Lab 6 Practice Problems

1

a) Yes! Each player is in only one academic year. Someone cannot be classified as both a junior <u>and</u> senior.

b) $P(\text{not senior}) = \frac{\#\text{ not seniors}}{\text{total}} = \frac{32+12+34}{99} = \frac{78}{99} \approx 0.788$

The probability that a randomly selected player is not a senior is 78.8%.

c) $P(\text{sophomore} \mid \text{not senior}) = \frac{\#\text{sophomore}}{\#\text{not seniors}} = \frac{12}{78} = 0.154$

Given that a randomly selected player is not a senior the probability that he is a sophomore is 15.4%.

d) $P(\text{junior}) = \frac{\#\text{ juniors}}{\text{total}} = \frac{34}{99}$

With replacement: $P(\text{two juniors}) = \left(\frac{34}{99}\right)^2 = 0.118$

note: since we are replacing the player, the draws are independent

With replacement, the probability two randomly selected players are juniors is 11.8%.

Without replacement: $P(\text{two juniors}) = \left(\frac{34}{99}\right)\underbrace{\left(\frac{33}{98}\right)}_{\text{one junior has been removed}} = 0.116$

Without replacement, the probability two randomly selected players are juniors is 11.6%.

2

Let M = male F = female H = healthy G = gingivitis P = perio

Given info: $P(M) = 0.3749$ $P(M \cap H) = 0.1429$ $P(M \cap P) = 0.1167$ $P(H) = 0.4672$ $P(F \cap P) = 0.1147$

a) $P(F) = 1 - P(M) = 0.6251$

$P(M \cap G) = P(M) - P(M \cap H) - P(M \cap P) = 0.1153$

$P(F \cap H) = P(H) - P(M \cap H) = 0.3243$

$P(P) = P(M \cap P) + P(F \cap P) = 0.2314$

$P(G) = 1 - P(H) - P(P) = 0.3014$

$P(F \cap G) = P(G) - P(M \cap G) = 0.1861$

	Healthy	Gingivitis	Perio	Total
Male	0.1429	0.1153	0.1167	0.3749
Female	0.3243	0.1861	0.1147	0.6251
Total	0.4672	0.3014	0.2314	1

b) $P(H \mid F) = \frac{F \cap H}{F} = \frac{3243}{6251} = 0.519$

$P(M \mid P) = \frac{M \cap P}{P} = \frac{1167}{2314} = 0.504$

$P(P \cup G \mid F) = \frac{P \cap F + G \cap F}{F} = \frac{1147 + 1861}{6251} = 0.481$

3. Let C = chameleon has CDS $\quad C^-$ = chameleon doesn't have CDS

T = positive test $\quad T^-$ = negative test

Given Info: $P(C) = 0.02 \quad P(T \mid C) = 0.85 \quad P(T \mid C^-) = 0.12$

We want $P(C \mid T)$.

By Bayes' Rule $P(C \mid T) = \frac{P(T \mid C)P(C)}{P(T \mid C)P(C) + P(T \mid C^-)P(C^-)}$

$P(C^-) = 1 - P(C)$

$= 1 - 0.02 = 0.98$

So, $P(C \mid T) = \frac{(0.85)(0.02)}{(0.85)(0.02) + (0.12)(0.98)}$

$= \frac{0.017}{0.1346}$

$= 0.126$

If a chameleon tests positive, the probability that it actually has CDS is 12.6%.

4. Let M = pangolin migrates $\quad M^-$ = pangolin doesn't migrate

W = pagolin gains enough weight $\quad W^-$ = pangolin doesn't gain enough weight

Given Info: $P(M) = 0.4 \quad P(M^-) = 0.6 \quad P(W|M) = 0.75 \quad P(W|M^-) = 0.45$

a) We want $P(W)$.

By the Law of Total Probability, $P(W) = P(W|M)P(M) + P(W|M^-)P(M^-)$

$$= (0.75)(0.4) + (0.45)(0.6)$$

$$= 0.57$$

Overall, 57% of pangolins gain enough weight for the winter.

b) We want $P(M|W)$.

By Bayes' Rule, $P(M|W) = \dfrac{P(W|M)P(M)}{P(W)}$

$$= \frac{(0.75)(0.4)}{0.57}$$

$$= 0.526$$

Given that a pangolin gained enough weight for winter, the probability it had migrated is 52.6%.

c) We need to see if $P(W|M) = P(W)$.

$P(W|M) = 0.75 \quad P(W) = 0.57$

$0.75 \neq 0.57$, so migration and weight gain are not independent.