IV SOLUTIONS TO EXERCISES

Note: Exercises whose answers are given in the back of the textbook are denoted by the symbol •.

CHAPTER 1
Introduction

1.2.1 It appears that the digestive problems were caused by the nocebo effect. People feared that fluoridation of their drinking water would cause health problems and this fear led to digestive problems when, in fact, fluoride was not yet being added to the water.

1.2.2 People eating potato chips made with olestra might expect to have gastrointestinal problems. Thus, the expectation of problems might lead to those problems occurring (a nocebo effect). It is important that the subjects don't know which group they are in, so that any nocebo effect is seen evenly across the two groups. Likewise, the persons evaluating the subjects should be blinded, so that there is no bias in recording any gastrointestinal symptoms that arise.

• 1.2.3 The acupuncturist expects acupuncture to work better than aspirin, so she or he is apt to "see" more improvement in someone given acupuncture than in someone given aspirin -- even if the two groups are truly equivalent to each other in their response to treatment.

1.2.4 The surgeons selected patients, rather than having patients chosen at random. It is not likely that a patient on the verge of death would have been enrolled in the Vitamin C study, since the surgeons would not have expected that person to live long enough to take much Vitamin C. It is more likely that relatively healthy patients (among those with terminal cancer) would be selected. Such selection would result in a treatment group that, even without the Vitamin C, would have been expected to live longer than did historical controls. Moreover, recently diagnosed cancer patients -- those in the study -- may have been diagnosed earlier in the progression of disease than the historical controls were diagnosed (due to improved medical testing). These factors would make Vitamin C look better than it really is.

1.2.5 This is an anecdote; it is not convincing evidence that the procedure is effective. For example, it might be that rigorous, daily adherence to a treatment regimen made the difference, but the particular treatment was not important. Or it may be that the cumulative effect of previous treatments provided the cure, so that the fungus would have vanished over 100 days even if the person had done nothing.

1.2.6 (a) (I) This should be an experiment; (II) it should be double-blind (i.e., neither the subjects nor the evaluating physicians should know who is in which group).

   (b) (I) This should be an observational study; (II) there is no need for blinding here.

1.2.7 (a) (I) This should be an observational study; (II) it should be single blind: The people who measure the brains should be blinded to the sexual orientations of the men.

   (b) (I) This should be an experiment, with people randomly assigned to one of two groups: high (more than 1 liter per day) vs low water intake; (II) it should be single blind: The people who measure the weights of the subjects should be blinded to the group assignments.

1.2.8 (a) This was an experiment, since the treatment was applied by the researchers.

(b) The experiment confounds two effects: the effect of the fertilizer and the effect of being on the west side of the garden. It might be that the fertilizer has no effect, but that plants on the west side of the garden grow better than do plants on the east side.

(c) The persons weighing the tomatoes could be blinded as to whether the plants came from the east side or the west side of the garden. Double-blinding, however, does not make sense, since this would involve the tomato plants somehow being unaware of what treatment they were getting.

1.2.9 No. This is an observational study, which means that confounding variables are a concern. In this case, one might expect that relatively healthy persons are more likely to attend religious services than are those with weak immune systems, so it may be that the immune system affects attendance, rather than the other way around. It could also be that attendance at services is beneficial to the immune system, but that the benefit is due to social interaction, not to the religious nature of the services, per se. Other explanations are also possible.

1.2.10 No. It might be that within a given age, sex, and socioeconomic group those people who are healthiest are most likely to play golf, while those in poorer health may not play golf or may have quite playing golf due to poor health.

• **1.3.1 (a)** Cluster sampling. The three clinics are the three clusters.

(b) Simple random sampling.

(c) Stratified random sampling. The strata are the altitudes.

(d) Simple random sampling.

(e) Stratified random sampling. The three breed sizes are the strata.

• **1.3.2 (a)** The sample is nonrandom and likely nonrepresentative of the general population because it consists of (1) volunteers from (2) nightclubs. (i) The social anxiety level of people who attend nightclubs is likely lower than the social anxiety level of the general public. (ii) A better sampling strategy would be to recruit subjects from across the population.

(b) Bias arises from the data being collected only on rainy days. (i) Water pollution readings in the stream might be lower when rain water is mixed in with regular stream water. (ii) A better method would be to sample during all types of weather.

(c) Recording observations only when random coordinates are within a tree canopy will induce bias. (i) Trees with large canopies are more likely to be included in the sample than are other trees, but canopy size is probably related to tree radius, resulting in a sample average that is too large. (ii) A better sampling method would be to measure whichever tree trunk is closest to randomly choose coordinates, but even this produces bias in favor of large trees. In order to avoid the bias, number all of the trees within a region and drawn random numbers to select trees to measure. Geographical regions could be used as strata within a stratified sampling plan of this type.

(d) Fish caught by a single vessel on one day are not a random sample. (i) If the vessel is in a region that has not been fished recently and thus contains large fish, for example, then the sample average

will be too large. (ii) To avoid this bias, use randomly chosen fishing vessels on randomly chosen days.

1.3.3 (a) Fish caught by a single vessel on one day are not a random sample. (i) If the vessel is in a region that has not been fished recently and thus contains large fish, for example, then the sample average will be too large. (ii) To avoid this bias, use randomly chosen fishing vessels on randomly chosen days.

(b) Students who eat breakfast, particularly those who eat before 8:30 am, are not a random sample. (i) Those who eat breakfast before 8:30 am in a dining hall might eat a healthier diet than other students, particularly since they don't have to cook breakfast for themselves. (ii) To avoid bias, use a random sample of students including those who do not eat breakfast at all.

(c) Residents who complain of headaches might be highly susceptible to the placebo effect. (i) Residents might experience rapid pain relief due to a placebo effect, meaning that if they were given a sugar tablet but told that it was a pain killer, then they might experience rapid pain relief for psychological reasons. (ii) To control for the placebo effect, give the pain killer to some residents but a placebo to others, in a randomized and double-blind experiment.

1.3.4 (a) Random selection would mean that each digit should be chosen 1/4th of the time.

(b) Results will vary. It is common for people to select the digit 3 more frequently than expected and the digits 1 and 4 less frequently. Based on the experience of the authors, typical proportions for the digits 1, 2, 3, and 4 are around 0.15, 0.25, 0.45, and 0.15, respectively.

(c) These sample proportions suggest that people do not chose numbers randomly, but instead favor certain numbers, particularly 3.

1.3.5 Divide the random digits into groups of size three and use these to select IDs:
$$7\,2\,8 \parallel 1\,2\,1 \parallel 8\,7\,6 \parallel 4\,4\,2 \parallel 1\,2\,1 \parallel 5\,9\,3 \parallel 7\,8\,7 \parallel 8\,0\,3 \parallel 5\,4\,7 \parallel 2\,1\,6 \parallel 5\,9\,6 \parallel 8\,5\,1$$
The first potential ID is 728, which is greater than 600 and thus is omitted. The second ID of 121 is included, then 876 is omitted because it is greater than 600, then 442 is included, but the second 121 is skipped since 121 is already in the sample. Continuing, we include 593, 547, and 216. The individuals selected are thus 121, 442, 593, 547, and 216.

1.3.6 – 1.3.7 See Section III of this Manual.