Unit 4

Different types of probability

- **Unions** - Either event happening, add probs.

  $P(A \cup B)$ → probability A or B happens

  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ ← to make sure you don't double count

  prob of A and B occuring simutaneously.

- **Intersections (and)** - Both events happening at same time. Multiply. Only works if Independent.

  $P(A \cap B)$ → prob A and B both happen

  $P(A \cap B) = P(A) \cdot P(B)$

- **With Replacement** -

  When drawing from group keep denominator same, and keep prob of certain event same:

  $\frac{7}{12} \cdot \frac{7}{12}$

  blue ball drawn, 2nd blue ball drawn

- **Without Replacement** -

  Change denominator and prob of certain event if drawn.

  ex) $\frac{4}{12} \cdot \frac{3}{11} \cdot \frac{2}{10}$

- **Conditional probability** - probability one event occurs given another event occured. $P(A|B)$ → prob A given B

  divide prob $A \cap B$ by prob of B. $\frac{P(A \cap B)}{P(B)}$

- **Independent vs. Dependent**

  Independent $P(A) = P(A|B)$

  dependent $P(A) \neq P(A|B)$

  Disjoint Events: $P(A \cap B) = 0$ cause Mutually exclusive.

- **Mutually exclusive** - 2 events can't occur at same time

  inclusive means can happen together.

Geometric Distribution

- Solves for # of trials needed to obtain sucess.
- $(1-ps)^{x-1}(ps)^1$ ps = probability of sucess.
  Expected values $= \frac{1}{ps}$ $\sigma = \frac{\sqrt{(1-ps)}}{ps}$
- to easily see all values do $y=(1-ps)^{x-1}(ps)^1$

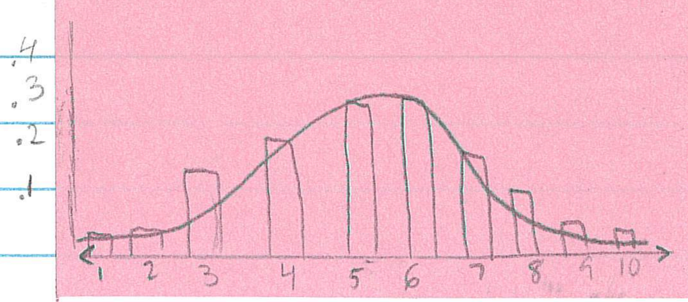
Binomial Distribution

- To find how many sucesses in a set # of trials.
- $nCr\,(p)^r(1-p)^{n-r}$ • Also set equal to y to view all trials

  $n \to$ # trials, $r \to x$, $p \to$ prob sucess

- $M_x = n \cdot p$
- variance: $\sigma_x = \sqrt{n \cdot p(1-p)}$

y= % success	.02	.1	.15	.2	.3	.3	.2	.15	.1	.02
trials	1	2	3	4	5	6	7	8	9	10



After finding Mean and Sx you can set up graph and table to answer Questions. If finding values greater/less than certain value, just find which values apply in the chart and add them up.
M_x = how we solve expected value
$\sigma_x = \sqrt{n \cdot p(1-P)}$ so $\sqrt{\underset{\text{trials}}{10} \cdot ps(1-ps)}$

Circles Combinations

- total # of circle arrangements without restrictions $= \frac{n!}{n}$
  ex) 7 people, how many ways to arrange: $\frac{7!}{7} = 720$
- If people must sit together, take the # that must sit together! times the normal equation but take away one from n for every new person that must be together. Ex) 3 people together: $3! \times \frac{5!}{5}$

Expected Value -

doesn't add to 1 →

p(x)	.2	.05	.01	.01
#	10	20	50	100

- Multiply probability by value of events. Often this involves game and how much won from game; Expected value = Mean of data
  - ex) $.2(10) + .05(20) + .01(50) + .01(100) + .73(0)$
- Make sure the probability adds to 1; if not, see why and adjust. Possibly another factor like % 0, or divide prob by total probability there. ex) $\frac{.2}{.27} = .74$

Fundamental Counting Principal - how many possible outcomes

flip coin, roll dice → $2 \cdot 6 = 12$ outcomes

nothing repeats: SWAIN → $5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$ • Decreases each time cause spots fill

repeats: POOP: $\frac{4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1}$ ← cause O's are same

- Decreasing #'s can be written as $5! \Rightarrow 5, 4, 3, 2, 1$

Permutations - Order matters, line things up. Calc: Math → prob → nPr

$_nP_r$ n = Starting # to choose from r = # you need

ex) line up 6 people from class of 20 → $_{20}P_6$

Combinations - When Order doesn't matter Calc: Math → prob → nCr

$_nC_r$ n = total to choose from r = # needed

Combining Variables

- Expected Value / Combined Means: $(P(x) \cdot Mx) + (P(y) \cdot My)$ probability x · Mean x, + prob y · Mean y
- for Combined Standard deviation: $\sqrt{Sx^2 + Sy^2}$ only add variation

Scaling Variables -

- Mean: Just Multiply Standard deviation: $\sqrt{x\sigma^2 + x\sigma^2}$ scale factor
- for adjusting means and standard deviation

for Sample, mean stays same, standard dev $= \frac{\sigma}{\sqrt{n}}$