Math Analysis/Statistics Spring Final Exam Review

(Note: You will be allowed one note card and your textbook for your final)

1. What type of sample would give the most unbiased data?
   a. A volunteer response sample.
   b. A random sample.
   c. A sample with a high number of respondents.
   d. None of the above.

2. Which of the following is a true statement?
   a. You can't totally eliminate bias in a study, no matter what you do.
   b. If you do everything right, you will come out with the right conclusion every time when using statistics.
   c. You don't need all seven of the components of a good study in order to be confident in your results; you only need most of them.
   d. All of the above are true statements.

3. Which of the following is a research strategy that involves the researcher manipulating the participants' environment in some way?
   a. Sample survey
   b. Randomized experiment
   c. Observational study
   d. None of the above

<u>For Questions 4 and 5 use the following narrative</u>
Narrative: Boat show
The annual Vacation & Boat Show in Columbus, Ohio offers four types of attractions: boats, fishing gear, outdoor equipment, and vacation planning services. Tickets sell for $6 per person, and children under 5 get in free. This year the show organizers want to find out which attraction was most popular, so they surveyed 100 people at random who attended the show, and asked them. The results showed that 67% of them liked the boats best.

4. {Boat show narrative} This study is an example of which type of research strategy?
   e. Sample survey
   f. Experiment
   g. Census
   h. None of the above

5. {Boat show narrative} The 100 people who were surveyed make up which group?
   i. The population
   j. The sample
   k. The sampling frame
   l. None of the above

6. What type of study takes place when the sample is equal to the population?
   m. A large-scale survey
   n. A census
   o. A nonrandom sample
   p. There is no such study. The sample can never be equal to the population.

7. What does the word 'unit' mean, in statistical terms?
   q. The unit of measurement that is used (for example feet, inches, etc.)
   r. The people doing the sampling are called the sampling unit.
   s. A single individual or object to be measured.
   t. None of the above.

8. Which of the following news story excerpts describes the results of a meta-analysis?
   u. "A recent analysis of eight international studies found that..."
   v. "A recent long-term study using 100,000 participants found that..."
   w. "This single study contained 10 parts; each part used a different type of statistical analysis to get the results. The results showed that..."
   x. None of the above.

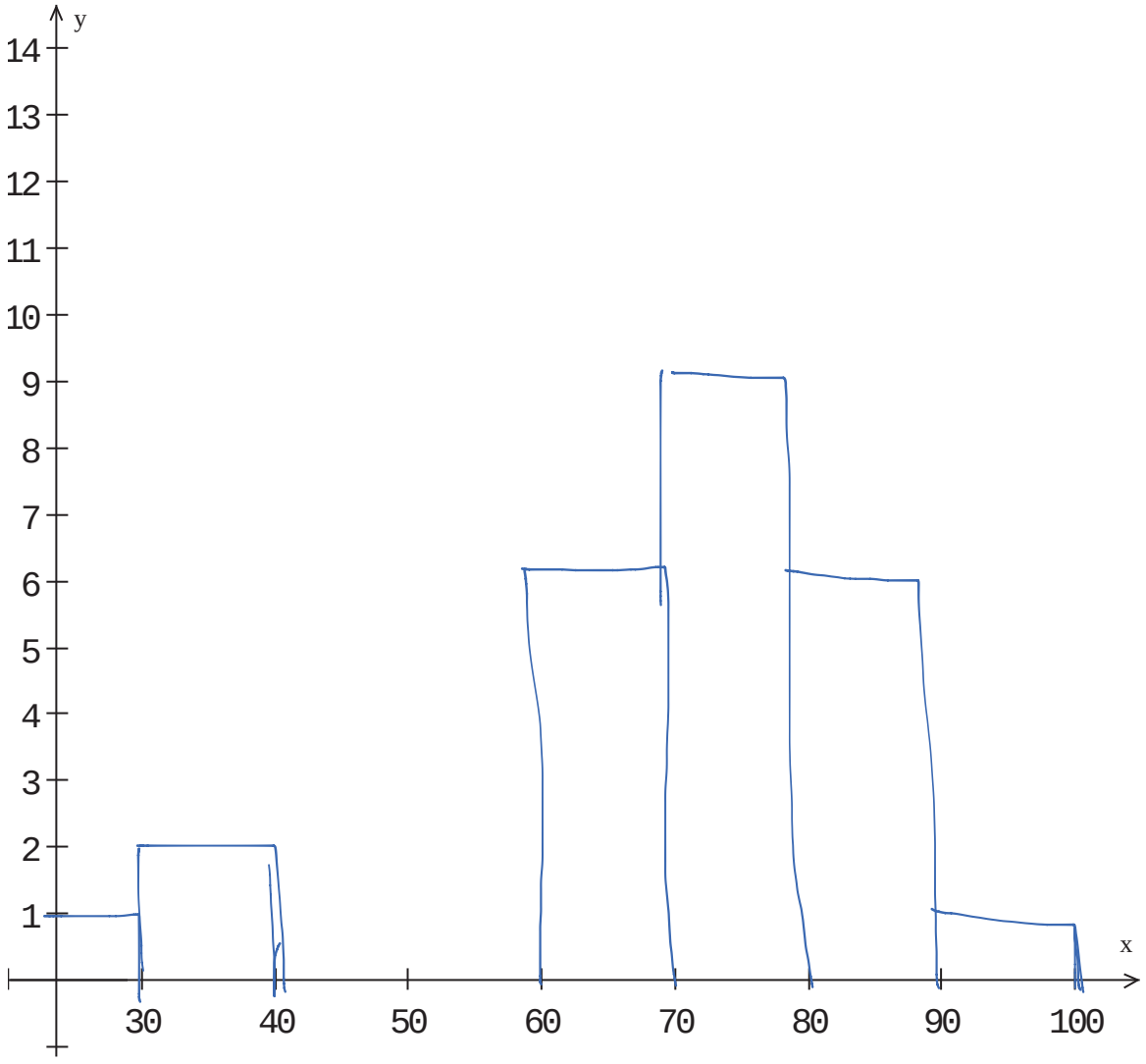
9. In an experiment, you measure the result of the feature being manipulated, called the _explanatory_ variable, on an outcome, called the _response_ variable.

10. The _population_ is the entire collection of units about which we would like information; the _sample_ is the collection of units we actually measure.

1) The stem plot below shows scores of 28 students on a test. Enter these values in your calculator

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

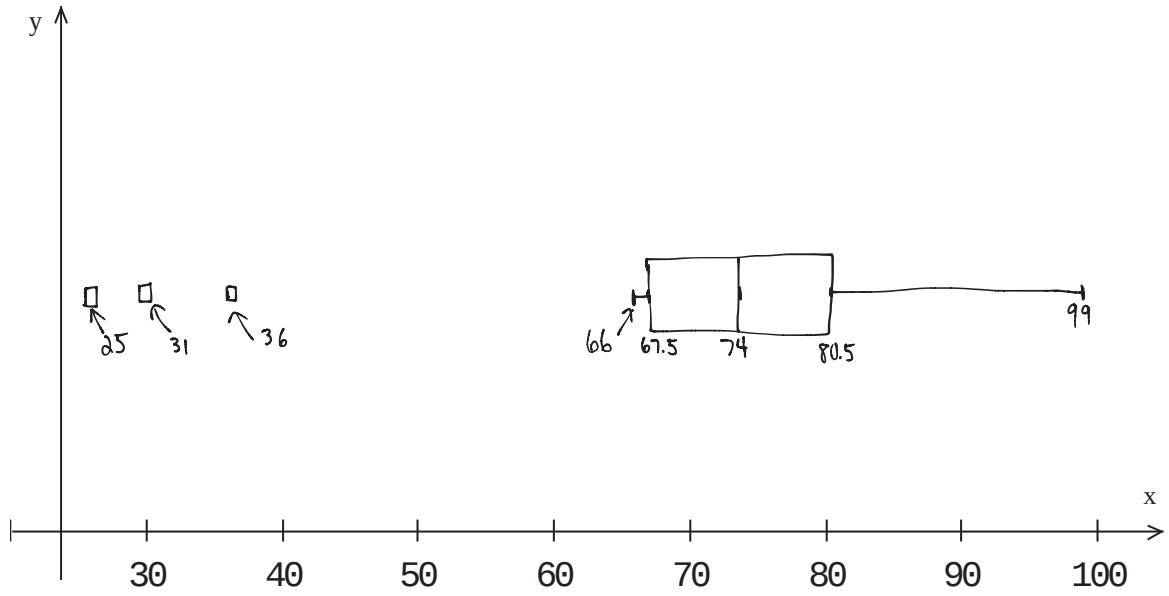
2) Construct a histogram of the data above according to the labels on the *x*-axes. Label the *y*-axes accurately



Are there any outliers? If so, justify your answer.

25, 31, 36 $IQR = 80.5 - 67.5 = 13 \Rightarrow 1.5(IQR) = 19.5 \Rightarrow 67.5 - 19.5 = 48$ since all three #'s (25, 31, 36) are less than 48, they are considered outliers

3) On the axes below, draw a box plot of the data. Indicate the values of the five number summary



For this data, would the mean/standard deviation be a more appropriate measurement than the five-number summary? Explain your answer.

Box plot is more appropriate because it more accurately reflects the spread of the data. The outliers would skew the mean and SD making them less indicative of the true spread of the data

Take the five numbers from the five number summary in the box plot and calculate

a) the mean (using the formula for the mean not the calculator) of those five numbers

$$\frac{66 + 67.5 + 74 + 80.5 + 99}{5} = 77.4$$

b) the standard deviation of those five numbers using the steps shown in the book

Deviations	$(\text{Deviations})^2$
$66 - 77.4 = -11.4$	129.96
$67.5 - 77.4 = -9.9$	98.01
$74 - 77.4 = -3.4$	11.56
$80.5 - 77.4 = 3.1$	9.61
$99 - 77.4 = 21.6$	466.56

$$\frac{715.7}{4} = \frac{\text{Sum of } (\text{Deviations})^2}{n-1} = 178.925 = \text{variance}$$

$n = 5$ because we have 5 scores

$\sqrt{178.925} = 13.376$ Standard Deviation

Find the derivative of each function using the power rule

1) $f(x) = 6x^2 - 4x - 5$ $f'(x) = 12x - 4$

2) $f(x) = \frac{-3}{x^4} + \frac{4}{x^2} - 5x = -3x^{-4} + 4x^{-2} - 5x \Rightarrow f'(x) = 12x^{-5} - 8x^{-3} - 5 = \frac{12}{x^5} - \frac{8}{x^3} - 5$

Find the slope of each function at the indicated point

3) $f(x) = -3x^4 + 4x^2 - 5x$ at $x = 2$ and -2

$f'(x) = -12x^3 + 8x - 5$

$f'(2) = -12(2)^3 + 8(2) - 5 = -96 + 16 - 5 = -85$

$f'(-2) = -12(-2)^3 + 8(-2) - 5 = 96 - 16 - 5 = 75$

4) $f(x) = \frac{-3}{x^4} + \frac{4}{x^2} - 5x$ at $x = 1$ and -1

$f'(x) = 12x^{-5} - 8x^{-3} - 5 = \frac{12}{x^5} - \frac{8}{x^3} - 5$

$f'(1) = \frac{12}{1^5} - \frac{8}{1^3} - 5 = -1$

$f(-1) = \frac{12}{(-1)^5} - \frac{8}{(-1)^3} - 5 = -12 + 8 - 5 = -9$

Find the points on the graph at which the slope is zero. Indicate if it is a maximum or a minimum.

5) $f(x) = \frac{1}{3}x^3 - 2x^2 + 3x - 1$

$f'(x) = x^2 - 4x + 3$

$0 = (x-3)(x+1)$

$x = -1, 3$

max min

$(-1, -6.\overline{3})$ $(3, -1)$

$-\frac{19}{3}$

Camila is wandering through the commons dizzy from all of James and Christian's philosophical arguments. Carlos and Camille are fascinated by this and decide to measure her position with the entrance to the commons being zero. They collect data over 10 seconds and get the following table:

t	Position (ft)
0	–2
1	8
2	0
3	–20
4	–46
5	–72
6	–92
7	–100
8	–90
9	–56
10	8

1) Find the equation for Camila's position relative to the entrance to the Commons.

$P(t) =$ $t^3-12t^2+21t-2$

2) At what times over those 8 seconds did Camila change directions?

$P'(t) = 3t^2-24t+21 = 0 = 3(t^2-8t+7) = 3(t-7)(t-1) = 0$

$t = 1, 7$

3) What was Camila's position (or location) at the times that she changed directions?

$P(1) = 8$ ft into the courtyard

$P(7) = -100$ ft into the commons