<u>PARTI:</u> What does it mean to be an Independent Event?

Two events are ***independent events*** if the occurrence of one event does not affect the occurrence of the other. Two events are ***dependent events*** if the occurrence of one event does affect the occurrence of the other.

EXAMPLE 1 Identifying Independent and Dependent Events

A jar contains red and blue marbles. You randomly choose a marble from the jar, and you do not replace it. Then you randomly choose another marble. Tell whether the events are *independent* or *dependent*.

Event *A*: The first marble you choose is red.

Event *B*: The second marble you choose is blue.

SOLUTION

After you choose a red marble, there are fewer marbles left in the jar. This affects the probability that the second marble you choose is blue. So, the events are dependent.

Tell whether the events are *independent* or *dependent*.

1. A box of energy bars contains an assortment of flavors. You randomly choose an energy bar and eat it. Then you randomly choose another bar.
Event A: You choose a honey-peanut bar first.
Event B: You choose a chocolate chip bar second.

2. You roll a number cube and flip a coin.
Event A: You get a 4 when rolling the number cube.
Event B: You get tails when flipping the coin.

3. Your CD collection contains hip-hop and rock CDs. You randomly choose a CD, then choose another without replacing the first CD.
Event A: You choose a hip-hop CD first.
Event B: You choose a rock CD second.

4. There are 22 volumes of an encyclopedia on a shelf. You randomly choose a volume and put it back. Then you randomly choose another volume.
Event A: You choose volume 7 first.
Event B: You choose volume 5 second.

PART II: **How can we calculate if events are independent?**

Independent Events

For two independent events A and B, the probability that both events occur is the product of the probabilities of the events.

$P(A \text{ and } B) = P(A) \cdot P(B)$ *Events A and B are independent.*

Example: The sedans, hatchbacks, and convertibles at a rental company are available with automatic or manual transmissions, as shown in the two-way table.

	Sedan (S)	Hatchback (H)	Convertible (C)	Total
Automatic (A)	8	4	6	18
Manual (M)	6	2	6	14
Total	14	6	12	32

(a) Find the probability that a randomly chosen car is a sedan.

(b) Find the probability that a randomly chosen car is a sedan given that the car has an automatic transmission.

(c) Are the events "car is a sedan" and "car has an automatic transmission" independent? Why or why not?

Scroll to the next page for solutions.

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SOLUTIONS:

(a) Since 14 of the 32 cars are sedans, $P(S) = \frac{14}{32}$.

(b) $P(S/A) = \frac{P(S \text{ and } A)}{P(A)} = \frac{8}{18}$

(c) If the events "car is a sedan" and "car has an automatic transmission" are independent, then P(A) • P(B) = P(A and B). We can find each probability, then see if the equation is true.

P(car is a sedan) = $\frac{14}{32}$ P(car has an automatic transmission) = $\frac{18}{32}$

$P(A) \cdot P(B) = \left(\frac{14}{32}\right)\left(\frac{18}{32}\right) = \frac{252}{1024} = 0.246$

P(Car is a Sedan AND car has an automatic transmission) = $\frac{8}{32}$

P(A and B) = $\frac{8}{32}$ = 0.25

Since these values are not the same, these events are *not* independent.

<u>PART III:</u> Practice & Application

In Exercises 1–3, use the following information.

The students at Allen High School were surveyed to find out how they get to school each day. The table shows the number of students at each grade level who walk, bike, or take the bus to school

	Walk	Bike	Bus	Total
Freshman	52	16	72	140
Sophomore	41	18	61	120
Junior	43	35	72	150
Senior	28	40	52	120
Total	164	109	257	530

1. (a.) What is the probability that a randomly-chosen student is a senior?

(b.) What is the probability that a randomly-chosen student is a senior given that the student bikes to school?

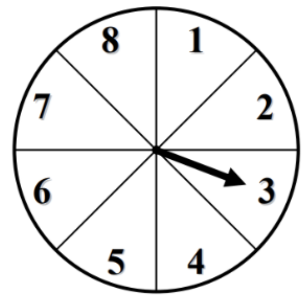
(c.) Are the events "student is a senior" and "student bikes to school" independent events?

2. What is the probability that a randomly-chosen student takes the bus given that the student is a junior?

3. What is the probability that a randomly-chosen sophomore does <u>not</u> take the bus?

4. The spinner below is spun once and its outcome is noted. Let *E* be the event of getting an even, let *P* be the event of getting a prime, and let *L* be the event of getting a number less than 5. Find the following probabilities:

(a) The probability of getting an even, P(E).



(b) The probability of getting an even given that the outcome was a prime number, P(E/P).

(c) The probability of getting an even given that the outcome was a number less than 5, P(E/L)?

(d) Which event does E depend on, P or L? How can you tell?

5. A survey of 57 sixth graders was done to determine which subject was their favorite. The results are shown in the table below sorted by gender.

	Math	English	Social Studies	Science	Total
Female	8	6	10	6	30
Male	10	4	9	4	27
Total	18	10	19	10	57

(a) Does it appear, based on the data in this table, that the preferences for math as a favorite subject has dependence on a student's gender?

(b) Does it appear, based on the data in this table, that the preference for social studies as a favorite subject has dependence on a student's gender.