Let's take a look at some pizza possibilities
(Run the program pizza.exe)

In situations where we consider combinations of items, or a succession of events such as flips of a coin, or the drawing of cards, or choosing pizza crusts, toppings, or meats, each result is called an **outcome.**

An **event** is a subset of outcomes (one draw of the card, one flip of the coin, or the choice of a pizza crust).

When several events occur together, such as choosing a card followed by choosing another card, or choosing a pizza crust followed by choosing a pizza topping, we have a **compound event**.

The Fundamental Counting Principle

In a compound event in which the first event may occur in n_1 ways, the second event may occur in n_2 ways, etc. The k^{th} event may occur in n_k different ways, so the total number of ways the compound event may occur is:

$n_1 \bullet n_2 \bullet n_3 \bullet \ldots \bullet n_k$

Ex 1) How many odd 2-digit whole numbers are there that are less than 70?

$$\underset{\text{tens digit}}{\underline{\quad 6 \quad}} \cdot \underset{\text{ones digit}}{\underline{\quad 5 \quad}} = 30$$

1, 2, 3, 4, 5, 6 1, 3, 5, 7, 9

To get to school, you can either walk or arrive by car. These are called **mutually exclusive** choices. You can do one or the other but not both at the same time.

If the possibilities being counted can be grouped into ***mutually exclusive*** cases, then the number of possibilities is the **sum** of the number of possibilities in each case.

Ex 2) How many positive integers less than 100 can be written using the digits 6, 7, 8, and 9?

There are two mutually exclusive cases here:
1) one digit integers, and
2) the two digit integers.

1) The one digit case: $\underset{\text{ones digit}}{\underline{\ 4\ }} = 4$

6,7,8,9

$+$

2) The two digit case: $\underset{\text{tens}}{\underline{\ 4\ }} \cdot \underset{\text{ones}}{\underline{\ 4\ }} = 16$

6,7,8,9 6,7,8,9

$\overline{}$

20

Ex 3) How many ID tags can be made using 3 symbols (letters and digits) with at least one letter in each?

1) one letter case: $\underset{a-z}{\underline{26}} \cdot \underset{0-9}{\underline{10}} \cdot \underset{0-9}{\underline{10}} = 2600$

The letter can occur in any of the three places, so there are: 3 • 2600 = 7800 possible 1 letter tags.

2) two letter case: $\underset{a-z}{\underline{26}} \cdot \underset{a-z}{\underline{26}} \cdot \underset{0-9}{\underline{10}} = 6760$

The digit can occur in any of the three places, so there are: 3 • 6760 = 20,280 possible 2 letter tags.

3) three letter case: $\underset{a-z}{\underline{26}} \cdot \underset{a-z}{\underline{26}} \cdot \underset{a-z}{\underline{26}} = 17576$

There are 17, 576 possible 3 letter tags.

The total number of tags is the sum of the 3 mutually exclusive possibilities: 7800 + 20,280 + 17,576 = 45,656