Homework 3

Math 243

Due July 6th at 11:59 PM

Textbook Exercises

Chapter 9: 29, 30, 32, 33, 39

Chapter 12: 32, 33, 35, 38

Chapter 13: 28, 29, 30, 34, 36

Chapter 15: 24, 25, 27, 31, 32

Exercise 1: In 2014, according to the National Center for Educational Statistics, 26% of college degrees awarded were associate degrees, 49% were bachelor's, 20% were master's, and 5% were doctoral. Women earned 61% of the associate, 57% of the bachelor's, 60% of the master's, and 52% of the doctoral degrees. What are the prior probabilities for each of the four types of degrees? Find the posterior probabilities for each type of degree given that the recipient is female. Is the relationship between the priors and posteriors what you expected? Explain. Here, we need to use Bayes' theorem. The priors are $P(A) = .26$, $P(B) = .49$, $P(M) = .2$, and $P(D) = .05$. To find the posteriors, we first know that if F is the event of a college degree recipient being female, then $P(F \mid A) = .61$, $P(F \mid B) = .57$, $P(F \mid M) = .6$, and $P(F \mid D) = .52$. We also know that $P(F) = .5$. Note: I took this problem from the book, and they seem to imply that that's the value we should use since they don't give any other information or reference other data, but I don't think it's correct. If some students use the earlier

table instead to find $P(F)$, that's more than fine. Using .5, we have that $P(A \mid F) = \dfrac{P(F \mid A)P(A)}{P(F)} = .317$, $P(B \mid F) = .559$, $P(M \mid F) = .24$, and $P(D \mid F) = .052$.

Exercise 2: You want to estimate the mean score μ of the students at UO who took the MCAT (Medical College Admission Test), so you take an SRS. According to public information, the score distribution is approximately Normal with standard deviation approximately 10.4. You want your sample mean, $\overline{x}$, to estimate μ with an error of no more than one point in either direction. What standard deviation must $\overline{x}$ have so that 99.7% of all samples give an $\overline{x}$ within one point of μ? How large of an SRS do you need to get $\overline{x}$ to have that standard deviation?

For this one, we want the sample standard deviation to be small enough that three times it is equal to one. With a sample size of n, the sample standard deviation is $\dfrac{10.4}{\sqrt{n}}$, so we want $\dfrac{10.4}{\sqrt{n}} \cdot 3 = 1$. Then $\sqrt{n} = 31.2$, so $n = 973.44$, which we should round up to 974.