Practice Problems Section 1F

1. Answer the following questions:

   a) What is meant by saying that data is normally distributed or "normal"?

   b) Define the mean average and explain how it is calculated.

   c) Define the standard deviation and explain how it is calculated.

2. Answer the following questions:

   a) If a data set is normally distributed, what measure of average should we use?

   b) If a data set is normally distributed, what measure of spread should we use?

   c) If a data set is normally distributed, how many standard deviations from the mean is considered typical?

   d) If a data set is normally distributed, what is the formula for finding typical values?

   e) If a data set is normally distributed, approximately what percentage is typical?

   f) If a data set is normally distributed, how many standard deviations from the mean is considered unusual?

   g) If a data set is normally distributed, approximately what percentage of the data is unusually high?

   h) If a data set is normally distributed, approximately what percentage of the data is unusually low?

(#3-4) Directions: The following graphs and statistics were calculated with Statcato and the "Bear" data from the website www.matt-teachout.org . Use the dot plot, histogram and summary statistics to answer the following questions. Here are the formulas for typical and unusual values.

Mean – Standard Deviation ≤ Typical Values for Normal Data ≤ Mean + Standard Deviation

Unusual Low Cutoff for Normal Data = Mean − (2 × Standard Deviation)

Unusual High Cutoff for Normal Data = Mean + (2 × Standard Deviation)

3. Bear neck circumference (inches)

   a) What is the data measuring and what are the units?
   b) How many numbers are in the data set?
   c) Is the data set normally distributed? (Yes or No)
   d) What is the minimum value?
   e) What is the maximum value?
   f) What is the average (center)? *(Give the number and the name of the statistic used.)*
   g) How much typical spread does the data set have?
      (Give the number and the name of the statistic used.)
   h) Find two numbers that typical values fall in between.
   i) What is the unusual high (high outlier) cutoff for this data?
   j) What is the unusual low (low outlier) cutoff for this data?
   k) List all high outliers in this data set. If there are no high outliers, put "none".
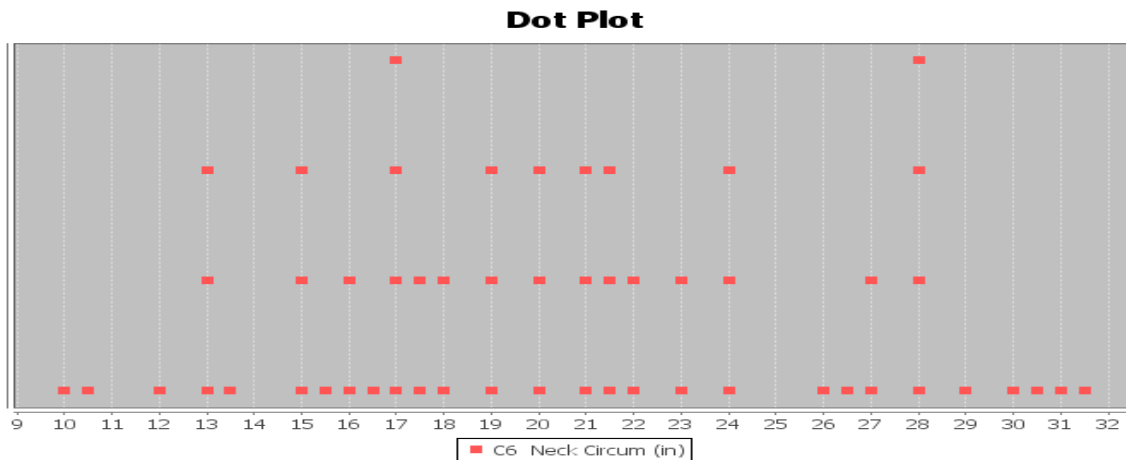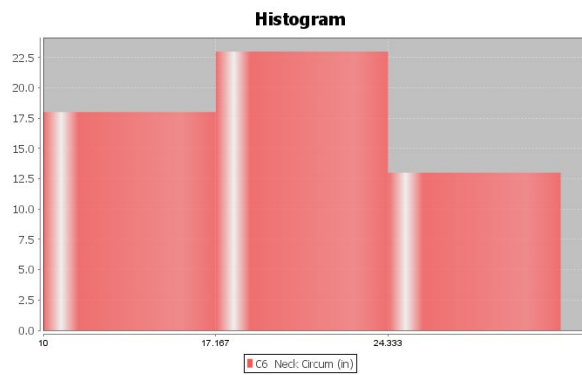   l) List all low outliers in this data set. If there are no high outliers, put "none".

Descriptive Statistics

Variable	Mean	Standard Deviation
C6 Neck Circum (in)	20.556	5.641

Variable	Min	Max
C6 Neck Circum (in)	10.0	31.5

Variable	N total
C6 Neck Circum (in)	54

Histogram

Dot Plot

4. Bear Chest Size (inches)

    a) What is the data measuring and what are the units?
    b) How many numbers are in the data set?
    c) Is the data set normally distributed? (Yes or No)
    d) What is the minimum value?
    e) What is the maximum value?
    f) What is the average (center)? *(Give the number and the name of the statistic used.)*
    g) How much typical spread does the data set have?
       (Give the number and the name of the statistic used.)
    h) Find two numbers that typical values fall in between.
    i) What is the unusual high (high outlier) cutoff for this data?
    j) What is the unusual low (low outlier) cutoff for this data?
    k) List all high outliers in this data set. If there are no high outliers, put "none".
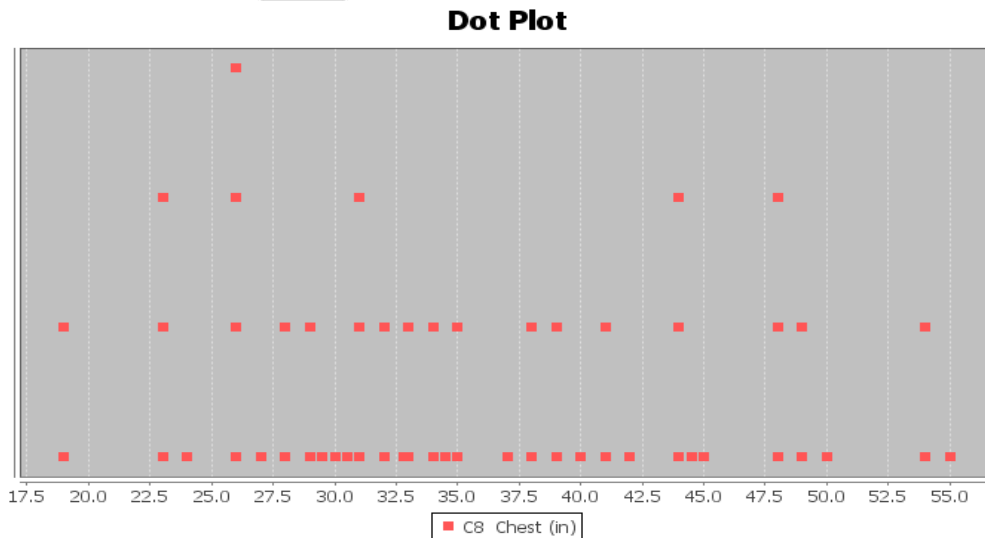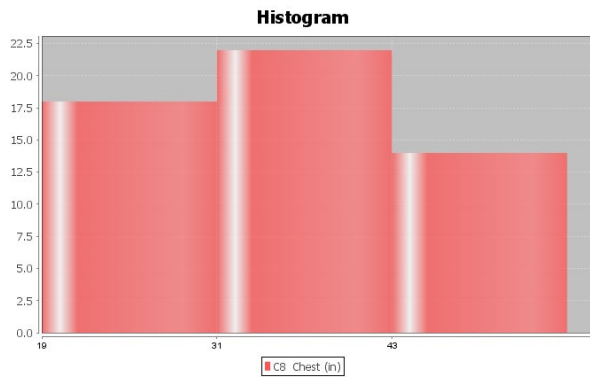   l) List all low outliers in this data set. If there are no high outliers, put "none".

Descriptive Statistics

Variable	Mean	Standard Deviation
C8 Chest (in)	35.663	9.352

Variable	Min	Max
C8 Chest (in)	19.0	55.0

Variable	N total
C8 Chest (in)	54

Histogram

Dot Plot

(#5-8) Directions: Open the "Health" data from the website www.matt-teachout.org . (Look under "Statistics" tab and then click the "data sets" tab.) Go to www.lock5stat.com and open StatKey. Under the "Descriptive Statistics and Graphs" menu, click on "One Quantitative Variable". Paste the indicated column of quantitative data into StatKey, create a dot plot and histogram, and find the summary statistics. Then answer the following questions. Here are the formulas for typical and unusual values.

Mean – Standard Deviation ≤ Typical Values for Normal Data ≤ Mean + Standard Deviation

Unusual Low Cutoff for Normal Data = Mean − (2 × Standard Deviation)

Unusual High Cutoff for Normal Data = Mean + (2 × Standard Deviation)

5. Women's Diastolic Blood Pressure (Millimeters of Mercury (mm of Hg))

   a) What is the data measuring and what are the units?
   b) How many numbers are in the data set?
   c) Is the data set normally distributed? (Yes or No)
   d) What is the minimum value?
   e) What is the maximum value?
   f) What is the average (center)? *(Give the number and the name of the statistic used.)*

   g) How much typical spread does the data set have?
       (Give the number and the name of the statistic used.)
   h) Find two numbers that typical values fall in between.

i) What is the unusual high (high outlier) cutoff for this data?

j) What is the unusual low (low outlier) cutoff for this data?

k) List all high outliers in this data set. If there are no high outliers, put "none".

l) List all low outliers in this data set. If there are no high outliers, put "none".

6. Women's Wrist Circumference (Inches)

a) What is the data measuring and what are the units?

b) How many numbers are in the data set?

c) Is the data set normally distributed? (Yes or No)

d) What is the minimum value?

e) What is the maximum value?

f) What is the average (center)? *(Give the number and the name of the statistic used.)*

g) How much typical spread does the data set have?
     (Give the number and the name of the statistic used.)

h) Find two numbers that typical values fall in between.

i) What is the unusual high (high outlier) cutoff for this data?

j) What is the unusual low (low outlier) cutoff for this data?

k) List all high outliers in this data set. If there are no high outliers, put "none".

l) List all low outliers in this data set. If there are no high outliers, put "none".

7. Men's Height (Inches)

a) What is the data measuring and what are the units?

b) How many numbers are in the data set?

c) Is the data set normally distributed? (Yes or No)

d) What is the minimum value?

e) What is the maximum value?

f) What is the average (center)? *(Give the number and the name of the statistic used.)*

g) How much typical spread does the data set have?
     (Give the number and the name of the statistic used.)

h) Find two numbers that typical values fall in between.

i) What is the unusual high (high outlier) cutoff for this data?

j) What is the unusual low (low outlier) cutoff for this data?

k) List all high outliers in this data set. If there are no high outliers, put "none".

l) List all low outliers in this data set. If there are no high outliers, put "none".

8. Men's Weight (Pounds)

a) What is the data measuring and what are the units?

b) How many numbers are in the data set?

c) Is the data set normally distributed? (Yes or No)

d) What is the minimum value?

e) What is the maximum value?

f) What is the average (center)? *(Give the number and the name of the statistic used.)*

g) How much typical spread does the data set have?
     (Give the number and the name of the statistic used.)

h) Find two numbers that typical values fall in between.

i) What is the unusual high (high outlier) cutoff for this data?

j) What is the unusual low (low outlier) cutoff for this data?

k) List all high outliers in this data set. If there are no high outliers, put "none".

l) List all low outliers in this data set. If there are no high outliers, put "none".

(#9-18) Directions: Use the following formula when needed and answer the following questions about Z-scores.

$$Z = \frac{(Amount - Mean)}{Standard\ Deviation}$$

9. Write the definition of a Z-score.

10. Explain how we can use Z-scores to tell if a number is typical in normal data?

11. Explain how we can use Z-scores to tell if a number is unusual in normal data?

12. A random sample of IQ tests is normally distributed with a mean of 99.8 and a standard deviation of 15.3. Bud has an IQ of 143. Use this information to answer the following Z-score questions.

   a) Calculate the Z-score for Bud's IQ.

   b) Write a sentence to explain the Z-score in context.

   c) Is Buds' IQ unusually high compared to other people in the data set? Explain your answer.

13. A random sample of IQ tests is normally distributed with a mean of 99.8 and a standard deviation of 15.3. Jan has an IQ of 89. Use this information to answer the following Z-score questions.

   a) Calculate the Z-score for Jan's' IQ.

   b) Write a sentence to explain the Z-score in context.

   c) Is Jan's' IQ unusually low compared to other people in the data set? Explain your answer.

14. A clothing store wants to study the amount of money spent in their store by customers. Census data indicated that the data is normally distributed with a mean of $46.89 and a standard deviation of $12.44. Maria spent $105.12 on merchandise in the store. Use this information to answer the following Z-score questions.

   a) Calculate the Z-score for the amount Maria spent.

   b) Write a sentence to explain the Z-score in context.

   c) Is the amount Maria spent unusually high compared to other people in the data set?
       Explain your answer.

15. A clothing store wants to study the amount of money spent in their store by customers. Census data indicated that the data is normally distributed with a mean of $46.89 and a standard deviation of $12.44. Julie spent $13.61 on merchandise in the store. Use this information to answer the following Z-score questions.

   a) Calculate the Z-score for the amount Julie spent.

   b) Write a sentence to explain the Z-score in context.

   c) Is the amount Julie spent unusually low compared to other people in the data set?
       Explain your answer.

16. Neck circumferences of bears are normally distributed with a mean circumference of 20.556 inches and a standard deviation of 5.641 inches. A bear has a neck circumference of 13.7 inches.

   a) Calculate the Z-score for this bears neck circumference.

   b) Write a sentence to explain the Z-score in context.

   c) Is this bears' neck circumference unusually low compared to other bears in the data set?
       Explain your answer.

17. Chest sizes of bears was normally distributed with a mean chest size of 35.663 inches and a standard deviation of 9.352 inches. A bear has a chest size of 57 inches.

    a) Calculate the Z-score for this bears chest size.

    b) Write a sentence to explain the Z-score in context.

    c) Is this bears' chest size unusually large compared to other bears in the data set?
   Explain your answer.

18. The diastolic blood pressure of a random sample of women had a mean of 67.425 mm of Hg and a standard deviation of 11.626. A woman in the data has a diastolic blood pressure of 72 mm of Hg.

    a) Calculate the Z-score for this woman's diastolic blood pressure.

    b) Write a sentence to explain the Z-score in context.

    c) Is this woman's diastolic blood pressure unusually high compared to other women in the data set?
       Explain your answer.

(#19-25) Answer the following questions about the empirical rule.

19. Draw that standard normal curve. Label the mean and the values for one, two and three standard deviations above and below the mean. Also, label the percentages that make up the empirical rule.

20. The salaries of employees at a company are normally distributed with a mean of 31.4 thousand dollars and a standard deviation of 2.1 thousand dollars. Use the Empirical Rule graph below to answer the following questions.


Salaries in Thousands of Dollars
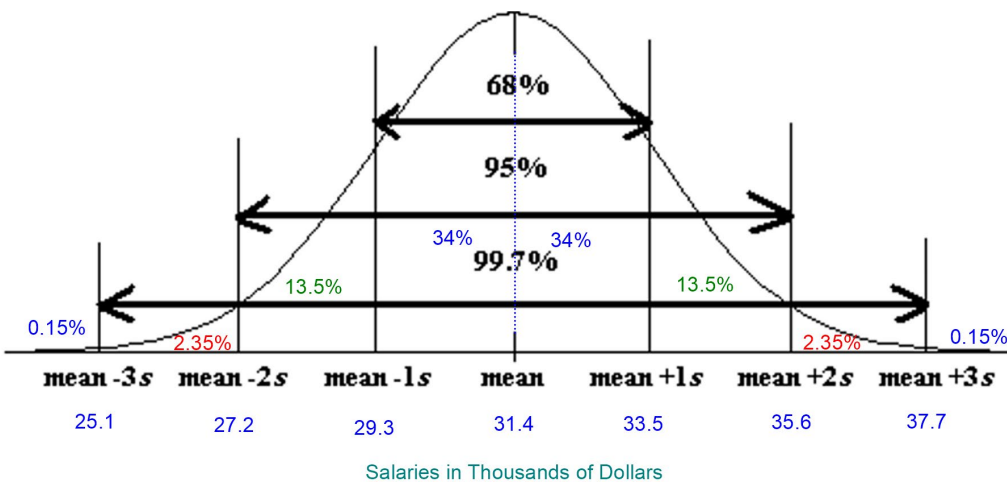
    a) What percentage of the employees have a salary between 27.2 thousand dollars and 35.6 thousand dollars?

    b) What percentage of the employees have a salary between 29.3 thousand dollars and 33.5 thousand dollars?

    c) What percentage of the employees have a salary between 25.1 thousand dollars and 37.7 thousand dollars?

    d) What percentage of the employees have a salary greater than 33.5 thousand dollars?

    e) What percentage of the employees have a salary less than 27.2 thousand dollars?

    f) Typical values for a normal curve are one standard deviation from the mean. Find two salaries that typical employee salaries fall in between?

g) The unusual high cutoff is two standard deviations above the mean. What salary represents the unusual high cutoff, which is the salary that 2.5% of the employees are greater than?

h) The unusual low cutoff is two standard deviations below the mean. What salary represents the unusual low cutoff, that is the salary that 2.5% of the employees are less than?

21. Neck circumferences of a sample of bears are normally distributed with a mean circumference of 20.556 inches and a standard deviation of 5.641 inches. Use the Empirical Rule graph below to answer the following questions.
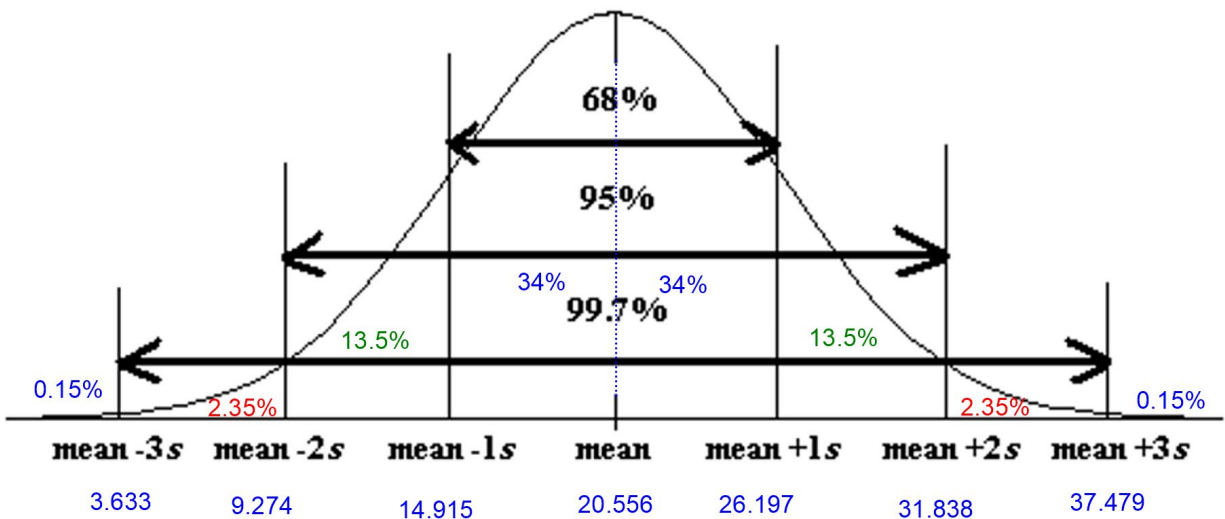

a) What percent of the bears have a neck circumference between 14.915 inches and 31.838 inches?

b) What percent of the bears have a neck circumference less than 26.197 inches?

c) Typical bears have a neck circumference between what two amounts?

d) What is the unusual high cutoff, that is the bear neck circumference that 2.5% of bears are more than.

e) What is the unusual low cutoff, that is the bear neck circumference that 2.5% of bears are less than.

f) What is the bear neck circumference that 84% of bear neck circumferences are more than?

g) What percent of the bears have a neck circumference less than 14.915 inches?

22. A clothing store wants to study the amount of money spent in their store by customers. Census data indicated that the data is normally distributed with a mean of $46.89 and a standard deviation of $12.44. Use the Empirical Rule graph below to answer the following questions.
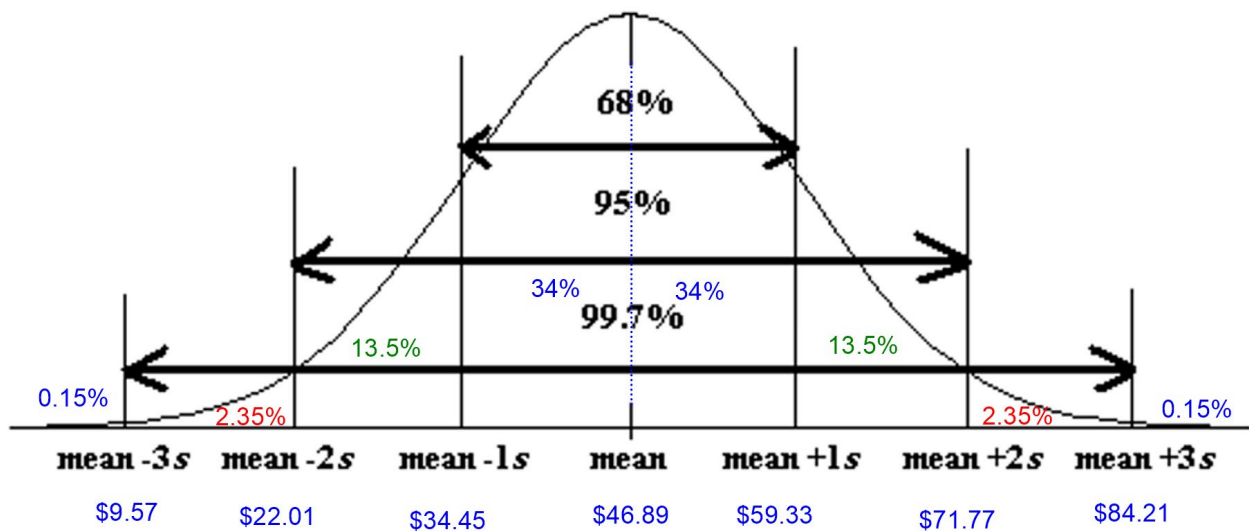
a) What percent of customers spent between $71.77 and $84.21 in the store?

b) What percent of customers spent less than $34.45 in the store?

c) Typical customers spent between what two amounts?

d) What is the unusual high cutoff, that is the dollar amount that 2.5% of customers spent more than.

e) What is the unusual low cutoff, that is the dollar amount that 2.5% of customers spent less than.

f) What is the dollar amount that 16% of customers spent more than?

g) What percent of customers spent less than $71.77?

23. A random sample of IQ tests is normally distributed with a mean of 99.8 and a standard deviation of 15.3. Use this information to answer the following questions. Go to www.lock5stat.com and open StatKey. Under the "Theoretical Distributions" menu, click on "Normal".

a) Use StatKey to calculate what percent of people in the IQ sample data that have an IQ greater than 77.
b) Use StatKey to calculate what percent of people in the IQ sample data that have an IQ less than 108.
c) Use StatKey to calculate what percent of people in the IQ sample data that have an IQ between 95 and 120.
d) Use StatKey to find the IQ score that 60% of people are less than.
e) Use StatKey to find the IQ score that 85% of people are greater than.
f) Use StatKey to find two IQ scores that the middle 40% of people are in between.

24. A clothing store wants to study the amount of money spent in their store by customers. Census data indicated that the data is normally distributed with a mean of $46.89 and a standard deviation of $12.44. Go to www.lock5stat.com and open StatKey. Under the "Theoretical Distributions" menu, click on "Normal".

   a) Use StatKey to calculate the percent of people that spent more than $25.
   b) Use StatKey to calculate the percent of people that spent less than $50.
   c) Use StatKey to calculate the percent of people spent between $35 and $60.
   d) Use StatKey to find the amount of money spent that 37% of people are less than.
   e) Use StatKey to find the amount of money spent that 15% of people are more than.
   f) Use StatKey to find two amounts that the middle 60% of people are in between.

25. The diastolic blood pressure of a random sample of women had a mean of 67.425 mm of Hg and a standard deviation of 11.626. Go to www.lock5stat.com and open StatKey. Under the "Theoretical Distributions" menu, click on "Normal".

   a) Use StatKey to calculate the percent of women that have a diastolic blood pressure below 75 mm of Hg.
   b) Use StatKey to calculate the percent of women that have a diastolic blood pressure above 50 mm of Hg.
   c) Use StatKey to calculate the percent of women that have a diastolic blood pressure between 60 and 70 mm of Hg.
   d) Use StatKey to find the diastolic blood pressure that 80% of women are lower than.
   e) Use StatKey to find the diastolic blood pressure that 45% of women are higher than.
   f) Use StatKey to find the two diastolic blood pressures that the middle 75% of women are in between.