Review of Part III

Math 2200
Statistical inference in practice

1. Define the population of interest based on the problem on hand.
2. Design the study
   - sampling scheme
   - experimental design
3. Collect data
   - sampling survey
   - perform the experiment
4. Construct the proper probability model
5. Estimation or hypothesis testing
Sampling schemes

- Simple random sampling
- Stratified sampling
  - Population is heterogeneous among the strata
  - Within a stratum, population is homogeneous
  - e.g., strata defined by gender
- Cluster sampling
  - Subjects are naturally in separate groups (clusters)
  - Different clusters may have similar characteristics
  - e.g., strata defined by grade level
- Multistage sampling
- Systematic sampling
  - Order does not matter
Avoiding biased samples

• Common errors
  – Relying on voluntary responses or convenience sampling
  – Under-coverage
    • Some portion of the population is not sampled or has a smaller representation in the sample
  – Non-response bias
    • This happens when those who do not respond differ from those who do
  – Response bias
    • This happens when something in the survey design influences the responses
Observational study and Experiment

1. Observational study
   - Retrospective study
   - Prospective study

2. Experiment
   - factor, response, level, treatment
   - Control
   - Randomization
   - Replicate
   - Block (more on the next slides)
Experimental design

• Completely randomized
• Randomized block design
  – Randomize within each block
Experimental design

1. Control treatment
   - Placebo effect

2. Blinding
   - Single-blind
   - Double-blind

3. Blocking

4. Confounding
   - Two factors are confounded when the levels of one factor are associated with the levels of another factor
Analyzing the results of a randomized comparative experiment

1. Statistically significant

- When an observed difference is too large for us to believe that it is likely to have occurred naturally, we consider the difference to be statistically significant.