



**Problem 2.** [20; 10 points each part] A truck can carry a maximum load of 4000 lb. A manufacturer wants to ship an order of 50 boxes. The weights of the boxes are normally distributed with mean  $\mu = 78$  lb. and standard deviation  $\sigma = 12$  lb.

a. What is the probability that all 50 boxes can be sent in one shipment?

b. If the weights are not normally distributed, will the answer be still approximately correct? Why or why not?

**Problem 3.** [18; 3 points each part] Data variables come in various types. For each of the following, decide whether it is nominal, ordinal, continuous, or discrete. (If it's unclear, explain in a short sentence why.)

A handbook lists the following information on accredited U.S. colleges and university:

- \_\_\_\_\_ a. enrollment
- \_\_\_\_\_ b. required entrance tests (ACT, SAT, or none)
- \_\_\_\_\_ c. annual tuition
- \_\_\_\_\_ d. fields of study
- \_\_\_\_\_ e. selectivity (high, moderate, low)
- \_\_\_\_\_ f. percent of applicants accepted

**Problem 4.** [15; 3 points each part] True or false. Write the whole word "true" or the whole word "false." (If it's not clear whether it's true or false, you may write a short explanation.)

- \_\_\_\_\_ a. A statistical study is one which compares two groups or methods is called a historical study.
- \_\_\_\_\_ b. Data variables come in two different types: (1) categorical variables, also called qualitative variables, which always have the same value for all experiments, and (2) numerical variables, also called quantitative variables, which have different values depending on the outcome of the experiment.
- \_\_\_\_\_ c. Three different kinds of experimental error are (1) systematic error, which is caused by the differences between experimental units, (2) random error, which is caused by the inherent variability in the responses of similar experimental units given the same treatment, and (3) measurement error, which is caused by imprecise measuring instruments.
- \_\_\_\_\_ d. The difference between a sample and a census is that all the individuals are surveyed in a census while only some of the individuals are surveyed in a sample.
- \_\_\_\_\_ e. A  $\chi^2$ - distribution with 10 degrees of freedom is the distribution that the sum of 10 independent standard normal random variables has.

**Problem 5.** [15; 5 points each part] Consider the  $\chi^2$  distribution with 8 degrees of freedom.

**a.** Using table A.5, find constants  $a, b, c, d,$  and  $e$  so that  $P(\chi_8^2 > a) = 0.05,$   $P(\chi_8^2 > b) = 0.99,$   $P(\chi_8^2 < c) = 0.90,$  and  $P(d < \chi_8^2 < e) = 0.95.$

$$a =$$

$$b =$$

$$c =$$

$$d =$$

$$e =$$

**b.** Express the constants from part **a** in terms of the notation  $\chi_{\nu, \alpha}^2.$

$$a =$$

$$b =$$

$$c =$$

$$d =$$

$$e =$$

**c.** Sketch each of the probabilities from part **b** as an area under a  $\chi^2$  probability density curve.

**Problem 6.** [16] Short essay. Explain the importance of a control group in a comparative study. First say what a control group is. (You may want to give an example to clarify the concept.) Then describe the advantages that an experiment that has both a control group and one or more treatment groups has over an experiment that has only treatment groups.

#1.[16]	
#2.[20]	
#3.[18]	
#4.[15]	
#5.[15]	
#6.[16]	
Total	