

## COMBINATIONS

- 1) No replacement
- 2) No order
- 3) Dependent events

2nd event is influenced  
by the outcome of the  
1st event.

## Individual Probabilities

- 1) Replacement
- 2) Order
- 3) Independent

$$\frac{2}{15} \cdot \frac{3}{14} \cdot \frac{1}{13}$$

# MORE PROBABILITY

## Grandma's Cookie Jar



3 100's  
5 20's  
6 5's

AND = \*  
OR = +

Prob (2 100's OR 3 5's)

$$\frac{{}^3C_2 \cdot {}^5C_1 + {}^6C_3}{14C_3}$$

$$= \frac{15 + 20}{364} = \frac{35}{364} = \frac{5}{52}$$

Mutually Exclusive Event

- no common items

- \* AND vs. OR
- \* AT Least/at most
- \* Specific order
- \* Binomial prob.

Select 2 from class

Prob (2 long hair OR 2 female)

$$\frac{{}^6C_2 + {}^4C_2 - {}^4C_2}{11C_2}$$

$$\frac{15 + 6 - 6}{55} = \frac{15}{55} = \frac{3}{11}$$

Mutually Inclusive Event  
= share common items

4	f
7	m
5	short
6	long

$$\frac{3}{11}$$

Select 3.

Prob (at least 1 Short hair)
$$0s+3L \quad | \quad 1s+2L \text{ OR } 2s+L \text{ OR } 3S$$

$$1 - \text{Prob}(\text{no short hair})$$

$$1 - \frac{{}^6C_3}{{}^{11}C_3} = 1 - \frac{20}{165} = 1 - \frac{4}{33} = \frac{29}{33}$$

$$\text{Prob (at least one)} = 1 - \text{Prob (none)}$$

Prob (at least 2 males) - Pick 3.

$$\cancel{0m+3f \text{ OR } 1m+2f} \quad | \quad 2m+1f \text{ OR } 3m$$

$$\frac{{}^7C_2 \cdot {}^4C_1 + {}^7C_3}{{}^{11}C_3}$$

## INDEPENDENT + DEPENDENT EVENTS

Dependent — the result of the 2nd event depends on the result of the 1st event

Independent — 2nd event is not influenced by the result of the 1st event

All must be true

Combinations

- 1) Dependent events
- 2) No order
- 3) No replacement

If ANY are true:

Individual Prob.  $\frac{2}{15} \cdot \frac{3}{14} \cdot \frac{1}{13}$

- 1) Indep events  
OR
- 2) Order  
OR
- 3) Replacement

2 Five 3 Extra  
5 Juicy Fruit 4 Spearmint

Pick 3.

Prob (J.F. then Extra then Juicy  
Order! fruit)

$$\frac{5}{14} \cdot \frac{3}{13} \cdot \frac{4}{12} = \frac{5}{182}$$

Prob (JF, put  
back, Five)

$$\frac{5}{14} \cdot \frac{2}{14} = \frac{5}{98}$$

Odds (1 JF, 1 then 1  
Sp, 5, Sp)

$$\text{Prob} = \frac{4}{14} \cdot \frac{2}{13} \cdot \frac{2}{12} = \frac{1}{91}$$

$$\text{Odds} = \frac{1}{90}$$

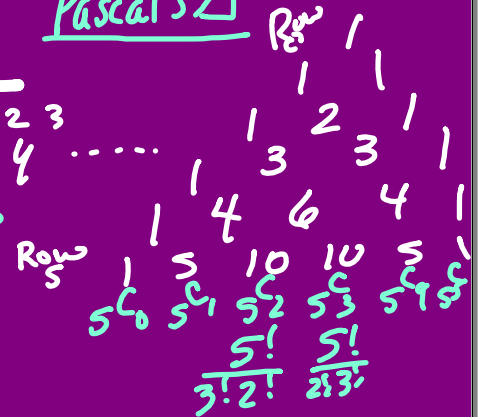
Always do Prob. first—  
then find odds!

# BINOMIAL PROBABILITY

(TRIALS)

Pascal's  $\Delta$ 

$$(x+y)^5 = \binom{5}{0}x^5y^0 + \binom{5}{1}x^4y^1 + \binom{5}{2}x^3y^2 + \binom{5}{3}x^2y^3 + \binom{5}{4}x^1y^4 + \binom{5}{5}x^0y^5$$



- 1) 2 possible outcomes
- 2) Independent Events (same chance every time)

## Basketball Free Throws

Anna = free throw = 60%

What is the prob. she will hit 8 of her next 10?

$${}_{10}C_2 H^8 M^2$$

$${}_{10}C_2 (0.6)^8 (0.4)^2$$

$$\approx 0.12$$

Prob (at least 8)

$${}_{10}C_2 H^8 M^2 \text{ OR } {}_{10}C_1 H^9 M^1 \text{ OR } {}_{10}C_0 H^{10} M^0$$

$${}_{10}C_2 (0.6)^8 (0.4)^2 + {}_{10}C_1 (0.6)^9 (0.4)^1 + {}_{10}C_0 (0.6)^{10}$$

$$\approx 0.167$$

To find one exact event

binomial pdf

At least/at most

binomial cdf