**Mathematics 106**
**Test, Chapter 12**

Name ANSWER KEY
April 28, 2009

Please show all work neatly. Use of a calculator is permitted. Please attach your card with notes to the back of this test.

1. (12 pts) An election was held on the question of whether to raise the county's property tax to pay for schools. Opponents of the tax increase, who wore buttons saying "No More Taxes," conducted a verbal survey of some of the parents who attended a back-to-school night, and got the following results: 35% said they favored increasing the tax, 40% opposed increasing the tax, and the rest said they were undecided. Based on this survey, the tax opponents claimed in their literature that polls showed that the tax increase would lose in the election.
   a) What is the population being studied?

   People in the county who will vote in the election.

   b) What sample of the population is used in the survey?

   Just the people at one back-to-school night who talked to the tax opponents.

   c) Do the results of this survey give a reliable prediction of the outcome of the election? NO Give two reasons to justify your answer.

   Many small samples; taken of parents at back-to-school night (segment of population most involved with schools); people may not have given honest responses because opinions of questioners were well known; people opposed to tax increase may have been more willing to talk to questioners.

2. (12 pts) A student club held a marshmallow-stuffing contest, in which the goal was for each student to stuff as many marshmallows into his or her mouth as possible. Twenty-five students participated with the following results:

| Number of marshmallows | Frequency (number of students) |
|---|---|
| 12 | 1 |
| 11 | 2 |
| 10 | 4 |
| 9 | 10 |
| 8 | 6 |
| 7 | 2 |

   a) What is the mean number of marshmallows that a student could stuff into his or her mouth? $\frac{(12\times1)+(11\times2)+(10\times4)+(9\times10)+(8\times6)+(7\times2)}{25} = \frac{226}{25} = 9.04$

   b) What is the median number of marshmallows that a student could stuff into his or her mouth? (13th position) 9

   c) What is the mode number of marshmallows that a student could stuff into his or her mouth? 9 (10 students did that number of marshmallows)

3. Ten students took a test. Their scores follow: 79, 88, 46, 98, 66, 85, 91, 70, 57, 83.
*Use this information for the sections below.*

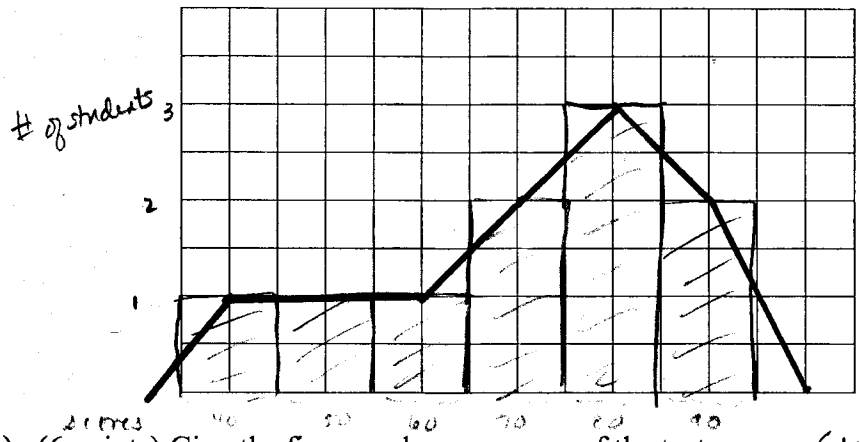
a) (4 points) Create a stem and leaf plot of the scores, using class sizes equal to 10 (e.g., start with 40-49).

| | |
|---|---|
| 9 | 8 1 |
| 8 | 8 5 3 |
| 7 | 9 0 |
| 6 | 6 |
| 5 | 7 |
| 4 | 6 |

Frequency Distribution:

| | |
|---|---|
| 90's | 2 |
| 80's | 3 |
| 70's | 2 |
| 60's | 1 |
| 50's | 1 |
| 40's | 1 |

b) (6 points) Construct a histogram and frequency polygon of the data in the graph paper below, using the same classes as in part *a*. Be sure to label your axes.

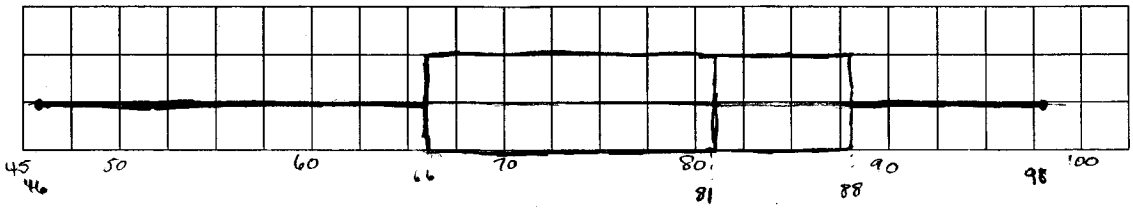



c) (6 points) Give the five-number summary of the test scores: {46, 66, 81, 88, 98}

Line 'em up: 46, 57, 66, 70, 79, 83, 85, 88, 91, 98
5 $Q_1$ $Q_3$ L

$m = \frac{79+83}{2} = 81$

d) (4 points) Draw a box-and-whiskers plot of the test scores:




e) (3 points) What is the mean of the scores? 76.3

f) (6 points) Identify:
i) The Range of the scores: 98-46 = 52

ii) The Interquartile Range (IQR) of the scores: 88-66 = 22

g) (4 points) Identify all outliers, if there are any. No Justify your response.

1.5(22) = 33 88+33 = 121 66-33 = 33

all data items lie between 33 and 121 (ends of reasonable whiskers)

$\frac{-4-4-3+0+2+3}{6} = \frac{-6}{6} = -1$

4. (10 pts) Consider the following data set: {-4, -4, -3, 0, 2, 3}
   a) What is the mean of this data set? $-1$ 2
   b) Use the table below to help you calculate the standard deviation of this data set.

| *Data Item* | *Deviation from Mean* | *(Deviation from mean)²* |
|---|---|---|
| -4 | $-4-(-1) = -3$ | 9 |
| -4 | $-4-(-1) = -3$ | 9 |
| -3 | $-3-(-1) = -2$ | 4 |
| 0 | $0-(-1) = 1$ | 1 |
| 2 | $2-(-1) = 3$ | 9 |
| 3 | $3-(-1) = 4$ | 16 |

3

$\Sigma = 48$

$S.D = \sqrt{\frac{48}{5}} = 3.098$

2 The standard deviation is: 3.1

4 c) Suppose that a second data set, also containing 6 items, has a standard deviation equal to 2. Which set has a greater dispersion (spread)? the set above Justify or explain your answer. A larger standard deviation corresponds to more data at extreme values, or a greater spread.

5. (12 pts) Five hundred students were randomly selected for a student survey. Of those selected, 264 favored lengthening the semester in order to have a longer reading period before final exams.
   a) What is the percentage of students in favor of the longer semester and reading period? 52.8% $\frac{264}{500} = 52.8\%$
   b) Find the margin of error for the percentage of students favoring the longer semester and reading period: _____

$ME = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{500}} = .0447 \sim .045$ (convert to %: 4.5%

   c) Find the 95% confidence interval for the percentage of all students who would favor the longer semester and reading period: $48.3\% < p < 57.3\%$ OR $.48 < p < .573$

$52.8\% - 4.5\% < p < 52.8\% + 4.5\%$ OR $.528 - .045 < p < .528 + .045$

$48.3\% < p < 57.3\%$

   d) The dean of the college reported to the Board of Visitors that based on this poll he is confident that a majority of students are in favor of the longer semester and reading period. Based on what you know about polls and confidence intervals, is he justified in making that statement? NO Explain or justify your answer. With 95% confidence he can only make the statement that the actual % of students favoring the longer period is between 48.3% and 57.3%. At the lower end of the confidence interval, that is less than a majority of students.

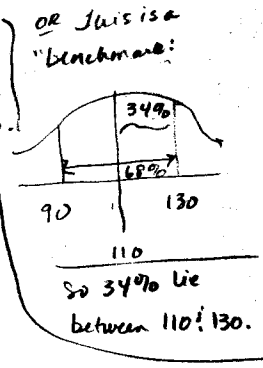
6. (12 pts) The distribution of scores on an Adult Intelligence Scale (an "IQ test") for the 20 to 34 age group is approximately normal, with a mean of 110 and a standard deviation of 20. (Table 12.13 is reproduced below.)

a) What percent of people in this age group have scores between 110 and 130?

$z = \frac{130-110}{20} = 1.00$ $\quad z = \frac{110-110}{20} = 0$ $\quad$ %-ile for 1: 84.13 %

%-ile for z = 0: 50.0 %

**34.13 %** between 110 & 130.




b) What percent of people in this age group have scores between 100 and 120?

$z = \frac{120-110}{20} = .5$ $\quad z = \frac{100-110}{20} = \frac{-10}{20} = -.5$ $\quad$ %-ile for .5: 69.15

- %-ile for -.5: 30.55

**38.30 %**

c) What percent of people in this age group have scores above 150?

$z = \frac{150-110}{20} = \frac{40}{20} = 2$ $\quad$ %-ile: 97.72

So % above: 100 % − 97.72 % = **2.28 %**

% below IQ = 150

d) What percent of people in this age group have scores below 74?

$z = \frac{74-110}{20} = \frac{-36}{20} = -1.8$ $\quad$ %-ile for -1.8 is **3.59 %** less than 74.

**z- Scores and Percentiles**

| z-score | Percentile | z-score | Percentile | z-score | Percentile | z-score | Percentile |
|---|---|---|---|---|---|---|---|
| - 4.0 | 0.003 | - 1.0 | 15.87 | 0.0 | 50.00 | 1.1 | 86.43 |
| - 3.5 | 0.02 | -0.95 | 17.11 | 0.05 | 51.99 | 1.2 | 88.49 |
| - 3.0 | 0.13 | -0.90 | 18.41 | 0.10 | 53.98 | 1.3 | 90.32 |
| - 2.9 | 0.19 | -0.85 | 19.77 | 0.15 | 55.96 | 1.4 | 91.92 |
| - 2.8 | 0.26 | -0.80 | 21.19 | 0.20 | 57.93 | 1.5 | 93.32 |
| - 2.7 | 0.35 | -0.75 | 22.66 | 0.25 | 59.87 | 1.6 | 94.52 |
| - 2.6 | 0.47 | -0.70 | 24.20 | 0.30 | 61.79 | 1.7 | 95.54 |
| - 2.5 | 0.62 | -0.65 | 25.78 | 0.35 | 63.68 | 1.8 | 96.41 |
| - 2.4 | 0.82 | -0.60 | 27.43 | 0.40 | 65.54 | 1.9 | 97.13 |
| - 2.3 | 1.07 | -0.55 | 29.12 | 0.45 | 67.36 | 2.0 | 97.72 |
| - 2.2 | 1.39 | -0.50 | 30.85 | 0.50 | 69.15 | 2.1 | 98.21 |
| - 2.1 | 1.79 | -0.45 | 32.64 | 0.55 | 70.88 | 2.2 | 98.61 |
| - 2.0 | 2.28 | -0.40 | 34.46 | 0.60 | 72.57 | 2.3 | 98.93 |
| - 1.9 | 2.87 | -0.35 | 36.32 | 0.65 | 74.22 | 2.4 | 99.18 |
| - 1.8 | 3.59 | -0.30 | 38.21 | 0.70 | 75.80 | 2.5 | 99.38 |
| - 1.7 | 4.46 | -0.25 | 40.13 | 0.75 | 77.34 | 2.6 | 99.53 |
| - 1.6 | 5.48 | -0.20 | 42.07 | 0.80 | 78.81 | 2.7 | 99.65 |
| - 1.5 | 6.68 | -0.15 | 44.04 | 0.85 | 80.23 | 2.8 | 99.74 |
| - 1.4 | 8.08 | -0.10 | 46.02 | 0.90 | 81.59 | 2.9 | 99.81 |
| - 1.3 | 9.68 | -0.05 | 48.01 | 0.95 | 82.89 | 3.0 | 99.87 |
| - 1.2 | 11.51 | 0.0 | 50.00 | 1.0 | 84.13 | 3.5 | 99.98 |
| - 1.1 | 13.57 | | | | | 4.0 | 99.997 |