A. Explain how you would carry out a completely randomized experiment for the study.
B. Describe an experimental design that would improve the design in part A by incorporating blocking.
C. Can the experiment in part B be carried out in a double blind manner? Explain.

Solution:

A. Assign each volunteer a different label with the same number of digits. Select groups of numbers from the Random Digit Table with as many digits as the labels for the volunteers until half of the volunteers are chosen to take the new drug. The remaining volunteers will take the old drug.

B. Assign each volunteer who exercises a different label with the same number of digits. Select groups of numbers from the Random Digit Table with as many digits as the labels for the volunteers until half of the volunteers are chosen to take the new drug. The remaining volunteers will take the old drug. Repeat the procedure for the volunteers who do not exercise.

C. The experiment in part B could be carried out in a double blind manner if neither the subjects nor the researchers who administered the drugs or monitored the results knew which of the drugs were being used. The new and old drugs must be identical in appearance and taste.

Because of concerns about employee stress, a large company is conducting a study to compare two programs (tai chi or yoga) that may help employees reduce their stress levels. Tai chi is a 1,200-year-old practice, originating in China, that consists of slow, fluid movements. Yoga is a practice, originating in India, that consists of breathing exercises and movements designed to stretch and relax muscles. The company has assembled a group of volunteer employees to participate in the study during the first half of their lunch hour each day for a 10-week period. Each volunteer will be assigned at random to one of the two programs. Volunteers will have their stress levels measured just before beginning the program and 10 weeks at the completion of it.

A. A group of volunteers who work together ask to be assigned to the same program so that they can participate in that program together. Give an example of a problem that might arise if this is permitted. Explain to this volunteer group why random assignment to the two programs will address this problem.

B. Someone proposes that a control group be included in the design as well. The stress level would be measured for each volunteer assigned to the control group at the start of the study and again 10 weeks later. What additional information, if any, would this provide about the effectiveness of the two programs?

C. Is it reasonable to generalize the findings of this study to all employees of this company? Explain.

Solution:

A. If the volunteers who worked together were assigned to the same program, it would be difficult to determine if the changes or absence of changes in stress levels were a result of the program or a result of the jobs. Random assignment will address this problem since each program will contain individuals from different departments, and the differences in the changes in stress levels are more likely to be the result of the two programs.

B. A control group would be beneficial since it would help to monitor the changes in stress levels which may occur since employees know that they are participating in a study to reduce stress levels. A control group would also help to monitor changes in stress levels which may occur due to circumstances within the company.

C. It is not reasonable to generalize the findings of this study since volunteers may have different attitudes and lifestyles which affect stress levels than those employees who chose not to participate in the study.

AP Statistics 2002 Free-Response Questions: Problem 2

A manufacturer of boots plans to conduct an experiment to compare a new method of waterproofing to the current method. The appearance of the boots is not changed by either method. The company recruits 100 volunteers in Seattle, where it rains frequently, to wear the boots as they normally would for 6 months. At the end of the 6 months, the boots will be returned to the company to be evaluated for water damage.

A. Describe a design for this experiment that uses the 100 volunteers. Include a few sentences on how it would be implemented.

B. Could your design be double blind? Explain.
Solution:

A. Each volunteer will receive a pair of boots. One of the boots will be treated with the new method of waterproofing and the other boot will be treated with the current method of waterproofing. The treatment each boot receives will be determined randomly. Assign each volunteer a two-digit label from 00 to 99. Select groups of two digits from the Random Digit Table until 50 volunteers are chosen to have the right boot treated with the new method of waterproofing and the left boot with the current method. The remaining 50 volunteers will have the left boot treated with the new method of waterproofing and the right boot with the current method. After 6 months, the difference in the water damage to the two boots will be evaluated for each volunteer.

B. The design could be double blind if neither the volunteers nor the researchers who evaluated the boots for water damage were told which method of waterproofing was used on the boots. This is possible since the appearance of the boots was not changed by either method of waterproofing.
Homework #44

Problem 1:  A preliminary study conducted at a medical center in St. Louis has shown that treatment with small, low-intensity magnets reduces the self-reported level of pain in polio patients. During each session, a patient rested on an examining table in the doctor's office while the magnets, embedded in soft pads, were strapped to the body at the site of pain. Sessions continued for several weeks, after which pain reduction was measured.

A new study is being designed to investigate whether magnets also reduce pain in patients suffering from herniated disks in the lower back. One hundred male patients are available for the new study.

A. Describe an appropriate design for the new study. Your discussion should briefly address treatments used, methods of treatment assignment, and what variables would be measured. Do not describe how the data would be analyzed.

B. Would you modify the design above if, instead of 100 male patients, there were 50 male and 50 female patients available for the study? If so, how would you modify your design? If not, why not?

Problem 2:  A hothouse for young plants has immovable planting beds and artificial lights as indicated in the figure below:

A new quick-grow fertilizer is to be tested in the hothouse. The treatment group is administered the new fertilizer while the control group receives the traditional fertilizer. All other conditions (cultivating, water, and so on) are applied uniformly to both groups of beds. Describe how you would assign the beds to the treatment and control group so that the amount of light does not confound the result. Also discuss the consequences of your design relative to the analysis of data.
Problem 1

A. 100 male - random patients assignment

Assign each male patient a two-digit number from 00 to 99. Select groups of two digits from the Random Digit Table until 50 male patients are chosen to receive magnets embedded in the pads. The remaining 50 male patients will receive pads without embedded magnets.

B. Yes

OR

No. The randomization done in part A should equalize the effects of gender in the two groups and gender should not affect the self-reported level of pain significantly.

Problem 2

The configuration of the room makes it very possible to find two beds with similar exposure to the light. The beds in each block will be 1-4, 2-5, and 3-6. In each block, one bed will receive the new fertilizer and the other will receive the traditional fertilizer. The bed which received the new fertilizer will be determined randomly, possibly by tossing a coin. At the conclusion of the experiment, the plant growth for the new and traditional fertilizer within each block will be compared.