Fall 2017, MATH 408, Exam 1

Monday, October 16, 2017; 1–1:50pm

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Name: ____

Circle the time of your discussion section: **2pm** **3pm**

Instructions:

- No books or notes of any kind.
- Turn off cell phones.
- You should have (and use!) a calculator and three distribution tables: normal, t, and χ^2. You are welcome to use statistical functions in your calculator instead of the tables.
- Answer all questions and clearly indicate your answers.
- **Each problem is worth 10 points.**
- **Show your work!** Points might be taken off for a correct answer with no explanations. Wrong answer with no explanations is worth zero points.

Problem	Possible	Actual
1	10	
2	10	
3	10	
4	10	
5	10	
Total	50	

Problem 1. Given the set of numbers 39, 54, 61, 72, 59, 49, and assuming that this is a sample from a normal population, construct the 90% confidence interval for the standard deviation.

Problem 2. Given a normal population with mean -1 and unknown standard deviation σ, construct the MLE of σ.

Problem 3. A study reports that freshmen at public universities work 10.2 hours a week for pay, on average, and the s_n is 8.5 hours; at private universities, the average is 8.1 hours and the s_n is 6.9 hours. Assume these data are based on two independent simple random samples, each of size 1,000. Is the difference between the averages due to chance? Explain your conclusion by stating the corresponding null and alternative hypotheses and computing the p-value.

Problem 4. For the first-year students at a certain university, the correlation between SAT scores and first-year GPA was 0.75. Assume the distribution of the scores is jointly normal. Predict the percentile rank on the first-year GPA for a student whose percentile rank on the SAT was 85%.

Problems 5. Let $X_1, \ldots, X_n$ be a random sample from exponential distribution with mean θ. Construct the most powerful test of size α if the null hypothesis is $H_0 : \theta = \theta_0$ and the alternative is $H_1 : \theta = \theta_1 > \theta_0$.