

### QUIZ 1 - SOLUTIONS

(LESSONS 1-10: INTRO and DESCRIPTIVE STATISTICS)  
MATH 119 – FALL 2019 – KUNIYUKI

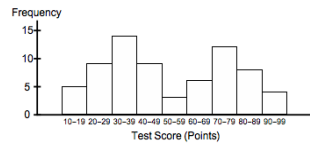
- 1) (3 points). A bookstore gives a survey to every tenth customer who makes a purchase. What sampling method is being used here? Box in one:

- simple random sampling
- systematic sampling
- cluster sampling
- stratified sampling

- 2) (3 points). A political polling firm randomly selects 250 registered voters in Fredonia and asks them if they are members of the Orange Party, the Purple Party, or neither. Based on the observed frequencies below, find the corresponding relative frequencies. You may write your answers in fraction, decimal, or percent form. Do not round off.

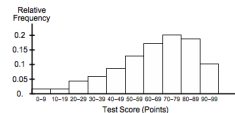
Party	Frequency	Relative Frequency
Orange	100	$\frac{100}{250}$ or $\frac{2}{5}$ or 0.4 or 40%
Purple	80	$\frac{80}{250}$ or $\frac{8}{25}$ or 0.32 or 32%
Neither	70	$\frac{70}{250}$ or $\frac{7}{25}$ or 0.28 or 28%
	Sum = $n$ = 250	

- 3) (3 points). 70 students take an exam. A frequency histogram for their scores is below. Estimate the number of students who scored in the 20s (between 20 and 29 points).



Between 5 and 10 students scored in the 20s. (In fact, 9 did.)

- 4) (4 points). 70 students take an exam. A relative frequency histogram for their scores is below. Describe the distribution shape. Consider modality and skewness.



This distribution is unimodal and left-skewed.

- 5) (3 points). Which statement below tends to be more true? Box in one:

- The mean is more sensitive to outliers than the median is.
- The median is more sensitive to outliers than the mean is.

- 6) (18 points). A drug company randomly selects seven people with diabetes to participate in a study. Their fasting blood glucose levels are tested and are recorded as follows (in milligrams per deciliter, or mg/dL).

160 209 177 209 179 300 166

- a) (4 points). Find the **mean** of the fasting blood glucose levels.

$$\text{The mean is: } \frac{160 + 209 + 177 + 209 + 179 + 300 + 166}{7} = \frac{1400}{7} = \boxed{200.0 \frac{\text{mg}}{\text{dL}}}$$

- b) (2 points). Find the **median position number** of this data set.

$$\text{The median position number is: } \frac{n+1}{2} = \frac{7+1}{2} = \boxed{4}$$

- c) (4 points). Find the **median** of the fasting blood glucose levels.

First, sort the values:  
160 166 177 179 209 209 300

The median is the fourth lowest value,  $\boxed{179 \frac{\text{mg}}{\text{dL}}}$ .

- d) (4 points). Find the **mode** of the fasting blood glucose levels.

The mode is the most frequent value,  $\boxed{209 \frac{\text{mg}}{\text{dL}}}$ .

- e) (4 points). Find the **midrange** of the fasting blood glucose levels.

$$\text{The midrange is: } \frac{\text{Min} + \text{Max}}{2} = \frac{160 + 300}{2} = \boxed{230 \frac{\text{mg}}{\text{dL}}}$$

- 7) (3 points). The mean is considered to be a very appropriate measure of center for which of the following types of distributions? Box in one (the best answer):

- a left-skewed distribution
- a right-skewed distribution
- a symmetric distribution

- 8) (12 points). A student's grade report for a term is below. Find the GPA for the term to two decimal places.

Grade Report		
Course	Number of Units	Grade
English	6	C+
Math	5	B
Music	3	A-

Number of units taken by the student =  $\sum w = 6 + 5 + 3 = 14$  units.

$$\text{GPA} = \frac{\sum w \cdot x}{\sum w} = \frac{(6)(2.3) + (5)(3) + (3)(3.7)}{14} = \frac{39.9}{14} = \boxed{2.85 \text{ grade points}}$$

9) (10 points). So far, your grade record in a class looks like this:

Exam	% of overall grade	Your score (out of 100 points)
Quiz 1	15%	40
Quiz 2	15%	55
Midterm 1	20%	65
Midterm 2	20%	70
Final	30%	c

What must you get on the Final to get at least 70% in the class overall?

$$\frac{(0.15)(40) + (0.15)(55) + (0.20)(65) + (0.20)(70) + 0.30c}{1} \geq 70$$

$$41.25 + 0.30c \geq 70$$

$$4125 + 30c \geq 7000$$

$$30c \geq 2875$$

$$c \geq 95.8 \text{ points}$$

You must get at least 96 points on the Final.

10) (23 points). 1000 students in a large lecture class take a test. Four of the tests are randomly selected and are graded. Their scores in points are as follows:

55      80      95      70

a) (4 points). Find the **range** of the sample data values.

$$\text{Range} = \text{Max} - \text{Min} = 95 - 55 = \boxed{40 \text{ points}}$$

b) (4 points). Find the **sample mean**.

$$\text{The sample mean is: } \bar{x} = \frac{55 + 80 + 95 + 70}{4} = \frac{300}{4} = \boxed{75.0 \text{ points}}$$

c) (6 points). Fill out the following table:

Data (x) values	Deviations (x - $\bar{x}$ ) values	Squared Deviations (x - $\bar{x}$ ) <sup>2</sup> values
55	-20	400
80	5	25
95	20	400
70	-5	25

d) (1 point). What do the deviations from the sample mean add up to?  $\boxed{0}$

e) (4 points). Find the **sample variance**. Round it off to one decimal place, but avoid rounding when doing f) below.

$$\text{The sample variance is: } s^2 = \frac{\sum(x - \bar{x})^2}{n-1} = \frac{850}{3} \approx \boxed{283.3 \text{ square points}}$$

f) (4 points). Find the **sample standard deviation**. Round it off to one decimal place.

$$\text{The sample SD is: } s = \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\frac{850}{3}} \approx \boxed{16.8 \text{ points}}$$

11) (10 points). Annual incomes of high-school teachers in Fredonia are approximately normally distributed with mean \$55,000 and standard deviation \$10,000.

a) (4 points). Use the “Two SD” ( $2\sigma$ ) Rule for Usual Values to give an appropriate interval of usual annual incomes for high-school teachers in Fredonia.

$$(\mu - 2\sigma, \mu + 2\sigma) = (\$55,000 - 2(\$10,000), \$55,000 + 2(\$10,000)) \\ = \boxed{(\$35,000, \$75,000)}$$

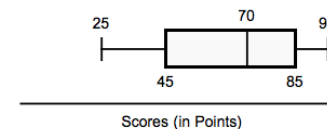
b) (2 points). According to the **Empirical Rule**, about what percent of annual incomes of high-school teachers in Fredonia are within two standard deviations of the mean?

About 95% of such annual incomes are within two SDs of the mean.

c) (4 points). If a high-school teacher in Fredonia makes an annual income of \$40,000, what would be the z score for that income to two decimal places?

$$z = \frac{x - \mu}{\sigma} = \frac{\$40,000 - \$55,000}{\$10,000} = \boxed{-1.50}$$

12) (8 points; 2 points each). The scores on a test (in points) in a large class are summarized by the boxplot (also known as a “box-and-whisker” plot) below. The minimum score is 25 points. The maximum score is 95 points. There are no extreme outliers.



a) A score of 85 points is at which quartile?

85 points is at  $\boxed{Q_3}$ , the third quartile.

b) A score of 85 points is at which percentile?

85 points is at  $\boxed{P_{75}}$ , the 75<sup>th</sup> percentile.

c) What is the **median** of the class scores?

The median is at  $\boxed{70 \text{ points}}$ .

d) What is the **IQR (Interquartile Range)** of the class scores?

$$\text{IQR} = Q_3 - Q_1 = 85 - 45 = \boxed{40 \text{ points}}$$