Homework # 5  
due Monday, 3 October

(1) Most American adolescents don’t eat well and don’t exercise enough. Can middle schools increase physical activity among their students? Can they persuade students to eat better?

Investigators designed a “physical activity intervention” to increase activity in physical education classes and during leisure periods throughout the school day. They also designed a “nutrition intervention” that improved school lunches and offered ideas for healthy home-packed lunches.

A study was conducted at several middle schools. In each of these schools four home-room classes in each of the sixth, seventh and eighth grades was used in the study. Within each grade (at each school), the four classes were randomly assigned to the physical-activity intervention, the nutrition intervention, both interventions, or no intervention. The investigators observed students’ physical activity and lunchtime consumption of fat.

Identify the experimental units, the factor(s), the treatments, the response variable(s) and the type of experimental design in the preceding study.

(2) based on 3.40 Which coffee is preferred? A coffeehouse wants to compare two new varieties of coffee, in terms of which variety its customers prefer.

(a) Describe an experiment in which different customers evaluate each variety. Be sure to provide details, including what if any randomization you will perform and what data you will collect.

(b) Do the same for an experiment in which each customer evaluates both varieties of coffee.

(c) What kinds of experimental designs are these two studies?

(d) Which experiment do you prefer. Give reasons for your answer.

(3) You have a study population of 300 colonies of some species of coral, of which 90 are infected with some disease. You do not know this proportion of infections and wish to estimate it: you will take an SRS of six colonies and determine how many of them are infected.

(a) Use Table B to simulate the presence or absence of infection in each colony in an SRS of six colonies from this population. Be sure to explain clearly how you did this: how you represented the population, infection status, etc., and how you selected the SRS (including which part of Table B you used and how). What proportion of your six sample colonies was infected?

(b) Repeat (a) with different lines from Table B, until you have simulated the results of 20 SRSs of size six. What proportion of the colonies in each of your 20 samples was infected? Make a histogram of the 20 values to display the sampling distribution of $\hat{p}$ in this case. What is the mean of this distribution? What is its shape?
(4) Based on 4.145 Bachelor’s degrees by gender Of the 2,325,000 bachelor’s, master’s and doctoral degrees given by U.S. colleges and universities in a recent year, 69% were bachelor’s degrees, 28% were master’s degrees, and the rest were doctorates. Moreover, women earned 57% of the bachelor’s degrees, 60% of the master’s degrees, and 52% of the doctorates.

(a) Construct the two-way table of counts of degrees awarded classified by degree and gender.

(b) If you choose a degree recipient at random, what is the probability that the person you choose is a woman?

(c) If you choose a degree at random and find it was awarded to a woman, what is the probability that it is a doctorate? What would you call this probability?

(d) Are the events ‘choose a woman’ and ‘choose a master’s degree recipient’ independent? How do you know?