HW5.1

Wednesday, April 26, 2023 9:33 PM

	toothache		¬ toothache	
	catch	¬ catch	catch	¬ catch
cavity	.108	.012	.072	.008
¬ cavity	.016	.064	.144	.576

(1) Probability that a person has no cavity:

$.016 + .064 + .144 + .576 = .80$

(2) Probability no toothache

$.072 + .008 + .144 + .576 = .80$

(3) Joint probability of cavity and no toothache.

$.072 + .008 = 0.08$

(4) No cavity, has toothache

$\frac{.016 + .064}{.108 + .012 + .016 + .064} = \frac{0.08}{0.2} = 0.4$

(5) No cavity, given no toothache.

$\frac{.144 + .576}{.072 + .144 + .008 + .576} = \frac{.72}{.8} = 0.9$

(6) Are cavity and toothache independent?

ind of A & B

is P of Both A & B = P(A and B)

ind = P(A and B) = P(A)P(B)

cavity = $.108 + .012 + .072 + .008 = 0.2$

toothache = $.108 + .012 + .016 + .064 = 0.2$

$0.2 + 0.2 = 0.4 \neq 0.2 \cdot 0.2 = 0.04$

$0.4 \neq 0.04$

No, they are not independent by proof above.

(7) Given a patient has cavity, determine whether probe catch is conditionally ind. of toothache or not, why?

Def of

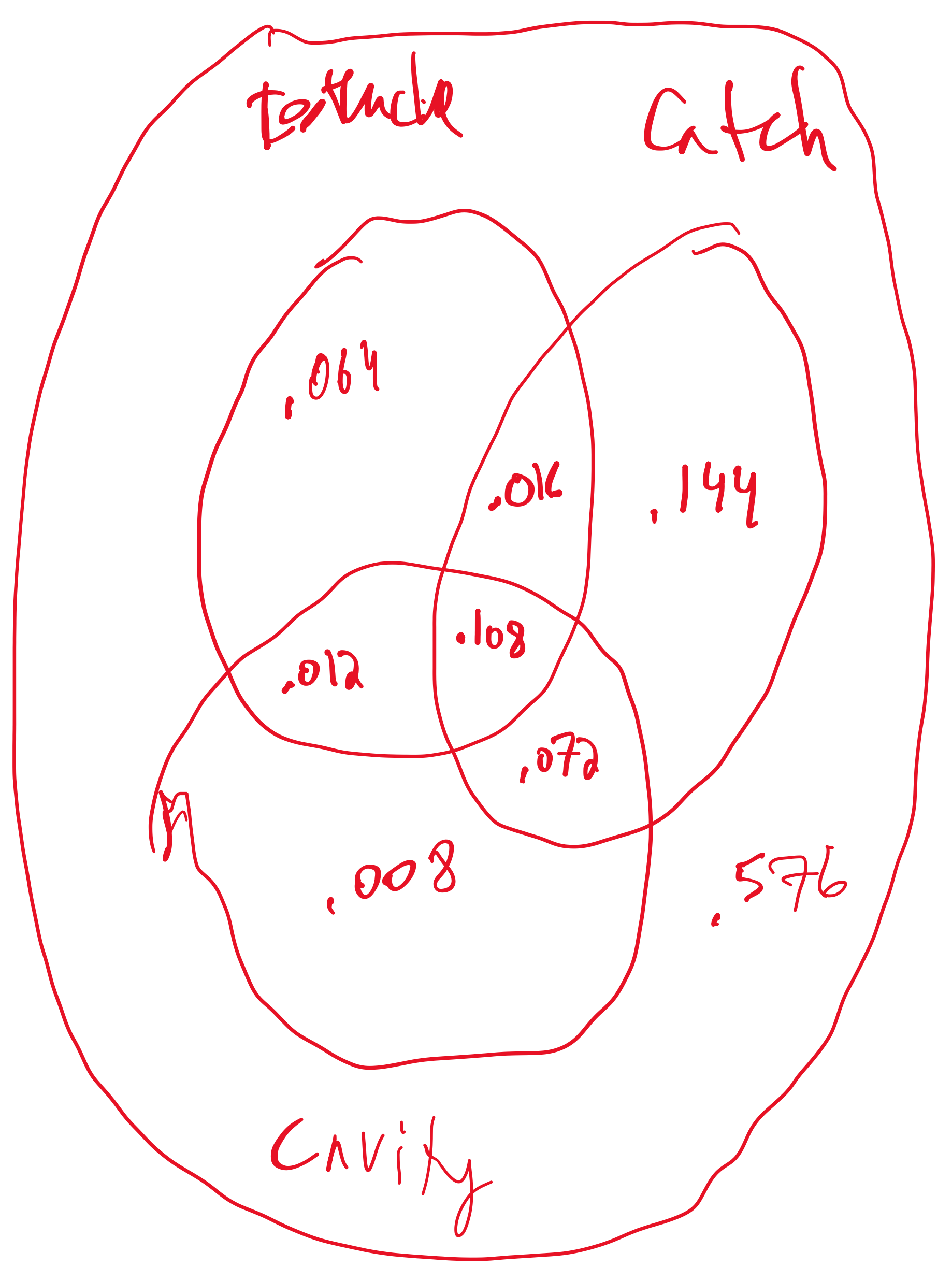
Ind. in original unconditional model

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

Conditional model

$P(A \cap B | C) = P(A|C)P(B|C)$

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



A = Catch

B = toothache

C = cavity

$P(A|C) = .108 + .072 = .18$

$P(B|C) = .012 + .108 = .12$

$P(A \cap B|C) = .108$

$.108 = .18 * .12 = 0.0216$

$P(A \cap B|C) = P(A|C)P(B|C)$

$.108 \neq 0.0216$

Are not conditionally independent

(8) Given a patient does not have cavity, determine whether probe is cond. ind. of toothache or not, why?

A = catch

B = toothache

C = ¬ cavity

$P(A|C) = .144 + .016 = .16$

$P(B|C) = .064 + .016 = .08$

$P(A \cap B|C) = .016$

$P(A \cap B|C) = P(A|C)P(B|C)$

$.016 = (.16)(.08)$

$.016 \neq 0.0128$

Are not conditionally independent

(8.)

A = catch

B = toothache

C = ¬ cavity

$P(A) = 0.34$

$P(B) = 0.2$

$P(C) = 0.8$

$P(A \cap C) = .016 + .144 = 0.16$

$P(B \cap C) = .016 + .064 = 0.08$

$P(B|C) =$