Study Guide – Math 107, Exam 2

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General Information

Exam 2 will be on Wednesday 5/11, in class. No books, notes, computers, or cell phones are allowed. A formula sheet will be provided for you.

Below is a rough outline of what material will be covered on Exam 2. To study, I recommend carefully going through class notes, homework problems, and handouts (especially this handout) actively (intermixing reading, thinking, solving problems, and asking questions). After reviewing those materials I recommend solving lots and lots of practice problems (there are many problems in the textbook that may be helpful—remember that the odd problems have solutions in the back of the textbook—I especially encourage you to complete the "Skill Builder" exercises). I will post a practice exam on the course webpage.

Chapter 3 - Confidence Intervals

- Definitions

  Population, parameter, sample, statistic, point estimate, confidence interval, statistical inference, sampling distribution, standard error, margin of error, confidence level, bootstrap sample, bootstrap statistic, bootstrap distribution, bootstrap standard error, bootstrap confidence interval, percentile bootstrap confidence interval

- Know the relationships between population, parameter, sample and statistic.
- Understand the properties of a sampling distribution.
- Understand the properties of a bootstrap distribution.
- Understand how to compute and interpret a bootstrap confidence interval using the "plug-in method/principle" (this is what I called it in class, not what the book calls it), and what conditions are required for this type of interval to be valid/appropriate.
- Understand how to use a confidence interval to recognize plausible values for the population parameter.
- Understand the concept of statistical confidence (this goes along with the interpretation of a confidence interval).
- Be able to describe how to select a bootstrap sample and compute a bootstrap statistic.
- Understand how the width of a confidence interval is affected by the confidence level and sample size.

Chapter 4 - Hypothesis Testing

- Definitions

Statistical test, null hypothesis, alternative hypothesis, statistical significance, p-value, randomization distribution, significance level, type I error, type II error, practical significance

- Know how to conduct a hypothesis test using a randomization distribution (including the specification of hypotheses, the calculation/interpretation of a p-value, making a decision, and stating a conclusion in context).
- Understand how the significance level affects the rejection of the null hypothesis.
- Understand the difference between type I and type II error.
- Understand how to generate a randomization distribution the properties of a randomization distribution.
- Understand the connection between a confidence interval and a two-tailed hypothesis test.
- Understand the difference between practical significance and statistical significance.
- Understand the problem of multiple testing.

Overview of Skill Building Problems from the Textbook

Topic	Skill Builders
Parameters vs. statistics	3.1–3.11
Sampling distributions	3.12–3.19
CIs using the margin of error	3.39–3.42
CI as a range of plausible values	3.43, 3.44
Plugin CIs	3.45–3.50, 3.67–3.74
Bootstrap samples	3.65, 3.66
Evidence	4.1–4.4
Specifying hypotheses	4.5–4.15, 4.21-4.25, 4.30–4.36
p-values	4.41–4.51
Using a significance level	4.67–4.76, 4.93–4.98
Errors in testing	4.99–4.103
Randomization distributions	4.107–4.122
CIs and two-sided tests	4.146–4.152

Formulas given on Exam 2

$$\overline{x} = \frac{\sum x_i}{n}$$

$$s_x = \sqrt{\frac{\sum (x_i - \overline{x})^2}{n-1}}$$

$$z = \frac{x - \overline{x}}{s}$$

$$\text{range} = \max - \min$$

$$\text{IQR} = Q_3 - Q_1$$

$$Q_1 - 1.5 \times \text{IQR}$$

$$Q_3 + 1.5 \times \text{IQR}$$

$$r = \frac{1}{n-1} \sum \left(\frac{x_i - \overline{x}}{s_x} \right) \left(\frac{y_i - \overline{y}}{s_y} \right)$$

$$\text{statistic} \pm 2 \cdot \text{SE}$$