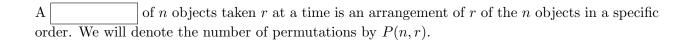
Section 5.5 Permutations and combinations

Math 1300 Fall 2019

Example 1:
 Consider the letters in the set {a,b,c}. How many different strings of two distinct letters can be formed? A construction crew has three members with names A, B, and C. How many different two-person teams can be formed from this crew?
Solution:

In this example, we have to consider two different kinds of situations: the case when order matters and the case when order does not matter.

Permutations



Example 2: Consider a baseball team of 9 players forming lines of 3,6, and 9 players. How many different ways can each of these types of lines be formed?
Solution:

You may notice that there's a pattern to each of the solutions above.

Permutation formula

The number of permutations of n objects taken r at a time, P(n,r), is given by

$$P(n,r) = n(n-1)(n-2)\cdots(n-r+1) = \frac{n!}{(n-r)!}.$$

Example 3:

Compute the following:

- 1. P(100, 2)
- 2. P(6,4)
- 3. P(5,5)

Solution:

Putting this product into the calculator is very tedious! So of course there is a way to plug it in faster.

Permutations on a calculator

You can find the number of permutations, P(n,r), using a calculator by the sequence of keys

$$\boxed{n}$$
 \boxed{nPr} \boxed{r} $\boxed{=}$.

Then for P(9,4), you would press

$$9 nPr 4 =$$

to get 3024.

Note: When asked how many ways you can order n objects, the answer is

$$P(n,n) = n!$$

Combinations

A of n objects taken r at a time is a selection of r objects from among the n, with order disregarded. The number of combinations is given by C(n,r). The formula is given by

Combination formula

The number of combinations of n objects taken r at a time is

$$C(n,r) = \frac{P(n,r)}{r!} = \frac{n(n-1)(n-2)\cdots(n-r+1)}{r!}$$

or

$$C(n,r) = \frac{n!}{r!(n-r)!}.$$

Example 4:

Compute the following:

- 1. C(100, 2)
- 2. C(6,4)
- 3. C(5,5)

Solution:

Yet again there is a way to calculate this in one move:

Combinations on a calculator

You can find the number of permutations, C(n,r), using a calculator by the sequence of keys

$$n$$
 nCr r $=$.

Applying the permutation and combination formulas

Example 5: A high school student decided to apply to four of the eight Ivy League colleges. In how many possible ways can the four colleges be selected?
Solution:
Example 6:
A board of directors has 10 members.
1. In how many ways can a committee of 3 be chosen?
2. In how many ways can a chairperson, vice chairperson, and secretary be chosen?
Solution:

Example 7: If 8 horses are entered in a horse race how many different 1st, 2nd, 3rd place finishes are possible?
Solution:
Example 8: A political pollster wishes to draw a sample of 1500 individuals from among a population of 5,000,000 individuals.
Solution:
Example 9: Three couples go to a movie together. In how many ways can they be seated in 6 seats so that each couple is seated together?
Solution:

Example 10: At a benefit concert, 6 bands have volunteered to perform but there is only enough time for four of the bands to play. How many lineups are possible?
Solution: