Math 106
Practice problems on box and whiskers plots (questions from old quizzes)
Spring 2009

1. A random sample of 15 Boy Scout leaders is selected from leaders attending a camporee. The following list gives their ages:
   57, 57, 58, 45, 39, 51, 62, 28, 37, 46, 45, 63, 29, 39, 43

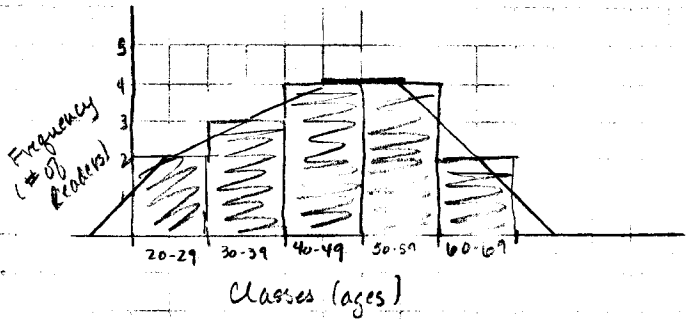
   a) Construct a Stem and Leaf plot for the data, using a class width of 10.

6	2 3
5	7 7 8 1
4	5 6 5 3
3	9 7 9
2	8 9

   b) Construct a frequency distribution (frequency table) for the data, using a class width of 10.

Classes	frequency
60-69	2
50-59	4
40-49	4
30-39	3
20-29	2

   c) Using your frequency distribution from question 2, construct a histogram and a frequency polygon for the data.



   d) Find the mean age of the leaders: 46.6

$$\frac{57+57+58+45+39+51+62+28+37+46+45+63+29+39+43}{15} = \frac{699}{15} = 46.6$$

   e) Find the median age of the leaders: 45

Step 1: Line up ages in order: 28, 29, 37, 39, 39, 43, 45, 45, 46, 51, 57, 57, 58, 62, 63

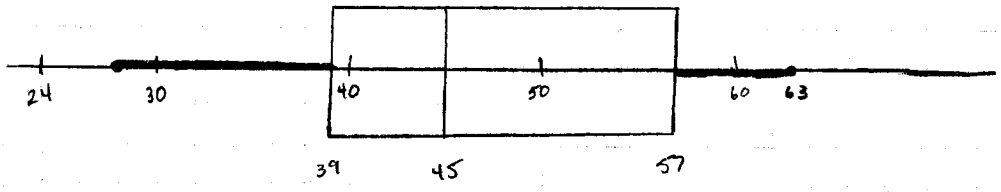
Step 2: Median sits in 8th spot $\left(\frac{15+1}{2} = 8\right)$

   f) Give the 5-number summary of the ages of the leaders: $\{5, q_1, m, q_3, L\} =$

$\{28, 39, 45, 57, 63\}$

↙ median of bottom half (exclude median (45) of data set)

g) Construct a box and whiskers plot of the ages of the leaders.



h) Are the ages of the leaders skewed? yes If so, are they skewed right or left? to the right (slightly) Briefly justify your answer. The mean = 46.6 is greater than the median.

2. A random sample of 15 college professors is selected from all professors at a university. The following list gives their ages:
63, 42, 41, 28, 51, 66, 51, 56, 40, 48, 29, 37, 47, 34, 35

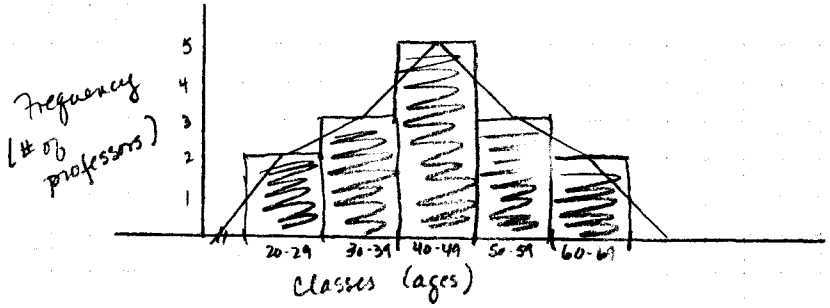
a) Construct a Stem and Leaf plot for the data.

6	3 6
5	1 1 6
4	2 1 0 8 7
3	7 4 5
2	8 9

b) Construct a frequency distribution (frequency table) for the data, using a class width of 10.

Classes	frequency
60-69	2
50-59	3
40-49	5
30-39	3
20-29	2

c) Using your frequency distribution from part b), construct a histogram and a frequency polygon for the data. Be sure to label your axes.



d) Find the mean age of the professors: $44.5\overline{3}$

$$\frac{63+42+41+28+51+66+51+56+40+48+29+37+47+34+35}{15} = \frac{668}{15} = 44.5\overline{3}$$

e) Find the median age of the professors: 42

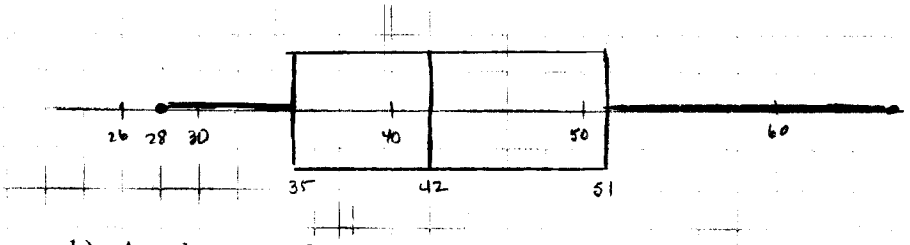
Step 1: Line 'em up: 28, 29, 34, 35, 37, 40, 41, 42, 47, 48, 51, 51, 56, 63, 66

(median is in 8th spot)

f) Give the 5-number summary of the ages of the professors: {28, 35, 42, 51, 66}

{s, q_1, m, q_3, L}

g) Construct a box and whiskers plot of the ages of the professors.



h) Are the ages of the professors skewed? yes If so, are they skewed right or left? slightly to the right Briefly justify your answer. mean = $44.5\bar{3}$ is greater than the median (= 42).

3. For this problem, use the data set: {1, 9, 7, 4, 12, 18, 35, 6, 8}

a) Give the 5-number summary: {1, 5, 8, 15, 35}

Step 1: line data up in order (small enough data set that stem & leaf plot is not necessary).

1, 4, 6, 7, 8, 9, 12, 18, 35

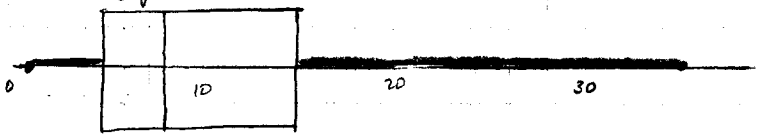
median

$q_1 = \frac{4+6}{2} = 5$

$q_3 = \frac{12+18}{2} = \frac{30}{2} = 15$

b) Draw a box and whiskers plot:

Plot directly from data set:



c) Are there any outliers? yes If so, what? 35 Give a mathematical justification for your answer:

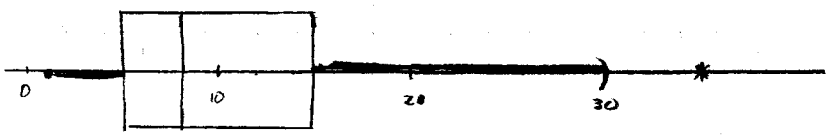
IQR = $q_3 - q_1$ = 15 − 5 = 10

Length of reasonable whisker: 1.5 (IQR) = 1.5 (10) = 15

So whiskers should end at: a) $q_1 - 15 = 5 - 15 = -10$. No outliers below, because no data items are less than −10.

b) $q_3 + 15 = 15 + 15 = 30$. The value 35 is an outlier, because it is outside the end of a reasonable whisker (beyond 15 + 15).

So: revised box & whiskers:



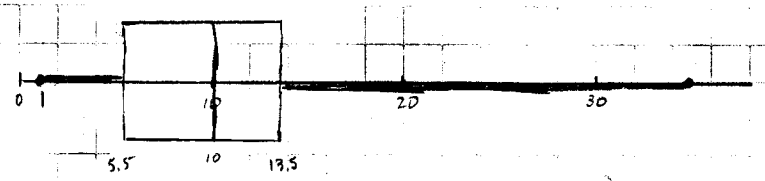
4. For this problem, use the data set: {1,10,7,5,12,15,35,6,11}

a) Give the 5-number summary: {1, 5.5, 10, 13.5, 35}

Step 1: line up data items: {1, 5, 6, 7, 10, 11, 12, 15, 35}

median $q_1 = \frac{5+6}{2} = 5.5$ $q_3 = \frac{12+15}{2} = 13.5$

b) Draw a box and whiskers plot:



(based on 5-number summary)

c) Are there any outliers? _____ If so, what? _____ Give a mathematical justification for your answer:

$IQR = q_3 - q_1 = 13.5 - 5.5 = 8$

Length of a "reasonable" whisker = $1.5(IQR) = 1.5(8) = 12$

Check data: $q_1 - 12 = 5.5 - 12 = -6.5$. No outliers below, because no data items are less than -6.5 (below the end of a reasonable whisker)

$q_3 + 12 = 13.5 + 12 = 25.5$. 35 is an outlier above, because it is above (beyond) the end of a "reasonable" whisker above the box.

Revised box & whiskers: