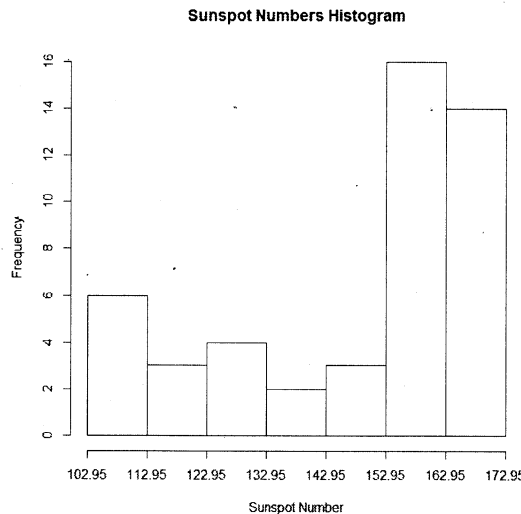


Math 153 - Test 1
February 14, 2019

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. (10 points) Scientists track solar cycles by counting sunspots. The histogram shown below summarizes the mean weekly sunspot numbers over a recent 48-week period of time. (A larger copy of the histogram is included on the last page of the test.)



$$6 + 3 + 4 + 2 + 3 + 16 + 14 = 48$$

- (a) For how many weeks was the mean sunspot number between 122.95 and 132.95?

4

- (b) What is the relative frequency of the class associated with 152.95–162.95?

$$\frac{16}{48} = 0.33\bar{3} = 33.\bar{3}\%$$

- (c) If a cumulative frequency distribution was constructed from the histogram, what frequency would be associated with the class " ≤ 132.95 "?

$$6 + 3 + 4 = 13$$

- (d) Do the data appear to be normally distributed? Explain.

No, THE HISTOGRAM IS NOT EVEN CLOSE TO BEING SYMMETRIC.

- (e) What would you expect to be greater, the mean of the data values or the median? Why?

I EXPECT THE MEDIAN TO BE GREATER.

THE MEAN WILL BE PULLED DOWN BY THE

LOWER DATA VALUES.

2. (12 points) A sample of PSC students is obtained as described. Identify the type of sampling (random, systematic, convenience, stratified, cluster).

(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 at random from each age group.

STRATIFIED

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

SYSTEMATIC

(d) Students are separated into groups according to the first letter of their last name. Ten letters are chosen at random and all students with that last 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 at random from each high school.

STRATIFIED

3. (6 points) Determine whether the data are discrete or continuous.

(a) Results of rolling a pair of dice

DISCRETE

(b) Human body temperatures

CONTINUOUS

(c) Numbers of paintings in art galleries

DISCRETE

4. (12 points) Use *frequency polygon*, *dot plot*, *bar graph*, *time-series graph*, *scatterplot*, *pie chart*, *ogive*, *histogram*, *stem-and-leaf plot*, or *Pareto chart* to answer each question. You may get partial credit if you offer brief explanations.

- (a) What type of graph simply displays a collection of plotted points obtained from ordered pairs of numbers?

SCATTERPLOT

- (b) What type of bar graph has the bars arranged in descending order according to frequencies?

PEREHO CHART

- (c) What type of graph might be described as a cumulative frequency polygon?

Ogive

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

PIE CHART

- (e) What type of display shows quantitative data by separating each data value into two parts?

STEM-AND-LEAF PLOT

- (f) If you used segments to connect class midpoints along the tops of the bars of a histogram, what type of graph would you obtain?

Frequency polygon

5. (2 points) A study conducted in Italy used data collected from 33,043 infants to find a link between a heart rhythm abnormality and sudden infant death syndrome. Identify the population and the sample.

Population: ITALIAN INFANTS

Sample: THE 33,043 ITALIAN INFANTS IN THE STUDY

6. (9 points) The numbers given below, are a random sample of movie budgets, in millions of dollars, from a certain studio. For convenience, the numbers are arranged in numerical order.

35 TOTAL BUDGETS

4.5	5	6.5	7	20	20	29	30	35	40
40	41	50	52	60	65	68	68	70	70
70	72	74	75	80	100	113	116	120	125
132	150	160	200	225					

- (a) At which percentile is the budget of \$80 million?

$$\frac{24}{35} \approx 68.57\%$$

\$80 million is approx

AT THE 68TH PERCENTILE.

- (b) What budget is at the 40th percentile?

$$35 \times 0.40 = 14 \Rightarrow \frac{14^{\text{TH}} + 15^{\text{TH}}}{2} = \frac{52 + 60}{2} = 56$$

\$56 million

- (c) What budget is at the 75th percentile?

$$35 \times 0.75 = 26.25 \Rightarrow 27^{\text{TH}} = \$113 \text{ million}$$

7. (6 points) SAT scores have mean 1060 and standard deviation 195. ACT scores have mean 21 and standard deviation 5.4. Compute the coefficients of variation (CV's). Which scores have greater spread?

SAT

$$\frac{195}{1060} \approx 18.4\%$$

ACT

$$\frac{5.4}{21} \approx 25.7\%$$

ACT SCORES HAVE MORE SPREAD.

8. In the following graphical display, 4|5 means 4.5.

16 VALUES

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

(a) (1 point) What is the name of this type of display?

STEM-AND-LEAF PLOT

(b) (6 points) Compute the mean, median, and mode.

MEAN:

$$\frac{3.1 + 3.6 + \dots + 7.4}{16} = \frac{86.1}{16} \approx \boxed{5.38}$$

MEDIAN:

$$\frac{8\text{TH} + 9\text{TH}}{2} = \frac{5.2 + 5.6}{2} = \boxed{5.4}$$

MODE:

TWO MODES ARE 5.0 AND 6.8

(c) (1 point) Explain why you should have expected the mean and median to be close in value.

THE DISTRIBUTION OF VALUES IS SYMMETRIC.

9. (9 points) Joe scored 180 on a math test with mean 157.9 and standard deviation 27.3. Liz scored 43 on a physics test with mean 38.1 and standard deviation 6.2.

(a) Compute the corresponding z scores. Who scored better and why?

Joe: $z = \frac{180 - 157.9}{27.3} \approx \boxed{0.81}$

Liz: $z = \frac{43 - 38.1}{6.2} \approx \boxed{0.79}$

JOE SCORED A LITTLE BETTER BECAUSE HE IS FARTHER ABOVE THE MATH MEAN RELATIVE TO ITS STD. DEV.

(b) Give an example of a z-score of a person who did unusually well, but not extraordinarily well, on the physics test.

$\boxed{2.1}$ IS ONLY 0.1 ABOVE THE UNUSUALLY HIGH CUTOFF.

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

$$157.9 + 2(27.3) = 212.5$$

ANY SCORE ABOVE 212.5 IS UNUSUALLY HIGH.

10. Field biologists have collected data on a number of adult male grackles. The birds' tarsus lengths, in millimeters (mm), are summarized below.

Length (mm)	Frequency
21.1-24.9	4
25.0-28.8	4
28.9-32.7	15
32.8-36.6	12
36.7-40.5	6
40.6-44.4	7

- (a) (2 points) What is the class width?

$$25 - 21.1 = 3.9$$

- (b) (2 points) What are the class boundaries associated with the second class?

$$24.95 \text{ \& } 28.85$$

- (c) (2 points) If the data were displayed in an ogive, what would be the height of the graph at its far right side?

$$4 + 4 + 15 + 12 + 6 + 7 = 48$$

- (d) (2 points) List all of the class midpoints.

$$\frac{21.1 + 24.9}{2} = 23, \underbrace{26.9, 30.8, 34.7, 38.6, 42.5}_{3.9}$$

- (e) (4 points) Estimate the mean tarsus length by using class midpoints to compute a weighted mean.

$$\bar{X} = \frac{4(23) + 4(26.9) + 15(30.8) + 12(34.7) + 6(38.6) + 7(42.5)}{48} = \frac{1607.1}{48} \approx 33.48$$

- (f) (4 points) Estimate the median tarsus length by using class midpoints to compute a weighted median.

$$\text{MEDIAN} \approx \frac{24^{\text{TH}} + 25^{\text{TH}}}{2} = \frac{34.7 + 34.7}{2} = 34.7$$

11. (6 points) Determine the level of measurement. Choose from nominal, ordinal, interval, or ratio.

(a) Jersey numbers of school athletes

NOMINAL

(b) Letter grades of Math 112 students

ORDINAL

(c) Volumes of drinking cups

RATIO

12. (4 points) For the five coldest months of the year, Karla's mean natural gas bill was \$110.46. For the other seven months, the mean bill was \$43.98. What was Karla's mean natural gas bill for the entire year?

$$\frac{5(110.46) + 7(43.98)}{12} = \frac{860.16}{12} = \$71.68$$

Here is a larger copy of the histogram associated with problem #1.

Sunspot Numbers Histogram

