Math 58B - Exam 1 Preparation - Spring 2023

**Logistics:**

• Thursday, March 9, 2023 – take exam at any time during the day, take as long as you need.

• Material up through Thursday, March 2, 2023

• Two sides of notes are allowed (one piece of paper)

• Bring calculator, no computers

**Overview:**

We modeled data measured with two quantitative variables. We produced a correlation coefficient and a least squares regression line. [n.b., we have not yet performed inference on the linear model, so far, our work has been only to **describe** the linear relationship.]

We have analyzed studies that involve one binary categorical (i.e., yes/no) variable, where the data are a sample (ideally, a random sample) from a random process or a large population. We have also analyzed studies that involve two binary variables, particularly those coming from a randomized experiment.

We have studied graphical and numerical summaries. We have used inference methods based on simulation/randomization, bootstrapping, and also approximate methods based on the normal distribution.

We have studied two primary types of statistical inference:

* Statistical significance, where the goal is to assess the degree to which the sample data provide evidence supporting a research conjecture;
* Statistical confidence, where the goal is to estimate a population parameter with an interval of plausible values.

We have studied three ways to conduct statistical inference in these situations:

* Randomization test / CI
	+ Tactile (e.g., with coins, cards) & Technology (e.g., with applet, infer R package)
* Bootstrapping
	+ Tactile (e.g., dice) & Technology (e.g., with applet, infer R package)
* Normal test / CI
	+ When CLT conditions are satisfied & with technology (e.g., xpnorm in R)

We have also considered how the scope of conclusions to be drawn depends on how the data were collected. More specifically:

* Random assignment allows for the possibility of drawing cause/effect conclusions.
* Random sampling allows for generalizing to a larger population.

We have examined confidence intervals and hypothesis tests for different parameters:

* Population success proportion / probability
* Difference in population success proportions / probabilities
* Population relative risk, population odds ratio

**Outline:**

* Observational unit, explanatory variable, response variable, parameter, statistic
* Correlation (r), least squares regression line, R2, interpretation of those quantities
* Null hypothesis, alternative hypothesis
* Reasoning process of statistical significance; null model, p-value, strength of evidence
* One-sided & two-sided tests
* Confidence interval, effect of confidence level
* Sampling variability, sampling dist of statistic, Central Limit Theorem (CLT)
* Normal probability model, normal probability calculations, empirical rule, z-score
* Test statistic, z-test for population proportion, effect of sample size
* Standard error of $\hat{p}$, critical value z\*, z-interval for pop proportion, effect of sample size
* Logic behind bootstrapping, calculating a bootstrap confidence interval
* Interpretation of confidence level
* Population, sample, sampling bias, simple random sampling
* Practical vs. statistical sig, importance of random sampling, effect of sample size
* Simulating randomization test for comparing two groups with binary response
* Significance level, test decision, type I & type II error, power, factors influence power
* Relative risk: interpretation and confidence intervals
* Odds Ratio: interpretation and confidence intervals
* case-control vs. cohort studies

**Advice:**

• Organize notes for efficient retrieval of information/formulas

• Don’t plan to use cheatsheet too much

* Prepare as if exam were closed book/notes
* **Focus on understanding, not memorization**

• Expect similar questions to what we answer in class every day, clicker Q, on HW

• Be ready to interpret computer output

* Possibly excluding irrelevant output

• Be prepared to **think/explain/interpret**

* Do not just plug into formulas
* Be ready to explain the process of how you would do calculations

• Read carefully

* Be sure to answer the question asked

• Take advantage of information provided

* Perhaps including output

• Relate conclusions to context

• Practice

* Work through solved examples at end of text chapters
* Re-work in-class examples, HW, clicker questions, sample exam 1 problems
* Be able to answer all of the reflection questions

• Give yourself enough time!

* Be cognizant of time constraints
* Attempt all questions
* Sleep well & eat well before the exam