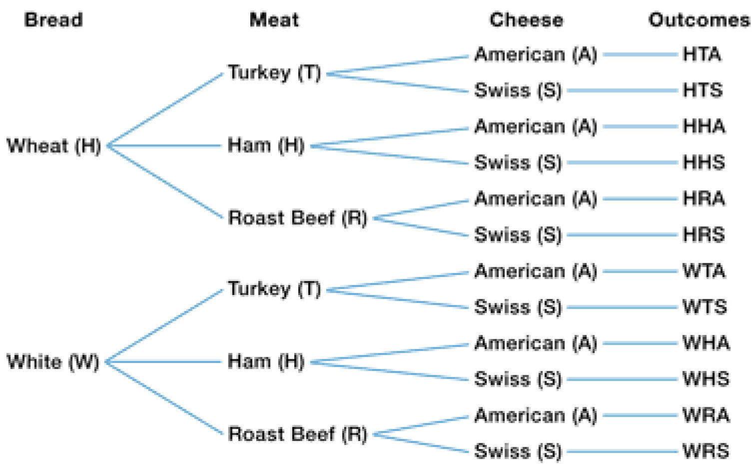
Lesson 14-1

Example 1 Tree Diagram
A sandwich shop uses either wheat or white bread. For a one topping sandwich, you can choose either ham, turkey, or roast beef. The cheese choice is either American or Swiss. Use a tree diagram to determine the number of possible one topping sandwiches.



The tree diagram shows that there are 12 possible sandwiches.

Example 2 Fundamental Counting Principle
A home building company is in charge of building all of the homes for a new subdivision. They offer 6 different floor plans, a basement or no basement and 11 different exterior colors. How many different homes can you choose from?
Multiply to find the number of homes.

$$\underbrace{6}_{\text{floor plans}} \cdot \underbrace{2}_{\text{basement choice}} \cdot \underbrace{11}_{\text{exterior color}} = \underbrace{132}_{\text{number of homes}}$$

The number of different homes is 132.

Example 3 Counting Arrangements
Kayla is in charge of a talent show at her school. There are 8 contestants. She must choose in what order they will appear. How many different ways can she schedule the performers?
The number of ways to schedule the performers can be found by multiplying the number of choices for each position.

- Kayla has eight contestants to choose from to be first.
- After choosing the first performer, there are seven performers left to be second.
- There are now six left to be third.
- This process continues until there is only one choice left for the last performer.

Let n represent the number of arrangements.
$n = 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ or 40,320
There are 40,320 different ways to schedule the performers.

Example 4 Factorial
Find the value of 15!.
$15! = 15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ Definition of factorial
$= 1{,}307{,}674{,}368{,}000$

Example 5 Use Factorials to Solve a Problem
Alan and Mike want to attend 10 major league games at different ball parks this year. They are trying to decide in which order to visit the parks.

a. In how many different orders can they visit the 10 different parks if they visit each once?
Use a factorial.
$10! = 10 \bullet 9 \bullet 8 \bullet 7 \bullet 6 \bullet 5 \bullet 4 \bullet 3 \bullet 2 \bullet 1$ Definition of factorial
$= 3{,}628{,}800$ Simplify.

There are 3,628,800 ways in which Alan and Mike can visit the 10 major league parks.

b. If they decide to only visit 4 major league parks this year, in how many ways can they do this?

Use the Fundamental Counting Principle to find the sample space.
$s = 10 \bullet 9 \bullet 8 \bullet 7$ Fundamental Counting Principle
$= 5040$ Simplify.

There are 5040 ways for Alan and Mike to visit 4 of the 10 major league parks.