Math 153 - Test 1
September 13, 2018

Name key

Score _____

Show all work to receive full credit. Supply explanations where necessary. You may get partial credit for correct work and explanations.

1. (3 points) There is very strong evidence that suggests that flossing your teeth daily can add to your life expectancy. Suppose flossing adds one month to your life expectancy. Is this result statistically significant, practically significant, both, or neither? Explain.

"STRONG EVIDENCE". SEEMS TO INDICATE THE RESULT IS STAT. SIGNIFICANT.

ADDING 1 MONTH TO LIFE EXPECTANCY DOESN'T SEEM TO HAVE GREAT PRACTICAL SIGNIFICANCE.

2. (3 points) A survey conducted by Planet 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?

VOLUNTARY RESPONSE WITH SELF-REPORTING! MAKES FOR MUCH BIAS.

BETTER TO COLLECT OBSERVATIONS, RATHER THAN ASK FOR SELF REPORTS.

3. (3 points) What is wrong with the following pair of survey questions? Explain.

- What is the biggest problem facing our nation today?
- Do you think the leaders of our country are qualified to solve the nation's problems?

THE PROBLEM IS POSSIBLE QUESTION ORDER BIAS. → ONCE YOU ARE THINKING OF SPECIFIC BIG PROBLEMS, YOU WILL LIKELY DOUBT OUR LEADERS' ABILITIES.

4. (2 points) During the European Upper Paleolithic period, roughly 30,000 years ago, human life span and artistic expression both rose very rapidly. Does this imply that having longer lives made humans more artistic?

No, (OBSERVED) CORRELATION DOES NOT IMPLY CAUSATION.

5. (3 points) Trying to find the best deal, Stan went shopping around for a certain DVD. At four stores, he found the DVD for about \$8. At two other stores, he found it for about \$9. And at one other store, it was about \$10. He took the average of his estimates and reported to his friend that the cost of the DVD is \$8.571428. Is Stan's reported cost accurate, precise, both, or neither? Explain.

THE REPORTED COST IS FAR TOO PRECISE THAN IS POSSIBLE WITH THE DATA. PRECISE, BUT NOT ACCURATE.

6. (2 points) What is the difference between an experiment and an observational study?

IN AN OBSERVATIONAL STUDY, WE OBSERVE & RECORD WITHOUT ATTEMPTING TO INFLUENCE OUR SUBJECTS. IN AN EXPERIMENT, WE APPLY A "TREATMENT" TO OUR SUBJECTS AND THEN OBSERVE THE EFFECTS OF THE TREATMENT.

7. (8 points) Determine whether the data are discrete or continuous.

   (a) Numbers of shoes in a closet

   DISCRETE

   (b) Weights of pumpkins being sold at a farmers market

   CONTINUOUS

   (c) Heights of children in a 2nd grade classroom

   CONTINUOUS

   (d) Numbers of peaches in bushel baskets

   DISCRETE

8. (8 points) Determine the level of measurement. Choose from nominal, ordinal, interval, or ratio.

   (a) Lengths of fish caught by fishermen on Lake Siskiwit

   RATIO

   (b) Body temperatures of sick adults

   INTERVAL

   (c) Letter grades of English 101 students

   ORDINAL

   (d) Ranks of enlisted women in the Marine Corps

   ORDINAL

9. (12 points) What type of sampling is described in each situation. Choose from random, systematic, convenience, stratified, or cluster.

(a) There are more than 50 two-year colleges in Illinois. Ten Illinois two-year colleges are selected at random to take part in a survey. All students at those colleges are asked to participate.

ALL FROM SOME → CLUSTER

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

CONVENIENCE

(c) In a contest for a free lunch, one hundred business cards are placed into a box. The cards are mixed up and five are selected.

RANDOM

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

SYSTEMATIC

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

SOME FROM ALL → STRATIFIED

(f) In order to obtain a sample of words from a 257-page book, Steve randomly selects eight pages from the book and records every word on all eight pages.

ALL FROM SOME → CLUSTER

10. (13 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	16
98.9–99.4	8

(a) How many children are in the sample?

$2+5+4+8+16+8 =$ 43

(b) What is the class width?

$96.5 - 95.9 =$ 0.6 °F

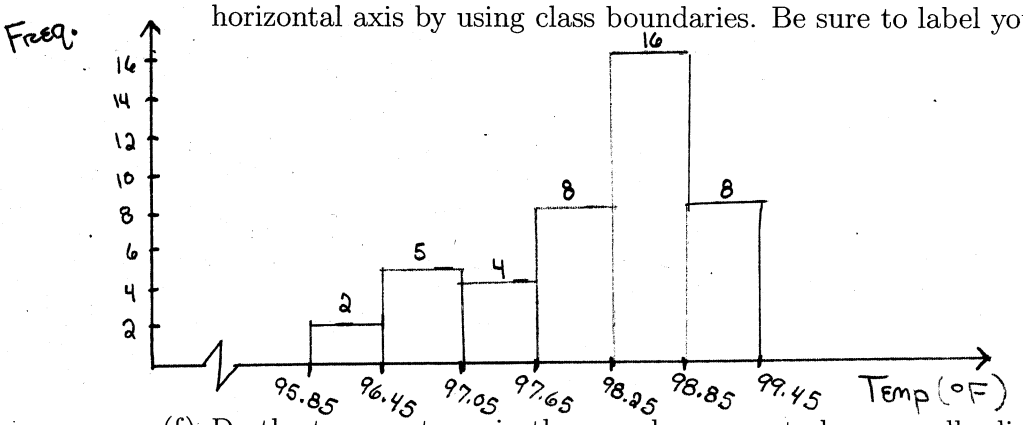
(c) What are the class midpoints?

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

(d) What are the class boundaries?

95.85, 96.45, 97.05, 97.65, 98.25, 98.85, 99.45

(e) Construct the histogram corresponding to the frequency distribution. Scale your horizontal axis by using class boundaries. Be sure to label your axes.



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

No, THE DATA ARE SKEWED LEFT (TAIL TO THE LEFT).

11. (10 points) In the following stem-and-leaf plot, 4 | 5 means 4.5.

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

(a) Construct the corresponding frequency distribution using 3.0 as the lowest class limit and 0.8 as the class width.

Classes	Frequency
3.0 - 3.7	2
3.8 - 4.5	4
4.6 - 5.3	3
5.4 - 6.1	3
6.2 - 6.9	3
7.0 - 7.7	2

< 5.35

$2+4+3 = 9$

(b) What are the class boundaries?

2.95, 3.75, 4.55, 5.35, 6.15, 6.95, 7.75

(c) Suppose you converted your frequency distribution to a cumulative frequency distribution. What cumulative frequency would be associated with the class "< 5.35"?

$2+4+3 = 9$

(d) Suppose you converted your original frequency distribution to a relative frequency distribution. What relative frequency would be associated with your 2nd class?

$2+4+3+3+3+2 = 17$

$\frac{4}{17} \approx 0.235 = 23.5\%$

12. (14 points) Jake at State Farm believes that people drive more carefully after reading about horrific traffic accidents. He asks drivers to read about about several bad accidents, and then he tracks their driving habits for one week.

(a) Is his study an experiment or an observational study? Briefly explain.

JAKE'S TREATMENT IS TO HAVE SUBJECTS READ ABOUT ACCIDENTS.

(b) In Jake's study, what is his population and what is his sample?

HIS POPULATION IS THE SET OF ALL DRIVERS.

HIS SAMPLE CONSISTS OF THE DRIVERS WHO READ ABOUT ACCIDENTS.

(c) From the collection of people Jake is tracking, he finds that the average speed driven in a 25-mph zone is 28.6 mph. Is 28.6 a parameter or a statistic? How do you know?

IT COMES FROM HIS SAMPLE, NOT HIS POPULATION.

(d) Are car speeds discrete or continuous?

THERE ARE MEASUREMENTS.

(e) Identify the level of measurement (nominal, ordinal, interval, ratio) for car speeds.

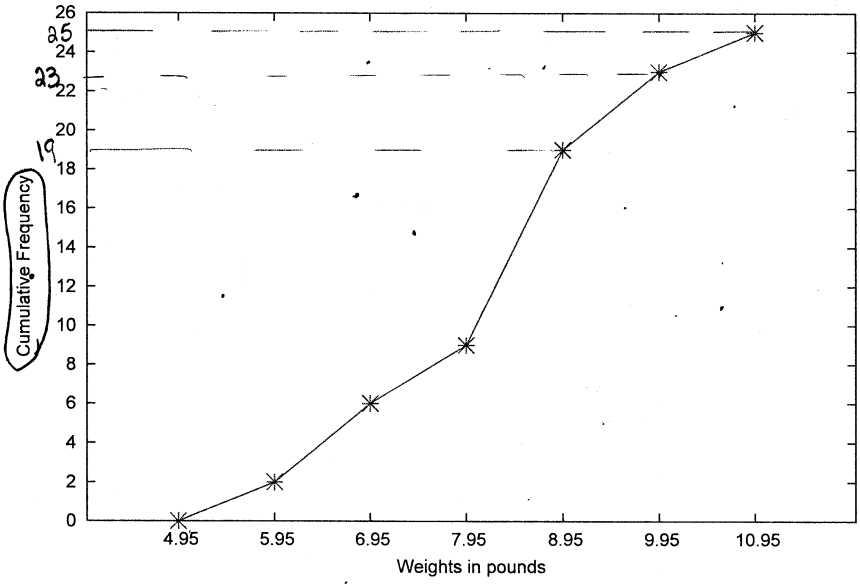
(f) Suppose Jake obtains his sample of 40 drivers by randomly selecting 20 males and 20 females from his list of clients. Is his sample a simple random sample of size 40? Briefly explain.

IT IS NOT A SIMPLE RANDOM SAMPLE. SOME SAMPLES OF SIZE 40 ARE IMPOSSIBLE (e.g. 19 MALES / 21 FEMALES).

(g) One of Jake's clients said, "After reading about this horrific accident, I am 1000% certain that I will never drink and drive!" What do you think about this person's quote?

100% CERTAIN IS AS CERTAIN AS A PERSON CAN BE. YOU CANNOT BE 10 TIMES MORE CERTAIN THAN COMPLETELY CERTAIN!

13. (10 points) The following ogive summarizes the birth weights of the full-term babies born last month at a local hospital.



(a) How many babies are in the sample described by the ogive?

25

(b) How many babies had birth weights between 8.95 lbs and 9.95 lbs?

23 - 19 = 4

(c) In which range of birth weights were there the most babies?

Steepest from 7.95 lbs to 8.95 lbs

(d) In which range of birth weights were there the fewest babies?

Least steep from

4.95 lbs to 5.95 lbs or 9.95 lbs to 10.95 lbs

(e) Are birth weights continuous or discrete? Are numbers of babies continuous or discrete?

14. (2 points) A table in the atrium was under a banner that read, "Please take our survey on abortion rights." 123 students took the survey. What is wrong with this survey?

IT IS A VOLUNTARY RESPONSE SURVEY. IT IS LIKELY THAT ONLY PEOPLE WITH STRONG OPINIONS WILL RESPOND.

15. (3 points) Explain why a systematic sample of 10 PSC students is not a simple random sample.

IN A SYSTEMATIC SAMPLE, 10 PREDETERMINED (BY THE "SYSTEM") PEOPLE ARE SELECTED. NOT EVERY GROUP OF 10 IS AS LIKELY AS ANOTHER. IN FACT, GROUPS OF 10 NOT DETERMINED BY THE "SYSTEM" ARE IMPOSSIBLE.

16. (2 points) A teacher graded 25 tests, and they all had scores that were whole numbers between 35 and 48. She wants to display the entire set of scores and chooses to use a dot plot. In this context, is a dot plot a better choice than a stem-and-leaf plot? Briefly explain.

A DOT PLOT IS MUCH BETTER -- THE NUMBER, RANGE, AND TYPE OF TEST SCORES ARE APPROPRIATE FOR A DOT PLOT. A STEM-AND-LEAF WOULD JUST BE BAD -- PROBABLY ONLY TWO STEMS 3 & 4, WITH LOTS OF LEAVES EACH.

17. (2 points) You share a 20 gigabyte cellular data plan with four other family members. Your service provider sends you a graph showing how data usage is shared among the five of you. Most likely, what type of graph did the service provider send? Why do you think so?

MOST LIKELY, IT'S A PIE GRAPH. THIS WILL SHOW EACH FAMILY MEMBER'S PORTION OF THE WHOLE USAGE.