Topics to be covered this week

STA 138
Fall Quarter, 2018

Monday, October 1 Binomial, multinomial and Poisson distributions (Sections 1.2.1, 1.2.2, 1.3.4, 3.3.0 from the text, and Handouts 2 and 3)

Wednesday, October 3 Poisson and negative binomial distributions (Sections 3.3.0, 3.3.4 in the text, and Handout 3), inference for binomial distribution (1.3.1-1.4.2 in the text, Handout 4)

Friday, October 5 Inference for a binomial (Sections 1.4.3-1.4.5 in the text, Handout 4), 2-way contingency tables (Sections 2.1.1-2.2.3 in the text, Handout 5)

Homework 1: Due on Monday, October 8

You may form a group of 3 students registered in this course and submit one completed homework for the group. The front page should display only the names of the students in the group. The actual work should start from the second page.

1. In the following examples, identify the response variable and the explanatory variables.
(a) Attitude toward gun control (favor, oppose), gender (female, male), mother's education (years of schooling completed) [A goal of the study is to examine how attitude towards gun control depends on gender and mother's educational level.]
(b) Heart disease (yes, no), blood pressure, cholesterol level. [A goal of the study is to investigate if/how heart disease depends on blood pressure and cholesterol level.]
(c) Race (white, nonwhite), religion (Catholic, Jewish, Protestant, others), vote for president (democrat, republican, other), annual income. [I goal of the study is to examine if/how race, religion and annual income affect voting pattern.]

2. Which scale of measurement is the most appropriate for the following variables - nominal or ordinal?
(a) Political part affiliation (democrat, republican, unaffiliated).
(b) Highest degree obtain (none, high school, bachelor's, master's, doctorate).
(c) Favorite beverage (beer, juice, milk, soft drink, wine, other).
(d) Patient condition (good, fair, serious, critical).

3. From the past records it is known that 75% of the students in a particular graduate course get A grades. This course has 6 registered students this quarter. Let Y be the number of students (out of 6) who will get A grades.

(a) What is the probability distribution of Y? Write down the formula of the probability density function.
(b) Calculate the mean and the standard deviation of this distribution.
(c) Calculate the probability that at least 4 students in the class will get A grades.
(d) Find the probability that between 3 and 5 students will get A grades in the course.

4. It is known that 40% of senior citizens are deficient in vitamin D. Let Y be the number of vitamin D efficient individuals in a random sample of $n = 15$ senior citizens.
(a) Calculate $P(Y = 5)$. Also obtain an approximation for this probability using the normal approximation.
(b) Calculate $P(Y \geq 7)$. Also obtain normal approximations for this probability with and without using continuity correction.
(c) Calculate $P(3 < Y < 10)$. Also obtain normal approximations for this probability with and without using continuity correction.

5. Suppose that a person invests in 6 stocks, each with a 40% chance of having no return, a 40% chance of having a positive return, and a 20% chance of having a negative return. You may assume that the stocks are independent and the probabilities do not change. Let (n_1, n_2, n_3) be the number of stocks with no returns, positive returns and negative returns respectively.
(a) Find the probability that 2 stocks have no return, 2 have positive returns, and 2 have negative returns.
(b) Find the probability that at least one stock has a positive return.
(c) Find the expected values and standard deviations of n_1, n_2 and n_3.
(d) Find the pairwise correlations of n_1, n_2, n_3.

6. From the past records it is known that a company receives 10 complaints on the average in a week (7 days). Let Y be the number of complaints this company will receive next week. Assume that a Poisson distribution is appropriate.
(a) Find the mean and standard deviation of Y.
(b) Find the chance that the company will receive exactly 10 complaints next week.
(c) Find the probability that the company will receive at least one complaint next week.

7. It is believed that in a 2020 presidential race between Senator Warren and President Trump, the senator has an edge over the president among college/university students. In a random sample of 20 students in a certain large university, 15 students favors Senator Warren over the President. Let π be proportion of students in this university who are in favor of the senator.
(a) Find a 95% confidence interval for π.
(b) It is desired to test $H_0 : \pi \leq 0.5$ $vs\, H_1 : \pi > 0.5$. Use the Wald statistic to carry out a test at a $\alpha = 0.5$ level of significance, and state your conclusion

(c) Find the p-value of your test in part (b) by finding the exact probability, using normal approximation with and without using continuity corrections. [Thus there will be three values: one exact, and two approximations.]