Oct. 30 1/13

PIE

$Pr(A \cup B) = Pr(A) + Pr(B) - Pr(A \cap B)$ principle of inclusion exclusion

$Pr(A') = 1 - Pr(A)$ Prob. of the complement

$Pr(A|B) = \frac{Pr(A \cap B)}{Pr(B)}$ conditional prob.

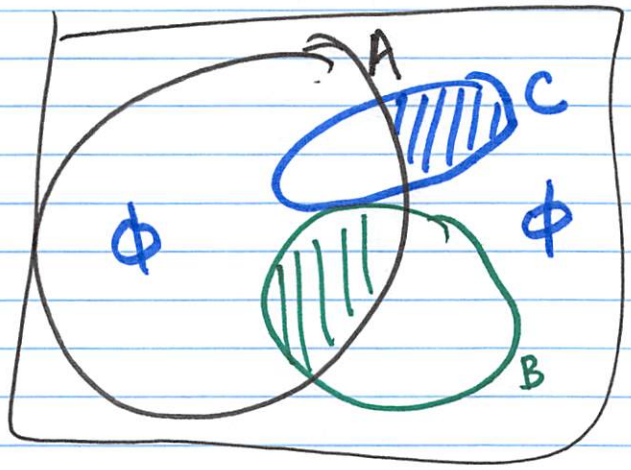
All of 6.5 & 6.4 can be summarized with the following skills.

- Correctly write down what a sample space is and an event is (given a question, how do you determine the sample space and event(s)?)
  - 6.1, 6.2 Chapter 5 (earlier)
- Count # of objects in S (sample space) and events E, if they are equally likely outcomes
  - Chapter 5 (later)
- Using $Pr(E) = \frac{n(E)}{n(S)}$
  - Chapter 6.4
- Using the 3 formulas above appropriately.
  - Ch. 6.5

Combine this with calculating the relevant probabilities by counting the right things.

#14 p. 158

U = students at college
A = regularly attend
B = First year
C = upperclass students



$Pr(A) = .5$

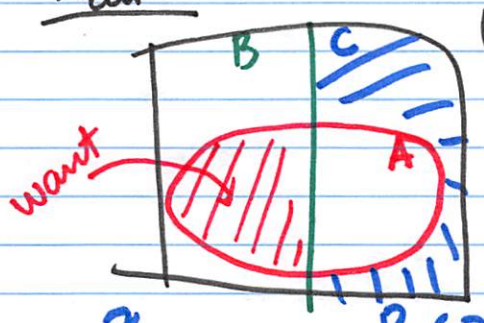
$Pr(B) = .3$

40% of students are in C but don't attend games.

$Pr(C \cap A') = .4$

(a) $Pr(B \cap A)$

Wait!



$C = B'$

$Pr(B' \cap A') = .4$

Better Venn diagram to use!

$Pr(A) = .5$
$Pr(B) = .3$

$Pr(B \cap A) = ?$

$Pr(A \cup B) = Pr(A) + Pr(B) - Pr(A \cap B)$

↑ But we don't know this!

$Pr(A \cap B)$ what we want.

$(A \cup B)' = A' \cap B'$
$= A' \cap C$ and we are given $Pr(A' \cap C) = .4$

$Pr((A \cup B)') = .4$

$Pr(A \cup B) = 1 - Pr((A \cup B)')$
$= 1 - .4 = .6$

PIE

$.6 = .5 + .3 - Pr(A \cap B)$

$\Rightarrow Pr(A \cap B) = .2$

(b) Conditional prob. the student attends games (A) given he's a 1st year (B)?

what we want

$$Pr(A|B) = \frac{Pr(A \cap B)}{Pr(B)} = \frac{.2}{.3} \approx .67$$

(c) Cond. prob. the student is 1st year given he attends games?

$$Pr(B|A) = \frac{Pr(A \cap B)}{Pr(A)} = \frac{.2}{.5} = .4$$

23. 30% of people over 50 own a CD player.

Pick 4 people over 50.
What's the prob. that none own a CD player?

Think of this as flipping 4 coins: 30% chance of H
70% chance of T.

S = {flips of 4 coins in a row} } NOT EQUALLY LIKELY!
E = {TTTT}

CAN'T DO: $\frac{n(E)}{n(S)}$

Break into 4 operations
pick 1st person, 2nd person, 3rd person, 4th person

$$Pr(TTTT) = Pr(T)\,Pr(T)\,Pr(T)\,Pr(T)$$

(1st, 2nd, 3rd, 4th)

$$= (.7)^4$$

Independence

$$Pr(A \cap B) = Pr(A)\,Pr(B)$$

In this case, we had:

A_1 = 1st person doesn't have CD. (no matter what others have)

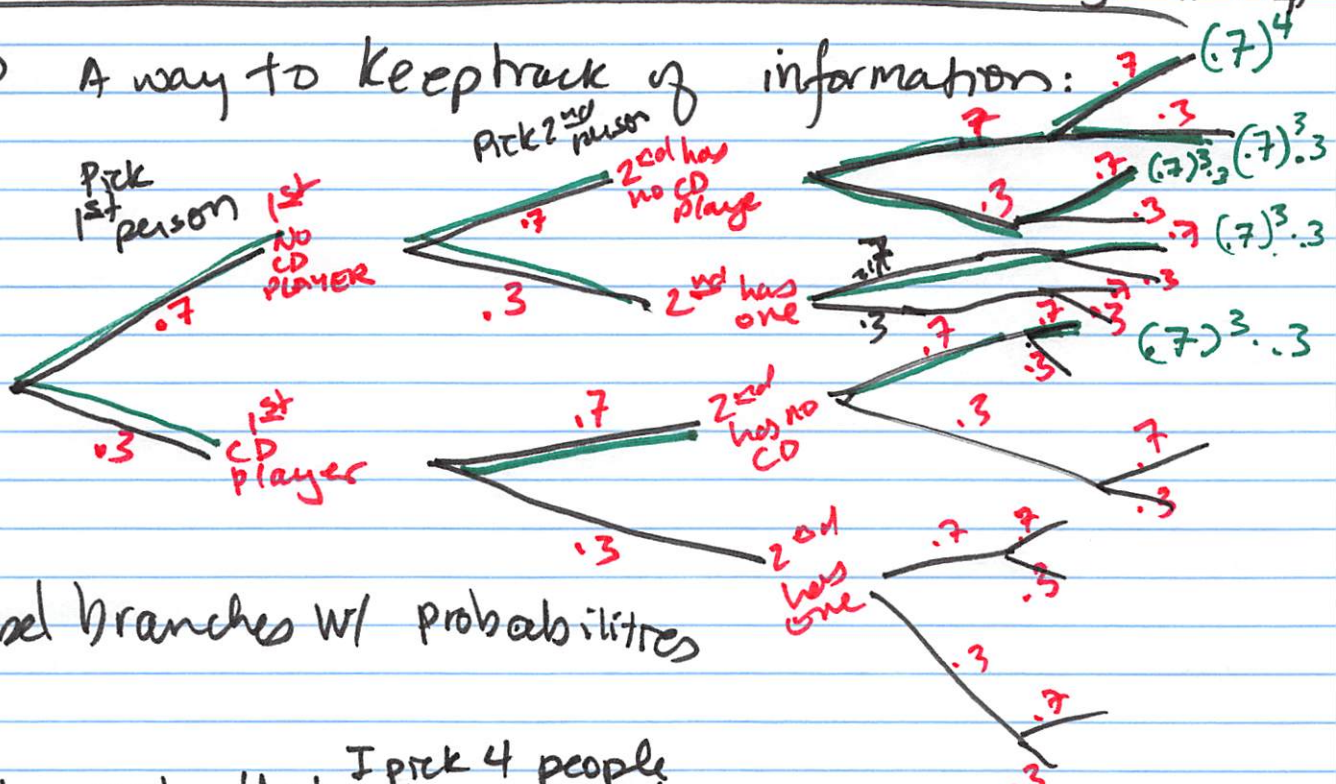
A_2 = 2nd person doesn't (no matter the what the others have)

A_3

A_4

$$Pr(A_1 \cap A_2 \cap A_3 \cap A_4) = Pr(A_1)\,Pr(A_2)\cdot Pr(A_3)\cdot Pr(A_4)$$

TREES A way to keep track of information:



label branches w/ probabilities

What's prob that I pick 4 people at most 1 person has CD Player.

Ans $(.7)^4 + 4\left((.7)^3 \cdot .3\right)$

prob. no one has a player

prob. that one person has CD player (one specific person)

$\binom{4}{1}$ ways for 1 person to have CD player

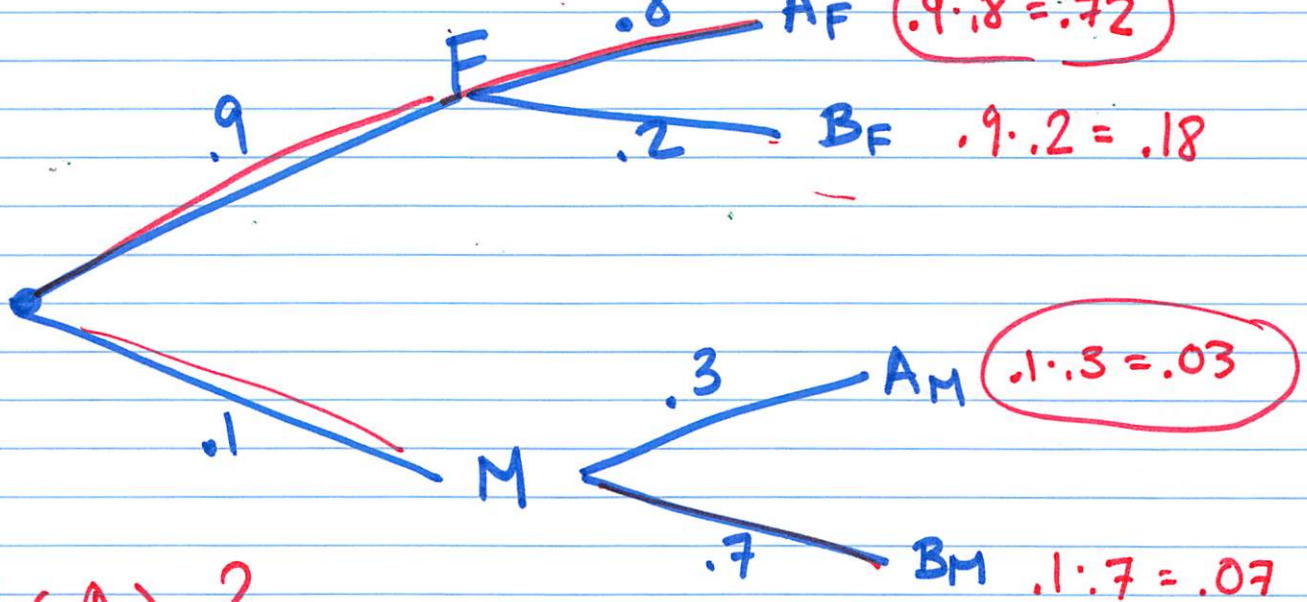
5

Suppose In French class, 80% of students get As and 20% get B's.

In math, 30% get A's and 70% get Bs.

Suppose 10% of students take math & the rest take French.

Pick a random student. What's the prob. they took math & got an A?



$Pr(A) \overset{?}{=} .72 + .03 = .75$

$Pr(F \mid A) = \frac{Pr(A \cap F)}{Pr(A)}$

$= \frac{.72}{.75}$