

QUIZ 1 - SOLUTIONS

(LESSONS 1-10: INTRO and DESCRIPTIVE STATISTICS)

MATH 119 – FALL 2022 – KUNIYUKI

1) (3 points). A college has 500 classes. Seven classes are randomly selected. All the students in the seven classes take a survey. What sampling method is being used here? Box in the best answer:

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

Clusters (classes) are randomly selected and all the elements (members) of the clusters are surveyed.

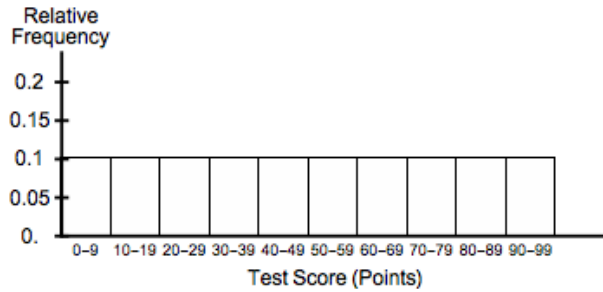
2) (5 points). A poll randomly selects 620 American adults. They are asked:

“What is the highest college degree that you hold: associate’s, bachelor’s, advanced, or none?”

Based on the observed frequencies below, find the corresponding relative frequencies. You may write your answers in fraction, decimal, or percent form. If you round off, round off to three significant digits. (Note: These figures are inspired by real data.)

Response	Frequency	Relative Frequency
Associate’s	65	$\frac{65}{620} \approx 0.105$ or 10.5%
Bachelor’s	146	$\frac{146}{620} \approx 0.235$ or 23.5%
Advanced	90	$\frac{90}{620} \approx 0.145$ or 14.5%
(No degree)	319	$\frac{319}{620} \approx 0.515$ or 51.5%
	Sum = n = 620	

- 3) (7 points). 70 students take an exam. A relative frequency histogram for their scores is below.



- a) (3 points). Estimate the relative frequency of scores in the 20s (between 20 and 29 points), as in class.

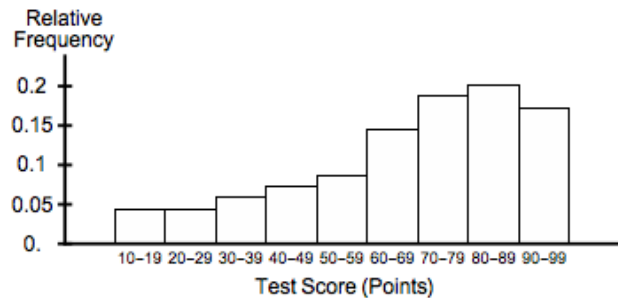
- b) (2 points). Name the type of distribution, as in class.

- c) (2 points). Box in the correct statement below.

§ The distribution is skewed.

§ The distribution is symmetric.

- 4) (2 points). Describe the skewness of the distribution below.



- 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) (37 points). The sample data below are the ages (in years) of people arrested for theft and booked at a county jail.

18 16 25 24 19 18

(Based on some real data.)

(Show work as we have in class.) Based on this data ...

- a) (4 points). Find the **mean** age (in years) of people arrested for theft and booked at the jail.

$$\text{The mean is: } \frac{18 + 16 + 25 + 24 + 19 + 18}{6} = \frac{120}{6} \approx \boxed{20.0 \text{ years}}$$

- b) (2 points). Find the **median position number**.

$$\text{The median position number is: } \frac{n + 1}{2} = \frac{6 + 1}{2} = \boxed{3.5}.$$

- c) (4 points). Find the **median** age (in years) of people arrested for theft and booked at the jail.

First, sort the values: 16 18 **18** **19** 24 25

The median is the **average of the third and fourth** lowest values: $\boxed{18.5 \text{ years}}$.

- d) (4 points). Find the **mode** of the ages (in years) of people arrested for theft and booked at the jail.

The mode is the most frequent value, $\boxed{18 \text{ years}}$.

- e) (4 points). Find the **midrange** of the ages (in years) of people arrested for theft and booked at the jail.

$$\text{The midrange is: } \frac{\text{Min} + \text{Max}}{2} = \frac{16 + 25}{2} = \boxed{20.5 \text{ years}}.$$

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

$$\text{Range} = \text{Max} - \text{Min} = 25 - 16 = \boxed{9 \text{ years}}.$$

- g) (6 points). Fill out the following table. For the sample mean, use your answer to Part a).

	Data (x) values in years	Deviations $(x - \bar{x})$ values	Squared Deviations $(x - \bar{x})^2$ values
Person #1	18	$18 - 20 = -2$	4
Person #2	16	$16 - 20 = -4$	16
Person #3	25	$25 - 20 = 5$	25
Person #4	24	$24 - 20 = 4$	16
Person #5	19	$19 - 20 = -1$	1
Person #6	18	$18 - 20 = -2$	4

- h) (1 point). What do the deviations from the sample mean add up to? .
- i) (4 points). Find the **sample variance**. Write your answer to one decimal place.

The sample variance is: $s^2 = \frac{\sum (x - \bar{x})^2}{n - 1} = \frac{66}{5} = \boxed{13.2 \text{ years}^2}$.

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

The sample SD is: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} = \sqrt{13.2} \approx \boxed{3.6 \text{ years}}$.

- 7) (12 points). A student's grade report for a term is below. Round off the GPA for the term to two decimal places. As stated in class, grades of "A," "B," "C," "D," and "F" are worth 4, 3, 2, 1, and 0 grade points, respectively. A "+" modifier adds 0.3, while a "-" subtracts 0.3. Show work, as in class!

Grade Report		
Course	Number of Units	Grade
Music	3	D-
Biology	5	B+
Math	7	A

Number of units taken by the student = $\sum w = 3 + 5 + 7 = 15$ units.

$$\text{GPA} = \frac{\sum w \cdot x}{\sum w} = \frac{(3)(0.7) + (5)(3.3) + (7)(4)}{15} = \frac{46.6}{15} \approx \boxed{3.11 \text{ grade points}}.$$

- 8) (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	10%	75
Quiz 2	10%	62
Midterm 1	15%	83
Midterm 2	15%	79
Final	50%	b

What must you get on the Final to get at least 80% in the class overall? (What kind of score do you need b to be?) Show work, as in class!

$$\frac{(0.10)(75) + (0.10)(62) + (0.15)(83) + (0.15)(79) + (0.50)b}{1} \geq 80$$

$$38 + 0.5b \geq 80$$

$$0.5b \geq 42$$

$$b > 84$$

You must get at least 84 points on the Final.

9) (12 points). According to the National Health Survey, the systolic blood pressures (in mm Hg) of women aged 18-24 years are approximately normally distributed with mean 114.8 mm Hg and standard deviation 13.1 mm Hg. (Note: mm Hg means “millimeters of mercury.”)

- a) (4 points). Use the “Two SD” (2σ) Rule for Usual Values to give an appropriate interval of usual systolic blood pressures (in mm Hg) of women aged 18-24 years.

$$\begin{aligned}(\mu - 2\sigma, \mu + 2\sigma) &= (114.8 - 2(13.1), 114.8 + 2(13.1)) \\ &= \boxed{(88.6 \text{ mm Hg}, 141.0 \text{ mm Hg})}\end{aligned}$$

- b) (2 points). According to the **Empirical Rule**, about what percent of systolic blood pressures (in mm Hg) of women aged 18-24 years are within **one** standard deviation of the mean?

About 68% of the systolic blood pressures (in mm Hg) of women aged 18-24 years are within one SD of the mean.

- c) (2 points). According to the **Empirical Rule**, about what percent of systolic blood pressures (in mm Hg) of women aged 18-24 years are within **two** standard deviations of the mean?

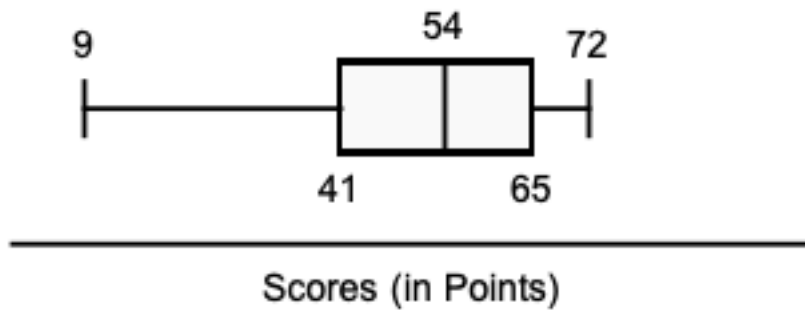
About 95% of the systolic blood pressures (in mm Hg) of women aged 18-24 years are within two SDs of the mean.

- d) (4 points). Elizabeth is a 21-year-old woman. Her systolic blood pressure is 130.0 mm Hg. What is the **z score** for Elizabeth’s systolic blood pressure (among women aged 18-24 years)? Round off your answer to two decimal places. Note: Elizabeth’s systolic blood pressure would be in the “usual” interval of values.

$$z = \frac{x - \mu}{\sigma} = \frac{130.0 - 114.8}{13.1} \approx \boxed{1.16}$$

Observe that this z score is between -2 and 2, which reflects the fact that 130.0 mm Hg was in the interval of usual values from a).

- 10) (9 points). 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 9 points. The maximum score is 72 points. There are no extreme outliers.



- a) (2 points). A score of 41 points is at which **percentile**?
41 points is at P_{25} , the 25th percentile.
- b) (2 points). A score of 65 points is at which **quartile**?
65 points is at Q_3 , the third quartile.
- c) (2 points). What is the **median** of the class scores?
The median is at 54 points.
- d) (3 points). What is the **IQR (Interquartile Range)** of the class scores?
 $IQR = Q_3 - Q_1 = 65 - 41 = 24$ points.