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Independent and dependent events

Independent events-

When the occurrence of one event does not affect the occurrence of the ther event.
Two events A and B are independent events if and only if the probability that both events occur is the product of the probabilities of the event.
Symbol- P(A and B)=P(A)*P(B)
Example -
If a coin is tossed twice, its landing heads up on the first toss and landing heads up on the second toss are independent events. The outcome of one toss does not affect the probability of heads on the other toss.

Example: what is the probability of getting a "Head" when tossing a coin?

Number of ways it can happen: 1 (Head)

Total number of outcomes: 2 (Head and Tail)

So the probability = 1/2 = 0.5

Example 2:

A dice is being thrown twice. Find the probability of getting 5 and 6 in both throws respectively.

Solution:

Probability of getting a 5 in first throw = 1/6

Probability of getting a 6 in second throw = 1/6

Probability of both the events happening = 1/6×1/6 = 1/36.

Dependent -

When the occurrence of one event does affect the occurrence of the other event

Conditional probability is when the probability that event B occurs given that event A has occurred, B given A and is written as P(B/A).

If two events A and B are dependent , then the probability that both events occur is the product of the probability of the first event and the conditional of the second event given event.
Symbol - P(A and B)=P(A)*P(B/A)

If *A* and *B* are dependent events, then the probability of *A* happening AND the probability of *B* happening, given *A*, is P(*A*) × P(*B* after *A*).

P(*A* and *B*) = P(*A*) × P(*B* after *A*)

P(*B* after *A*) can also be written as P(*B* | *A*)

then P(*A* and *B*) = P(*A*) × P(*B* | *A*)

Example :

Two balls are drawn successively without replacement from a box which contains 4 white balls and 3 red balls. Find the probability that

(a) the first ball drawn is white and the second is red;

(b) both balls are red.

Solution :

a) The second event is dependent on the first.

$P(E_1)$ = *P*(white) =7/4

There are 6 balls left and out of those 6, three of them are red. So the probability that the second one is red is given by:

$P(E_2 \mid E_1)$ = *P*(red)=3/6=/21/2

Dependent events, so

P(*E*1 and *E*2)=*P*(*E*1)×*P*(*E*2|*E*1)=4/7*1/2=2/7

(b) Also dependent events. Using similar reasoning, but realising there will be 2 red balls on the second draw, we have:

P(*RR*)=3/7*2/6=1/7

Problems

Determine whether the scenario involves independent or dependent events.

1) You flip a coin and then roll a fair six-sided die. The coin lands heads-up and the die shows a one.

2) A bag contains eight red marbles and four blue marbles. You randomly pick a marble and then pick a second marble without returning the marbles to the bag. The first marble is red and the second marble is blue.

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3).On a library shelf, three geometry and five algebra books. Books are not replaced after someone borrow it. If two books are taken then ,what is the probability that first is of geometry and other of algebra?

4).From a deck of 52 cards, two cards are being chosen without replacement. What will be the probability of first one being black and second one being red?

5.)A purse contains four $5 bills, five $10 bills and three $20 bills. Two bills are selected without the first selection being replaced. Find P($5, then $5)

6.)A bag contains 6 red, 5 blue and 4 yellow marbles. Two marbles are drawn, but the first marble drawn is not replaced.
a) Find P(red, then blue)

b) Find P(blue, then blue)

Answers

1.)independent

2.) dependent

3.)Solution:

The probability of first book to be of geometry = 3/8

The probability of second book to be of algebra = 5/7

As in total number of books one is already taken out, the total has become 7.

Probability of both events occurring = 38×57 = 15/56.

4.)Solution:

Probability of first card being black = 26/52 = 1/2

Probability of second card being red = 26/51

Probability of first card being black and second being red = 1/2×26/51 = 26/102 = 13/51

5.)Solution:

There are four $5 bills.

There are a total of twelve bills.

P($5) =4/12

The result of the first draw affected the probability of the second draw.

There are three $5 bills left.

There are a total of eleven bills left.

P($5 after $5) =3/11

P($5, then $5) = P($5) · P($5 after $5) =4/12 *3/11=1/11

The probability of drawing a $5 bill and then a $5 bill is 1/11

6.)Solution:
a) There are 6 red marbles.

There are a total of 15 marbles.

P(red) =6/15

The result of the first draw affected the probability of the second draw.

There are 5 blue marbles.

There are a total of 14 marbles left.

P(blue after red) =5/14

P(red, then blue) = P(red) · P(blue after red) =6/15*5/14=1/7

The probability of drawing a red marble and then a blue marble is 1/7

b) There are 5 blue marbles.

There are a total of 15 marbles.

P(blue) = 5/15

The result of the first draw affected the probability of the second draw.

There are 4 blue marbles left.

There are a total of 14 marbles left.

P(blue after blue) =4/14

P(blue, then blue) = P(blue) · P(blue after blue) =5/15*4/14=2/21

The probability of drawing a red marble and then a blue marble is 2/21