name: ____________________________
Mathematics 109 first test solutions
Friday, January 27, 2012
please show your work to get credit for each problem
it’s O.K. to use a half-sheet of notes and a calculator

1. Identify the population & the sample in the following:
To determine whether monkeys can experience pain, a group of scientists devise tests on a group of 500 monkeys.

The sample is the group of 500 monkeys.
The population is the group of all monkeys.

2. In a class of 30 students, six students had scores between 80 and 84.
(a) What is the frequency of scores between 80 and 84?

frequency = 6

(b) What is the relative frequency of scores between 80 and 84?

relative frequency = \( \frac{6}{30} = 0.20 = 20\% \)

3. Identify the sampling technique:
(a) To measure the satisfaction rate of students at North Seattle, I stand outside my office and ask students walking past my office how satisfied they are with the college.

convenience sampling

(b) To measure support for President Obama’s re-election in Washington state, twelve zip codes are selected randomly throughout the state, and then every voter in each of the zip codes is asked whether they will vote for President Obama.

cluster sampling

(c) To determine support for marijuana legalization in Washington state, 500 randomly chosen whites, 200 randomly chosen African-Americans, 150 randomly chosen Hispanics, and 150 randomly chosen Asians are surveyed.

stratified sampling
4. In a group of 33 students, Sarah finds only three students weigh less than she does, while 29 weigh more than she does. Calculate the percentile of Sarah’s weight.

\[ \frac{3}{33} \approx 0.09 = 9^{th} \text{ percentile} \]

5. Determine whether each number is a parameter or a statistic:

(a) to determine the mean age of death in Denmark in the year 2011, the ages of each person who died in Denmark during 2011 are averaged together. 

parameter

(b) to determine the median income of students at North Seattle Community College, the median income of 200 randomly selected students is calculated.

statistic

6. Jaime has a test score of 95. The mean score for the entire class was 85, and the standard deviation of the test scores for the entire class was 20. Calculate the z-score for Jaime’s test score of 95.

\[ z = \frac{x - \mu}{\sigma} = \frac{95 - 85}{20} = 0.5 \]

7. The battery in a certain cell-phone model lasts for around 20 hours. The company finds out when testing 500 batteries that the mean time the battery stays charged is 20 hours, with a standard deviation of 2 hours. The battery charge data has a symmetric bell-shaped distribution.

(a) Approximately what percent of the batteries last between 18 and 22 hours?

\[ P(18 < x < 22) = P(-1 < z < 1) \approx 0.6829 \approx 68\% \]

(b) Approximately what percent of the batteries last less than 18 hours?

\[ P(x < 18) = P(z < -1) \approx 0.1587 \approx 16\% \]

(c) Approximately how many of the batteries last more than 26 hours?

\[ P(x > 26) = P(z > 3) \approx 0.0013 \]

number \approx 0.0013 \times 500 \approx 0.67 \approx 1
8. Given the following 17 intelligence quotient (I.Q.) scores:

82 92 92 95 108 109 112 112 112 112 123 132 132 136 143 143 157

(a) determine the mode of the data

= 112

(b) calculate the range of the data

= 157 − 82 = 75

(c) calculate the five number summary of the data (minimum, first quartile, median, third quartile, maximum)

\[
\min = 82, \quad Q_1 = \frac{95 + 108}{2} = 101.5, \quad \text{med} = 112, \quad Q_3 = \frac{132 + 136}{2} = 134, \quad \max = 157
\]

(d) sketch a histogram of the data, with class boundaries at 80, 100, 120, 140, and 160.

(e) sketch a box-and-whisker plot of this I.Q. data.

(f) does the distribution of data skew to the left? to the right? right
9. Further analysis of the I.Q. data of problem (8) was done: 24% of the I.Q. scores were between 80 and 100, 35% of the scores were between 100 and 120, 24% of the scores were between 120 and 140, and 17% were between 140 and 160. Use this to sketch an ogive (cumulative relative frequency graph) with class boundaries at 80, 100, 120, 140, and 160.

10. A sample of the four test scores 100, 90, 80, and 60 is collected from a larger classroom. Calculate from this small data sample

(a) the mean = 82.5

(b) the variance ≈ 291.7

(c) the standard deviation ≈ 17.1