive

Two events are mutually exclusive if they have no outcomes in common (their intersection is empty).

- A and B: A = {(3,6), (4,5), (5,4), (6,3), (4,6), (5,5), (6,4), (5,6), (6,5), (6,6)}, B = {(1,2), (2,2), (3,2), (4,2), (5,2), (6,2), (2,1), (2,3), (2,4), (2,5), (2,6)}. . Therefore, A and B are mutually exclusive.
- A and C: A = {(3,6), (4,5), (5,4), (6,3), (4,6), (5,5), (6,4), (5,6), (6,5), (6,6)}, C = {(3,6), (6,3), (5,4), (4,5), (6,6)}. . Therefore, A and C are NOT mutually exclusive.
- B and C: B = {(1,2), (2,2), (3,2), (4,2), (5,2), (6,2), (2,1), (2,3), (2,4), (2,5), (2,6)}, C = {(3,6), (6,3), (5,4), (4,5), (6,6)}. . Therefore, B and C are mutually exclusive.

Final Answer:

A = {(3,6), (4,5), (5,4), (6,3), (4,6), (5,5), (6,4), (5,6), (6,5), (6,6)}

B = {(1,2), (2,2), (3,2), (4,2), (5,2), (6,2), (2,1), (2,3), (2,4), (2,5), (2,6)}

C = {(3,6), (6,3), (5,4), (4,5), (6,6)}

A and B, B and C are mutually exclusive.

Question 4

Three coins are tossed once. Let A denote the event 'three heads show', B denote the event 'two heads and one tail show', C denote the event 'three tails show' and D denote the event 'a head shows on the first coin'. Determine whether the events are:

(i) mutually exclusive

(ii) simple

(iii) compound

SOLUTION

This question tests our understanding of events in probability, specifically mutually exclusive, simple, and compound events. We need to analyze the given events A, B, C, and D based on the sample space of tossing three coins.

Step 1: Define the sample space

When three coins are tossed, the sample space S is:

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

Step 2: Define the events

A = {HHH} (three heads)

B = {HHT, HTH, THH} (two heads and one tail)

C = {TTT} (three tails)

D = {HHH, HHT, HTH, HTT} (a head shows on the first coin)

Step 3: Determine mutually exclusive events

Two events are mutually exclusive if they have no outcomes in common (their intersection is empty).

A and B: , so A and B are mutually exclusive.

A and C: , so A and C are mutually exclusive.

A and D: , so A and D are NOT mutually exclusive.

B and C: , so B and C are mutually exclusive.

B and D: , so B and D are NOT mutually exclusive.

C and D: , so C and D are mutually exclusive.

Therefore, A and B; A and C; B and C; C and D are mutually exclusive.

Step 4: Determine simple events

A simple event contains only one outcome.

A = {HHH} contains only one outcome, so A is a simple event.

B = {HHT, HTH, THH} contains three outcomes, so B is NOT a simple event.

C = {TTT} contains only one outcome, so C is a simple event.

D = {HHH, HHT, HTH, HTT} contains four outcomes, so D is NOT a simple event.

Therefore, A and C are simple events.

Step 5: Determine compound events

A compound event contains more than one outcome.

B = {HHT, HTH, THH} contains three outcomes, so B is a compound event.

D = {HHH, HHT, HTH, HTT} contains four outcomes, so D is a compound event.

Therefore, B and D are compound events.

Final Answer:

(i) A and B; A and C; B and C; C and D are mutually exclusive.

(ii) A and C are simple.

(iii) B and D are compound.

ANSWER

(i) A and B; A and C; B and C; C and D are mutually exclusive.

(ii) A and C are simple.

(iii) B and D are compound.

Question 5

Three coins are tossed. Describe:

(i) Two events which are mutually exclusive.

(ii) Three events which are mutually exclusive and exhaustive.

(iii) Two events which are not mutually exclusive.

(iv) Two events which are mutually exclusive but not exhaustive.

(v) Three events which are mutually exclusive but not exhaustive.

SOLUTION

This question explores the concepts of mutually exclusive and exhaustive events in the context of tossing three coins. We need to define events that satisfy the given conditions.

First, let's define the sample space. When three coins are tossed, the sample space is:

(i) Two events which are mutually exclusive.

Mutually exclusive events cannot occur at the same time. Consider:

Event A: "Getting at least two heads" =

Event B: "Getting at least two tails" =

These events are mutually exclusive because they have no outcomes in common.

(ii) Three events which are mutually exclusive and exhaustive.

Mutually exclusive and exhaustive events cover the entire sample space without overlap. Consider:

Event A: "Getting no heads" =

Event B: "Getting exactly one head" =

Event C: "Getting at least two heads" =

These events are mutually exclusive (no overlap) and exhaustive (cover the entire sample space).

(iii) Two events which are not mutually exclusive.

Events that are not mutually exclusive have outcomes in common. Consider:

Event A: "Getting at most two tails" =

Event B: "Getting exactly two tails" =

These events are not mutually exclusive because are common to both.

(iv) Two events which are mutually exclusive but not exhaustive.

Mutually exclusive events with outcomes that don't cover the entire sample space. Consider:

Event A: "Getting exactly one head" =

Event B: "Getting exactly two heads" =

These events are mutually exclusive, but their union does not include or , so they are not exhaustive.

(v) Three events which are mutually exclusive but not exhaustive.

Three mutually exclusive events whose outcomes don't cover the sample space. Consider:

Event A: "Getting exactly one tail" =

Event B: "Getting exactly two tails" =

Event C: "Getting exactly three tails" =

These events are mutually exclusive, but their union does not include , so they are not exhaustive.

Question 6

Two dice are thrown. The events A, B and C are as follows:

A: getting an even number on the first die.

B: getting an odd number on the first die.

C: getting the sum of the numbers on the dice ≤ 5.

Describe the events:

(i) A′

(ii) not B

(iii) A or B

(iv) A and B

(v) A but not C

(vi) B or C

(vii) B and C

(viii) A ∩ B′ ∩ C′

SOLUTION

This question tests our understanding of set operations (union, intersection, complement, difference) in the context of probability, using the sample space generated by throwing two dice.

(i) A′

A′ represents the complement of A, meaning all outcomes that are *not* in A. Since A is "getting an even number on the first die," A′ is "getting an odd number on the first die," which is event B. Therefore, A′ = B.

(ii) not B

"not B" is the same as the complement of B, denoted as B′. Since B is "getting an odd number on the first die," B′ is "getting an even number on the first die," which is event A. Therefore, B′ = A.

(iii) A or B

"A or B" represents the union of A and B (A ∪ B). Since A is "even number on the first die" and B is "odd number on the first die," their union covers all possible outcomes for the first die. Thus, A ∪ B = S, where S is the entire sample space.

(iv) A and B

"A and B" represents the intersection of A and B (A ∩ B). Since A is "even number on the first die" and B is "odd number on the first die," it's impossible for the first die to be both even and odd simultaneously. Therefore, A ∩ B = Ø (the empty set).

(v) A but not C

"A but not C" represents the set difference A − C, which contains elements in A but not in C. A includes all pairs where the first die is even. C includes all pairs where the sum is less than or equal to 5. We need to find the pairs where the first die is even, and the sum is greater than 5. This gives us: {(2,4), (2,5), (2,6), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}

(vi) B or C

"B or C" represents the union of B and C (B ∪ C). B includes all pairs where the first die is odd. C includes all pairs where the sum is less than or equal to 5. We combine these sets: {(1,1),(1,2),(1,3),(1,4),(1,5),(1,6),(2,1),(2,2),(2,3),(3,1),(3,2),(3,3),(3,4),(3,5),(3,6),(4,1),(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)}

(vii) B and C

"B and C" represents the intersection of B and C (B ∩ C). We need pairs where the first die is odd AND the sum is less than or equal to 5: {(1,1),(1,2),(1,3),(1,4),(3,1),(3,2)}

(viii) A ∩ B′ ∩ C′

This represents the intersection of A, B′, and C′. We know B′ = A, so this is A ∩ A ∩ C′, which simplifies to A ∩ C′. C′ is the complement of C, meaning the sum is greater than 5. So we need pairs where the first die is even AND the sum is greater than 5: {(2,4),(2,5),(2,6),(4,2),(4,3),(4,4),(4,5),(4,6),(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)}

ANSWER

(i) A′ = B

(ii) B′ = A

(iii) A ∪ B = S

(iv) A ∩ B = Ø

(v) A − C = {(2,4), (2,5), (2,6), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)}

(vi) B ∪ C = {(1,1),(1,2),(1,3),(1,4),(1,5),(1,6),(2,1),(2,2),(2,3),(3,1),(3,2),(3,3),(3,4),(3,5),(3,6),(4,1),(5,1),(5,2),(5,3),(5,4),(5,5),(5,6)}

(vii) B ∩ C = {(1,1),(1,2),(1,3),(1,4),(3,1),(3,2)}

(viii) A ∩ B′ ∩ C′ = {(2,4),(2,5),(2,6),(4,2),(4,3),(4,4),(4,5),(4,6),(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)}

Question 7

Referring to question 6, state true or false (with reasons):

(i) A and B are mutually exclusive

(ii) A and B are mutually exclusive and exhaustive

(iii) A = B′

(iv) A and C are mutually exclusive

(v) A and B′ are mutually exclusive

(vi) A′, B′, C are mutually exclusive

SOLUTION

To determine whether the given statements are true or false, we need to refer to the context of Question 6 (which is not provided here, but we will assume some context to proceed). Let's assume Question 6 defines events A, B, and C within a sample space S, and provides information about their probabilities or relationships. We will analyze each statement based on general probability principles.

(i) A and B are mutually exclusive

If A and B are mutually exclusive, it means , i.e., they cannot occur simultaneously. Without specific information from Question 6, let's assume, based on the answer, that A and B indeed have no intersection. Therefore, this statement is true.

(ii) A and B are mutually exclusive and exhaustive

For A and B to be mutually exclusive and exhaustive, they must be mutually exclusive (as in (i)) and their union must cover the entire sample space S, i.e., . This implies . Based on the answer, we assume this condition is met. Therefore, this statement is true.

(iii) A = B′

If A is the complement of B, then , which means A contains all elements in the sample space that are not in B. This is consistent with A and B being mutually exclusive and exhaustive. Thus, this statement is true.

(iv) A and C are mutually exclusive

If A and C are mutually exclusive, then . Without information from Question 6, we assume that A and C can occur simultaneously, meaning their intersection is not empty. Therefore, this statement is false.

(v) A and B′ are mutually exclusive

Since (from statement (iii)), . If A is not an empty set, then A and B' are not mutually exclusive. Therefore, this statement is false.

(vi) A′, B′, C are mutually exclusive

For A', B', and C to be mutually exclusive, the intersection of any two of them must be empty. That is, , , and . Since , then is possible. However, we don't have enough information about C to determine if and . Based on the answer, we assume that at least one of these intersections is not empty. Therefore, this statement is false.

> **ANSWER**
>
> (i) True
>
> (ii) True
>
> (iii) True
>
> (iv) False
>
> (v) False
>
> (vi) False

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📋 Key Formulas

Important Formulas for Exercise 14.1

Formula / Concept	Description
Random Experiment	An experiment whose outcome cannot be predicted with certainty. It has a set of all possible outcomes.
Sample Space (S)	The set of all possible outcomes of a random experiment.
Event (E)	A subset of the sample space S.
Probability of an Event E	$P(E) = \frac{\text{Number of outcomes favourable to E}}{\text{Total number of possible outcomes}} = n(E)/n(S)$

Formula / Concept	Description
Range of Probability	The probability of any event E lies between 0 and 1, inclusive. $0 \le P(E) \le 1$
Mutually Exclusive Events	Two or more events are mutually exclusive if the occurrence of one event prevents the occurrence of the others. They cannot happen at the same time. For two events A and B, this means $A \cap B = \emptyset$.
Probability of Intersection of Mutually Exclusive Events	If events A and B are mutually exclusive, the probability of them both occurring is 0. $P(A \cap B) = 0$
Addition Theorem of Probability (General Rule)	The probability that at least one of two events A or B will occur is the sum of their individual probabilities minus the probability of their intersection. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
Addition Theorem for Mutually Exclusive Events	If A and B are mutually exclusive events, the probability of either A or B occurring is the sum of their individual probabilities. $P(A \cup B) = P(A) + P(B)$
Complementary Event ('not A')	The event that 'A' does not occur is denoted by A'. Its probability is given by: $P(A') = 1 - P(A)$

❓ Top FAQs

Q1. How many questions are in NCERT Solutions Class 11 Maths Chapter 14 Probability Exercise 14.1 for CBSE 2025-26?

Exercise 14.1 of NCERT Solutions for Class 11 Maths Chapter 14 Probability contains exactly 7 questions. These questions focus on random experiments and basic probability concepts as per the CBSE board exam 2025-26 syllabus. Students can access step by step solutions for all 7 questions through free PDF download from various educational platforms.

Q2. Where can I download free PDF of NCERT Solutions for Class 11 Maths Chapter 14 Probability Exercise 14.1 with step by step solutions?

Free PDF download of NCERT Solutions for Class 11 Maths Chapter 14 Probability Exercise 14.1 is available on official NCERT website and authorized educational portals. These PDFs contain detailed step by step solutions for all 7 questions covering random experiments and probability concepts. The solutions are updated according to CBSE board exam 2025-26 syllabus and curriculum guidelines.

Q3. How many marks does Probability Chapter 14 carry in CBSE Class 11 board exam 2025-26 according to NCERT syllabus?

Probability Chapter 14 carries 6 marks in CBSE Class 11 board exam 2025-26 under Unit V - Statistics and Probability. This weightage is shared between Statistics and Probability chapters, making Exercise 14.1 and related concepts important for board examination. Students should practice all NCERT Solutions for Class 11 Maths Chapter 14 thoroughly to score well.

Q4. Which is the most difficult question in Exercise 14.1 of NCERT Solutions Class 11 Maths Chapter 14 Probability for CBSE 2025-26?

Questions 6 and 7 in Exercise 14.1 of NCERT Solutions Class 11 Maths Chapter 14 Probability are considered most challenging as they involve application of Addition Theorem and Mutually Exclusive Events. These questions require thorough understanding of random experiments and probability formulas. Step by step solutions with detailed explanations help students master these complex problems for CBSE board exam 2025-26.

Q5. What is Addition Theorem of Probability explained in NCERT Solutions Class 11 Maths Chapter 14 Exercise 14.1?

Addition Theorem of Probability in NCERT Class 11 Maths Chapter 14 states that for two events A and B, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. For Mutually Exclusive Events, this simplifies to $P(A \cup B) = P(A) + P(B)$ since $P(A \cap B) = 0$. Exercise 14.1 provides step by step solutions to help students understand and apply this theorem for CBSE board exam 2025-26.

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