

Section 5.3 The Multiplication Principle

Generalized Multiplication Principle

Suppose a task T_1 can be performed in N_1 ways, a task T_2 can be performed in N_2 ways, ..., and, finally a task T_n can be performed in N_n ways. Then the number of ways of performing the tasks T_1, T_2, \dots, T_n in succession is given by the product

$$N_1 \cdot N_2 \cdot \dots \cdot N_n.$$

Example 1: A coin is tossed 3 times, and the sequence of heads and tails is recorded.

- a. Determine the number of outcomes of this activity.

- b. List the outcomes of this experiment by first drawing a tree diagram.

Example 2: The Burger Bar offers the following items on its menu:

<u>Burger</u>	<u>Sides</u>	<u>Beverages</u>	<u>Desserts</u>
Single Meat	Fries	Tea	Cheesecake
Double Meat	Onion Rings	Coffee	Brownie
	Fruit Bowl	Soda	Cookie
	Cheddar Peppers		Ice Cream Cone

If a customer chooses 1 item from each category, how many meals can be made? List 1 meal possible.

Example 3: An identification number for employees at a certain company contains six digits. How many ID numbers are possible if repetition is allowed?

Example 4: A license plate consists of 2 letters followed by 4 digits. How many license plates are possible if the 1st letter can't be O, the 1st digit can't be 0 and no repetitions are allowed?

Example 5: In the original plan for area codes in 1945, the first digit could be any number from 2 through 9, the second digit was either 0 or 1, and the third digit could be any number except 0. With this plan, how many different area codes were possible?

Example 6: Six performers are to present their comedy acts on a weekend evening at a comedy club. One of the performers insists on being the last stand-up comic of the evening. If this performer's request is granted, how many different ways are there to schedule the appearances?

Example 7: The call letters for radio station begin with K or W, followed by 3 additional letters. How many sets of call letters having 4 letters are possible? Repetition is allowed.