

**Math 153 - Test 1**  
September 11, 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) What is the difference between a statistic and a parameter?

A PARAMETER IS A NUMBER THAT DESCRIBES A CHARACTERISTIC OF A POPULATION. A STATISTIC DESCRIBES A SAMPLE.

2. (2 points) Joanna sells childrens' t-shirts. One morning she sold 14 shirts—their sizes are shown below.

6, 10, 8, 12, 12, 8, 12, 6, 10, 12, 12, 12, 6, 12

Someone asked Joanna the size of her average customer. Should she report the mean, median, or mode? Briefly explain.

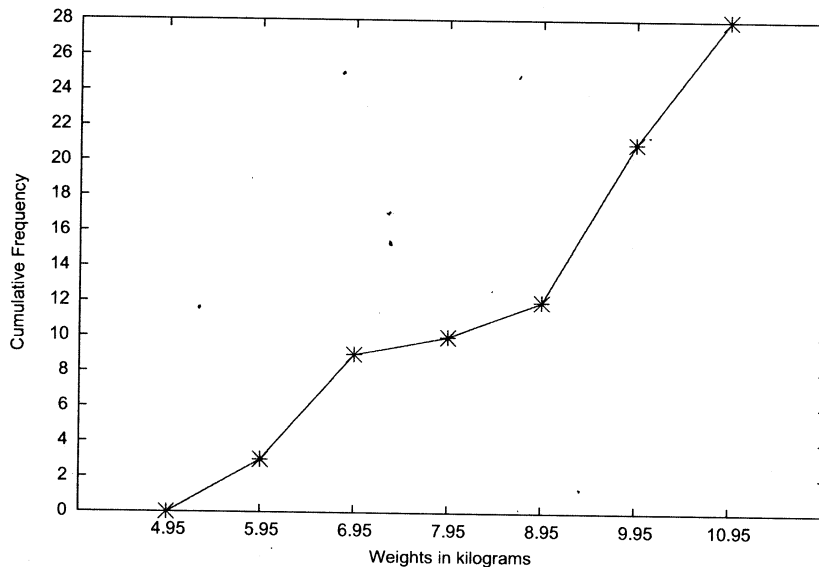
IN THIS CASE, "AVERAGE CUSTOMER" PROBABLY REFERS TO MOST COMMON CUSTOMER. JOANNA SHOULD REPORT THE MODE 12. ADDITIONALLY, SIZES ARE JUST LABELS, SO A MEAN IS PROBABLY NOT APPROPRIATE.

3. (2 points) Sketch a histogram showing a distribution that is skewed left.



1  
TAIL TO THE LEFT.

4. (9 points) The following ogive shows the distribution of weights (in kilograms) of five-week-old piglets in a sample taken by a local farmer.



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

28

Ogives count cumulative freq!

- (b) How many piglets had weights between 6.95 kg and 8.95 kg?

$$12 - 9 = \boxed{3}$$

- (c) In which range of weights (4.95–5.95, 5.95–6.95, etc.) were there the most piglets?

8.95 - 9.95 shows the greatest increase

- (d) If a **relative frequency histogram** was constructed with the same data, what would be the height of the bar associated with the interval 5.95–6.95?

$$9 - 3 = 6 \rightarrow \frac{6}{28} \approx 21.43\%$$

- (e) If the marks along the horizontal axis represent class boundaries, what would be reasonable approximations for the class lower limits?

5.0, 6.0, 7.0, 8.0, 9.0, 10.0

- (f) The farmer surveyed several other farmers by asking the following question: *Because large factory farms are bad for the environment, should they be banned?* What is wrong with this survey question?

IT IS A LOADED QUESTION. SAYING THEY ARE BAD, LEADS

ONE TO SAY THEY SHOULD BE BANNED.

5. (5 points) A collection of test scores have mean 68.5 and standard deviation 4.3. What are the cut-offs for unusually low and high test scores?

UNUSUALLY LOW ARE LESS THAN  $68.5 - 2(4.3) = 59.9$

UNUSUALLY HIGH ARE GREATER THAN  $68.5 + 2(4.3) = 77.1$

6. (6 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) For a class project, Bill constructs a graph to show how the population of Greenland has changed over the years.

→ TIME-SERIES GRAPH

- (b) The chief financial officer for a large company wants to sketch a graph showing how the company's operating budget is divided among 5 different categories.

PIE CHART --- THE CFO WANTS TO SHOW PORTIONS OF THE WHOLE

- (c) The author of a geography textbook wants to show a graph displaying the current populations of the seven continents.

BAR GRAPH --- NOMINAL DATA (NAMES) ALONG HORIZ AXIS.  
POPULATION ALONG VERTICAL AXIS.

- (d) Sally randomly selected 75 Initech employees. For each employee, she recorded age and annual salary. She then formed ordered pairs and plotted the data.

→ SCATTERPLOT

- (e) A teacher graded 25 tests, and they all had scores that were whole numbers between 37 and 55. She wants to display the entire set of scores.

ONLY 25 TESTS AND SMALL RANGE ⇒ DOT PLOT

- (f) Health researchers weighed 250 fourth-grade children. They want to make a graph showing the numbers of children in the different weight classes.

FREQ ALONG VERTICAL AXIS. CONTINUOUS DATA (WEIGHTS) SEPARATED INTO CLASSES ALONG HORIZ. AXIS.

⇒ HISTOGRAM

7. (8 points) Listed below are the numbers of manatee deaths caused each year by collisions with watercraft.

78 81 95 73 69 79 92 73 90 97

Compute the mean and standard deviation. Based on the numbers, is it unusual to have 95 annual deaths? What about 72 deaths?

$$\bar{X} = 82.7$$

$$S = 10.1$$

$$\text{UNUSUALLY SMALL: } 82.7 - 2(10.1) = 62.5$$

$$\text{UNUSUALLY LARGE: } 82.7 + 2(10.1) = 102.9$$

NEITHER 95 NOR 72

ARE UNUSUAL.

8. (4 points) According to Chebyshev's Theorem, at least what percent of the data values from any set will lie within 2.25 standard deviations of the mean?

$$1 - \frac{1}{2.25^2} \approx 0.8025$$

$$= \boxed{80.25\%}$$

9. (6 points) Determine the level of measurement. Choose from nominal, ordinal, interval, or ratio. You may get partial credit if you offer brief explanations.

(a) Names of books written by Jhumpa Lahiri      NOMINAL

(b) Weights of newborn babies      RATIO

(c) College and university rankings      ORDINAL

(d) Years in which popes were elected      INTERVAL

10. (16 points) The following frequency distribution shows the costs (in dollars) of 30 portable GPS navigators.

GPS Costs (\$)	Frequency
65-104	6
105-144	9
145-184	6
185-224	4
225-264	2
265-304	1
305-344	2

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

$$64.5 \text{ AND } 104.5$$

- (b) What is the class width?

$$40$$

- (c) If the frequency distribution was changed to a cumulative frequency distribution, what number would be associated with the class " $\leq 224$ "?

$$6 + 9 + 6 + 4 = 25$$

- (d) What are the class midpoints?

$$\frac{65+104}{2} = 84.5 \Rightarrow$$

$$84.5, 124.5, 164.5, \dots, 324.5$$

- (e) Use class midpoints to estimate the mean cost.

$$\bar{X} \approx \frac{6(84.5) + 9(124.5) + 6(164.5) + \dots + 2(324.5)}{30} = \frac{4855}{30} \approx 161.8$$

- (f) Use class midpoints to estimate the median cost.

$$M_{ED} \approx \frac{15^{TH} + 16^{TH}}{2} = \frac{124.5 + 164.5}{2} = \frac{289}{2} = 144.5$$

- (g) Of the two measures of center computed above, which is better and why?

THE MEDIAN IS BETTER BECAUSE THE MEAN IS PULLED UP BY THE FEW HIGH COSTS.

- (h) Do the costs appear to be normally distributed? If so, explain why you think so. If not, describe the type of distribution.

NO, THE DISTRIBUTION OF COSTS IS SKEWED RIGHT.

11. (8 points) Math tests had a mean of 157.9 and a standard deviation of 27.3. Physics tests had a mean of 38.1 and a standard deviation of 6.2.

(a) Compute the coefficients of variation for the tests. Which tests (math or physics) had greater variation?

$$\text{MATH CV} = \frac{27.3}{157.9} \approx 17.3\% \qquad \text{Physics CV} = \frac{6.2}{38.1} \approx 16.3\%$$

MATH TESTS HAD GREATER VARIATION.

(b) What would be an unusually high score on the math test?

Any score greater than

$$157.9 + 2(27.3) = \boxed{212.5}$$

12. (9 points) A sample of PSC students is obtained as described. Identify the type of sampling (random, systematic, convenience, stratified, cluster). You may get partial credit if you offer brief explanations.

(a) Students are selected as they walk in the main door.

CONVENIENCE

(b) Students are separated into groups according to age, then 20 students are selected from each age group.

STRATIFIED

(c) A complete list of students is compiled and every 150th name is selected.

SYSTEMATIC

(d) Students are separated into groups according to last initial. Ten letters are chosen at random and all students with that initial are selected.

CLUSTER

(e) Student ID numbers are selected at random by using a computer.

RANDOM

(f) Students are grouped according to which high school they attended. Two students are selected from each high school.

STRATIFIED

13. (6 points) Organize the following data into a stem-and-leaf plot. Are the data approximately normally distributed? Explain.

~~47 32 48 51 10 27 50 21 24 12~~  
~~21 32 48 12 28 32 30 37 38 49~~

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

3|2 represents 32

THE DATA LOOK  
 APPROXIMATELY  
 NORMAL.

THE DISTRIBUTION  
 IS PEAKED IN THE  
 MIDDLE, SYMMETRIC,  
 DECREASING TO THE  
 SIDES.

14. (3 points) A survey conducted by Globo Gym 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?

IT IS A VOLUNTARY RESPONSE SURVEY.

IT WOULD BE BETTER IF GLOBO GYM COLLECTED  
 THE DATA BY ACTUALLY OBSERVING & RECORDING.

15. (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.

16. (12 points) A group of 15 doctors believe that by playing Fruit Ninja, a smoker's desire for nicotine decreases. In order to justify their beliefs, they plan to study a sample of 90 people who smoke an average of 10 cigarettes per day. Some of the smokers will be asked to play Fruit Ninja for 30 minutes each day.

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

EXPERIMENT --- THE TREATMENT GROUP  
PLAYS FRUIT NINJA.

(b) Are the numbers of cigarettes smoked per day discrete or continuous?

DISCRETE

(c) Study participants must rank their desire for nicotine on a scale of 0 through 10. Identify the level of measurement (nominal, ordinal, interval, ratio) associated with desires for nicotine.

ORDINAL

(d) The sample of 90 participants is obtained by each doctor randomly selecting 6 volunteers from his or her own practice. Is this sample a simple random sample? Briefly explain.

NO, WITH EACH DOCTOR SUPPLYING EXACTLY 6 PEOPLE,  
NO SAMPLE OF 90 COULD HAVE 7 PARTICIPANTS FROM  
A SINGLE DOCTOR.

(e) Suppose the sample of participants is selected by placing a radio advertisement asking smokers to volunteer. What type of sample is this?

CONVENIENCE

(f) At the end of their study, the doctors conclusively showed that the Fruit Ninja players desired only 9 cigarettes per day. Is their result statistically significant, practically significant, or both? Explain.

BECAUSE THE DOCTORS "CONCLUSIVELY SHOWED",

WE CAN ASSUME THE RESULT IS STAT. SIG.

ON THE OTHER HAND, DROPPING FROM 10 CIGS

A DAY TO 9 CIGS A DAY HARDLY SEEMS OF PRACTICAL  
VALUE.