Chapter 11 Project: Electric Bills and Super Bulbs

Name _____ Name _____

Before starting this project: For this project, each student will need a copy of an electricity bill for a recent billing period (the more recent the better). On the electricity bill, record the number of people that were living in the household during the billing period. *If you rent an apartment or a house and your landlord pays for the electricity, ask for a copy of the bill. If you live in a dormitory, ask the dorm manager for electricity consumption data for your housing unit. As a last resort, obtain a copy of a bill from someone you know that lives nearby in a house or an apartment. If none of these options are available to you, consult with your instructor for further directions.*

Introduction:

In this project you will compile electricity consumption data for all students in your class, and use basic statistics to describe the class data. Then you'll analyze the costs of two types of light bulbs, and determine the expected energy savings in switching to the more energy efficient model. How does your electricity usage compare to your classmates? How much money could you save by becoming a green consumer? Forge ahead!

1. Comparing electric bills

a) Your electric bill should list the number of kilowatt-hours (kWh) of electricity consumed during the billing period. Determine for your electric bill the **kilowatt-hours** consumed of electricity **per person per day**. Round answer to 1 decimal place. Record your value on the front board of the classroom.

b) Open a new worksheet in StatCrunch (see Enviromath.com). If this is your first time using StatCrunch, you will need to register. Enter the class data into column var1, then select **Data > Save data**. Choose a file name such as "class e-bills," keep the delimiter set on "space," and then select **Save**. *Save frequently!*

To find the 5 number summary for the data, select **Stat > Summary Stats > Columns**. Click on var1 and then press **Calculate**. Record the 5 number summary below.

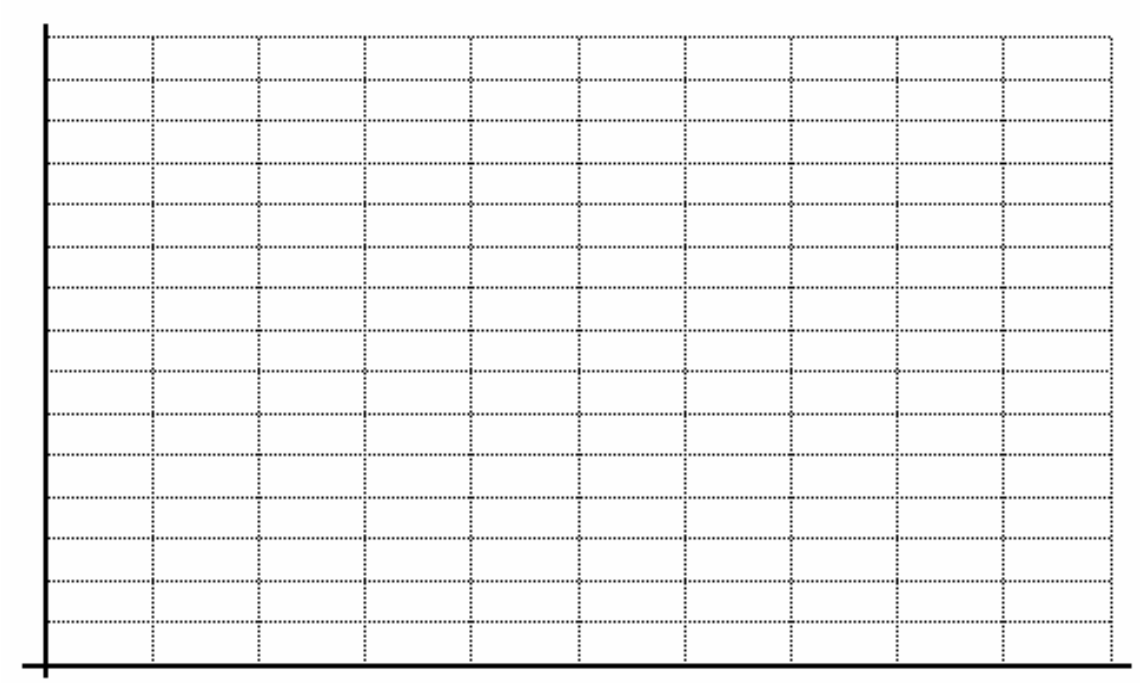
c) Draw a boxplot of the class data set. Label appropriately. Indicate with an arrow ⇑ the position of your electric bill on the boxplot.

Sort the class data in your calculator into ascending order. To do this, select **Data > Sort columns**. Click on var1 and then press **Sort Columns**. A new column will be created with the sorted data. Save your work by selecting **Data > Save data**. Save under the same filename by overwriting the existing file.

d) What is the size of the class data set? n = _____ In the sorted list, what position is your electric bill? _____ At what **percentile** is your electric bill? That is, what percent of your class consumes the same or less energy than you?

e) Make a frequency histogram of the class data. List the bins and their frequencies in the table below. Then record your histogram on the graph paper provided on the next page. Label the scales and axes appropriately.

bin	**frequency**



f) Find the value of the skew of the class data using Bowley's formula given in Chapter 11. Discuss how the skew value compares with the shape of your histogram.

g) Compare the mean and the median for the data set. How do the magnitudes of these two statistics tie in with the shape of the histogram?

2. Saving Energy

The Science in Depth article in Chapter 11 discusses some simple home remedies that can help save energy and lower your electricity bill, such as switching from traditional incandescent light bulbs to compact fluorescent light (CFL) bulbs. CFLs can be used in most lamps and ceiling light fixtures, and don't flicker or hum like older-style fluorescent tubes. The light color emitted from CFLs is close to that of incandescents, so that ghostly skin tones are not a big problem. Furthermore, manufacturers of these "eco-bulbs" claim that they are 75 percent more efficient than incandescent bulbs and last over 10 times longer.

Incandescent light bulb

Compact fluorescent light (CFL) bulb

Most of the power used to run an incandescent light is converted into heat energy, while a CFL converts most of the power into light. For example, to produce about 1,600 lumens of light, you would need a 100-watt incandescent bulb but only a 25-watt CFL. (A lumen is the common unit of light output. See the Appendix for lumens and other units related to power and energy.) So CFLs use about 75% less energy to produce the same amount of light! Better still, CFLs last longer; a standard incandescent lasts about 750 hours, whereas a CFL will run for 10,000 hours! Because CFLs last longer, they are also more convenient to use in hard-to-reach locations.

The biggest downside to CFLs for most consumers is that they cost quite a bit more than standard incandescent bulbs. A typical 25-watt CFL costs about $6.00, whereas you can buy a 100-watt incandescent for $0.75. Prices will depend, of course, on where you purchase the bulbs, and if you buy them in bulk. An environmental downside to CFLs is their mercury content. Mercury is a poisonous metal and the CFLs need to be properly discarded at a hazardous waste collection site. A practical downside for some CFLs is they cannot be used in enclosed lamp fixtures or with dimmers. And then there's the issue of breakage—drop a CFL and you'll spend all your lunch money to replace it!

a) Let's look at the numbers to determine the economic savings in switching from incandescents to CFLs. Make a comparison table: an ordinary 100-watt incandescent light bulb lasts how many hours? draws how many watts of electricity? and costs about how much on average? The 25-watt CFL lasts how many hours? draws how many watts of electricity? and costs about how much on average?

b) Now run both bulbs for 10,000 hours. How many weeks is this? How many kilowatt-hours (kWh) will the incandescent and fluorescent bulbs use during this time?

c) Look up the average residential cost for electricity in your state on the electricity rate map. Using that rate, determine how much you would be charged for running each bulb 10,000 hours.

d) Calculate the purchase cost for each type of bulb during a 10,000-hour time period.

e) What is the total cost (electricity cost + purchase cost) for each lighting system for this 10,000-hour time period?

f) Are you convinced that CFLs are more economical than standard incandescent light bulbs? Are they more eco-friendly as the manufactures claim? What has been ignored in these calculations that would favor one bulb over another? Discuss.

3. Home energy savings

Suppose that you change 50% of all incandescent bulbs to CFLs in your home, apartment, etc. How much electricity and money will you save *each year*? Be sure to include the costs of the bulbs and the electricity used. Write up your analysis below using complete sentences and clear mathematics. *Hint: You will need to count all the incandescent bulbs where you live, and estimate the number of hours each is turned on each day.*