QUIZ 1 - SOLUTIONS

(LESSONS 1-10: INTRO and DESCRIPTIVE STATISTICS)
STAT C1000 – FALL 2026 – KUNIYUKI

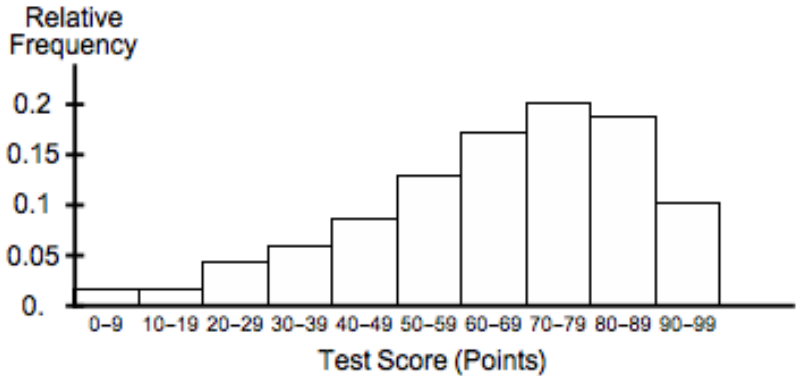
1) (3 points). A bookstore gives a survey to every tenth customer who makes a purchase. What sampling method is being used here? Box in one:

- 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) (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 50s (between 50 and 59 points).

  The relative frequency is between 0.1 and 0.15. (In fact, it is about 0.13.)

- b) (4 points). Describe the distribution shape. Consider modality and skewness.

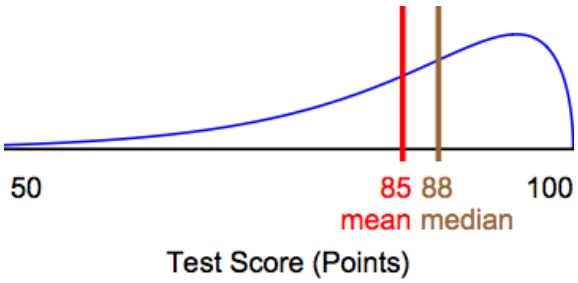
  This distribution is unimodal and left-skewed.

4) (3 points) Let's say we are analyzing a **left-skewed** distribution with no extreme outliers. For this kind of distribution, how does the mean tend to compare to the median? Box in one:

• The mean tends to be **lower** than the median.

• The mean tends to be **higher** than the median.

Consider the sample picture below:



5) (3 points). 30 schoolchildren are weighed one-by-one by the school nurse. The nurse writes down the resulting estimate of their mean weight. The nurse later finds that the scale is overestimating the weights, and the recorded weights of the 30 schoolchildren are all lowered by 5 pounds. The nurse then writes down the new estimate for their mean weight. How should the new estimate for the mean weight compare to the old estimate?

The new estimate for the mean weight should be 5 pounds lower than the old estimate.

6) (37 points). Six airlines are randomly sampled. The time period studied was from October 2008 to May 2009, and investigators counted "on-ground" flight delays of at least three hours for each of the six airlines. The investigators wanted to analyze the rate of such delays per 10,000 flights, and the following data was obtained:

Airline	**Rate of such delays per 10,000 flights**
American	1.3
Continental	4.1
Delta	2.8
Mesa	1.1
United	1.1
US Airways	1.6

• a) (4 points). Find the **mean** rate of such delays per 10,000 flights.

The mean is: $\frac{1.3+4.1+2.8+1.1+1.1+1.6}{6} = \frac{12}{6} =$ 2.00 delays per 10,000 flights.

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

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

• c) (4 points). Find the **median** rate of such delays per 10,000 flights.

First, sort the values: 1.1 1.1 **1.3** **1.6** 2.8 4.1

The median is the **average** of the **third** and **fourth** lowest values:

$$\frac{1.3+1.6}{2} = \frac{2.9}{2} = \boxed{1.45 \text{ delays per 10,000 flights}}.$$

• d) (4 points). Find the **mode** of the rate of such delays per 10,000 flights.

The mode is the most frequent value, $\boxed{1.1 \text{ delays per 10,000 flights}}$.

• e) (4 points). Find the **midrange** of the rate of such delays per 10,000 flights.

The midrange is: $\frac{\text{Min+Max}}{2} = \frac{1.1+4.1}{2} = \frac{5.2}{2} = \boxed{2.6 \text{ delays per 10,000 flights}}$.

Treat the airline data as sample data.

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

Range = Max – Min = 4.1 – 1.1 = $\boxed{3.0 \text{ delays per 10,000 flights}}$.

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

Airline	**Data** (x) values	**Deviations** $(x-\bar{x})$ values	**Squared Deviations** $(x-\bar{x})^2$ values
American	1.3	1.3 – 2 = $\boxed{-0.7}$	$\boxed{0.49}$
Continental	4.1	4.1 – 2 = $\boxed{2.1}$	$\boxed{4.41}$
Delta	2.8	2.8 – 2 = $\boxed{0.8}$	$\boxed{0.64}$
Mesa	1.1	1.1 – 2 = $\boxed{-0.9}$	$\boxed{0.81}$
United	1.1	1.1 – 2 = $\boxed{-0.9}$	$\boxed{0.81}$
US Airways	1.6	1.6 – 2 = $\boxed{-0.4}$	$\boxed{0.16}$

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

• i) (4 points). Find the **sample variance**. Round it off to two decimal places, but avoid rounding when doing Part j) below.

The sample variance is: $s^2 = \frac{\sum(x-\bar{x})^2}{n-1} = \frac{7.32}{5} \approx \boxed{1.46 \text{ delays}^2 \text{ per 10,000 flights}}$.

• j) (4 points). Find the **sample standard deviation**. Round it off to two decimal places.

The sample SD is: $s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} = \sqrt{\frac{7.32}{5}} \approx \boxed{1.21 \text{ delays per 10,000 flights}}$.

7) (11 points). A student's grade report for a term is below. Find 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**
English	5	C-
Math	4	B+
Volleyball	3	A

Number of units taken by the student = $\sum w = 5 + 4 + 3 = 12$ units.

$$\text{GPA} = \frac{\sum w \cdot x}{\sum w} = \frac{(5)(1.7) + (4)(3.3) + (3)(4)}{12} = \frac{33.7}{12} \approx \boxed{2.81 \text{ grade points}}.$$

8) (9 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?

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

$$41.25 + 0.30c \geq 70$$

$$4125 + 30c \geq 7000$$

$$30c \geq 2875$$

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

$\boxed{\text{You must get at least 96 points on the Final.}}$

9) (14 points). The birth weights of full-term babies are approximately normally distributed with mean 3500 grams and standard deviation 600 grams. (Source: *Ultrasound in Obstetrics and Gynecology*, 2009.)

- a) (4 points). Use the "Two SD" (2σ) Rule for Usual Values to give an appropriate interval of usual birth weights of full-term babies.

$$(\mu - 2\sigma, \mu + 2\sigma) = (3500 - 2(600), 3500 + 2(600))$$
$$= \boxed{(2300 \text{ grams}, 4700 \text{ grams})}$$

- b) (2 points). According to the **Empirical Rule**, about what percent of birth weights of full-term babies are within **one** standard deviation of the mean?

  About 68% of such birth weights are within one SD of the mean.

- c) (2 points). According to the **Empirical Rule**, about what percent of birth weights of full-term babies are within **two** standard deviations of the mean?

  About 95% of such birth weights are within two SDs of the mean.

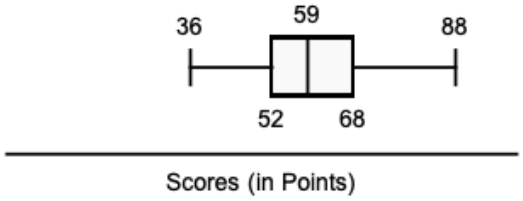
- d) (4 points). If the birth weight of a full-term baby is 2500 grams, what would be the ***z* score** for that birth weight to two decimal places?

$$z = \frac{x-\mu}{\sigma} = \frac{2500-3500}{600} \approx \boxed{-1.67}$$

- e) (2 points). **Interpret the *z* score** from d), as in class.

  The baby's birth weight is **1.67 standard deviations (SDs) below the mean**.

10) (10 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 36 points. The maximum score is 88 points. There are no extreme outliers.



- a) (2 points). A score of 52 points is at which **quartile**?

  52 points is at Q_1, the first quartile.

- b) (2 points). A score of 52 points is at which **percentile**?

  52 points is at P_{25}, the 25th percentile.

- c) (2 points). What is the **median** of the test scores in the class?

  The median is at 59 points.

- d) (4 points). What is the **IQR (Interquartile Range)** of the test scores?

  IQR = $Q_3 - Q_1$ = 68 – 52 = 16 points.