

Midterm 1 - STAT 303  
Fall 2021

Name: Solutions

**Signature for Aggie Honor Code:**

1. This is a closed book examination. You can only bring the normal z-tables to this exam. Use the cheat sheet provided on my website.
2. You have 60 minutes to work on this exam. There are 15 multiple choice questions. If you cannot do one question move on to the next.
3. You may use a calculator.
4. Partial credit is only given to answers which are correct (not partially correct).
5. If you are unsure of what a question is asking for, do not hesitate to ask the instructor or course assistant for clarification.
6. I use  $sd$  to denote standard deviation.
7. Please return the exam question paper and your scantron after completing the exam. I will return your exam question paper on a later date.
8. Good Luck!!!

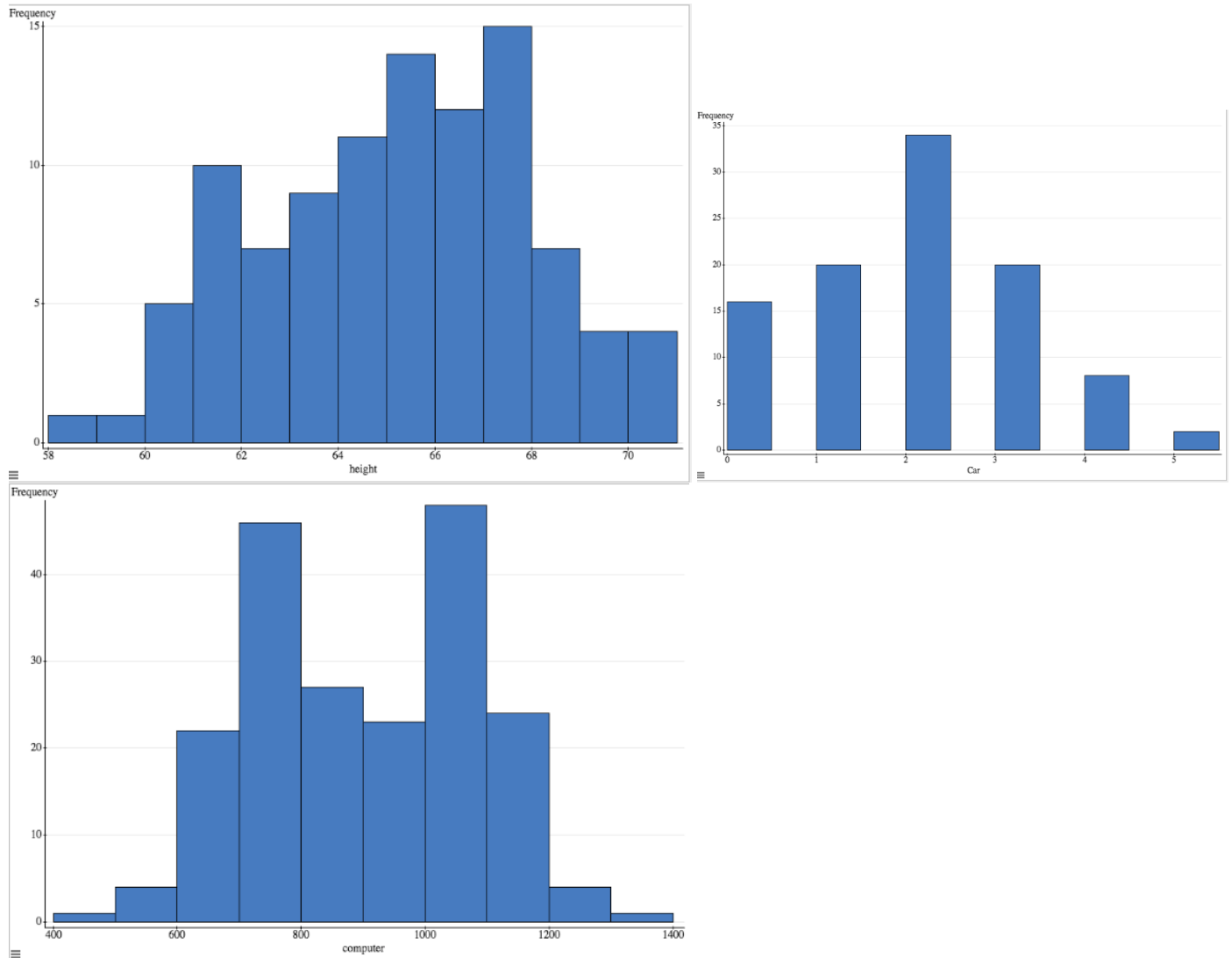


Figure 1: Top Left: Plot (1) x-axis goes from 58-71. Top Right: Plot (2) x-axis goes from 0-6. Bottom Left: Plot (3). x-axis goes from 400-1400.

1.

Match the plot with the mean and standard deviation (sd).

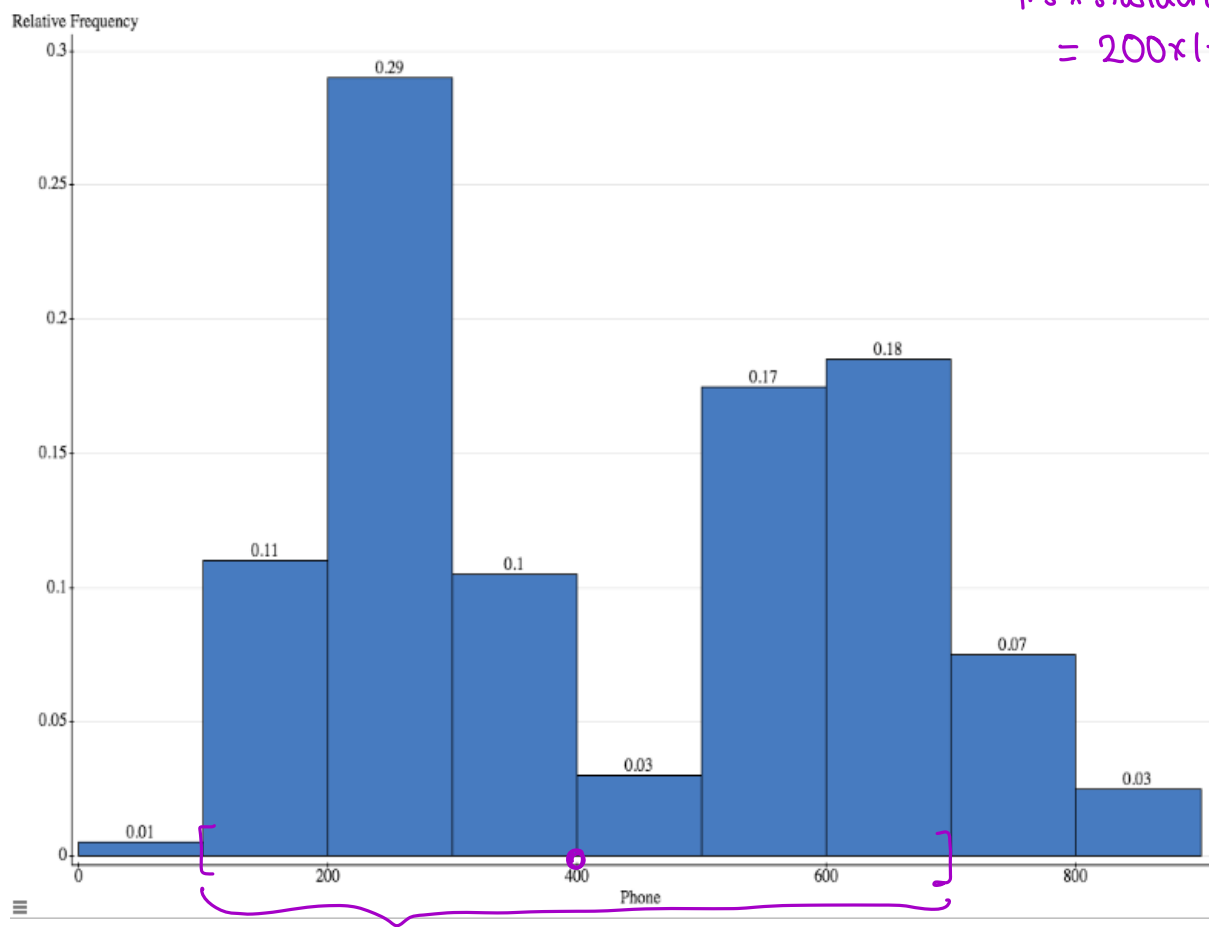
	(1)	(2)	(3)
A	mean = 65, sd = 1	mean = 1.9, sd = 0.8	mean = 900, sd 60
<b>B</b>	mean = 65, sd = 2.7	mean = 1.9, sd = 1.2	mean = 900, sd = 179
C	mean = 70, sd = 12	mean 2, sd = 6	mean = 900, sd = 1000
D	mean = 63, sd = 6.5	mean = 2, sd = 3	mean = 1000, sd = 500
E	mean = 70, sd = 6.5	mean = 5, sd = 6	mean 1400, sd = 1000

- (2) Student walking into the MSC are being interviewed. They are asked (1) their Covid vaccine status (yes, no) (2) what bus they take (3) the number of house mates (4) their weight. Match the variable with the most appropriate type of variable.

	Vaccine?	Bus?	Number of Housemates?	Weight?
A	Categorical	Numerical discrete	Numerical discrete	Numerical discrete
<b>B</b>	Binary	Categorical	Numerical discrete	Numerical continuous
C	Binary	Numerical discrete	Binary	Numerical continuous
D	Numerical continuous	Numerical discrete	Binary	Numerical continuous
E	Numerical discrete	Numerical discrete	Categorical	Numerical discrete

3. Below is a relative frequency histogram for the price of cell phones (in dollars). The mean is **400** and standard deviation **200**.

Use the relative frequency histogram, below, to find the proportion of temperatures that are within **1.5** standard deviations of the mean (the answer is **not** stated as a percentage)?



- (A) 0.13 (B) 0.3 (C) 0.6 **(D) 0.88** (E) 1

$$\left. \begin{array}{l} Q_1 = 25\% = 5 \\ Q_3 = 75\% = 5 \end{array} \right\} \text{At least 50\% of data is the same.}$$

4. The **first** quartile of a data set is 5 and the **third** quartile is 5. Based on this information which statement is correct?

- (A) The standard deviation must be zero and all the data **must** be the same.
- $\frac{1}{2}$  (B) At **least** 50% of the data is the same.
- (C) At **most** 50% of the data is the same.
- $\frac{1}{2}$  (D) The median is 5.
- (E) [B] and [D]. \*

5. Last week the mean temperature was  $90^\circ F$  and the interquartile range (difference between third and first quartile  $Q_3 - Q_1$ ) was  $15^\circ F$ .

The formula for converting temperatures from Fahrenheit to Celsius is

$$\text{Celsius} = \frac{5}{9} \times \text{Fahrenheit} - \frac{160}{9}.$$

What is the mean temperature and interquartile ranges for the temperatures last week in Celsius?

- (A) The mean was  $50^\circ C$  and the interquartile range was  $9.4^\circ C$ .
- (B) The mean was  $50^\circ C$  and the interquartile range was  $-9.4^\circ C$ .
- (C) The mean was  $32^\circ C$  and the interquartile range was  $8.3^\circ C$ .
- (D) The mean was  $32^\circ C$  and the interquartile range was  $-9.4^\circ C$ .
- (E) The mean was  $32^\circ C$  and the interquartile range was  $-8.3^\circ C$ .

$$\text{New mean} = \frac{5}{9} \times 90 - \frac{160}{9}$$

$$= 32^\circ C$$

$$\text{New IQR} = \frac{5}{9} \times 15$$

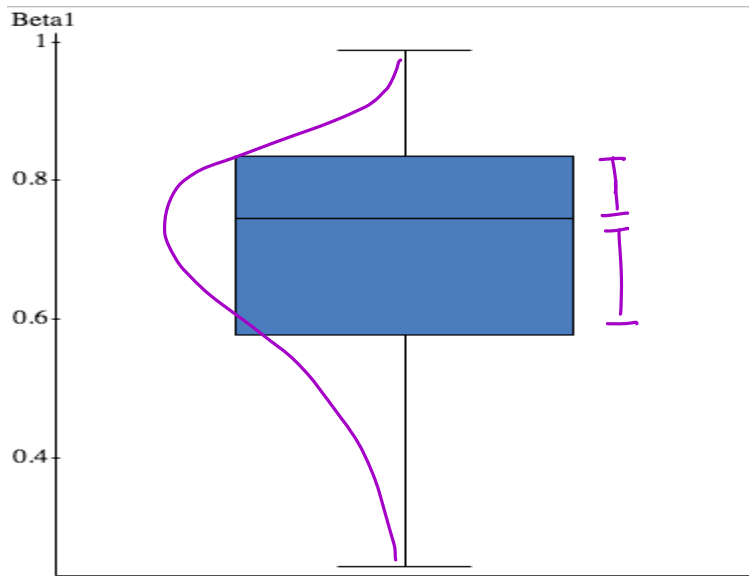
$$= 8.3$$

6. The mean temperature in College Station during September is **90F** with standard deviation **10F**. Last Wednesday, the temperature was **2.5** standard deviations to the **left** of the mean. What was the temperature?

- (A) 87.5F (B) 115F (C) 80F (D) 65F (E) 92.5F

$$90 - 2.5 \times 10 = 90 - 25 = 65 F$$

7. The following boxplots is based on a certain data set.



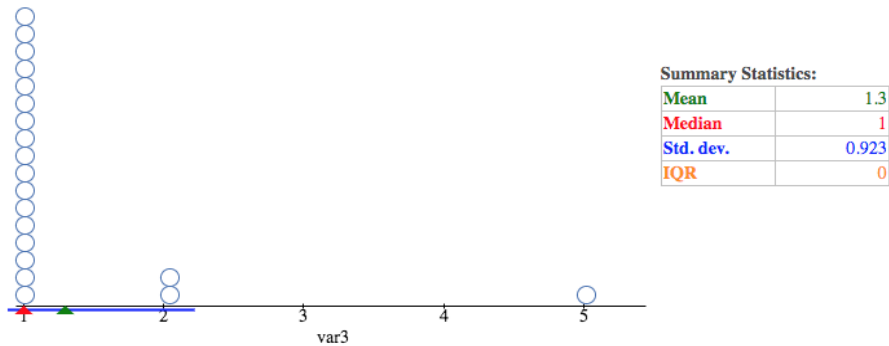
Based on the boxplot, what is the most likely shape of the underlying distribution.

- (A) Uniform
- (B) Symmetric
- (C) Bimodal
- (D) Right skewed.
- (E) Left skewed.

8. In order to draw a sample of 100 children from College Station, each child in College Station is assigned a number and 100 numbers are randomly drawn (with replacement). What can we say about this method of sampling?

- (A) It is a simple random sample (SRS)
- (B) It is a **biased** sample of children from College Station.
- (C) It is an **unbiased** sample of children from College Station.
- (D) [A] and [C]
- (E) [A] and [B].

9. Below 20 observations are plotted on a time line.



What happens if **one** ball on number **1** is moved to number **5**.

- (A) The *median* and *IQR* stay the **same**, but the *mean* and *standard deviation* **change**.
- (B) The *mean* and *standard deviation* stay the **same**, but the *median* and *IQR* **change**.
- (C) The *mean* and *median* stay the **same**, but the *standard deviation* and *IQR* **change**.
- (D) The *standard deviation* and *IQR* stay the **same**, but the *mean* and *median* **change**.
- (E) None of the above.

10. In the Oxford-AstroZenca vaccine trials 34,400 participants were involved. 17195 were given the vaccine and 17205 were given a placebo (the placebo was the vaccine for meningitis). Below the numbers who developed Covid and did not develop Covid after their second vaccination is given below.

Group	Covid Positive	Covid Negative	Total
Vaccine	12	17183	17195
Placebo	85	17120	17205

The numbers in both groups are about the same. so we can compare

Which statement is correct?

- (A) The proportion of people who developed Covid in both groups is approximately the same.
- (B) Among the participants who we given the placebo, the proportion who went on to develop Covid is 0.24% (stated as percent).
- (C) Approximately 7 times **more** people given the placebo developed Covid as compared to those given the vaccine.
- (D) [A] and [B]    (E) [B] and [C].

$$\frac{85}{12} \approx 7$$

11. Guy scores 85% in both his maths exam and history exam.

The mean grade in the math exam is 75% with standard deviation 3%.  $z = \frac{85-75}{3} = 3.3$

The mean grade in the history is 75% with standard deviation 15%.  $z = \frac{85-75}{15} = 0.66$

Based on this information, which statement(s) is true?

- (A) Guy's math grade lies far above the majority of grades.  $\rightarrow z$ -score is in the tails
- (B) Guy's math grade lies reasonable close to the mean grade, relative to the standard deviation.
- (C) Guy's history grade lies far above the majority of grades.
- (D) (A) and (C)      [E] (B) and (C).

12. Around the world scientists are monitoring the efficacy of Covid vaccines. The data is being collected in different ways:

*Experimental because there was an intervention*

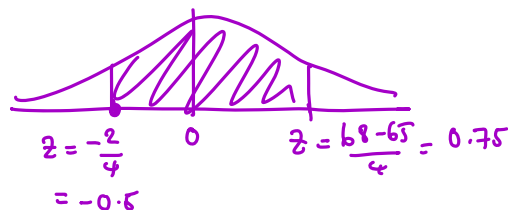
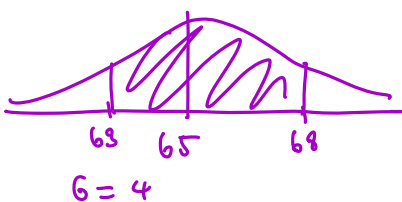
1. In a Human Challenge Trial, 20 volunteers (under the age of 30) were placed into two groups. One group was given a Covid vaccine the other was given a Placebo. Three weeks later all the 20 volunteers were injected with small amounts of Covid and monitored in a hospital.
2. TAMU survey 100 students on campus, the students were asked if they have been vaccinated and had the contracted Covid at least 2 weeks after vaccinations.
3. At CVS pharmacy everyone who takes a Covid test is asked about their vaccination status. This information is recorded and reported to the CDC.

The above are examples of:

	1	2	3
A	Observational	Experimental	Experimental
B	Observational	Observational	Experimental
C	Anecdotal Evidence	Observational	Experimental
D	Experimental	Observational	Observational
E	Observational	Experimental	Anecdotal Evidence

13. The mean height of American females is 65 inches with standard deviation 4 inches. Suppose female is normally distributed. What proportion of females are between 63 to 68 inches?

- (A) 46.5%    (B) 75%    (C) 8%    (D) 25% p    (E) 68%



14. The mean height of American males is **69** inches with standard deviation **3** inches.

The mean height of American females is **65** inches with standard deviation **4** inches.

Jack (male) and Emily (female) are siblings. Jack's height is **66** inches and Emily's height is **63** inches.

Male and female heights are normally distributed. Relative to their gender, which statement is correct?

(A) Jack is 3 inches taller than Emily.

(B) Emily is in the 30th percentile, whereas Jack is in the 16 percentile. Emily is taller than Jack, relative to gender.

(C) Emily is in the 70th percentile, whereas Jack is in the 84 percentile. Jack is taller than Emily, relative to gender.

(D) Emily is in the 50th percentile, whereas Jack is in the 10 percentile. Emily is taller than Jack, relative to gender.

15. A doctor takes 10 blood samples from 10 healthy patients and obtains the measurements 18.47 21.09 15.15 17.73 17.17 23.11 16.91 15.42 16.57 18.95. The mean of this sample is **18.06** and the standard deviation is **2.48**. Another patient arrives at the doctors surgery. The doctor takes her sample which is **20**. How many standard deviations is she from the (healthy) mean and would you say her measurement is far from the majority (bulk) of healthy patient measurements?

(A) The patient's measurement is 0.78 standard deviations to the right of the mean, this lies within the majority of healthy patients. The data does not suggest anything abnormal. → But we cannot know for sure from just the data

(B) The patient's measurement is 0.78 standard deviations to the right of the mean, this lies within the majority of healthy patients. Based on this measurement she is definitely healthy.

(C) The patient's measurement is 1.94 standard deviations to the right of the mean. This is 'far' from where the majority of healthy measurements, this suggests her measurement may be abnormal.

(D) The patient's measurement is 1.94 standard deviations to the left of the mean. This is quite close to where most healthy measurements lie, so she must be healthy.

(E) The patient's measurement is 8 standard deviations to the right of the mean. This far from where the majority of healthy measurements lie, so she must be healthy.