MATH 321 – QUIZ 5 & 6 (take home) – SPRING 2019 || 50 POINTS

Instructions: Show all work. Collaboration and references are allowed. Approved computational devices allowed.

Print Name _____

1. (2 pts) Following are given two confidence intervals which were constructed from the same data set. One has 95% confidence level and the other has 99% confidence level. Which is which?

$$(19.44, 21.48) \qquad (19.11, 21.81)$$

2. (3 pts) Find the level of confidence associated with confidence interval $\overline{X} \pm 2.33\frac{\sigma}{\sqrt{n}}$. Write the R code and use R to calculate it.

3. (4 pts) For a dataset of size $n = 120$ with sample mean $\overline{X} = 32$ taken from a population with known variance $\sigma^2 = 9$, construct a 95% confidence interval for the population mean μ. Write any R code used.

4. (5 pts) In a consumer preference survey of 1,500 individuals, it is found that 347 stated that they are willing buy brand A. Estimate the true population proportion that would buy brand A with a 95% confidence interval.

5. (4 pts) Calculate the p-value, for a hypothesis test for a population mean. Use R and write the R code used.

(a) Two-sided test, unknown variance, sample size $n = 10$, test statistic $t = -2.5$.

(b) One-sided test $H_a : \mu < \mu_0$, unknown variance, sample size $n = 10$, test statistic $t = -2.5$.

6. (6 pts) A rope manufacturer claims that their ropes can handle a load of at least 6,000 lbs before failing. A sample of 15 rope segments are collected and tested until failure, and the average force required to cause failure was found to be $\overline{X}_{15} = 5,800$ lb with standard deviation $s = 500$ lb.
(a) Write the null and alternative hypotheses.
(b) Test the manufacturer's claim at significance level $\alpha = 0.1$.
(c) Clearly state your conclusion.

7. (5 pts) If we are to perform a hypothesis, we need to choose the significance level α. If we assume the null hypothesis is true, what does α represent? What will happen if we increase or decrease α?

8. (6 pts) A company is interested in testing whether or not any particular day of the week tends to have more or less customers. Here are the number of customers observed on each day for one week:

Day	Mon	Tues	Weds	Thurs	Fri
# customers	123	107	92	118	105

Does this data call into question the claim that each day should on average have the same number of customers? Write any R code used. Clearly state your conclusion. *(Hint: Use chi-squared goodness of fit test.)*

9. (7 pts) The current US House of Representatives is composed of 235 Democrats and 197 Republicans (there are 3 vacant seats). If 141 Demcorats support a particular bill, what is the maximum number of Republicans that can support it and still see a statistically significant difference at the 5% level? Write all R code used.

(Hint: Start at the same level of support among Republicans, perform a two proportion hypothesis test. Then decrease the number of republicans supporting the bill and re-do the hypothesis test. Continue decreasing the number of Republicans supporting the bill until the outcome of the test is to reject the null hypothesis that both parties support the bill equally. Carefully think whether this should be one- or two-sided.)

10. (8 pts) The following table show real gross domestic product (GDP) and real personal expenditures (PE), both in trillions of US $, for the years 2009 to 2018. Write any R code used in answering the questions below.

(a) Find the covariance of GDP and PE.
(b) Find the correlation coefficient between GDP and PE.
(c) Construct a linear regression line for GDP as a linear function of PE.
(d) Find the SSE, sum of the squared errors.

Year	GDP	PE
2009	15.20	10.50
2010	15.60	10.60
2011	15.80	10.80
2012	16.20	11.00
2013	16.50	11.20
2014	16.90	11.50
2015	17.40	11.90
2016	17.70	12.20
2017	18.10	12.60
2018	18.60	12.90