Keith Folsom
MSDA Math Workshop
Assignment #2

2.16 PB & J

80% of people like peanut butter
78% of people like jelly
78% like both

Given that a randomly sampled person likes peanut butter, what's the probability that he also likes jelly?

$$P(\text{jelly} \mid \text{peanut butter}) = \frac{P(\text{peanut butter and jelly})}{P(\text{peanut butter})} = \frac{.78}{.802} = .975$$

2.18 Weight and health coverage

a.) probability that a randomly chosen individual is obese?

0.2839

b.) probability that a randomly chosen individual is obese given that he has health coverage

$$P(\text{obese} \mid \text{health coverage}) = \frac{P(\text{health coverage and obese})}{P(\text{health coverage})} = \frac{0.2503}{0.8954} = 0.279$$

c.) probability that a randomly chosen individual is obese given that he has no health coverage

$$P(\text{obese} \mid \text{no health coverage}) = \frac{P(\text{no health coverage and obese})}{P(\text{no health coverage})} = \frac{0.0336}{0.1046} = 0.321$$

d.) Do being overweight and having health care coverage appear to be independent?

$$P(\text{overweight and health coverage}) = \frac{0.3306}{0.8954} = 0.3692$$

$P(\text{overweight}) = .3664$

These two appear very close to being independent. We see that the probability of being overweight with health coverage is **36.9%** while the probability of being overweight (regardless of health coverage) is **36.6%**

2.20 Assortative Mating

a.) probability that a randomly chosen male respondent or his partner has blue eyes?

"Or" --> P(A or B) = P(A) + P(B) - P(A and B)

$$P(\text{male blue eyes}) = \frac{114}{204}$$

$$P(\text{female blue eyes}) = \frac{108}{204}$$

$$P(\text{male blue eyes and female blue eyes}) = \frac{78}{204}$$

$$P(\text{male blue eyes or female blue eyes}) = \frac{114 + 108 - 78}{204} = \frac{144}{204} = 0.705$$

b.) probability a randomly chosen male respondent with blue eyes has a partner with blue eyes?

$$P(\text{female with blue eyes} \mid \text{male with blue eyes}) = \frac{P(\text{male blue eyes and female blue eyes})}{P(\text{male blue eyes})}$$

$$= \frac{\frac{78}{204}}{\frac{114}{204}} = 78/114 = 0.6842$$

c.) probability a randomly chosen male respondent with brown eyes has a partner with blue eyes?

$$P(\text{female with blue eyes} \mid \text{male with brown eyes}) = \frac{P(\text{male brown eyes and female blue eyes})}{P(\text{male brown eyes})}$$

= 19
---
204 = 19/54 = 0.3519

54

204

probability of a randomly chosen male respondent with green eyes has a partner with blue eyes?

P(female with blue eyes | male with green eyes)

= P(male with green eyes and female with blue eyes)

P(male with green eyes)

= 11/204
------- = 11/36 = 0.3056
36/204

d.) are the eye colors of the male respondent and their partners independent?

If these were independent, the probability of a choosing a male respondent with green eyes having a partner with green eyes would be equal to the marginal probability of a female having green eyes

P(male with green eyes | female with green eyes) = P(female with green eyes)

= 11/204
-------- = 11/36 = 0.3056
36/204

P(female with green eyes) = 41/204 = 0.201

We see that these two are not the same; 0.3056 != 0.201

2.26 Twins

What's the probability of identical twins, given you have twin girls

-------- both male0 .5 = 0.15
---- identical .30
-------- both female 0.5 = 0.15

-------- both male 0.25 = 0.175

---- fraternal .70

-------- both female 0.25 = 0.175

-------- 1 male; 1 female 0.5 = 0.35

= P(identical | twin girls)

$$= \frac{P(\text{identical twins and girls})}{P(\text{having twin girls})}$$

= 0.15/(0.15 + 0.175) = 0.4615

R Challenge Question for 2.18

```
health.coverage <- c("Yes", "No", "Total")
neither.overweight.nor.obese <- c(0.3145, 0.0352, 0.3497)
overweight <- c(0.3306, 0.0358, 0.3664)
obese <- c(0.2503, 0.0336, 0.2839)
total <- c(0.8954, 0.1046, 1.0)
weight.table <- data.frame(health.coverage, neither.overweight.nor.obese, overweight, obese, total)

weight.table


#  health.coverage neither.overweight.nor.obese overweight  obese  total
#1           Yes                    0.3145     0.3306 0.2503 0.8954
#2            No                    0.0352     0.0358 0.0336 0.1046
#3         Total                    0.3497     0.3664 0.2839 1.0000

#Question 2.18

# Part A -

subset(weight.table, health.coverage == "Total", select = obese)

# Part B -
```

```
subset(weight.table, health.coverage == "Yes", select = obese) / subset(weight.table, health.coverage == "Yes", select = total)

# Part C -

subset(weight.table, health.coverage == "No", select = obese) / subset(weight.table, health.coverage == "No", select = total)
```