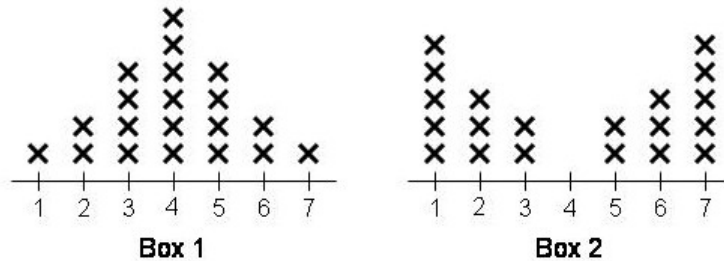


1. (15 pts) Two boxes, Box 1 and Box 2, each contain 20 vouchers inscribed with dollar values. The number of vouchers in each box and their dollar values are indicated in the following frequency plots.



You are presented with one of the boxes, but you do not know which one. You draw one voucher from the box at random, read its value, and decide which box you believe it is. The hypotheses are

H_0 : The box is Box 1.

H_1 : The box is Box 2.

- What is the direction of extreme?
 - Suppose your decision rule is to reject H_0 if the selected voucher is at least as extreme as 2. Which values are in the rejection region?
 - Use the decision rule in part (b) throughout the rest of this problem. What is the value of α ?
 - What is the value of β ?
 - If the selected voucher is worth \$3, what is the p -value?
2. (12 pts) Suppose that a study is being done to determine whether a new type of automobile airbag is better than the old type.
- Write the null and alternative hypotheses.
 - Describe verbally a Type I error in this situation.
 - If the data gathered in the study were found to be statistically significant, which hypotheses would be supported?
3. (10 pts) Administrators at a college want to conduct a survey students on campus. They know that mailed surveys have a low response rate, so they decide to conduct their survey in three randomly selected classes. They use the TI-83's random number generator to select the classes and then when the classes meet they distribute the survey to all the students in those classes and get their responses.

- (a) What sampling method are they using?
 - (b) Suppose that there are 500 classes on campus. Using a seed of 87 on the TI-83, find the three classes (by number) that will be in their sample?
4. (18 pts) Read the following article¹ and answer the questions below.

Diabetes May Be Cause of Deaths Linked to Obesity

September 25, 2006

By Salynn Boyles

Another wrinkle has been added to the debate over whether obesity is a major cause of early death. New research suggests that it is, but only in people who also have diabetes.

People with diabetes were three times as likely as those without it to develop life-threatening critical illness and die prematurely, shows a newly published study. But obese people who did not have diabetes had the same risk of death or organ failure as normal-weight people without the disease.

Being obese is a huge risk factor for type 2 diabetes. Nine out of 10 people with newly diagnosed type 2-diabetes are overweight or obese, according to the American Diabetes Association.

But most previous studies that have linked obesity to early death have not considered the independent impact of diabetes, researcher David M. Mannino, MD, tells WebMD.

“What this paper shows pretty clearly is that diabetes is really the driving factor in early death from critical illness among people who are overweight or obese,” Mannino says.

Obesity was measured by calculating body mass index (BMI), and hospital records were examined to determine if the participants experienced either acute organ failure (critical illness) or death from organ failure during the critical-illness hospitalization or within three years after the acute organ failure.

In the absence of diabetes, obese people in the study were not found to have an increased risk for either organ failure or early death.

But obese study participants – those with BMIs over 30 – were four times as likely to have diabetes as those who were normal weight.

The study appears in today's issue of the journal *Critical Care*.

“Our results do not support the contention that obesity itself is a risk factor for increased mortality in patients with acute organ failure, the researchers wrote. It brings up a new perspective on this still controversial subject of obesity, critical illness, and mortality.”

- (a) (3 pts) Was this an observational or an experimental study?
- (b) (5 pts) What are the two explanatory variables mentioned in the article? Be specific.
- (c) (3 pts) What is the response variable? Be specific.
- (d) (3 pts) Was a control group used in this study?

¹See <http://www.foxnews.com/story/0,2933,215604,00.html>

(e) (3 pts) Let the two hypotheses be

H_0 : Obese people without diabetes have the same risk of acute organ failure or death as people of normal weight without diabetes.

H_1 : Obese people without diabetes have a higher risk of acute organ failure or death than people of normal weight without diabetes.

Which hypothesis was supported by the researchers' data?

(f) (3 pts) The article mentions that most earlier studies did not take into account whether the participants had diabetes. For those earlier studies, what kind of a variable do we call this?

5. (10 pts) Suppose that an anti-gun organization uses the following method to conduct a survey. They send out a questionnaire to a random sample of their membership. The questionnaire presents the statement "Given that handguns kill hundreds, if not thousands, of children each year, reasonable legislation restricting handgun ownership should be passed." Then it asks the respondent to select "Agree," "Disagree," or "Undecided," and then return the questionnaire along with a contribution. Describe the three sources of bias that are incorporated into this survey method.

6. (13 pts) The American National Election Studies² reports that in 2004 the U.S. population identified itself as 33% Democratic, 28% Republican, and 39% independent. A survey is to be conducted to measure public opinion on whether George W. Bush is more to blame than Bill Clinton for not catching Osama bin Laden. (Such a survey was actually done.) Suspecting that opinion on this question may be influenced by party affiliation, the researchers decide to take a stratified sample.

(a) (4 pts) If the total sample size is to be 500, how many Democrats, Republicans, and Independents should be in the sample?

(b) (5 pts) Draw either a pie chart or a bar graph (your choice) of the data cited at the beginning of this problem.

(c) (4 pts) What information is your graph designed to convey?

7. (12 pts) A new drug is being tested on a group of patients in a double-blind experiment. The new drug is given to half the group and a placebo is given to the other half.

(a) What is the purpose of having a control group?

(b) Explain what is meant by "double-blind."

(c) What type of bias(es) is the double-blindedness intended to eliminate?

²See <http://www.umich.edu/~nes/>

8. (10 pts) Identify each of the following variables as qualitative, quantitative discrete, or quantitative continuous.
- (a) The number of pages in a book.
 - (b) A person's religious affiliation.
 - (c) The volume of mustard in a bottle.
 - (d) The number of overweight people in a group.
 - (e) A legislator's vote on a proposed amendment.