

# Fall 2020, MATH 408, Exam 1

Friday, October 2; 9–9:50am

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## Instructions:

- If you have a question, please write to the instructor using the private chat function of the zoom meeting. Other than that, please do not communicate with anybody during the exam.
- You should have (and use!) a calculator or other computing device and three distribution tables: normal,  $t$ , and  $\chi^2$ . Instead of the tables, you are welcome to use the corresponding statistical functions on your computing device.
- Answer all questions and clearly indicate your answers.
- **Each problem is worth 10 points.**

**Problem 1.** Given the set of numbers 39, 55, 60, 72, 59, and assuming that this is a sample from a normal population, construct the 95% confidence interval for the standard deviation.

To get full credit, indicate the values of the sample mean, sample standard deviation, and the quantiles of the corresponding distribution you need to construct the confidence interval.

**Problem 2.** Let  $X_1, \dots, X_n$  be an independent random sample from exponential distribution with unknown mean  $\theta$ . Construct the MLE of  $\theta$ .

**Problem 3.** A study reports that freshmen at public universities work 11.1 hours a week for pay, on average, and the  $s_n$  is 8.6 hours; at private universities, the average is 9.2 hours and the  $s_n$  is 7.1 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.

**Problems 4.** Let  $X_1, \dots, X_n$  be a random sample from exponential distribution with mean  $1/\theta$ . Construct the most powerful test with Type-I error equal to 0.05 for testing  $H_0 : \theta = 1$  against  $H_1 : \theta = 2$ .