Math 161

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1. Chapter 6: Experiments in the Real World

Treating Subjects Equally

- Treating Subjects Equally: Main principle of randomized comparative experiments: all subject are treated equally except for the treatments being compared.
- Double-Blind Experiments: Neither the subject nor the people working with them know which treatment the subject is receiving.
- Used to address the placebo effect: change in response variables due to a inert (fake) treatment.
- The placebo effect is very real: see Example 2 on p.97 of text

More Complex Experimental Designs

- Completely Randomized Design: all subjects allocated at random among all treatments.
- Example: We wish to study the effect of coffee and tea on exam performance. A study is designed to give subjects two cups of coffee, tea, or water just before their Math 161 exam. The time of day the exam is written may also have an effect, so some subjects write exams in the morning, the others in the afternoon. In all there are $3 \times 2 = 6$ treatments: (morning, coffee), (afternoon, coffee), (morning, tea) (afternoon, tea), (morning, water), (afternoon, water). Test subject are randomly assigned to one of the six treatments.
- explanatory variables: time of day exam written and beverage consumed
- response variable: score on exam

More Complex Experimental Designs (cont'd)

- Matched Pairs: compare two treatments using pairs of subjects as closely matched as possible.
- randomly assigning one subject in each pair to the first treatment, the other subject in the pair gets the second treatment (possibly a control).
- Example: Test the effectiveness of a new cholesterol reducing drug. The effectiveness of the drug may be linked to the blood cholesterol levels of the subjects prior to taking the drug. For example, high cholesterol subjects may respond very dramatically, while moderately high cholesterol subjects less so. Simply dividing subjects into treatment and placebo groups may not tell the whole story. Instead, form pairs of subject with similar cholesterol levels, and randomly assign one member of each pair to the new drug while the second subject gets a placebo.

More Complex Experimental Designs (cont'd)

- Block Designs: Subjects of similar characteristics thought to affect the response are placed into groups (or blocks), and the random assignment of treatments is carried out within each block.
- Example: Study the effectiveness of online learning using two treatments: classroom instruction alone, or classroom instruction plus online course supplements and exercises. The attitudes of the subjects toward online learning is suspected to be different for males and females, so we block our design by sex: first divide test subjects into male and female groups, then randomly assign one of the two treatments to subjects within each group.