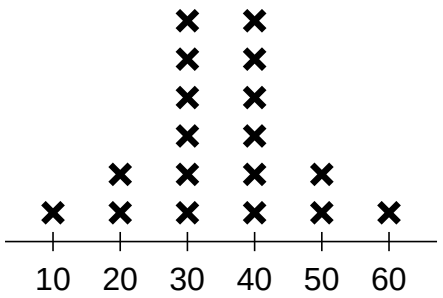
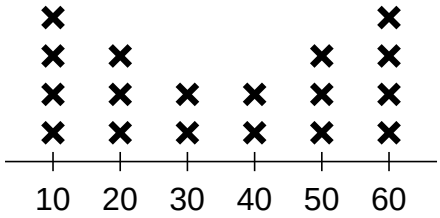
Math 121 **Test #1** **Spring 2009**

1. (24 pts) Two bags, Bag A and Bag B, each contain 18 vouchers with values from \$10 to \$60. Their distributions are shown in the following diagrams.





The bags are identical in appearance. You are presented with one of the two bags. The hypotheses are

H_0 : The bag is Bag A.

H_1 : The bag is Bag B.

You select one voucher at random from the bag you are holding. Based on its value, you decide which bag you believe you are holding.

(a) (3 pts) What is the direction of extreme in this situation?

(b) (4 pts) State a reasonable decision rule for this situation.

(c) (8 pts) Using your decision rule in part (a), find the values of α and β.

(d) (5 pts) What is the p-value of 20?

(e) (2 pts) If you conclude that the bag you are holding is Bag A, is it possible that you made a Type I error?

(f) (2 pts) If the bag you are holding really is Bag A, is it possible that you will make a Type I error?

2. (14 pts) The following excerpt is from an article "Study Finds Black Women's Height Falling" in the *Richmond Times-Dispatch*, Jan. 10, 2009.

> On average, black American women are getting shorter.
>
> That's the conclusion reached by John Komlos, an economist who researches the relationship between standards of living and human health and body size.
>
> According the the NHANES [National Health and Nutrition Examination Survey] data, black women who were born in the United States around 1980 are, on average, a little shorter than 5-foot-4 today.

> Those born in the mid-1960s are, on average, a little more than half an inch taller.
>
> White women born around 1980, meanwhile, are more than three-fourths of an inch taller than black women of the same age. Komlos' study found white men to be a little bit taller on average than black men but not to a statistically significant extent.

In this study, Komlos compares black women born around 1980 to white women born around 1980 and to black women born in the mid-1960s. He also compares black men to white men (presumably born around 1980).

(a) (6 pts) For the comparison of black men to white men, state the competing hypotheses. Be sure to identify one as the null hypothesis and the other as the alternative hypothesis.

(b) (4 pts) The article states that the difference between the heights of white and black men was not statistically significant. Suppose Komlos used a 5% level of significance. Give a possible p-value for this part of the study.

(c) (4 pts) Suppose the researchers intentionally selected 100 people from each of the following groups born around 1980: black women, white women, black men, white men. What sampling method would this be?

3. (16 pts) The following excerpt is from an article "Stop Colds with a Dose of Dozing" in the *Richmond Times-Dispatch*, Jan. 13, 2009.

> Fluff up the pillows and pull up the covers. Preventing the common cold may be as easy as getting more sleep.
>
> Researchers paid healthy adults $800 to have cold viruses sprayed up their noses, then wait five days in a hotel to see if they got sick. Habitual 8-hour sleepers were much less likely to get sick than those who slept less than 7 hours or slept fitfully.

(a) (4 pts) What is the explanatory variable in this study?

(b) (4 pts) What is the response variable in this study?

(c) (4 pts) Is this an observational study of an experimental study? Explain.

(d) (4 pts) Describe a possible confounding variable in this study.

4. (16 pts) Suppose the study described in the previous problem involved 50 subjects and that 25 of them were told to sleep at least 8 hours and 25 of them were told to sleep no more than 7 hours.

(a) (4 pts) Assume that the researchers randomly selected who will be in the 8-hour group. Use the TI-83 random number generator, with seed 30, to select the first 5 subjects who should be assigned to the 8-hour group.

(b) (4 pts) What type of bias is this procedure designed to avoid? Explain.

(c) (4 pts) Describe how experimenter bias might occur in this situation (even when the subjects are randomly placed in the groups).

(d) (4 pts) How could experimenter bias be avoided?

5. (10 pts) Describe each of the following variables as (1) qualitative, (2) quantitative discrete, or (3) quantitative continuous.

   (a) (2 pts) The number of heart-attack patients that a hospital received in 2008.

   (b) (2 pts) The city or county in which one resides.

   (c) (2 pts) The height of a person.

   (d) (2 pts) Whether a person catches a cold during a specified 5-day period.

   (e) (2 pts) The amount of sleep a person gets per night, on average.

6. (10 pts) The following table shows the number of home mortgage foreclosures in 2007 and 2008 in several Virginia localities.[1]

Locality	2007	2008	% Change
Prince William County	3344	7672	129.4%
Fairfax County	2412	5726	137.4%
Loudoun County	1215	2073	70.6%
Stafford County	185	948	412.4%
Spotsylvania County	214	871	307.0%
Virginia Beach	166	751	352.4%
Richmond City	160	599	274.4%
Norfolk	126	515	308.7%
Chesapeake	85	489	475.3%
Frederick County	102	469	359.8%

   (a) (4 pts) Which type of graph would be most appropriate to represent the "% Change" data?

   (b) (6 pts) Draw a graph of that type to represent the "% Change" data.

7. (10 pts)

   (a) (6 pts) Draw a stem-and-leaf display of the data shown below.

   (b) (4 pts) Using proper terminology, describe the shape of the distribution.

0.4	0.8	3.1	0.2	2.1	0.5	2.1	8.3	0.8	0.7
5.8	3.0	1.6	1.5	4.3	3.0	12.9	2.3	9.1	0.6

[1] Housing Problem Expands in Region, *Richmond Times-Dispatch*, Jan. 4, 2009.