Warm up

The following table shows the number of people that like a particular fast food restaurant.

	McD's	BK	Wendy's
Male	20	15	10
Female	20	10	25

1. What is the probability that a person likes Wendy's?

7/20

2. What is the probability that a person is male **given they like BK?** **3/5**

Probability

Independent and Dependent Events

Independent Events

A **occurring does NOT affect the probability of** ***B*** **occurring.**

"*AND*" means to MULTIPLY!

Independent Event FORMULA

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

also known as

$$P(A \cap B) = P(A) \bullet P(B)$$

Example 1

A coin is tossed and a 6-sided die is rolled. Find the probability of landing on the head side of the coin and rolling a 3 on the die. P(Head and 3)

$$P(A \cap B) = P(A) \bullet P(B)$$

$$\frac{1}{2} \bullet \frac{1}{6} = \frac{1}{12}$$

Example 2

A card is chosen at random from a deck of 52 cards. It is then replaced and a second card is chosen. What is the probability of choosing a jack and an eight?

P(Jack and 8)

$$P(A \cap B) = P(A) \bullet P(B)$$

$$\frac{4}{52} \bullet \frac{4}{52} = \frac{1}{169}$$

Example 3

A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. After replacing it, a second marble is chosen. What is the probability of choosing a green and a yellow marble?

P(Green and Yellow)

$$P(A \cap B) = P(A) \bullet P(B)$$

$$\frac{5}{16} \bullet \frac{6}{16} = \frac{15}{128}$$

Example 4

A school survey found that 9 out of 10 students like pizza. If three students are chosen at random with replacement, what is the probability that all three students like pizza? P(Like and Like and Like)

$$\frac{9}{10} \bullet \frac{9}{10} \bullet \frac{9}{10} = \frac{729}{1000}$$

Dependent Events

A **occurring AFFECTS the probability of B occurring**

Usually you will see the words "*without replacing*"

"*AND*" still means to MULTIPLY!

Dependent Event Formula

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

also known as

$$P(A \cap B) = P(A) \bullet P(B \mid A)$$

Example 5

A jar contains 3 red, 5 green, 2 blue and 6 yellow marbles. A marble is chosen at random from the jar. A second marble is chosen without replacing the first one. What is the probability of choosing a green and a yellow marble?

P(Green and Yellow)

$$P(A \cap B) = P(A) \bullet P(B \mid A)$$

$$\frac{5}{16} \bullet \frac{6}{15} = \frac{1}{8}$$

Example 6

An aquarium contains 6 male goldfish and 4 female goldfish. You randomly select a fish from the tank, do not replace it, and then randomly select a second fish. What is the probability that both fish are male? P(Male and Male)

$$P(A \cap B) = P(A) \bullet P(B \mid A)$$

$$\frac{6}{10} \bullet \frac{5}{9} = \frac{1}{3}$$

Example 7

A random sample of parts coming off a machine is done by an inspector. He found that 5 out of 100 parts are bad on average. If he were to do a new sample, what is the probability that he picks a bad part and then, picks another bad part if he doesn't replace the first? P(Bad and Bad)

$$P(A \cap B) = P(A) \bullet P(B \mid A)$$

$$\frac{5}{100} \bullet \frac{4}{99} = \frac{1}{495}$$

Determining if 2 Events are Independent

Determining if Events are Independent

3 Ways to check. We are going to practice one of the ways:

$$P(A \cap B) = P(A) \bullet P(B)$$

Substitute in what you know and check to see if left side equals right side.

Example 8

Let event M = taking a math class. Let event S = taking a science class. Then, M and S = taking a math class and a science class.

Suppose P(M) = 0.6, P(S) = 0.5, and P(M and S) = 0.3.

Are M and S independent?

$$P(M \cap S) \overset{?}{=} P(M) \bullet P(S)$$

$$.3 \overset{?}{=} .6 \bullet .5$$

$$.3 = .3 \quad \text{YES!}$$

Conclusion: Taking a math class and taking a science class are independent of each other.

Example 9

In a particular college class, 60% of the students are female. 50% of all students in the class have long hair. 45% of the students are female and have long hair. Of the female students, 75% have long hair. Let F be the event that the student is female. Let L be the event that the student has long hair. One student is picked randomly.

Are the events of being female and having long hair independent?

$$P(F \cap L) \overset{?}{=} P(F) \bullet P(L)$$

$$45\% \overset{?}{=} 60\% \bullet 50\%$$

$$.45 = .60 \bullet .50$$

$$.45 \neq .30 \quad \text{NO!!!}$$

Conclusion: Being a female and having long hair are not independent.

Homework

Practice Worksheet