Math 206 - Test 2

March 11, 2015

Name key

Score _____

Show all work to receive full credit. Supply explanations where necessary. All statistical computations can be done with your calculator.

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1. (3 points) The Insurance Institute for Highway Safety conducted tests with crashes of new cars traveling at 6 mi/h. The costs of damage from a random sample are shown below. Compute the mean and standard deviation of the sample data. Based on your result, is damage of \$10,000 unusual? Briefly explain.

\$7448 \$4911 \$9051 \$6374 \$4277

TI-84

$\bar{x} = \$6412.2$

$\sigma \approx \$1723.385$

CUTOFFS FOR UNUSUAL COSTS:

$\bar{x} - 2\sigma = \$2965.43$

$\bar{x} + 2\sigma = \$9858.97$

↳ BASED ON THIS SAMPLE, DAMAGE OF \$10,000 IS UNUSUAL.

2. (3 points) In a certain neighborhood, all households have between 1 and 6 people. The following table shows the probabilities associated with finding a household of a certain size. In this neighborhood, what is the average number of people per household. (Compute the expected value.)

Size of Household	Probability
1	16%
2	40%
3	8%
4	28%
5	3%
6	5%

$\bar{x} = 1(0.16) + 2(0.40) + 3(0.08) + 4(0.28) + 5(0.03) + 6(0.05)$

$= 2.77$

ON AVERAGE, 2.77 PEOPLE PER HOUSEHOLD.

3. (5 points) Use *dot plot*, *bar graph*, *line graph*, *scatterplot*, *circle graph*, *histogram*, or *stem-and-leaf plot* to answer each question. You may get partial credit if you offer brief explanations.

   (a) What type of graph should be used to show how portions of a whole are divided among categories?

   Circle graph

   (b) What type of graph is generally used to show the trend of a variable over time?

   Line graph

   (c) What type of graph is used to display a collection of points represented by ordered pairs of numbers?

   Scatterplot

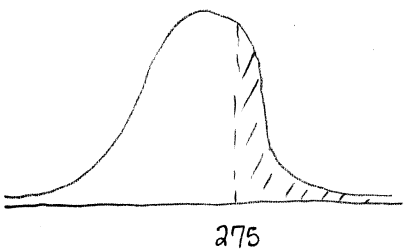
   (d) What type of graph is typically used to illustrate a frequency table?

   Histogram

   (e) What type of graph represents quantitative data by separating each data value into two parts?

   Stem-and-leaf plot

4. (4 points) Lengths of pregnancies are normally distributed with mean 268 days and standard deviation 15 days. In 200 pregnancies, about how many are longer than 275 days?



normalcdf(275, 99999, 268, 15) ≈ 0.3204

32.04% of 200 ≈ 64

About 64 are longer than 275 days.

5. (5 points) Professor Granger has taught a calculus course every semester for many years. The following list gives the numbers of students enrolled each semester, in the order in which they occurred.

29 27 27 21 34 24 24
32 27 25 10 25 28 26
29 37 32 23 20 29 21

Determine the quartiles, the IQR, and the cutoffs for outliers. Then sketch the boxplot on the attached graph paper.

LOWER HALF | UPPER HALF

10, 20, 21, 21, 23, 24, 24, 25, 25, 26, 27, 27, 27, 28, 29, 29, 29, 32, 32, 34, 37

$Q_1 = 23.5$ | MEDIAN = 27 | $Q_3 = 29$

* BOXPLOT ON GRAPH PAPER.

$IQR = 29 - 23.5 = \boxed{5.5}$

CUTOFFS: $23.5 - 1.5(5.5) = \boxed{15.25}$ → 10 IS THE ONLY OUTLIER

$29 + 1.5(5.5) = \boxed{37.25}$

6. (4 points) Fred takes home \$4000 per month. His earnings are budgeted as follows: \$1000 mortgage, \$200 insurance, \$600 food, \$200 auto gas & maintenance, \$600 utilities, \$300 loan payment, \$450 savings, and the rest is reserved for miscellaneous expenses.

(a) Explain why a circle graph is particularly appropriate for displaying this data.

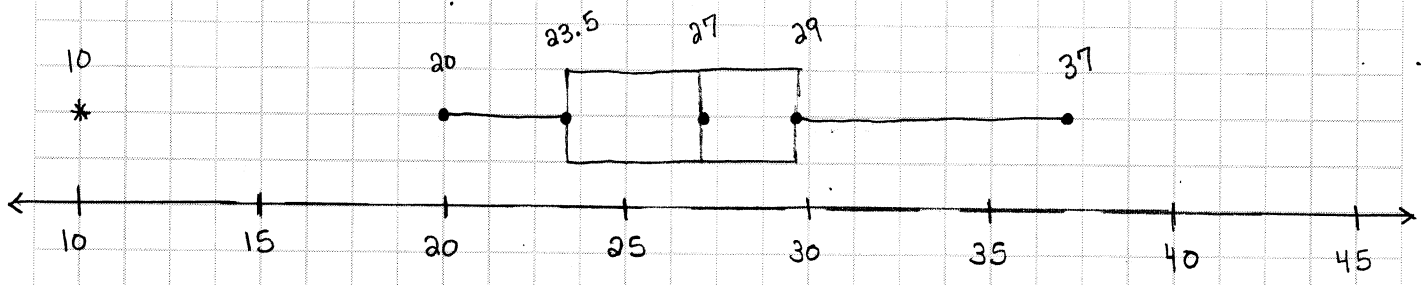
A CIRCLE GRAPH IS VERY GOOD AT SHOWING HOW PORTIONS OF A WHOLE ARE DIVIDED INTO A SMALL NUMBER OF CATEGORIES.

(b) Recall that there are 360 degrees in a circle. Suppose you constructed the circle graph corresponding to the data above. What should be the degree measure of the angle in the portion associated with insurance?

$\frac{200}{4000} = 5\%$ $\quad 5\%$ OF $360^\circ = \boxed{18^\circ}$

#5

COURSE ENROLLMENTS



7. (3 points) In January 2014, the mean maximum daily temperature was 21.8°F with a standard deviation of 12.8°F. Compute the z-score for -6.9°F. Do you think that -6.9°F was an unusually low temperature? Explain.

$$z = \frac{-6.9 - 21.8}{12.8} \approx -2.24$$

-6.9°F IS 2.24 STD. DEV.'S BELOW THE MEAN. THIS IS UNUSUAL.

8. (5 points) In the following stem-and-leaf plot, 4 | 2 means 42.

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

15 VALUES

(a) Compute the mean, median, and mode(s).

SUM OF DATA VALUES = 818

$\bar{x} = \frac{818}{15} = \boxed{54.5\overline{3}}$

MEDIAN = 8^{TH} VALUE = $\boxed{56}$

MODE = $\boxed{67}$

(b) Compute the range.

$75 - 36 = \boxed{39}$

(c) Are the data values shown above approximately normally distributed? Briefly explain.

YES, WHEN VIEWED SIDEWAYS THE DISTRIBUTION OF VALUES LOOKS AS IF IT IS TRACED BY A SMOOTH BELL-SHAPED CURVE. THE DATA PEAKS IN THE MIDDLE, AROUND THE MEAN/MEDIAN, AND THEN DECREASES SMOOTHLY TO THE SIDES.

9. (5 points) Design a simulation that could be used to estimate the solution of the following problem.

> Each cap of a bottle of Yum Berry Tea has one of 20 different messages printed on it. If you buy bottles at random, about how many bottles must you buy before you see a message repeat.

Perform ten trials of your simulation. Then use your data to estimate the solution.

ROLL A TWENTY SIDE DIE TO SIMULATE BUYING A BOTTLE.

ROLL THE DIE UNTIL A NUMBER GETS REPEATED. THIS IS ANALOGOUS TO A REPEATED MESSAGE. A SINGLE TRIAL IS COMPLETE ONCE A NUMBER IS REPEATED.

TEN TRIALS...

TRIAL 1: 13, 17, 17

TRIAL 2: 14, 2, 7, 20, 8, 12, 16, 4, 13, 12

TRIAL 3: 9, 9

TRIAL 4: 14, 20, 2, 12, 19, 9, 19

TRIAL 5: 8, 10, 17, 17

TRIAL 6: 17, 5, 13, 10, 1, 18, 1

TRIAL 7: 5, 13, 4, 19, 5

TRIAL 8: 15, 10, 14, 13, 20, 2, 7, 12, 6, 11, 12

TRIAL 9: 17, 12, 9, 16, 10, 3, 17

TRIAL 10: 9, 18, 4, 4

$$\text{AVERAGE \# OF BOTTLES} = \frac{3+10+2+7+4+7+5+11+7+4}{10} = \frac{60}{10} = \boxed{6}$$

10. (3 points) Halfway through the semester, Alexandria lost her notebook and along with it, her first three graded tests. She did remember, however, that her mean score of the three tests was 82. If Alexandria scored 72 and 90 on her last two tests, what is the mean score of all her tests?

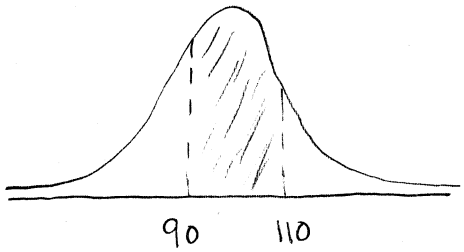
$$\bar{X} = \frac{3(82) + 72 + 90}{5} = \boxed{81.6}$$

11. (3 points) The prices for a gallon of gasoline have mean \$2.44 and standard deviation \$0.18. What are the cut-offs for unusually low and high gas prices?

Low: $2.44 - 2(0.18) =$ \$2.08

High: $2.44 + 2(0.18) =$ \$2.80

12. (3 points) Ages of registered U.S. automobiles are normally distributed with mean 96 months and standard deviation 16 months. What percent of automobiles have ages between 90 and 110 months?



normalcdf(90, 110, 96, 16) ≈ 0.4554

About 45.54%

13. (4 points) A game consists of rolling a regular die with prizes awarded as follows:

- Roll a 1 and win \$5
- Roll a 2, 4, or 6 and win \$2
- Roll a 3 or 5 and win \$1

If the game is to be fair, how much should it cost to play?

→ Cost to play = Expected value

Expected value $= 5\left(\frac{1}{6}\right) + 2\left(\frac{3}{6}\right) + 1\left(\frac{2}{6}\right)$

$= \frac{13}{6} = 2.1\overline{6}$

It should cost \$ $2.1\overline{6}$ per play.