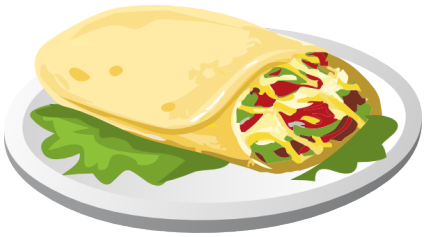
Combinatorics

Warm-up

1. A taqueria sells burritos with the following fillings: pork, chicken, beef, or tofu. Burritos come either small, medium, or large, with or without cheese, and with or without guacamole. How many different burritos can be ordered?



2. A school has 677 students. Explain why at least 2 students must have the same pair of initials (first and last initial).

1 Bike locks, dice, and passwords

1. You are a designer of a combination bike lock. Each combination will consist of 4 digits. For example, one combination is 0-5-8-3.

   (a) How many different combinations are possible?

   (b) What if you only use the digits 1 through 9 instead of 0 through 9?

   (c) How many different combinations are there if you use the digits 0 through 9 and each combination must have at least one 0 in it. Hint: use the answers to part (a) and part (b).

2. You roll a 6-sided die three times. Among all possible outcomes, how many outcomes have one or more occurrence of the number 6? For example, 3-6-1 has an occurrence of the number 6, but 3-4-2 does not. Assume the order of the rolls matters here, so 3-6-1 is different from 3-1-6.

Extra Problem:

3. You need to create a six character password. Each character can be either a lower case letter or one of the special characters #, *, $, %. A password must contain at least one letter and at least one special character. How many different passwords are possible? (Write out how you would find the number, but you don't have to do the arithmetic.)

2 Clubs

1. There are 5 kids in cooking club. In how many different orders can they line up to wash their hands before cooking?

2. There are 20 kids in robotics club. How many ways are there to choose a president, vice president, and treasurer?

3. There are 12 kids in Model UN club. How many ways are there to pick a delegation of 3 to represent Russia?

Extra problem

4. If there are 3 people in a room, and everyone shakes everyone else's hand, how many handshakes take place? What if there are 4 people? 5 people? 15 people?