Math 58/58B - Exam 1 Preparation - Spring 2020

**Logistics:**

• Thursday Mar 12, 2-hour block between 9am – 2:30pm

• Take home problem due Thursday, March 26, in class

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

• Bring calculator, no computer use in class

• Material up through Thursday, Mar 5

**Overview:**

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 categorical variables, for which the results can be organized in a 2×2 (or r x c) table.

We have studied graphical and numerical summaries for such data. We have used inference methods based on simulation/randomization and also approximate methods based on the normal distribution. Sometimes, exact calculations can be done using the binomial distributions (Math 58 only).

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:

* Simulation
  + Tactile (e.g., with coins) & Technology (e.g., with applet or infer)
* Binomial probability distribution (Math 58 only)
  + By hand & With technology (applet or R)
* Normal distribution
  + When CLT conditions are satisfied & With technology (applet or 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 for different parameters:

* Population success proportion
* Difference in population success proportions
* Population relative risk, population odds ratio (Math 58B only)

**Outline:**

* Reasoning process of stat sig; null model, simulation, p-value, strength of evidence
* Binomial probabilities (Math 58 only)
* Observational unit, explanatory variable, response variable, parameter, statistic
* Null hypothesis, alternative hypothesis
* One-sided & two-sided tests, confidence interval, effect of confidence level
* Sig level, rej region, test decision, type I & type II error, power, factors influence power
* Normal probability model/curve, mean, standard deviation, empirical rule, z-score
* Sampling variability, sampling dist of statistic, Central Limit Theorem (CLT)
* Normal probability model, normal probability calculations, z-score
* Test statistic, z-test for population proportion, effect of sample size
* Standard error, critical value z\*, z-interval for pop proportion, effect of sample size
* 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
* Two sample z-test & two sample z-interval for differences in proportions
* Relative risk: interpretation and confidence intervals (Math 58B only)
* Odds Ratio: interpretation and confidence intervals (Math 58B only)
* Chi-square goodness-of-fit test (one variable, ≥ 2 categories)
* Chi-square test of independence (two variables, each ≥ 2 categories)

**Advice:**

• Organize notes for efficient retrieval of information/formulas

• Don’t plan to use notes 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

* And possibly excluding irrelevant output

• Be prepared to think/explain/interpret

* Do not just plug into formulas
* Be ready to explain 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
* Be able to answer all of the reflection questions

• Show up on time!

* Be cognizant of time constraints
* Attempt all questions