

PERMUTATIONS AND COMBINATIONS

Fundamental Counting Principle

- Let A and B be two events.

If event A has n_1 possible outcomes and event B has n_2 possible outcomes, then the total number of outcomes for A then B is $n_1 \cdot n_2$.

Bread - White, wheat, rye, sourdough
4

Meat - ham, turkey, roast beef,
4 none

Veggies - yes no
2

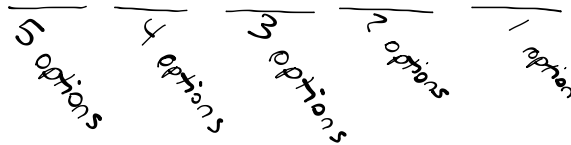
cheese - Swiss American Cheddar
4 none

Condiments - Mayo mustard both
4 none

$$4 \cdot 4 \cdot 2 \cdot 4 \cdot 4 = 512 \text{ options}$$

Permutations

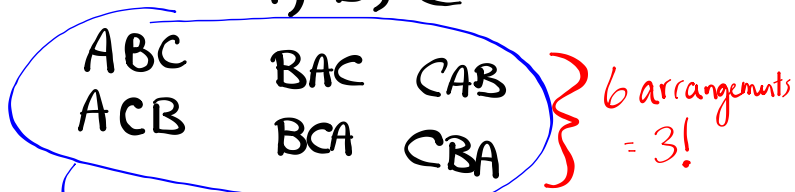
Example: Make a 5 digit passcode with 1, 2, 3, 4, 5. No repeats. How many options are there?



$$5 \times 4 \times 3 \times 2 \times 1 = 120 \text{ options}$$

Factorial - $5! = 5 \times 4 \times 3 \times 2 \times 1$

A, B, C



These arrangements are permutations of the letters A, B, and C.

* Permutations = order matters

$${}_n P_r \leftarrow \text{Permutations on Calculator.}$$

Ex. 20 runners, Gold, silver, bronze medals.
How many different outcomes?

$$\left. \begin{matrix} n=20 \\ r=3 \end{matrix} \right\} {}_{20} P_3 = 6,840$$

COMBINATIONS

* Combinations = order doesn't matter

$${}^n C_r$$

Ex. 20 runners, top 3 move on
to districts
How many outcomes?

$$\begin{array}{l} n=20 \\ r=3 \end{array} \quad {}^{20} C_3 = 1,140$$

25 students

2 StuCo Reps

$${}_{25}C_2 = 300$$

President
Vice President

$${}_{25}P_2 = 600$$