# 9.7 Independent & Dependent Events

The 100-meter dash features 20 runners competing in a preliminary round of 4 heats. The winner of each heat advances to the final race. Before the race, each runner chooses a number from jar 1 to determine the heat in which he runs and a number from jar 2 to determine one of five lanes he occupies. Omar is the first runner to choose from the jars.

a) What is the probability of Omar being in the second heat?

b) What is the probability of Omar being in lane 3?

c) Multiply your answers from a & b above. What does this number mean? Explain.

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In the activity above, choosing the heat and the lane is a compound event. A **compound event** consists of two or more simple events. Since choosing the heat number does not affect choosing the lane number, both events are called **independent events**.

**Probability of Independent Events**

The probability of two independent events can be found by multiplying the probability of the first event by the probability of the second event.

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

**Examples: Independent Events**

1. A number cube is rolled, and the spinner at the right is spun. Find the probability of rolling a 2 and spinning a vowel.


$$P(2) = \frac{1}{6} \qquad P(\text{vowel}) = \frac{2}{5}$$

$$P(2 \text{ and vowel}) = \frac{1}{6} \cdot \frac{2}{5} = \frac{2}{30} = \frac{1}{15}$$

So, the probability of rolling a 2 and spinning a vowel is $\frac{1}{15}$.

You can make a tree diagram to check your answer.

If the outcome of one event affects the outcome of a second event, the events are called **dependent events**.

**Example: Dependent Events**

2. A box contains 2 oatmeal, 3 strawberry, and 6 cinnamon snack bars. Ruby reaches in the box and randomly takes two snack bars, one after the other. Find the probability that she will choose a cinnamon bar and then a strawberry bar.

$$P(\text{cinnamon}) = \frac{6}{11}$$ ← 11 snack bars, 6 are cinnamon

$$P(\text{strawberry}) = \frac{3}{10}$$ ← 10 snack bars after 1 cinnamon snack bar has been removed, 3 are strawberry

$$P(\text{cinnamon, then strawberry}) = \frac{6}{11} \bullet \frac{3}{10} = \frac{18}{110} = \frac{9}{55}$$

So, the probability that Ruby will choose a cinnamon snack bar and then a strawberry snack bar is $\frac{9}{55}$, or about 16%..

**Probability of Dependent Events**

The probability of two dependent events can be found by multiplying the probability of the first event by the probability that the second event occurs after the first.

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