Biostatistics Final Exam Prep

Problem 1

In some city the only type of precipitation it gets is rain; it rains in this city about 35% of the time. When it rains the buses arrive late about 30% of the time, and when it's not raining the buses arrive on time about 90% of the time.

a) Write probability statements for the given information:

b) Create a tree diagram for the conditional probabilities. If a bus is late, what is the probability that it is raining?

Problem 2

From this list:

- Confidence interval for a population mean
- Confidence interval for proportion
- Confidence interval for paired data
- Confidence interval for the difference between 2 proportions
- Confidence interval for the difference between 2 means
- Hypothesis test for a population mean
- Hypothesis test for a population proportion
- Hypothesis test for paired data
- Hypothesis test for the difference between 2 proportions
- Hypothesis test for the difference between 2 means

classify the following statistical problems by matching the appropriate analysis procedure with each situation:

a) How much of the food that a person buys ends up being thrown out? A refrigerator was monitored that had 58 perishable items.

b) Before the the recent increase to a city's businesses' taxes, 68% of all new businesses closed down within one year of opening. 48 businesses that have opened since the tax increase are being tracked. Has the new business rate of failure increased since the tax increase?

c) 500 drivers using cell phones and 700 drivers not using cell phones were observed to compare the accident rates. How much more likely are drivers that use their cell phones while driving to get into an accident?

d) 60 college students and 60 high school students were asked what percent of their free time they spent listening to podcasts. Estimate the difference in time that high school students spend listening to podcasts vs college students.

e) 78 University of Iowa students were asked how many cups of coffee they drank each week and how many glasses of water they drank each week. Estimate the mean difference between the average number of cups of coffee and the average number of glasses of water that University of Iowa students drink each week.

f) Will plants grow larger in soil treated with a phosphorus fertilizer vs a nitrogen fertilizer? 62 plants were grown in phosphorus fertilized soil and 62 plants in nitrogen fertilized soil.

g) At ISU, the average student takes 14 semester hours. 47 University of Iowa students were asked how many semester hours they were planning to take next semester. Is there evidence to suggest that University of Iowa students take fewer semester hours on average than ISU college students?

h) Are people more likely to die from a stroke or respiratory disease? 8,000 death certificates were examined.

i) Do more car accidents happen during the daylight hours compared to night? Police records from 180 consecutive days were considered.

j) You want to estimate the average number of hours that college students spend watching Netflix each week. You survey 200 college students.

Problem 3

We want to see if whether a person is introverted or extroverted is related to if they are left handed or right handed. Two hundred-eighty Americans were randomly chosen for the study. Subjects reported whether they were right handed or left handed and then were given a psychological exam to determine if they were introverted or extroverted. The data is presented in the following contingency table:

Table 1: Observed data

	Introvert	Extrovert	Total
Left Handed	20	15	35
Right Handed	116	129	245
Total	136	144	280

Perform a Chi-Square test of independence to see if the categorical variables are related, and find the expected cell counts assuming the variables are independent.

Table 2: Expected cell counts under assumption of independence

	Introvert	Extrovert	Total
Left Handed			
Right Handed			
Total			

Problem 4

A civil engineer randomly chooses 90 days from the previous two years to look at and see how many traffic accidents there were per day in Iowa City. They observe the following data:

Traffic accidents on a given day	Days observed
0	52
1	22
2	9
3	5
4	2

The civil engineer wants to see if they can model the rate of traffic accidents as a Poisson distribution. Using the observed data, they estimate an average rate of 0.7 accidents per day and the following probability distribution:

P(X=0)	P(X=1)	P(X=2)	P(X=3)	P(X=4)
0.497	0.348	0.122	0.028	0.005

Find the expected number of days out of 90 days that one would observe these number of traffic accidents under the assumption of the civil engineer's proposed model and perform a Chi-Square goodness of fit test.

Traffic accidents on a given day	Expected days observed
0	
1	
2	
3	
4	

Problem 5

We want to see if we can linearly model the relationship between miles-per-gallon and vehicle weight. We sample 30 random vehicles and obtain their weights and respective miles per gallon. We get a standard deviation of mpg observations of 5.62 and a standard deviation of weight observations of 1.03. We find a correlation between the variables of -0.862. The average mpg for our sample is 20.61, and the average weight is 3.97 tons.

Determine the linear regression model for our data.

What is the coefficient of determination and what does it mean?

We observe a vehicle that weighs 2.2 tons and gets about 34 miles per gallon. What is the residual for this observation based on our model?

Interpret the slope of our linear regression model.