Name: _____

MAT 222
Fall 2019
Homework 5

"Brian! There's a message in my cereal. It says 'Ooooooooo'. [Brian] Peter, those are Cheerios."

–Peter & Brian Griffin, Family Guy

Problem 1: A random sample of n observations is selected from a normal population to test the null hypothesis that $H_0 : \mu = 98.9$. For each of the following alternative hypotheses below, specify for which t-values you would reject the null hypothesis.

(a) $H_a : \mu \neq 98.9, \quad \alpha = 0.05, \quad n = 12,$ _____

(b) $H_a : \mu > 98.9, \quad \alpha = 0.10, \quad n = 14,$ _____

(c) $H_a : \mu < 98.9, \quad \alpha = 0.01, \quad n = 30,$ _____

(d) $H_a : \mu > 98.9, \quad \alpha = 0.05, \quad n = 91,$ _____

(e) $H_a : \mu \neq 98.9, \quad \alpha = 0.01, \quad n = 23,$ _____

Problem 2: What does it mean for a statistical inference to be robust? Are t-procedures robust?

Problem 3: Assessment of highway conditions is important for their maintenance. One way of measuring the safety of highways is to measure crack intensity—a measurement of the average number of cracks per some fixed distance of road. A local government sends out a crew to measure the crack intensity in a local strip of highway. They took 15 samples of 50-meter stretches of the highway and found a mean crack intensity of 0.129 with standard deviation 0.23.

(a) Construct a 95% confidence interval for the crack intensity of this highway. Interpret your result.

(b) The American Association of State Highway and Transportation Officials (AASHTO) recommends a maximum crack intensity of 0.100 before repairs. Using an appropriate null and alternative hypothesis and a significance level of 5%, determine if this highway exceeds this standard.

Problem 4: A study of business students was performed to determine if students felt having a printed version of lecture notes was (or would be) helpful in understanding the material. Eighty-six students from a class with lecture notes and thirty-five students from a class without such notes were surveyed. Responses were measured on a scale of 1–9 with 1 being "strongly disagree" and 9 being "strongly agree." The data is summarized below.[1]

	n	$\overline{x}$	s
Notes	86	8.48	0.94
No Notes	35	7.80	2.99

(a) Is a pooled two-sample t-test appropriate? Why or why not?

(b) Construct a 99% confidence interval for the difference in opinions between these two groups. Interpret your results.

[1] Gray, J.I., and Abernathy, A.M. "Pros and cons of lecture notes and handout packages: Faculty and student opinions." *Marketing Education Review*, Vol 4, No. 3, p.25, 1984.

(c) Use an appropriate hypothesis test with significance level 1% to determine if there is any significant difference between the mean response rates. Interpret your results.

(d) Explain how you could have used (b) to answer (c).

(e) What if the researchers had a reason to believe the difference in the average response was 1? Recompute the test statistic in (c) using this assumption.

Problem 5: Which is more important for t-procedures: that the sample be normal or have no skewness or that the samples be SRS?

Problem 6: Must degrees of freedom (especially in a computer system) for two-sample t-procedures always be integers?

Problem 7: Most people believe that there is a difference between male and female heights, on average. The traditional 'wisdom' is that men are, on average, taller than women. To test this, you take a simple random sample of 23 men and 27 women. You find the men have an average height of 178.4 cm and the women have an average height of 164 cm with standard deviations 7.59 cm and 7 cm, respectively. Use an appropriate t-procedure to test the hypothesis that, on average, men are taller than women using a significance level of 0.1%.