Probability of Dependent and Independent Events

Independent Events: Two events are independent if the occurrence of the first event does not affect that of the second.

Dependent Events: When the outcome of one event affects the outcome of a second event, the events are dependent.

Probability of the Intersection of two Independent Events: If events A and B are independent, the probability of both events occurring is found by multiplying the probabilities of the events

If A and B are independent events in a sample space S, then the probability that both A and B occur is

$$P(A \text{ and } B) = P(A \cap B) = P(A) \cdot P(B)$$

Probability of Dependent Events: The probability of an event B occurring given that an event A has already occurred is given by

$$P(A \text{ and } B) = P(A \cap B) = P(A) \cdot P(B|A)$$

Practice Exercises

A. State whether the events are independent or dependent.

1. Selecting a math book and a science book in a shelf.
2. Chips are numbered 1 through 15 and placed in a box. Three of them are selected one after the other without replacing any of the chip.
3. Answering the questions of a 5-item true-false test.
4. Juan has 14 coins. He takes 3 of them at random, then he puts these back, and then picks 2 more coins at random.
5. Getting a face card in the first draw from a deck of playing cards and getting a face card in the second draw. (The first card is not replaced.)

B. Solve each problem completely.

1. A box contains 4 red socks, 3 white socks, and 3 blue socks. Without looking, you select a sock at random, replace it, and select a second sock at random. What is the probability that the first sock is blue and the second sock is red?
2. A rental agency has 12 white cars, 8 gray cars, 6 red cars, and 3 green cars for rent. Mang Canor rents a car, returns it because the radio is broken, and gets another car. What is the probability that Mang Canor is given a green car and then a gray car?
3. A basket contains 6 apples, 5 bananas, 4 oranges, and 5 guavas. Dominic randomly chooses one piece of fruit, eats it, and chooses another piece of fruit. What is the probability that he chose a banana and then an apple?
4. A box contains 7 white marbles and 7 red marbles. What is the probability of drawing 2 white marbles and 1 red marble in succession without replacement?

Problem Set

A. State whether the events are independent or dependent.

1. Deni has a blue, red, and green tie. He also has a blue and green shirt. Deni chooses a random tie and shirt for work today.
2. Amboy plays card games. He picks a card at random. Then without putting the first card back, he picks a second card at random.
3. Canady has 10 handmade sheets. She takes 6 sheets at random. Then without putting these sheets back, she picks 2 sheets at random.
4. Jeff has 3 children. His first 2 children are boys. His last child is a girl.
5. A tree has 4 red flowers and 2 blue flowers. Brandy plucks 1 flower from the tree. After some time her sister plucks a flower from the same tree.

B. Solve each problem completely.

1. A box of chocolates contains 10 milk chocolates, 8 dark chocolates, and 6 white chocolates. Hanissa randomly chooses a chocolate, eats it, and then randomly chooses another chocolate. What is the probability that Hanissa chose a milk chocolate, and then, a white chocolate?
2. A toy box contains 12 toys, 8 stuffed animals, and 3 board games. Maria randomly chooses 2 toys for the child she is babysitting to play with. What is the probability that she chose 2 stuffed animals as the first two choices?
3. Nick has 4 black pens, 3 blue pens, and 2 red pens in his school bag. He randomly picks two pens out of his school bag. What is the probability that Nick chose two blue pens if he replaced the first pen back in his pocket before choosing a second pen?
4. A bag contains 6 black marbles, 9 blue marbles, 4 yellow marbles, and 2 green marbles. A marble is randomly selected, replaced, and a second marble is randomly selected. Find the probability of selecting a black marble, then a yellow marble.

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