Perms & Combs

- How many arrangements of the letters A B C D E ?

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

$$n!$$

- How many arrangements of the letters A A B B B C ?

$$\frac{6!}{2!3!} = \frac{720}{12} = 60$$

$$\frac{n!}{p!q!r!}$$ where p,q,r are the number of repeat letters

- How many arrangements of A B C D E so that A & B are together? (Treating A & B as one unit with 2! arrangements of their subset)

$$4!2! = 48$$

Permutations – order matters, so EACH possible selection will be rearranged in all possible orders.

- How many arrangements of 4 letters from 7 different letters?

$$^{7}p_{4} = 840$$

Combinations – order doesn't matter, so each possible selection counts only once.

- How many ways to choose 11 players from a squad of 16?

$$^{16}C_{11} = 4368$$

- Number of ways to choose 11 from 16 is same as number of ways to choose 5 from 16

$$^{16}C_{11} = {}^{16}C_{5}$$

$$^{n}C_{r} = {}^{n}C_{(n-r)}$$

- 2 Sets - How many ways to choose 2 from 10 **and** 3 from another set of 8? (The 'and $\Rightarrow$ multiply' rule)

$$^{10}c_2 \times ^8c_3 = 45 \times 56 = 2520$$

- Multiple options – How many ways to choose 2 from 10 and 3 from another set of 8, **OR**, 4 from 10 and 1 from 8? (The 'or $\Rightarrow$ add' rule)

$$\left(^{10}c_2 \times ^8c_3\right) + \left(^{10}c_4 \times ^8c_1\right) = \left(45 \times 56\right) + \left(210 \times 8\right) = 2520 + 1680 = 4200$$

- Probabilities based on selections

$$\frac{\text{Number of selections satisfying criteria}}{\text{Total number of possible selections}}$$

e.g. 10 people in a room. What is the probability that A and B sit next to each other?

Number of selections with A,B next to each other: 9!×2!=725760
Total number of ways 10 people can sit: 10!=3628800

Probability is therefore 725760/3628800

- "What is the *permutation* for the safe?"

Permutations	Combinations
$^n p_r$	$^n c_r$
Order Matters	**Order doesn't matter**