Lab 6 Practice Question Solutions
BIOS4120

Question 1:

(a) Yes (you can't be a junior and a senior, for example.)

(b) $P(S^c) = \frac{99-21}{99} = \boxed{0.7878}$

$P(S^c) = 1 - P(S) = 1 - \frac{21}{99} = \boxed{0.7878}$ (multiple ways to get solution)

(c) $P(Soph \mid S^c) = \frac{12}{99-21} = \boxed{0.15}$

$P(soph \mid Scn^c) = \frac{P(soph \cap scn^c)}{P(Scn^c)} = \frac{P(soph)}{P(Scn^c)} = \frac{0.12}{0.78} = \boxed{0.15}$ (multiple ways to get solution)

(d) w/ Replacement: $\left(\frac{34}{99}\right)\left(\frac{34}{99}\right) = \boxed{0.1179}$

w/o Replacement: $\left(\frac{34}{99}\right)\left(\frac{33}{98}\right) = \boxed{0.1156}$

Question 2:

The table is filled in using the given information as follows:

	Periodontal Status			
Gender	Healthy	Gingivitis	Perio	Total
Male	1147*	926	936	3009
Female	2603	1495	920	5018
Total	3750	2421	1856	8027

* $(8027)(0.1429) = 1147$

(a) $P(Male \cup Healthy) = \frac{3009 + 3750 - 1147}{8027} = \boxed{0.699}$

(b) $P(Fem \cap Gin \cup Per) = P(Fem)\,P(Gin \cup Per \mid Female)$

Hint: Use Multiplication Rule with $A = Fem$, $B = (Gin \cup Per)$

$= \left(\frac{5018}{8027}\right)\left(\frac{1495 + 920}{5018}\right) = (0.625)(0.48) = \boxed{0.3}$

(c) $P(Per \mid Female) = \frac{920}{5018} = \boxed{0.1833}$

Question 3:

(a) Info from the problem:

$$P(H^+) = 0.001$$

$$P(T^+ \mid H^+) = 0.95 \longrightarrow \text{Sensitivity}$$

(b) $P(H^+ \cap T^+) = P(H^+)P(T^+ \mid H^+) = (0.001)(0.95) = 9.5e\text{-}4$

$\Longrightarrow$ Rate per 10,000 : $(9.5e\text{-}4)(10{,}000) = \boxed{9.5}$

(c) $P(T^- \mid H^+) = 1 - P(T^+ \mid H^+) = 1 - 0.95 = \boxed{0.05}$

Question 4:

What we know from the given information:

- Prevalence : $P(D^+) = 0.01 \Longrightarrow P(D^-) = 1 - 0.01 = 0.99$
- Sensitivity : $P(T^+ \mid D^+) = 0.9$
- False pos. Rate : $P(T^+ \mid D^-) = 0.09$

Setting up our Bayes formula:

$$P(D^+ \mid T^+) = \frac{P(T^+ \mid D^+)P(D^+)}{P(T^+ \mid D^+)P(D^+) + P(T^+ \mid D^-)P(D^-)}$$

Plugging in our components:

$$P(D^+ \mid T^+) = \frac{(0.9)(0.01)}{(0.9)(0.01) + (0.09)(1 - 0.01)} = \frac{0.09}{0.09 + 0.081} = \boxed{0.0917}$$

Question 5:

Let H denote the event it rains in Hawaii
Let IC denote the event it rains in Iowa City

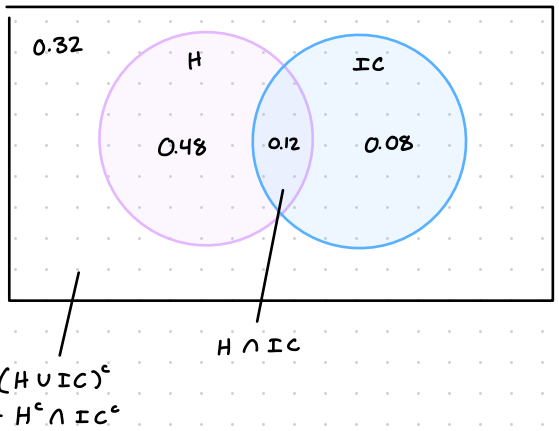
$P(H \cap IC) = P(H)P(IC) = (0.6)(0.2) = 0.12$ ← independence

$P(H \cap IC^c) = 0.6 - 0.12 = 0.48$

$P(IC \cap H^c) = 0.2 - 0.12 = 0.08$

$P(H \cup IC)^c = P(H^c \cap IC^c) = 1 - 0.48 - 0.08 - 0.12$

$= 0.32$



Question 6:

(a) $P(\text{face card}) = \frac{12}{52} = \boxed{0.2307}$

(b) $P(\text{Red face card}) = \frac{6}{52} = \boxed{0.1153}$

(c) $P(\text{Red OR face card}) = P(\text{Red card}) + P(\text{face card}) - P(\text{red face card})$

$= \frac{26}{52} + \frac{12}{52} - \frac{6}{52} = \boxed{0.6153}$

(d) $P(\text{red card OR face card OR 7}) = P(\text{red card OR face card}) + P(7) - P(\text{red 7})$

$= 0.6153 + \frac{4}{52} - \frac{2}{52} = \boxed{0.6538}$