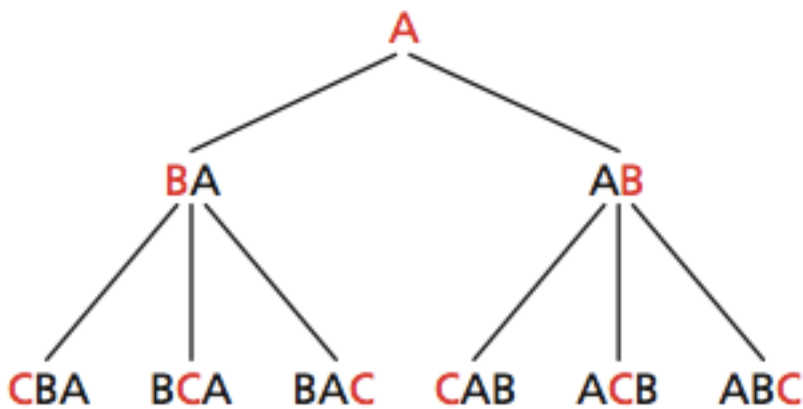


11.1

Permutations and Combinations

A ***Permutation*** is a selection of a group of objects in which order is important.



Permutations

NUMBERS

The number of permutations of 7 items taken 3 at a time is

$${}_7P_3 = \frac{7!}{(7-3)!} = \frac{7!}{4!}$$

ALGEBRA

The number of permutations of n items taken r at a time is

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

I Try:
Solve for ${}_5P_3$

$$\frac{5!}{(5-3)!} = \frac{5!}{2!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = 5 \cdot 4 \cdot 3 = 60$$

We Try:

Solve for ${}_7P_5$

You Try:
Solve for

1) ${}_8P_6$

2) ${}_8P_8$

3) ${}_8P_1$

In Mr. Yen's restaurant, how many people can he choose to for the position of a barista, host, and cook from a group of 6 people?

Does order matter in this case?
Why or why not?

This is selecting and arranging 3 items from 6.

$${}_6P_3$$

$$\frac{6!}{(6-3)!} = \frac{6!}{3!} = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1} = 6 \cdot 5 \cdot 4 = 120$$

There are 120 ways to select 3 people from 6 with different jobs.

A ***Combination*** is a grouping of items in which order does not matter.

6 permutations $\rightarrow \{ABC, ACB, BAC, BCA, CAB, CBA\}$

1 combination $\rightarrow \{ABC\}$

To find the number of combinations, the formula for permutations can be modified.

$$\text{number of permutations} = \frac{\text{ways to arrange all items}}{\text{ways to arrange items not selected}}$$

Because order does not matter, divide the number of permutations by the number of ways to arrange the selected items.

$$\text{number of combinations} = \frac{\text{ways to arrange all items}}{(\text{ways to arrange selected items})(\text{ways to arrange items not selected})}$$

Combinations

NUMBERS

The number of combinations of 7 items taken 3 at a time is

$${}^7C_3 = \frac{7!}{3!(7-3)!}$$

ALGEBRA

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

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

Mr. Yen is going to adopt fish from a school of 7. How many ways can he choose a group of 4 fish?
Does order matter?

$${}_7C_4$$

$$\frac{7!}{4!(7-4)!} = \frac{7!}{4!3!} = \frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(4 \cdot 3 \cdot 2 \cdot 1)(3 \cdot 2 \cdot 1)} =$$
$$\frac{7 \cdot 6 \cdot 5}{3 \cdot 2 \cdot 1} = \frac{210}{6} = 35$$