Fundamental Counting Principle

If one selection can be made in \( m \) ways and a second in \( n \) ways, then the number of ways the two selections can be made is \( m \cdot n \).

EXAMPLE 1 – Using the Fundamental Counting Principle

a. At a used book sale, you are interested in 5 novels, 3 books of non-fiction, and 7 comic books. If you buy one of each kind, how many different choices do you have?

\[
5 \cdot 3 \cdot 7 = 105
\]

b. At TCBY you are trying to make the best Shiver ever. You have 6 choices for yogurt, 9 choices of dry toppings, and 6 different fruits. How many different Shivers can you create if you choose one yogurt, and one of each topping category.

\[
6 \cdot 9 \cdot 6 = 324
\]

EXAMPLE 2 – Using the Fundamental Counting Principle with Repetition

The standard configuration for a Michigan License plate is 2 digits, followed by 3 letters, then 1 digit

a. How many different license plates are possible if letters and digits can be repeated?

\[
\frac{10}{D} \cdot \frac{10}{D} \cdot \frac{26}{L} \cdot \frac{26}{L} \cdot \frac{10}{D} = 175,760,000
\]

b. How many different license plates are possible if letters and digits cannot be repeated?

\[
\frac{10}{D} \cdot \frac{9}{D} \cdot \frac{26}{L} \cdot \frac{25}{L} \cdot \frac{24}{L} \cdot \frac{8}{D} = 11,232,000
\]

c. How many different license plates are possible if letters and digits cannot be repeated and the letters A and Z cannot be used.

\[
\frac{10}{D} \cdot \frac{9}{D} \cdot \frac{24}{L} \cdot \frac{23}{L} \cdot \frac{22}{L} \cdot \frac{7}{D} = 8,743,680
\]

Mutually Exclusive Events

When the possibilities being counted can be counted into mutually exclusive (totally separate) cases, then the total possibilities is the sum of each separate case possibility.

EXAMPLE 3 – Mutually Exclusive Events

a. How many odd numbers between 10 and 1000 start and end with the same digit?

\[
1 \cdot 5 \text{ or } 1 \cdot 10 \cdot 5 = 5 + 50 = 55
\]

b. How many license plates of 2 symbols (letters and digits) can be made using at least one letter in each?

\[
\frac{26}{L} \cdot \frac{10}{D} \text{ or } \frac{10}{D} \cdot \frac{26}{L} \text{ or } \frac{26}{L} \cdot \frac{26}{L} = 260 + 260 + 676 = 1196
\]