11.1-11.3 – Counting Techniques

Suppose a person has a choice between 3 shirts and 2 pairs of pants. You can use a tree diagram to show the possible combinations

Fundamental Counting Principle: The number of ways in which a series of successive items can occur is found by multiplying the number of ways in which each item can occur.

For a two-item choice, if you can choose one item from a group that has M items and one item from a group that has N items, then the total number of two-item choices is $M \times N$.

Example:

11.2

Example: A flagpole contains three flags; one each of Blue, Yellow, and Red. List the ways the flags can be arranged on the pole? How many are there?

We can use the fundamental counting property to count the number of permutations of the three flags.

Permutation is an ordered arrangement of objects

$n!$, read, n factorial is given by: $n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 3 \cdot 2 \cdot 1$

Also, $0! = 1$

The number of permutations of n distinct objects, taken all together, is $n!$.

What if you do not need to use all objects?

Example: If there are four flags available (Blue, Yellow, Red, and Green), how many permutations of two of the four flags numbers are possible? List them.

Example: You have 10 posters and have room for only 3 on your wall. How many ways can you arrange 3 posters on your wall?

Example: Consider a group of 12 people consisting of 4 men and 8 women.

a) How many ways can all 12 of them line up?

b) How many ways can they line up if all the men line up first?

c) How many ways can five people of the group line up?

11.3

Combination is a collection of objects where order does not matter.

Example:

a) A group has Bethany, Kristopher, and Caitlin. How many combinations of the three people are possible?

b) How many combinations of two of the three people are possible? List them.

The number of permutations of r objects chosen from n objects, where $0 \le r \le n$, is

$${}_nP_r = \frac{n!}{(n-r)!}$$

The number of combinations of r objects chosen from n objects, where $0 \le r \le n$, is

$${}_nC_r = \frac{n!}{(n-r)!\ r!}$$