Assignment 4
CIS 471/571 Introduction to Articial Intelligence, Fall 2018
due 11:59 pm, Wednesday, November 14th
1.

① a) $.108 + .012 + .072 + .008 = \boxed{.2}$

b) $.108 + .016 + .072 + .144 = \boxed{.34}$

c) $P(\text{Tooth} \mid \text{Catch}) = \dfrac{P(\text{Tooth} \wedge \text{Catch})}{P(\text{Catch})} = \dfrac{.108 + .016}{.34} \approx \boxed{.365}$

d) $P(\text{cav} \mid \text{too} \vee \text{cat}) = \dfrac{P(\text{cav} \wedge (\text{too} \vee \text{cat}))}{P(\text{too} \vee \text{cat})} = \dfrac{P((\text{cav} \wedge \text{too}) \vee (\text{cav} \wedge \text{cat}))}{1 - P(\neg \text{too} \wedge \neg \text{cat})} =$

$\dfrac{.108 + .012 + .072}{1 - (.008 + .576)} \approx \boxed{.462}$

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

X_1	X_2	X_3			
T	H	H	O		
H	T	H	T		$3/8$
H	H	T	T		

(a)

$$\boxed{\begin{array}{l} P(A) = .\bar{3} \\ P(B) = .\bar{3} \\ P(C) = .\bar{3} \end{array}}$$

choice

$$X_i \Rightarrow X_i = \text{Heads}$$

Choice	$P(X_i | \text{choice})$
A	.4
B	.5
C	.6

choice → X_1, X_2, X_3

(b) $P(\text{choice} = A | (X_1 \wedge X_2 \wedge \neg X_3) \vee (X_1 \wedge \neg X_2 \wedge X_3) \vee (\neg X_1 \wedge X_2 \wedge X_3)) =$

→ $P(A | 2\text{ heads}) = \dfrac{P(2\text{ heads} | A)\, P(A)}{P(2\text{ heads})}$

$$= \frac{P(X_1 \wedge X_2 \wedge \neg X_3)|A) * 3 * (.\bar{3})}{3/8} = \frac{.288 * .\bar{3}}{3/8} = .256$$

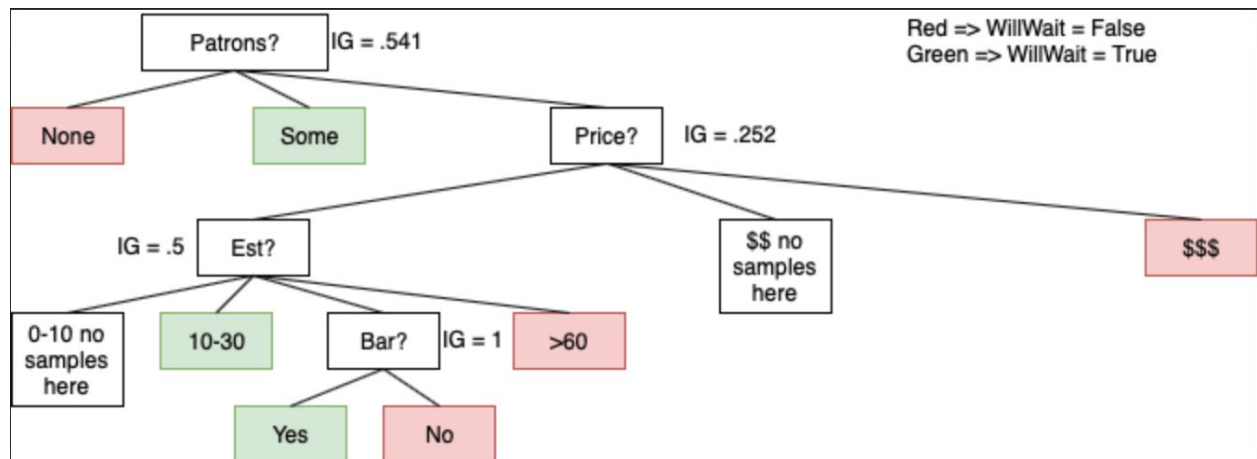$$P(B | 2\text{ heads}) = \frac{P(2\text{ heads} | B)\, P(B)}{P(2\text{ heads})}$$

$$= \frac{.5^3 \cdot 3 \cdot .\bar{3}}{3/8} = .\bar{3}$$

$$P(C | 2\text{ heads}) = \frac{(.6)(.6)(.4)(3)(.\bar{3})}{3/8} = \boxed{.384}$$

C is the most likely coin

2.

3.

Red => WillWait = False
Green => WillWait = True

Step
1. All data
   a. Feature providing max info gain: Pat
      i. IG = .541
2. Pat = Full
   a. Feature providing max info gain: Price, Res, Type, and Est all have equal info gain values. We'll go with Price.
      i. IG = .252
3. Pat = Full, Price = $
   a. Feature providing max info gain: Est
      i. IG = .5
4. Pat = Full, Price = $, Est = 30-60
   a. Feature providing max info gain: Bar.
      i. IG = 1