

COMBINATORICS & PROBABILITY

How many ways an event can be performed.

Permutations

of ways objects can be arranged in different patterns

Combinations

of different groups that can be formed (does not care about order)

Linear Permutations

1) Arrange all objects = $n!$

$$\begin{aligned} & \underline{9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \\ & = 9! \leftarrow \text{factorial} \\ & = 362,880 \end{aligned}$$

2) Arrange a small group
Chosen from larger group.

$$\frac{\text{total}}{\#} = n P_r \quad \# \text{ used}$$

Arrange 5 cheerleaders
Chosen from 9.

$$9 P_5 = 15,120$$

$$9 P_5$$

3) Alike Objects = $\frac{\text{total!}}{\text{alike!} \cdot \text{alike!}}$

BANANA

$$\frac{6!}{3! \cdot 2!} = \frac{6 \cdot 5 \cdot \cancel{4} \cdot \cancel{3} \cdot 2 \cdot 1}{\cancel{3} \cdot \cancel{2} \cdot 1 \cdot 2 \cdot 1} = 60$$

4) repeated objects
or specific locations
= draw blanks

Radio call Letters

$$2 \cdot 26 \cdot 26 \cdot 26 = 35,152$$

Combinations

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

$$7 C_2 = \frac{7!}{5! \cdot 2!}$$

$$= \frac{7 \cdot 6}{2 \cdot 1} = 21$$

$$11 C_2 = \frac{11 \cdot 10}{2 \cdot 1}$$

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

$$9 P_5 = \frac{9!}{4!} = \frac{9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}{\cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}$$

3 identical basketballs
 2 identical soccer
 5 identical volleyb.
 How many arrangements?

$$\frac{10!}{3! \cdot 2! \cdot 5!} = 2520$$

Basketball Starters

3 Seniors

2 jrs

How many different
 Intro orders if seniors
 must be last?

$$2 \cdot 1 \cdot 3 \cdot 2 \cdot 1 = 12$$

Student Section
 Committee
 of 2 guys, 2 girls
 5 guys, 6 girls volunteered.
 How many committees?

$${}^5C_2 \cdot {}^6C_2$$

$$10 \cdot 15 = 150$$

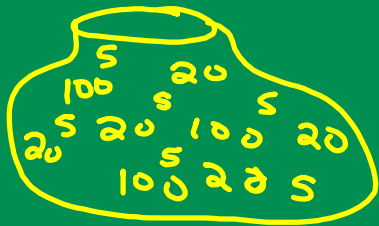
PROBABILITY = $\frac{\# \text{ of ways to succeed}}{\text{total possible}}$

$$\text{Prob (boots)} = \frac{3}{15} = \frac{1}{5}$$

$$\text{Odds (boots)} = \frac{3}{12} = \frac{1}{4}$$

$$\text{Odds} = \frac{\# \text{ of ways to succeed}}{\# \text{ of ways to fail}}$$

Grandma's Cookie Jar



Birthday - Select + Keep 3 bills

$$\text{Prob } (\$300) = \frac{{}^3C_3}{{}^{14}C_3} = \frac{1}{364}$$

$$\text{Odds } (\$15) = \frac{{}^6C_3}{{}^{14}C_3} = \frac{20}{364}$$

↑ Do prob first

$$= \frac{5}{91} = 0.0549$$

$$\text{Odds} = \frac{5}{86}$$