Multiplication Counting Principle:
The number of outcomes is the product of the number of choices for each step.

$19 \cdot 18 \cdot 17$

Factorial:
Is mostly used when you are using ALL of a given amount of items and order IS important.

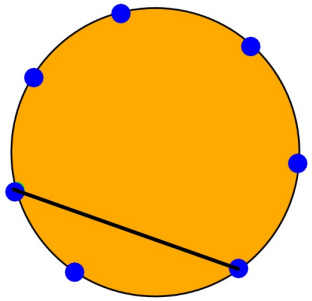
$5!$

Permutation:
The number of outcomes when order DOES matter.

${}_5P_3$

Combination:
The number of outcomes when order DOESN'T matter.

${}_5C_3$



How many segments can be formed by connecting two of these points?

${}_7C_2 = 21$

How many Pentagons?

${}_7C_5 = 21$

You want to order a 1-topping pizza. There are 3 sizes to choose from, 4 kinds of crust to choose from, and there are 7 different toppings to choose from. How many different 1-topping pizzas are possible?

$\underset{\text{size}}{3} \cdot \underset{\text{crusts}}{4} \cdot \underset{\text{Topping}}{7} = 84$

You want to order a 2-topping pizza. There are 3 sizes to choose from, 4 kinds of crust to choose from, and there are 7 different toppings to choose from. How many different 2-topping pizzas are possible?

$\underset{\text{size}}{{}_3C_1 = 3} \cdot \underset{\text{crust}}{{}_4C_1 = 4} \cdot \underset{\text{2-Toppings}}{{}_7C_2 = 21}$

$= 252$

A class has 18 students and the teacher wants students to work in pairs. How many ways can the teacher have the students work in pairs?

$_{18}C_2 = 153$

Another class has 24 students and the teacher wants them to work in groups. Because of the number of students, groups of 3 or 4 makes sense.

How many ways can you make groups of 3 or 4 with this class?

$_{24}C_3 + {}_{24}C_4$

$2024 + 10626 = 12,650$

Another teacher has a 1st hour with 20 students and a 2nd hour with 15 students. How many ways can this teacher have their 1st hour work in groups of 4 and their 2nd hour work in groups of 3?

$_{20}C_4 \cdot {}_{15}C_3$

$4845 \cdot 455$

$= 2,204,475$

There are 15 students in a class.

1. If there are only 15 desks, how many different seating charts could the teacher make?

$_{15}P_{15}$ or $15! = 1.31 \times 10^{12}$

2. If there are 20 desks, how many different seating charts could the teacher make?

$_{20}P_{15} = 2.03 \times 10^{16}$

You are playing cards with a friend. You are dealt 6 cards.

1. How many ways can you arrange all 6 cards in your hand?

$6! = {}_6P_6 = 720$

2. When it's your turn you get to take 3 cards out of your hand and trade them in for three new cards. How many ways can you do this?

$_6C_3 = 20$

3. How many different six card hands can be dealt?

$_{52}C_6 = 20,358,520$

At a resaurant you go up to the salad bar to make a salad. There are 10 different toppings to choose from. Your plate can only hold 5 toppings. How many different salads can you make?

$_{10}C_5 = 252$

There are 18 students in the class.

a How many ways could I select 2 students to go to the office to get some more chairs?

$_{18}C_2 = 153$

b There are 4 different problems to work out on the board. How many ways could I select 4 students to do these 4 problems?

$_{18}P_4 = 73,440$

You can now finish Hwk #13

Sec 6-7

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Problems: 9, 18-20, 29-32, 39, 40, 46-49, 55

This "combination" lock has the numbers from 0 to 39.

Let's assume a "combo" to this lock is 3 different numbers.

Why is the phrase Combination Lock not a good name?

because the order DOES matter so it should be a Permutation Lock!

Find all possible "combos".

$_{40}P_3 = 59,280$

The lottery game Mega Millions requires you to pick 5 numbers from 1 to 56 then pick the Gold Ball which is a number from 1 to 46.

1. If you buy an Easy Pick ticket then the computer picks these numbers for you. How many different Easy Pick tickets are possible?

ways to pick 5 of 56 numbers $({}_{56}C_5) \cdot ({}_{46}C_1)$ # ways to pick 1 of 46 numbers $= 175,711,536$

2. What is the probability that you get a winning ticket?

$$\frac{1}{175,711,536}$$

(there is only 1 winning combination of numbers so only 1 favorable outcome)