Example:
for 1.3???

	B_1 Has disease	B_2 doesn't have disease	Total
A_1 Test positive	4,900	False positive 70,100	75,000
A_2 Test negative	False negative 100	924,900	925,000
Total	5,000	995,000	1,000,000

Test for some disease

Don't question this example. Is perfect. (Golik) for our purposes

$P(A_1) = 75{,}000/1{,}000{,}000$

pick 1 person

$P(B_1) = 5{,}000/1{,}000{,}000$

etc...

$P(A_2)$

$P(B_2)$

$P(A_1 \cap B_1) = 4{,}900/1{,}000{,}000$

$P(A_1 \cap A_2) = 0/1{,}000{,}000$

given

$P(A_1 \mid B_1) = 4{,}900/5{,}000$

A_1 given that B_1

limit set of people to B_1

pick person in A_1 that has disease

$P(A_2) = 925{,}000/1{,}000{,}000$

$P(A_2 \cap B_1) = 100/1{,}000{,}000$

$P(B_1 \mid A_2) = \dfrac{100}{925{,}000}$

given A_2

$$\frac{P(A_1 \cap B_1)}{P(B_1)} = P(A_1 \mid B_1)$$

$$P(A_1 | B_1) = \frac{\frac{4{,}900}{\cancel{1{,}000{,}000}}}{\frac{5{,}000}{\cancel{1{,}000{,}000}}} = \frac{4{,}900}{5{,}000}$$

$$P(B_1 | A_2) = \frac{100}{925{,}000} = \frac{P(B_1 \cap A_2)}{P(A_2)}$$

Flip given equation

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(A_2 | B_1) = \frac{100}{5{,}000}$$

golit's way

Addition theorem THM

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

$P(A \cap B) = 0$ if A & B disjoint

Multiplication theorem

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

Also $= P(B \cap A)$ same

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

therefore,

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

problem

1.3-4)

Golik spent 2 minutes explaing what a deck of cards is :)

- pull 2 cards from 52 without replacement

where H is event heart is pulled, C event club pulled,

a) $P(H \cap H) = \frac{13}{52} \cdot \frac{12}{51} = \frac{1}{17}$

1st pull is a heart and 2nd pull is a heart would be

$$P({}^{1st}H) \cdot P(2nd\ H \mid 1st\ H)$$

back to 52 cards

b) $P(\text{1st } H \text{ and 2nd } C) = P(\text{1st } H) \cdot P(\text{2nd } C \mid \text{1st } H)$

$$= \frac{13}{52} \cdot \frac{13}{51} = \frac{13}{204}$$

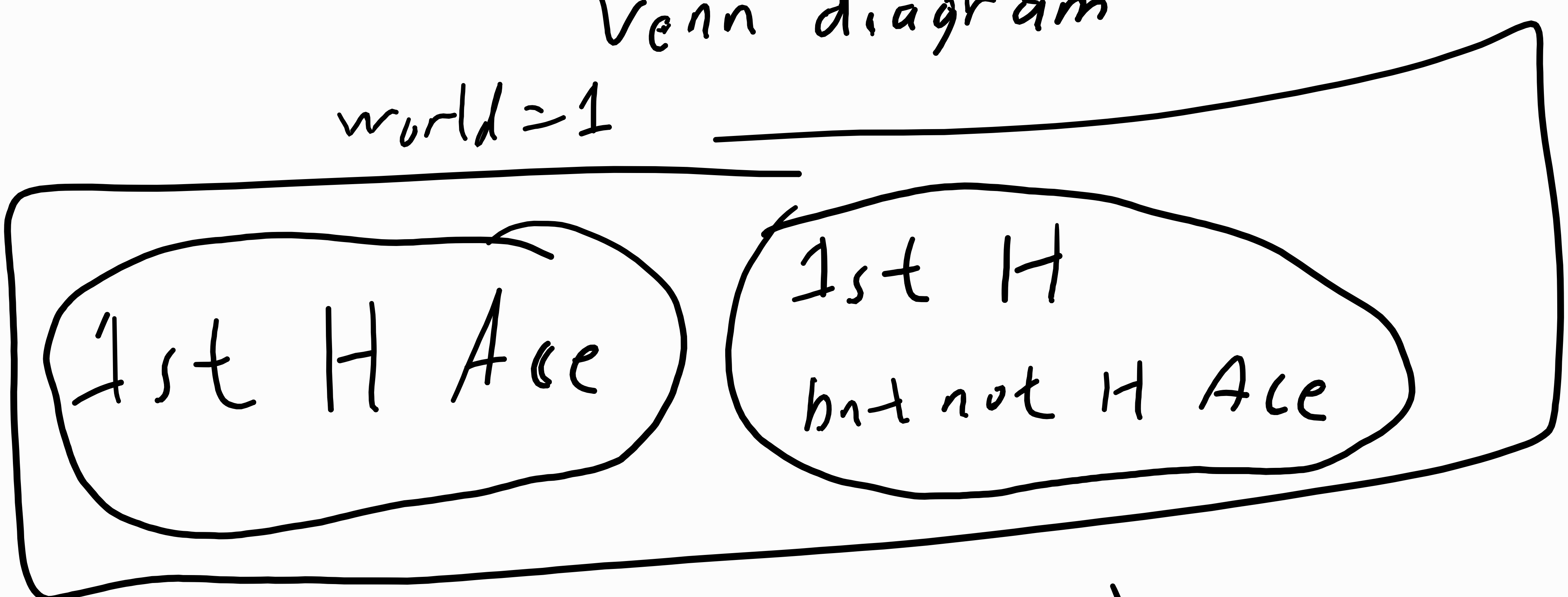
back to 52 cards

c) $P(\text{1st } H \text{ and 2nd Ace}) =$

$$= \frac{13}{52} \cdot ?$$

Separate cases of pulling ace of hearts and not, will be disjoint.

Venn diagram



$P(\text{1st H Ace} \cap \text{2nd Ace}) =$

$$= \frac{1}{52} \cdot \frac{3}{51} = \frac{1}{884}$$

$$P((\text{1st H and not H Ace}) \text{ and 2nd Ace}) =$$

$$= \frac{12}{52} \cdot \frac{4}{51}$$

$$= \frac{4}{221}$$

So

$$P(\text{1st H} \cap \text{2nd Ace}) =$$

$$= \frac{1}{884} + \frac{4}{221} = \frac{1}{52}$$

$$= \frac{1 \cdot 3}{52 \cdot 51} + \frac{12 \cdot 4}{52 \cdot 51} = \frac{3+48}{52 \cdot 51} = \frac{\cancel{51}}{52 \cdot \cancel{51}}$$

$$= \frac{1}{52}$$

Golik: We had a professor who played in the casino. She did pretty good! (The ! is Golik style)