Practice Problems for Exam 2

For this exam you MUST indicate which piece of R Output you are using to answer EACH question. Failure to do so will result in a lower grade. You do not have to do ANY hand calculations to answer any questions. Be sure to demonstrate all 5 steps of ANY hypothesis test.

1. A food safety inspector is called upon to investigate a restaurant with a few customer reports of poor sanitation practices. The food safety inspector uses a hypothesis testing framework to evaluate whether regulations are not being met. If she decides the restaurant is in gross violation, its license to serve food will be revoked.

   (a) Write the hypotheses in words.

   (b) What is a Type I Error in this context?

   (c) What is a Type II Error in this context?

   (d) Which error (Type I or Type II) is more problematic for the restaurant owner? Why?

2. In 2013, the Pew Research Foundation reported that "45% of U.S. adults report that they live with one or more chronic conditions", and the standard error for this estimate is 1.2%. Identify each of the following statements as true or false.

   (a) T F If we repeated this study 1,000 times and constructed a 95% confidence interval for each study, then approximately 950 of those confidence intervals would contain the true fraction of U.S. adults who suffer from chronic illnesses.

   (b) T F Since the standard error is 1.2%, only 1.2% of people in the study communicated uncertainty about their answer.

3. According to the US Department of Energy's website www.fueleconomy.gov, my 1999 Nissan Frontier pickup truck should get a combined EPA estimated 21 MPG. At a significance level of 0.5, is there reason to believe that my truck gets better than that?

4. Calculate and interpret a 99% Confidence Interval for the true average MPG for my truck.

5. In a survey of 1430 undergraduate students, 1087 reported that they had one or more credit cards. **Using a 90% confidence interval**, test the claim that more than three-quarters of college undergraduate students have at least one credit card. Explain why you can make this claim using the CI.

R code and subsequent output

Not all code present will be used. It is part of the exam for you to correctly identify which piece of output you need to answer a specific question.

```
t.test(truck$mpg, mu=21, alternative="less") #A1
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 3.7535, df = 80, p-value = 0.9998
## alternative hypothesis: true mean is less than 21
## 95 percent confidence interval:
##      -Inf 23.31328
## sample estimates:
## mean of x
##  22.60272
```

```
t.test(truck$mpg, mu=21, alternative="greater") #A2
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 3.7535, df = 80, p-value = 0.0001645
## alternative hypothesis: true mean is greater than 21
## 95 percent confidence interval:
##  21.89215      Inf
## sample estimates:
## mean of x
##  22.60272
```

```
t.test(truck$mpg, mu=21, alternative="two.sided") #A3
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 3.7535, df = 80, p-value = 0.0003291
## alternative hypothesis: true mean is not equal to 21
## 95 percent confidence interval:
##  21.75298 23.45245
## sample estimates:
## mean of x
##  22.60272
```

```r
t.test(truck$mpg, alternative="two.sided") #B1
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 52.935, df = 80, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  21.75298 23.45245
## sample estimates:
## mean of x
##  22.60272
```

```r
t.test(truck$mpg, alternative="two.sided", conf.level = .99) #B2
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 52.935, df = 80, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 99 percent confidence interval:
##  21.47602 23.72941
## sample estimates:
## mean of x
##  22.60272
```

```r
t.test(truck$mpg, alternative="greater", conf.level = .99) #B3
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 52.935, df = 80, p-value < 2.2e-16
## alternative hypothesis: true mean is greater than 0
## 99 percent confidence interval:
##  21.5891     Inf
## sample estimates:
## mean of x
##  22.60272
```

```r
t.test(truck$mpg, mu=21, alternative="less", conf.level = .99) #C1
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 3.7535, df = 80, p-value = 0.9998
## alternative hypothesis: true mean is less than 21
## 99 percent confidence interval:
##      -Inf 23.61634
## sample estimates:
## mean of x
##  22.60272
```

```r
t.test(truck$mpg, mu=21, alternative="greater", conf.level = .99) #C2
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 3.7535, df = 80, p-value = 0.0001645
## alternative hypothesis: true mean is greater than 21
## 99 percent confidence interval:
##  21.5891     Inf
## sample estimates:
## mean of x
##  22.60272
```

```r
t.test(truck$mpg, mu=21, alternative="two.sided", conf.level = .99) #C3
```

```
##
##  One Sample t-test
##
## data:  truck$mpg
## t = 3.7535, df = 80, p-value = 0.0003291
## alternative hypothesis: true mean is not equal to 21
## 99 percent confidence interval:
##  21.47602 23.72941
## sample estimates:
## mean of x
##  22.60272
```

```r
prop.test(x=1087, n=1430, conf.level=.90) #D1
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  1087 out of 1430, null probability 0.5
## X-squared = 386.05, df = 1, p-value < 2.2e-16
## alternative hypothesis: true p is not equal to 0.5
## 90 percent confidence interval:
##  0.7407283 0.7785504
## sample estimates:
##         p
## 0.7601399
```

```r
prop.test(x=1087, n=1430, conf.level=.95) #D2
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  1087 out of 1430, null probability 0.5
## X-squared = 386.05, df = 1, p-value < 2.2e-16
## alternative hypothesis: true p is not equal to 0.5
## 95 percent confidence interval:
##  0.7369706 0.7818932
## sample estimates:
##         p
## 0.7601399
```

```r
prop.test(x=1087, n=1430, p=.75) #D2
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  1087 out of 1430, null probability 0.75
## X-squared = 0.731, df = 1, p-value = 0.3926
## alternative hypothesis: true p is not equal to 0.75
## 95 percent confidence interval:
##  0.7369706 0.7818932
## sample estimates:
##         p
## 0.7601399
```