

Math 153 - Test 1

February 13, 2014

Name Key

Score _____

Show all work to receive full credit. Supply explanations where necessary. You may use your calculator for all statistical computations.

1. (2 points) Recent research indicates there is a strong correlation between the extinction of the woolly mammoths and the disappearance of a certain type of flower eaten by the mammoths. Does this suggest that mammoth extinction was caused by the flower disappearance? Explain.

NO, CORRELATION DOES NOT IMPLY CAUSATION.

2. (2 points) A survey conducted by LA Fitness asked members to report the amount of time they work out each day. What is wrong with such a survey? How could the data collection be improved?

THE SURVEY ASKS MEMBERS TO SELF-REPORT. DATA COLLECTION WOULD BE IMPROVED BY LA FITNESS OBSERVING AND RECORDING WORK-OUT TIMES.

3. (2 points) After stopping him for speeding, the state trooper told John that his speed was 93.18935 mph. Is this number an example of too much accuracy or too much precision? Explain.

THE NUMBER IS TOO PRECISE. IT IS UNLIKELY THAT THE STATE TROOPER MEASURED THE SPEED THAT PRECISELY.

4. (2 points) What is wrong with the following pair of survey questions?

- Are you aware of the research that suggests that people with higher IQ scores wash their cars more often?
- How often do you wash your car?

INDIVIDUALLY THE QUESTIONS ARE OKAY. TOGETHER, IN THE ORDER THEY ARE GIVEN, YOU ARE UNLIKELY TO GET TRUTHFUL ANSWERS TO THE SECOND QUESTION.

5. (2 points) Evidence suggests that flossing your teeth regularly can add 6 months to your life expectancy. Is this result statistically significant or practically significant?

THE RESULT IS STATISTICALLY SIGNIFICANT BUT OF NO REAL PRACTICAL SIGNIFICANCE.

6. (10 points) What type of sampling is described in each situation. Choose from random, systematic, convenience, stratified, or cluster.

(a) The first ten people to enter a store are asked about their shopping preferences.

CONVENIENCE

(b) One hundred business cards are placed into a box. The cards are mixed up and five are selected.

RANDOM

(c) PSC students are divided into groups according to age, and ten people are selected at random from each group.

STRATIFIED (ALSO RANDOM)

(d) Every third problem in a textbook's exercise set is selected for homework.

SYSTEMATIC

(e) Ten Illinois community colleges are selected at random to take part in a survey. All students at those colleges are asked to participate.

CLUSTER (ALSO RANDOM)

7. (6 points) Determine whether the data are discrete or continuous.

(a) The body temperatures of humans

CONTINUOUS

(b) The numbers of wheels on vehicles on interstate I-80

DISCRETE

(c) The numbers of pages of newspapers

DISCRETE

(d) The weights of newspapers

CONTINUOUS

8. (2 points) What is the difference between an experiment and an observational study?

IN AN EXPERIMENT A "TREATMENT" IS APPLIED TO SUBJECTS IN ORDER TO PRODUCE AN EFFECT. IN AN OBSERVATIONAL STUDY, THE SUBJECTS ARE MERELY OBSERVED.

9. (6 points) Determine the level of measurement. Choose from nominal, ordinal, interval, or ratio.

(a) Years in which winter olympics were held

INTERVAL

(b) Colors of Starburst fruit chews

NOMINAL

(c) Weights of Starburst fruit chews

RATIO

(d) Movie ratings on a scale of 5 stars

ORDINAL

10. (5 points) The prices for a gallon of gasoline have mean \$3.48 and standard deviation \$0.18. What are the cut-offs for unusually low and high gas prices?

$$\bar{x} - 2s = 3.48 - 2(0.18) = 3.12 \quad \text{UNUSUALLY LOW PRICES ARE BELOW \$3.12.}$$

$$\bar{x} + 2s = 3.48 + 2(0.18) = 3.84 \quad \text{UNUSUALLY HIGH PRICES ARE ABOVE \$3.84.}$$

11. (5 points) For each of the following situations, tell which type of graph would best display the data. Choose from *dot plot*, *bar graph*, *time-series graph*, *scatterplot*, *pie chart*, *ogive*, *histogram*, or *stem-and-leaf plot*. You may get partial credit if you offer brief explanations.

- (a) Biologists caught, weighed, and released 350 fish. They want to make a graph showing the numbers of fish in the different weight classes.

HISTOGRAM

- (b) A couple wants to sketch a graph showing how they budget their monthly earnings. They'd like to show how their money is divided among 7 different categories.

PIE CHART

- (c) A teacher graded 25 tests, and they all had scores that were whole numbers between 17 and 55. She wants to display the entire set of scores.

STEM-AND-LEAF PLOT

- (d) Among other things, Pike's dairy sells ice cream, milk, butter, and cheese. A manager would like to show a graph displaying monthly sales of these products.

BAR GRAPH

- (e) Oscar randomly selected 100 women. For each woman, he recorded her age and the number of minutes each day that she read. He formed ordered pairs and plotted the data.

SCATTER PLOT

12. (14 points) In the following stem-and-leaf plot, 4|5 means 45.

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

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

YES, THE DISTRIBUTION OF SCORES IS PEAKED IN THE MIDDLE, TAPERING OFF SMOOTHLY ON EACH SIDE. IT IS ALSO ROUGHLY SYMMETRIC.

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

$$\begin{array}{l} \bar{X} = 52.\bar{3} \\ \text{MEDIAN} = 52 \end{array} \quad \left. \vphantom{\begin{array}{l} \bar{X} = 52.\bar{3} \\ \text{MEDIAN} = 52 \end{array}} \right\} \text{ FROM CALCULATOR}$$

MODES ARE 50 & 68

(c) Compute the range.

$$70 - 31 = \boxed{39}$$

(d) Without actually computing it, find a reasonable approximation for the standard deviation. Explain.

ONE POSSIBLE APPROX COMES FROM

$$\frac{\text{RANGE}}{4} = 9.75$$

(e) Briefly explain how the values of the mean and median support your conclusion in part (a).

IN NORMAL DISTRIBUTIONS, THE MEAN & MEDIAN ARE ABOUT THE SAME.

THAT'S TRUE HERE.

13. (2 points) What is the difference between a statistic and a parameter?

A PARAMETER IS A MEASUREMENT DESCRIBING A CHARACTERISTIC OF A POPULATION, WHEREAS A STATISTIC DESCRIBES A CHARACTERISTIC OF A SAMPLE.

14. (6 points) Listed below are amounts spent by candidates in running campaigns for local county board seats.

\$45,263 \$39,875 \$29,500 \$53,276 \$79,034 \$55,611

Based on these numbers, would it be unusual for a candidate to spend \$80,000? What about \$15,000?

From CALCULATOR, $\bar{X} = 50,426.50$ & $S = 16,907.41$

$\bar{X} - 2S = 16,611.68$ ← CUTOFF FOR UNUSUALLY LOW

$\bar{X} + 2S = 84,241.32$ ← CUTOFF FOR UNUSUALLY HIGH

\$80,000 IS NOT UNUSUAL,

BUT \$15,000 IS.

15. (5 points) Some teens and adults were asked how much cash they were carrying. 15 teens were carrying a mean amount of \$9.75, and 25 adults were carrying a mean amount of \$28.15. What was the mean amount carried by all 40 people?

$$\bar{X} = \frac{9.75(15) + 28.15(25)}{40} = \frac{850}{40} = \boxed{\$21.25}$$

16. (14 points) Normal body temperatures (taken orally) for children of ages 3–10 range from 95.9°F to 99.4°F. The frequency distribution shown below gives the temperatures of some children in a random sample.

Temperature (°F)	Frequency
95.9–96.4	2
96.5–97.0	5
97.1–97.6	4
97.7–98.2	8
98.3–98.8	19
98.9–99.4	8

$$2 + 5 + 4 + 8 + 19 + 8 = 46$$

- (a) What are the class boundaries associated with the last class listed above?

98.85 AND 99.45

- (b) What is the class width?

$$96.5 - 95.9 = 0.6$$

- (c) What are the class midpoints?

$$\frac{95.9 + 96.4}{2} = 96.15 \rightarrow 96.15, 96.75, 97.35, 97.95, 98.55, 99.15$$

- (d) Use class midpoints to estimate the mean temperature.

$$\frac{96.15(2) + 96.75(5) + \dots + 99.15(8)}{46} = \frac{4514.7}{46} \approx 98.146$$

- (e) Use class midpoints to estimate the median.

WITH 46 VALUES, MEDIAN IS $\frac{23^{\text{RD}} + 24^{\text{TH}}}{2} = 98.55$

- (f) Do the temperatures appear to be normally distributed? Explain.

No, THEY APPEAR TO BE SKEWED LEFT.

Intentionally blank

17. (15 points) Refer to the ammonium ion concentration data on the attached sheet.

(a) Construct a frequency distribution for the data. Use at least five classes.

CONCENTRATION (%)	FREQUENCY	REL FREQ
1.0 - 1.9	1	2%
2.0 - 2.9	11	22%
3.0 - 3.9	13	26%
4.0 - 4.9	17	34%
5.0 - 5.9	5	10%
6.0 - 6.9	2	4%
7.0 - 7.9	1	2%

(b) On graph paper, construct the corresponding relative frequency histogram. Use class boundaries to label your horizontal axis.

SEE ATTACHED SHEET.

Concentration of Ammonium Ions in 50 Samples
(In Percentages)

1.4	2.3	2.4	2.6	2.6	2.7	2.7	2.8	2.8	2.9
2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.5	3.5
3.6	3.7	3.7	3.9	3.9	4.0	4.0	4.1	4.1	4.2
4.2	4.2	4.4	4.5	4.6	4.6	4.6	4.7	4.8	4.8
4.8	4.9	5.2	5.2	5.5	5.6	5.7	6.5	6.8	7.6

Relative Frequency

CONCENTRATION OF Ammonium ions
(in %)

