

**Math 1431**  
**Spring 2003 – Test #1**

NAME \_\_\_\_\_

**You are allowed to use your calculator. Explain all answers – answers with no explanation will receive only partial credit. Use complete sentences. Label all graphs.**

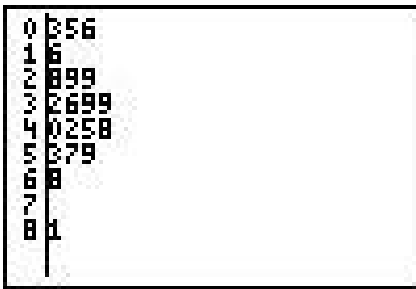
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(20 pts.) 1. Below are the unique weekly visitors to <http://john-weber.com> for the last 20 weeks:

16 57 48 68 39 39 42 28 59 29 32 81 29 6 3 5 36 53 45 40

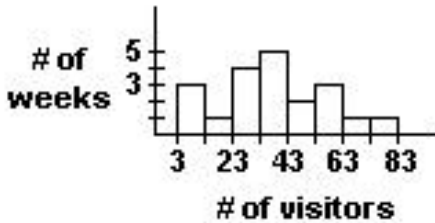
a. Make a stemplot showing the distribution of visitors.

ANS:



b. Make a histogram (with a class width of 10) showing the distribution of visitors.

ANS:



c. Describe the distribution.

ANS: The five number summary is:

3      28.5      39      50.5      81

The standard deviation is 20.09. The mean is: 37.75.

**(on basis of stemplot):** There are possible outliers at 3, 5, 6 and 81. Ignoring these possible outliers, the distribution looks symmetric, the spread is 16 to 68, the center is at 39 and there is a small peak near the center.

**(on basis of histogram):** There does not seem to be any outliers. The center is at 39, the distribution looks right-skewed (because  $81-39$  is larger than  $39-3$ ), the spread is 16 to 68, and there is a small peak near the center.

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(25 pts.) 2. The following are the number of semester credits taken by 11 students and GPA earned for the semester:

<b>credits, x</b>	10	18	12	15	16	16	22	9	10	12	15
<b>GPA, y</b>	3.5	2.8	3.3	3.7	2.9	3.0	2.4	3.1	3.5	3.4	3.2

a. Describe the overall pattern of the scatterplot.

**ANS:** The scatterplot looks somewhat linear with a negative association among the variables (i.e., the correlation is between  $-0.5$  and  $-1$ ). There are possible outliers at  $(15, 3.7)$ ,  $(22, 2.4)$  [and I'll accept  $(9, 3.1)$ ].

b. Compute the correlation coefficient. **ANS:** The correlation coefficient is  $r = -0.74$ .

c. Find the least-squares regression line. **ANS:** The least-squares regression line is  $y = -0.071x + 4.161$ .

d. What percent of the observed variation in GPA is explained by a straight-line relationship with the number of credits taken? **ANS:**  $r^2 = 0.552$ , so 55.2% of the observed variation in GPA is explained by a straight-line relationship with the number of credits.

e. Predict the GPA of a student taking 6 credits. **ANS:** Use the least-squares regression line:  $y = -0.071x + 4.161$  with  $x = 6$ .  $y = -0.071(6) + 4.161 = 3.7$ .

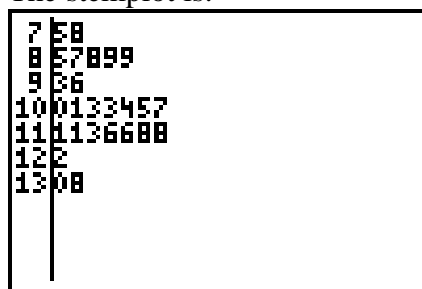
(20 pts.) 3.

113 105 130 101 138 118 87 116 75 96 122 103 116  
 107 118 103 111 104 111 89 78 100 89 85 88 93

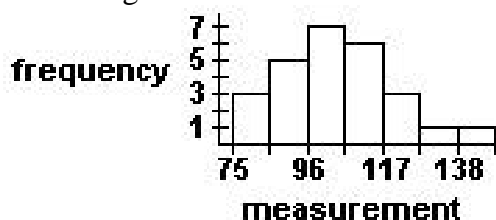
a. Find the mean, five-number summary and standard deviation of the data below: **ANS:** mean is 103.7, standard deviation is 15.6 and the five-number summary is: 75 89 103.5 116 138.

b. Present these measurements with the graph of your choice. Explain why you chose the type of graph. **ANS:** Appropriate graphs are the histogram or stemplot; boxplots are mainly used for comparisons of two or more distributions.

The stemplot is:



The histogram is:

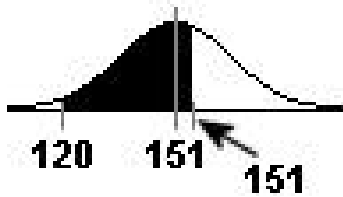


c. Does the shape of the distribution allow the use of mean and standard deviation to describe it? Explain. **ANS:** The distribution is NOT symmetric, thus you cannot use the mean (as a measure of the center) nor the standard deviation (as a measure of the spread) to describe it. You will need to use the median (as a measure of the center) and the first and third quartiles (as a measure of the spread).

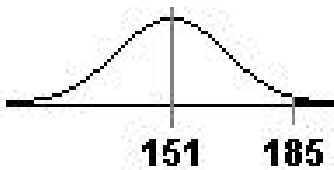
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(25 pts.) 4. The mean weight of males at a certain college is 151 pounds and the standard deviation is 15 pounds. Assuming that the weights are normally distributed, find the proportion of male students who weigh:

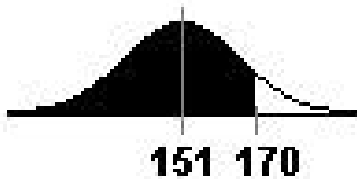
a. between 120 and 155 pounds. Sketch the area. **ANS:** 58.6% of males weigh between 120 and 155 pounds.



b. more than 185 pounds. Sketch the area. **ANS:** 1.2% of males weigh more than 185 pounds.



c. less than 170 pounds. Sketch the area. **ANS:** 89.7% of males weigh less than 170 pounds.



d. What weights would males in the lowest 3% weigh? **ANS:** Use  $\text{invNorm}(0.03, 151, 15)$ . The lowest 3% males' weights are less than 122.8 pounds.

e. Use the 68–95–99.7 rule to determine between what two weights do the middle 95% of men fall. **ANS:** You need to show the use of the 68–95–99.7 rule. According to the rule 95% of the observations fall within 2 standard deviations of the mean (i.e., between  $\mu - 2\sigma = 151 - 2(15) = 121$  and  $\mu + 2\sigma = 151 + 2(15) = 181$ ). Thus, 95% of the men's weights fall between 121 and 181 pounds.

f. Use the 68–95–99.7 rule to what percent of men whose weights are lower than 106 pounds. **ANS:** You need to show the use of the 68–95–99.7 rule. According to the rule 99.7% of the observations fall within 3 standard deviations of the mean (i.e., between  $\mu - 3\sigma = 151 - 3(15) = 106$  and  $\mu + 3\sigma = 151 + 3(15) = 196$ ). So, 99.7% of the men's weights fall between 106 and 196 pounds. So, only 0.3% of the weights are below 106 pounds and above 196 pounds. Since the normal curve is symmetric, each tail has the same area, thus the area (or proportion or percent) below 106 pounds is  $0.3\%/2 = 0.15\%$ .

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### Short Answers

(5 pts.) 5. Name two measures of a distribution which are resistant measures and two that are not resistant measures. Explain. **ANS:** The median is a resistant measure of the center and  $Q_1$ - $Q_3$  is a resistant measure of the spread. They are resistant measures because any change in the value of an observation does not change these measures. The mean is not a resistant measure of the center, the standard deviation is not a resistant measure of the spread because any change in the value of an observation does change these measures. Other measures that are not resistant are the correlation coefficient and least-squares regression line.

(5 pts.) 6. What is the purpose of a standard normal distribution? **ANS:** The purpose of the standard normal distribution is to compare all normal distributions to the one standard distribution (and to use the standard normal table to calculate information about the distribution).

### Extra Credit

(2 pts.) 7. Given a normal distribution with  $\mu = 505$  and  $\sigma = 101$ , what is the  $z$ -score for  $x = 645$ ?

**ANS:** The  $z$ -score =  $\frac{x - m}{s} = \frac{645 - 505}{100} = 1.386$ .