

NCERT Solutions for Class-XI Maths

Chapter-16 Exercise-16.1 NCERT Math Class 11

1. Describe the sample space for the indicated experiment: A coin is tossed three times.
1. A coin has two faces: head (H) and tail (T).

When a coin is tossed three times, the total number of possible outcomes is $2^3 = 8$ Thus, when a coin is tossed three times, the sample space is given by:

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

2. Describe the sample space for the indicated experiment: A die is thrown two times.
2. Let 1,2,3,4,5,6 denote the event the respective numbers comes when the die is thrown

The total number of sample space $= (6 \times 6) = 36$

We define the possible outcomes by an ordered set (x, y)

where

x denotes the outcome of the first time the die is thrown

y denotes the outcome of the second time the die is thrown

The sample space

$$S = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$$

3. Describe the sample space for the indicated experiment: A coin is tossed four times.
3. When a coin is tossed once, there are two possible outcomes: head (H) and tail (T).

When a coin is tossed four times, the total number of possible outcomes is $2^4 = 16$

Thus, when a coin is tossed four times, the sample space is given by:

$$S = \{HHHH, HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, HTTT, THHH, THHT, THTH, THTT, TTHH, TTHT, TTTH, TTTT\}$$

4. A coin is tossed and a die is thrown.
4. Let H denote the event of a head and T denote the event of a tail ,
1,2,3,4,5,6 denote the event the respective numbers comes when the die is thrown
Total Number of space $= (2 \times 6) = 12$
We define the possible outcomes by an ordered set (x, y)

x denotes the first event when the coin is tossed
y denotes the second event when the die is thrown

Sample

Space

$$S = \{(H,1),(H,2),(H,3),(H,4),(H,5),(H,6),(T,1),(T,2),(T,3),(T,4),(T,5),(T,6)\}$$

5. Describe the sample space for the indicated experiment: A coin is tossed and then a die is rolled only in case a head is shown on the coin.

5. A coin has two faces: head (H) and tail (T).

A die has six faces that are numbered from 1 to 6 , with one number on each face.

Thus, when a coin is tossed and then a die is rolled only in case a head is shown on the coin, the sample space is given by: $S = \{H1, H2, H3, H4, H5, H6, T\}$

6. 2 boys and 2 girls are in Room X, and 1 boy and 3 girls in Room Y. Specify the sample space for the experiment in which a room is selected and then a person.

6. Let X denote the event Room X is selected , Y denote the event Room Y is selected
B1, B2 denote the event a boy is selected from room X , B3 denote the event a boy is selected from Room Y and G1,G2 denote the event a girl is selected from Room X and G3,G4,G5 denote the event a girl is selected among the three girls from Room Y

The problem is solved by dividing into two cases

Case 1: Room X is selected

We define the possible outcomes by an ordered set (x , y)

x denotes the event Room X is chosen

y denotes the second event a student is selected

$$\text{Sample Space } S_1 = \{(X,B1),(X,B2),(X,G1),(X,G2)\}$$

Case 2: Room Y is selected

We define the possible outcomes by an ordered set (x , y)

x denotes the event Room Y is chosen

y denotes the second event a student is selected

$$\text{Sample Space } S_2 = \{(Y,B3),(Y,G3),(Y,G4),(Y,G5)\}$$

The overall sample space

$$S = \{(X, B1),(X,B2),(X,G1),(X,G2),(Y,B3),(Y,G3),(Y,G4),(Y,G5)\}$$

7. One die of red colour, one of white colour and one of blue colour are placed in a bag. One die is selected at random and rolled, its colour and the number on its uppermost face is noted.

Describe the sample space.

7. A die has six faces that are numbered from 1 to 6 , with one number on each face. Let us denote the red, white, and blue dices as R, W , and B respectively.

Accordingly, when a die is selected and then rolled, the sample space is given by

$$S = \{R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, W6, B1, B2, B3, B4, B5, B6\}$$

8. An experiment consists of recording boy–girl composition of families with 2 children.
- (i) What is the sample space if we are interested in knowing whether it is a boy or girl in the order of their births?
- (ii) What is the sample space if we are interested in the number of girls in the family?
8. Let B be the event a boy is born, G be the event a girl is born
- (i) We define the possible outcomes by an ordered set (x , y)
x denotes the event the first child is born
y denotes the event the second child is born
Sample space $S = \{(G,G),(G,B),(B,G),(B,B)\}$
- (ii) When there are two child in the family then only three possible cases are possible, 2 Girl child, 1 Girl Child or no Girl Child
Sample Space $S = \{2, 1, 0\}$
9. A box contains 1 red and 3 identical white balls. Two balls are drawn at random in succession without replacement. Write the sample space for this experiment.
9. It is given that the box contains 1 red ball and 3 identical white balls. Let us denote the red ball with R and a white ball with W.
When two balls are drawn at random in succession without replacement, the sample space is given by $S = \{RW, WR, WW\}$
10. An experiment consists of tossing a coin and then throwing it second time if a head occurs. If a tail occurs on the first toss, then a die is rolled once. Find the sample space.
10. Let H denote the event of a head and T denote the event of a tail ,
1,2,3,4,5,6 denote the event the respective numbers comes when the die is thrown
The problem can be solved by breaking it into two cases
- Case 1: Head is encountered**
We define the possible outcomes by an ordered set (x, y)
x denotes the first event when the head is encountered
y denotes the second event the coin is tossed again
Sample space $S_1 = \{(H,T),(H,H)\}$
- Case 2: Tail is encountered**
We define the possible outcomes by an ordered set (x, y)
x denotes the first event when the tail is encountered
y denotes the second event when the die is thrown
Sample Space $S_2 = \{(T,1),(T,2),(T,3),(T,4),(T,5),(T,6)\}$

The Overall Sample space

11. Suppose 3 bulbs are selected at random from a lot. Each bulb is tested and classified as defective (D) or non-defective (N). Write the sample space of this experiment?

11. 3 bulbs are to be selected at random from the lot. Each bulb in the lot is tested and classified as defective (D) or non-defective (N).

The sample space of this experiment is given by $S = \{DDD, DDN, DND, DNN, NDD, NDN, NND, NNN\}$

12. A coin is tossed. If the outcome is a head, a die is thrown. If the die shows up an even number, the die is thrown again. What is the sample space for the experiment?

12. Let H denote the event of a head and T denote the event of a tail ,

1,2,3,4,5,6 denote the event the respective numbers comes when the die is thrown

The problem can be solved by dividing it into 3 cases

Case 1: Head is encountered and the corresponding number on the die is Odd

Total number of sample space= $(1 \times 3) = 3$

We define the possible outcomes by an ordered set (x , y)

x denotes the first event the head is encountered

y denotes the second event the number on the die is Odd

Sample space $S_1 = \{(H,1), (H,3), (H,5)\}$

Case 2: Head is encountered and the corresponding number is even

Total number of sample space= $(1 \times 3 \times 6) = 18$

We define the possible outcomes by an ordered set (x, y, z)

where

x denotes the outcomes when the coin is tossed and head is encountered

y denotes the outcomes when the die is tossed and the number encountered is even

z denotes the outcomes when the die is tossed for the second time

Sample Space

$S_2 = \{(H,2,1), (H,2,2), (H,2,3), (H,2,4), (H,2,5), (H,2,6), (H,4,1), (H,4,2), (H,4,3), (H,2,4), (H,4,5), (H,4,6), (H,6,1), (H,6,2), (H,6,3), (H,6,4), (H,6,5), (H,6,6)\}$

Case 3: Tail is encountered

Total number of sample space=1

Sample space $S_3 = \{(T)\}$

The overall sample space

$S = \{(H,1), (H,3), (H,5),$

$(H,2,1), (H,2,2), (H,2,3), (H,2,4), (H,2,5), (H,2,6), (H,4,1), (H,4,2), (H,4,3), (H,2,4), (H,4,5), (H,4,6), (H,6,1), (H,6,2), (H,6,3), (H,6,4), (H,6,5), (H,6,6), (T)\}$

13. The numbers 1, 2, 3 and 4 are written separately on four slips of paper. The slips are put in a box and mixed thoroughly. A person draws two slips from the box, one after the other, without replacement. Describe the sample space for the experiment.

13. If 1 appears on the first drawn slip, then the possibilities that the number appears on the second drawn slip are 2, 3, or 4. Similarly, if 2 appears on the first drawn slip, then the possibilities that the number appears on the second drawn slip are 1, 3, or 4. The same holds true for the remaining numbers too.

Thus, the sample space of this experiment is given by

$$S = \{(1,2), (1,3), (1,4), (2,1), (2,3), (2,4), (3,1), (3,2), (3,4), (4,1), (4,2), (4,3)\}$$

14. An experiment consists of rolling a die and then tossing a coin once if the number on the die is even. If the number on the die is odd, the coin is tossed twice. Write the sample space for this experiment.

14. Let 1, 2, 3, 4, 5, 6 denote the event the respective numbers comes when the die is thrown
H denote the event of a head and T denote the event of a tail when coin is tossed

The following problem can be divided in two cases

Case 1: Even number shows up in the die

We define the possible outcomes by an ordered set (x, y)

x denotes the first event even number shows up

y denotes the second event a coin is thrown

The sample space $S_1 = \{(2,H), (4,H), (6,H), (2,T), (4,T), (6,T)\}$

Case 2: Odd number shows up in the die

We define the possible outcomes by an ordered set (x, y, z)

x denotes the first event odd number shows up in the die

y denotes the second event the coin is thrown for first time

z denote the third event the coin is thrown for second time

The sample space

$$S_2 = \{(1,H,H), (3,H,H), (5,H,H), (1,H,T), (3,H,T), (5,H,T), (1,T,H), (3,T,H), (5,T,H), (1,T,T), (3,T,T), (5,T,T)\}$$

Therefore the overall sample space for the problem = $S_1 + S_2$

$$S = \{(2,H), (4,H), (6,H), (2,T), (4,T), (6,T), (1,H,H), (3,H,H), (5,H,H), (1,H,T), (3,H,T), (5,H,T), (1,T,H), (3,T,H), (5,T,H), (1,T,T), (3,T,T), (5,T,T)\}$$

15. A coin is tossed. If it shows a tail, we draw a ball from a box which contains 2 red and 3 black balls. If it shows head, we throw a die. Find the sample space for this experiment.

15. The box contains 2 red balls and 3 black balls. Let us denote the 2 red balls as R_1, R_2 and the 3 black balls as B_1, B_2 , and B_3 .

The sample space of this experiment is given by

$$S = \{TR_1, TR_2, TB_1, TB_2, TB_3, H1, H2, H3, H4, H5, H6\}$$

16. A die is thrown repeatedly until a six comes up. What is the sample space for this experiment?

16. Let 1,2,3,4,5,6 denote the event the respective numbers comes when the die is thrown
Since this is a continuous event and doesn't stop until six is found so the sample space is continuous in nature.

The six may come up on the very first throw or the second or the third and this goes on continuously until six comes

The sample space when 6 comes on very first throw = $\{6\}$

The sample space when 6 comes on second throw = $\{(1,6),(2,6),(3,6),(4,6),(5,6)\}$

This event can go on for infinite times hence the sample space is infinitely defined

$S = \{(6),(1,6),(2,6),(3,6),(4,6),(5,6), (1,1,6),(1,2,6).....(1,1,1,6).....\}$



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