

## COMBINATORICS + PROBABILITY

How many ways an event can be performed  
How many ways are there to perform an action.

Permutations - ways to arrange objects in patterns

Combinations - ways to select groups of objects  
(no concern for the order of selection)

## Linear Permutations

1) Arrange all objects =  $n!$

$$6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$$

2) Arrange a small group chosen from a larger group

$$6 \quad 5 \quad 4 \quad 3$$

$$\boxed{n P_r} = {}_6 P_4 = 360$$

total #      # to use  
Menu-5-2

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

$$8 P_3 = \frac{8!}{5!} = 8 \cdot 7 \cdot 6$$

3) Alike Objects  
MISSISSIPPI

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

S I P  
total!  
alike!, alike!

4) Repeated objects OR Specific locations

Draw blanks

Radio call signs

$$\frac{2 \cdot 26 \cdot 26 \cdot 26}{K \text{ or } W} = 35,152$$

## COMBINATIONS - Select groups of objects

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

$${}^9 C_2 = \frac{9!}{7! 2!}$$

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

$$= 36$$

How many ways can a committee of 2 guys + 2 gals be chosen from a group of 6 guys + 5 gals?

$${}^6 C_2 \cdot {}^5 C_2 \quad \begin{array}{l} \text{AND} = * \\ \text{OR} = + \end{array}$$

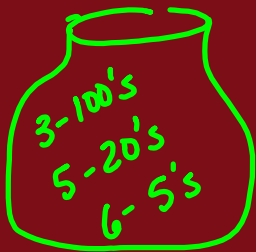
$$15 \cdot 10 = \textcircled{150}$$

$$\text{PROBABILITY} = \frac{\text{Ways to succeed}}{\text{total}}$$

$$\text{ODDS} = \frac{\text{Ways to succeed}}{\text{Ways to fail}}$$

$$\text{Prob (Hey Dude's)} = \frac{2}{6} = \frac{1}{3}$$

$$\text{Odds (not wearing Hey Dudes)} = \frac{4}{2} = \frac{2}{1}$$



Pick 3.

$$\text{Prob (3 100's)} = \frac{{}^3C_3}{{}^{14}C_3} = \frac{1}{364}$$

Find prob.  
first!

$$\text{Prob (1 100 + 2 20's)} = \frac{{}^3C_1 \cdot {}^5C_2}{{}^{14}C_3} = \frac{15 \text{ suc}}{182 \text{ total}} \approx 0.0824$$

$$\text{Odds} = \frac{15 \text{ suc}}{182 - 15 \text{ fail}}$$

$$= \frac{15}{167}$$

38 DVDs - 4 defective, Select 3.

Prob (at least one good DVD) =

0 Good | 1 Good + 2 bad OR 2 Good + 1 bad OR 3 good  
0.07

$1 - \text{Prob}(\overset{3}{\text{bad}})$

$$1 - \frac{{}^4C_3}{{}^{38}C_3} = 1 - \frac{1}{2109} = \boxed{\frac{2108}{2109}}$$

At least/at most  
At least =  $1 - \text{Prob}(\text{none})$