PSTAT 5A / **MIDTERM EXAM 1** / Spring 2023 Instructor: **Ethan Marzban**

Name:_____ **UCSB NetID:**_____
First, then Last *NOT your Perm Number!*

Circle the section you <u>attend</u>:

Yuan 10 - 10:50am   Jason 11 - 11:50am   Nickolas 12 - 12:50pm   Nickolas 1 - 1:50pm

Your Seat Number:_____

Person Sitting to your Left:_____

Person Sitting to your Right:_____

Instructions:

- You will have **65 minutes** to complete this exam.

- You are allowed the use of a single **8.5 × 11-inch** sheet, front and back, of notes. You are also permitted the use of **calculators**; the use of any and all other electronic devices (laptops, cell phones, airpods/headphones, etc.) is prohibited.

- For Multiple Choice Questions: fill in the bubble corresponding to your answer directly on the exam. Partial credit will **not** be awarded.

- For Free Response Questions: be sure to include **all** of your work! Correct answers with no supporting work will **not** receive full points.

- **PLEASE DO NOT DETACH ANY PAGES FROM THIS EXAM.**

- Good Luck!!!

Honor Code: In signing my name below, I certify that all work appearing on this exam is entirely my own and not copied from any external source. I further certify that I have not received any unauthorized aid while taking this exam.

✕_____

Problem 1. If the variable X contains measurements on the duration (in minutes) of 100 different flights from SBA to EWR, what is the correct classification of X? [1pts.]

    ○ discrete

    ○ continuous

    ○ nominal

    ○ ordinal

Problem 2. Suppose a password for a particular website must be 5 characters long, consisting of exactly 2 digits (0 through 9), 2 letters (A through Z), and 1 special character (!, @, #, $, %), <u>in that order</u>. What is the total number of passwords that can be constructed using this scheme? [1pts.]

    ○ 1,300

    ○ 73,125

    ○ 292,500

    ○ 338,000

    ○ None of the above.

Problem 3. Jana has run the following code: [1pts.]

```python
def f(x, y):
    """return the sum of x and y"""
    x + y
```

What will be the output of running `f(1, 2)`?

    ○ 3

    ○ Nothing

    ○ An Error

    ○ [1, 2]

    ○ None of the above.

Problem 4. Events A and B are such that $\mathbb{P}(A) = 0.3$, $\mathbb{P}(B) = 0.8$, and $\mathbb{P}(A \cap B) = 0.24$. Select the statement that is correct. [1pts.]

    ○ A and B are independent, but not disjoint

    ○ A and B are disjoint, but not independent

    ○ A and B are both disjoint and independent

    ○ A and B are neither disjoint nor independent

Problem 5. **True or False:** If $\{x_i\}_{i=1}^n$ is a set of numbers with mean $\overline{x}$, then the mean of the set $\{ax_i\}_{i=1}^n$ for a fixed constant a is simply $a \cdot \overline{x}$. [1pts.]

○ True

○ False

○ Not Enough Information to Determine

Problem 6. Guadalupe would like to visualize the relationship between a person's favorite color and their height. Which type of graph should she use? [1pts.]

○ A bargraph

○ A histogram

○ A side-by-side boxplot

○ A scatterplot

○ None of the above

Problem 7. In what module is the function `make_array()` found? [1pts.]

○ `datascience`

○ `numpy`

○ `python_arrays`

○ None of the above

Problem 8. In a variable re-assignment statement in Python, which side of the equality does Python evaluate first? [1pts.]

○ Right

○ Left

Problem 9. In order for $\mathbb{P}(A \mid B)$ to be defined for two events A and B, which of the following conditions must be true? **Select only ONE answer choice**. [1pts.]

○ $\mathbb{P}(A) \neq 0$

○ $\mathbb{P}(B) \neq 0$

○ $\mathbb{P}(A \cap B) \neq 0$

○ $\mathbb{P}(A \cup B) \neq 0$

○ None of the above.

Problem 10. Which of the following is **not** a measure of spread? [1pts.]

○ Interquartile Range

○ Standard Deviation

○ 50th Percentile

○ Range

○ None of the above

Free Response Questions

Problem 11. In a clinical trial, subjects were administered one of three different dosages of a particular drug. 3 hours later, the insulin count (in miU/Liter) of each subject was taken and recorded. The results of the trial are displayed below:

Results of the Clinical Trial
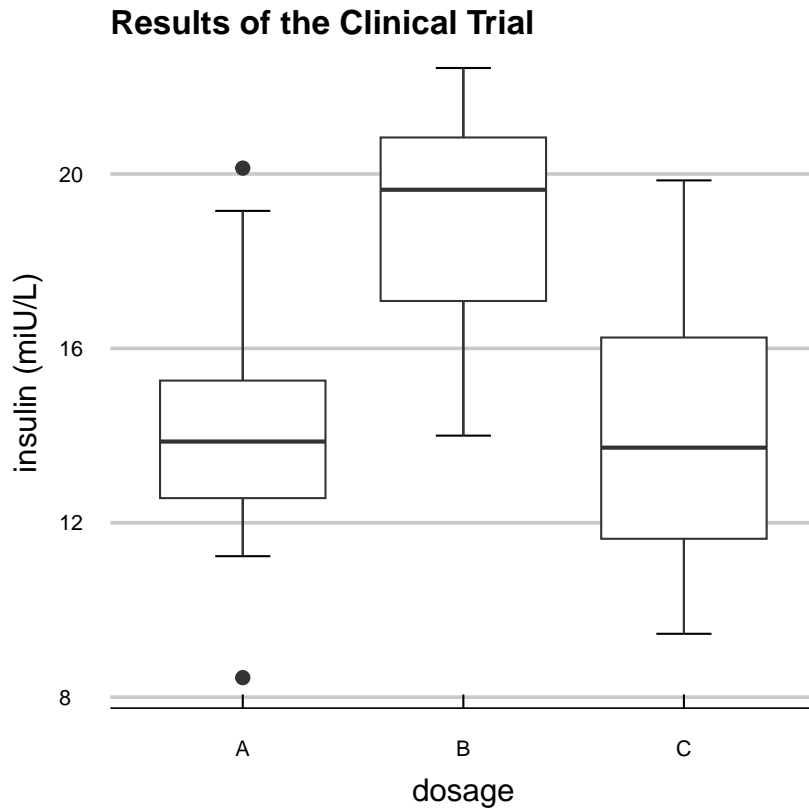
(a) Provide the 5-number summary for the insulin levels of subjects who were administered dosage A. Round your numbers to the nearest decimal place. [3pts.]

(b) Approximately what percent of subjects who were administered dosage C had insulin levels lower than 16.1 miU/L? [2pts.]

(c) Does there appear to be a difference in insulin levels across dosages? Explain in one or two brief sentences. [3pts.]

Problem 12. Consider the set of numbers

$$B = \{-2, \ -1.5, \ 0, \ 8\}$$

(a) Compute $\bar{b}$, the mean of B. [3pts.]

(b) Compute the standard deviation of B. [4pts.]

(c) Compute the median of B. [2pts.]

Problem 13. Three numbers are to be selected at random from the set $\{-1, 1\}$. Assume we replace the numbers after each draw, and assume that the order in which the numbers are selected <u>is</u> important.

(a) Write down the outcome space Ω for this experiment. [3pts.]

(b) How many elements are in Ω? [2pts.]

(c) Are we justified in using the Classical Approach to probability in this problem? Why or why not? [1pts.]

(d) Let A denote the event "the first number selected was greater than the second number selected." Write down the mathematical formulation of A; i.e. identify the outcomes that are contained in A.   [3pts.]

(e) Let E denote the event "the sum of the three numbers selected is 1". Compute $\mathbb{P}(E)$ using the classical approach to probability.   [4pts.]

Problem 14. It is known that 5% of people in the town of *Gauchoville* are affected by a particular disease. There is a test for this disease, however it is imperfect-specifically, it has a 25% false positive rate and a 10% false negative rate.

(a) Define appropriate notation (i.e. define relevant events), and translate the information provided into the problem to be in terms of the events you define. [2pts.]

(b) What is the probability that a randomly selected person will both have the disease <u>and</u> test positive? [2pts.]

(c) What is the probability that a randomly selected person will test positive? [3pts.]

(d) Suppose Fatima has tested herself for the disease, and her test returned a positive result. What is the probability that she actually has the disease? [3pts.]

You may use this page for scratch work, if necessary. Keep in mind that NOTHING on this page will be graded.