AP Statistics Exam Study Session Materials 4/24/14

2011 Exam B – Topic: Characteristics of a well-conducted experiment; Generalizing results; Methods of data collection

2. People with acrophobia (fear of heights) sometimes enroll in therapy sessions to help them overcome this fear. Typically, seven or eight therapy sessions are needed before improvement is noticed. A study was conducted to determine whether the drug D-cycloserine, used in combination with fewer therapy sessions, would help people with acrophobia overcome this fear.

   Each of 27 people who participated in the study received a pill before each of two therapy sessions. Seventeen of the 27 people were randomly assigned to receive a D-cycloserine pill, and the remaining 10 people received a placebo. After the two therapy sessions, none of the 27 people received additional pills or therapy. Three months after the administration of the pills and the two therapy sessions, each of the 27 people was evaluated to see if he or she had improved.

   (a) Was this study an experiment or an observational study? Provide an explanation to support your answer.

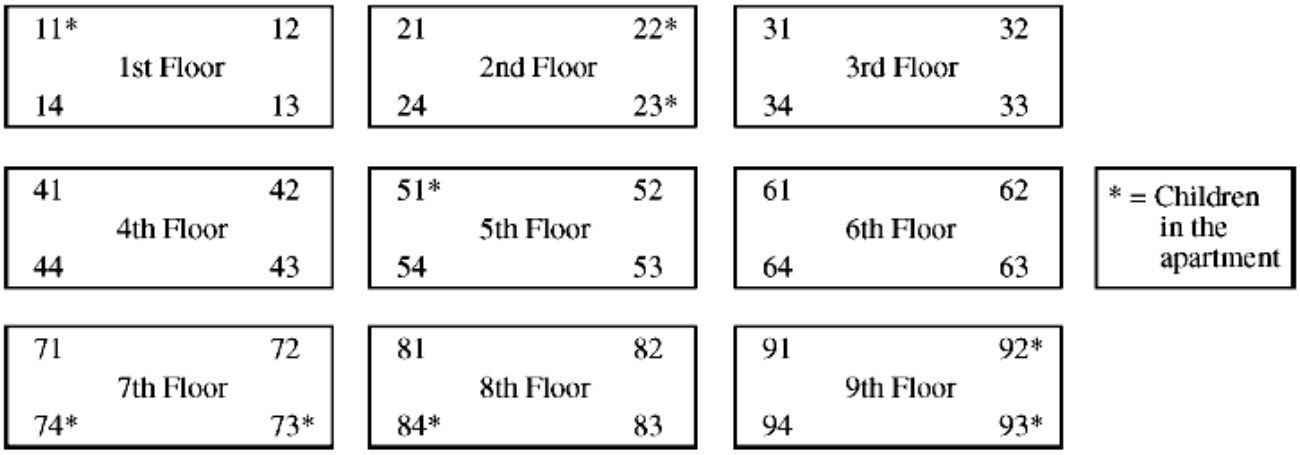
   (b) When the data were analyzed, the D-cycloserine group showed statistically significantly more improvement than the placebo group did. Based on this result, would the researchers be justified in concluding that the D-cycloserine pill and two therapy sessions are as beneficial as eight therapy sessions without the pill? Justify your answer.

   (c) A newspaper article that summarized the results of this study did not explain how it was determined which people received D-cycloserine and which received the placebo. Suppose the researchers allowed the therapists to choose which people received D-cycloserine and which received the placebo, and no randomization was used. Explain why such a method of assignment might lead to an incorrect conclusion.

2011 Exam – Topic: Planning a study; Sampling methods

3. An apartment building has nine floors and each floor has four apartments. The building owner wants to install new carpeting in eight apartments to see how well it wears before she decides whether to replace the carpet in the entire building.

The figure below shows the floors of apartments in the building with their apartment numbers. Only the nine apartments indicated with an asterisk (*) have children in the apartment.



(a) For convenience, the apartment building owner wants to use a cluster sampling method, in which the floors are clusters, to select the eight apartments. Describe a process for randomly selecting eight different apartments using this method.

(b) An alternative sampling method would be to select a stratified random sample of eight apartments, where the strata are apartments with children and apartments with no children. A stratified random sample of size eight might include two randomly selected apartments with children and six randomly selected apartments with no children. In the context of this situation, give one statistical advantage of selecting such a stratified sample as opposed to a cluster sample of eight apartments using the floors as clusters.

2009 Exam B – Topic: Random assignment; Concept of powe

4. A manufacturer of toxic pesticide granules plans to use a dye to color the pesticide so that birds will avoid eating it. A series of experiments will be designed to find colors or patterns that three bird species (blackbirds, starlings, and geese) will avoid eating. Representative samples of birds will be captured to use in the experiments, and the response variable will be the amount of time a hungry bird will avoid eating food of a particular color or pattern.

   (a) Previous research has shown that male birds do not avoid solid colors. However, it is possible that males might avoid colors displayed in a pattern, such as stripes. In an effort to prevent males from eating the pesticide, the following two treatments are applied to the pesticide granules.

   Treatment 1: A red background with narrow blue stripes

   Treatment 2: A blue background with narrow red stripes

   To increase the power of detecting a difference in the two treatments in the analysis of the experiment, the researcher decided to block on the three species of birds (blackbirds, starlings, and geese). Assuming there are 100 birds of each of the three species, explain how you would assign birds to treatments in such a block design.

   (b) Other than blocking, what could the researcher do to increase the power of detecting a difference in the two treatments in the analysis of the experiment? Explain how your approach would increase the power.

2009 Exam B – Topic: Random assignment; Sources of bias and confounding

3. Before beginning a unit on frog anatomy, a seventh-grade biology teacher gives each of the 24 students in the class a pretest to assess their knowledge of frog anatomy. The teacher wants to compare the effectiveness of an instructional program in which students physically dissect frogs with the effectiveness of a different program in which students use computer software that only simulates the dissection of a frog. After completing one of the two programs, students will be given a posttest to assess their knowledge of frog anatomy. The teacher will then analyze the changes in the test scores (score on posttest minus score on pretest).

   (a) Describe a method for assigning the 24 students to two groups of equal size that allows for a statistically valid comparison of the two instructional programs.

(b) Suppose the teacher decided to allow the students in the class to select which instructional program on frog anatomy (physical dissection or computer simulation) they prefer to take, and 11 students choose actual dissection and 13 students choose computer simulation. How might that self-selection process jeopardize a statistically valid comparison of the changes in the test scores (score on posttest minus score on pretest) for the two instructional programs? Provide a specific example to support your answer.

2008 Exam B – Topic: Completely randomized design; Concepts of type I and type II errors

4. A researcher wants to conduct a study to test whether listening to soothing music for 20 minutes helps to reduce diastolic blood pressure in patients with high blood pressure, compared to simply sitting quietly in a noise-free environment for 20 minutes. One hundred patients with high blood pressure at a large medical clinic are available to participate in this study.

   (a) Propose a design for this study to compare these two treatments.

   (b) The null hypothesis for this study is that there is no difference in the mean reduction of diastolic blood pressure for the two treatments and the alternative hypothesis is that the mean reduction in diastolic blood pressure is greater for the music treatment. If the null hypothesis is rejected, the clinic will offer this music therapy as a free service to their patients with high blood pressure. Describe Type I and Type II errors and the consequences of each in the context of this study, and discuss which one you think is more serious.

2005 Exam B – Topic: Planning and conducting experiments

3. In search of a mosquito repellent that is safer than the ones that are currently on the market, scientists have developed a new compound that is rated as less toxic than the current compound, thus making a repellent that contains this new compound safer for human use. Scientists also believe that a repellent containing the new compound will be more effective than the ones that contain the current compound. To test the effectiveness of the new compound versus that of the current compound, scientists have randomly selected 100 people from a state.

   Up to 100 bins, with an equal number of mosquitoes in each bin, are available for use in the study. After a compound is applied to a participant's forearm, the participant will insert his or her forearm into a bin for 1 minute, and the number of mosquito bites on the arm at the end of that time will be determined.

   (a) Suppose this study is to be conducted using a completely randomized design. Describe a randomization process and identify an inference procedure for the study.

   (b) Suppose this study is to be conducted using a matched-pairs design. Describe a randomization process and identify an inference procedure for the study.

   (c) Which of the designs, the one in part (a) or the one in part (b), is better for testing the effectiveness of the new compound versus that of the current compound? Justify your answer.