Example

A class of 12 students will divide into 3 teams of 4. How many ways can this be done?

$C(12,4) \cdot C(8,4) \cdot C(4,4)$

team 1 team 2 team 3

Example

A school is putting together a committee. The committee will have a chair and an assistant chair chosen from a group of 10 teachers, two parents chosen from a group of 15 parents and two students chosen from a group of 20 students. How many different committees are possible?

$10 \cdot 9 \cdot C(15,2) \cdot C(20,2)$

C AC 2 Parents 2 students

Example

You are dealt a hand of four cards from a well-shuffled standard deck of 52 cards.

"at most" "or" ⇒ + "and" ⇒ ·

(a) How many ways can you be dealt at least 3 spades?

3S 1C + 4S 0C

$C(13,3) \cdot C(39,1) + C(13,4) \cdot C(39,0)$

3S 1C 4S 0C

(b) How many ways can you be dealt exactly two diamonds or exactly two clubs?

2D 2D^C + 2C 2C^C − 2D2C

$C(13,2) \cdot C(39,2) + C(13,2) \cdot C(39,2) - C(13,2) \cdot C(13,2) \cdot C(26,0)$

2D 2D^C 2C 2C^C 2D 2C neither

Example

How many different "words" can be made from the letters in MISSISSIPPI?

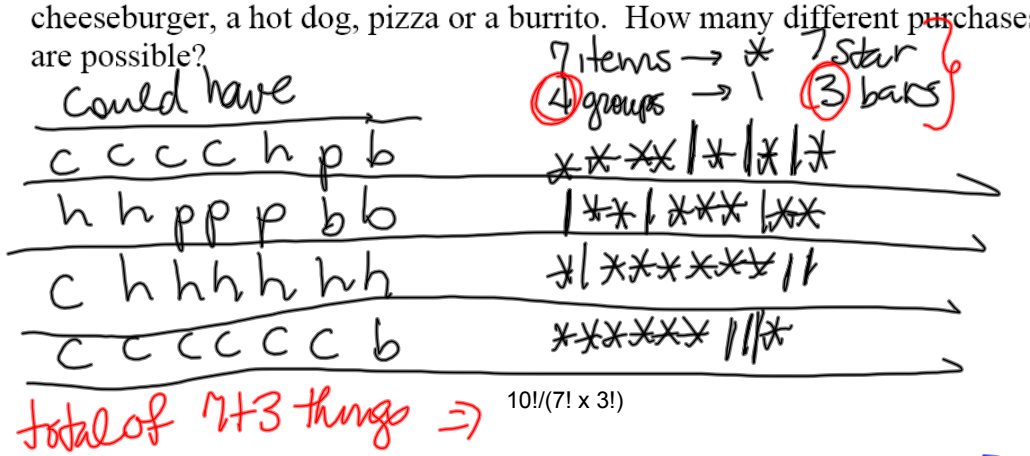
$$\frac{11!}{(4!)(4!)(2!)(1!)} = 34{,}650$$

(4! for the S's, 4! for I, 2! for P, 1! for M)

If you are arranging n items some of which are identical (n_1 of type 1, n_2 of type 2, etc.)
# of dist. arrangements is $\frac{n!}{(n_1!)(n_2!)\cdots(n_i!)}$

Example

Seven children stop at a restaurant where they have a choice of a cheeseburger, a hot dog, pizza or a burrito. How many different purchases are possible?



How many subsets? for a set with 1 element

$\{A\}$: $\{A\}$, $\emptyset$ 2 subsets

$\{A,B\}$: $\{A,B\}$, $\{A\}$, $\{B\}$, $\emptyset$ 4 subsets

$\{A,B,C\}$: $\{A,B,C\}$, $\{A,B\}$, $\{A,C\}$, $\{B,C\}$, $\{A\}$, $\{B\}$, $\{C\}$, $\emptyset$ 8 subsets

Set with n elements has 2^n subsets

$$\frac{2}{1}\cdot\frac{2}{2}\cdot\frac{2}{3}\cdots\frac{2}{n} = 2^n$$