

PSTAT 5A / MIDTERM EXAM 1 / Spring 2023

Instructor: Ethan Marzban

Name: \_\_\_\_\_  
*First, then Last*

UCSB NetID: \_\_\_\_\_  
*NOT your Perm Number!*

Circle the section you attend:

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.

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

- True
- False
- Not Enough Information to Determine

**Problem 2.** 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 3.** Jana has run the following code: [1pts.]

```
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.** 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 ( $!$ ,  $@$ ,  $\#$ ,  $\$$ ,  $\%$ ), in that order. 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 5.** In a variable re-assignment statement in Python, which side of the equality does Python evaluate first? [1pts.]

- Right
- Left

**Problem 6.** Which of the following is **not** a measure of spread? [1pts.]

- Interquartile Range
- Standard Deviation
- 50<sup>th</sup> Percentile
- Range
- None of the above

**Problem 7.** 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 8.** In order for  $\mathbb{P}(A | B)$  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 9.** Guadalupe would like to visualize the relationship between a person's favorite color and their height. Which type of graph should she use? [1pts.]

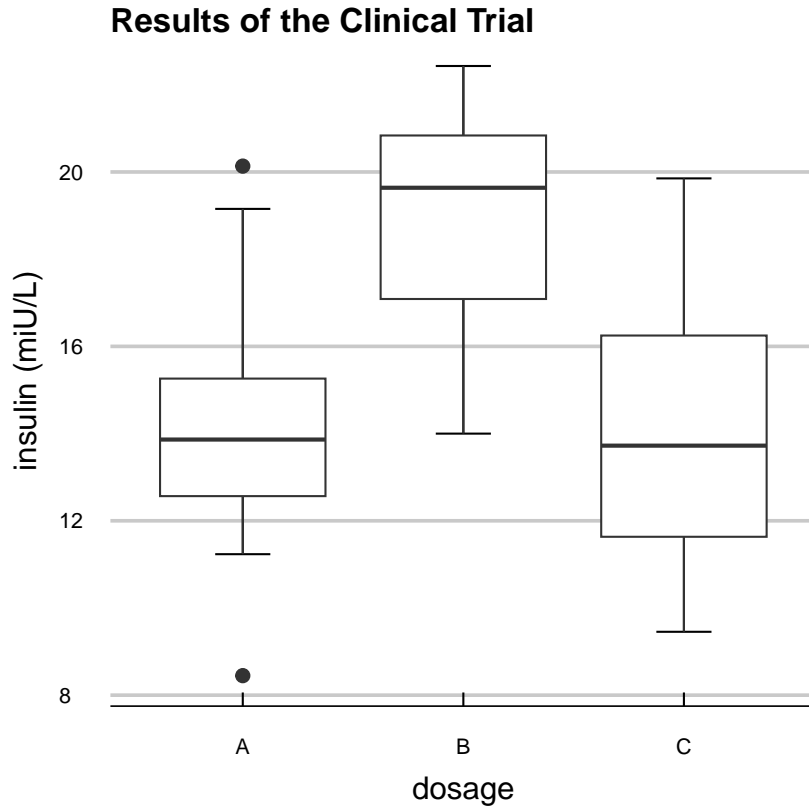
- A bargraph
- A histogram
- A side-by-side boxplot
- A scatterplot
- None of the above

**Problem 10.** In what module is the function `make_array()` found? [1pts.]

- datascience
- numpy
- python\_arrays
- 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:



(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.** 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 and 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.]

**Problem 14.** Three numbers are to be selected from the set  $\{-1, 1\}$ . Assume we replace the numbers after each draw, and assume that the order in which the numbers are selected is important.

(a) Write down the outcome space  $\Omega$  for this experiment.

[3pts.]

(b) How many elements are in  $\Omega$ ?

[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.]



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

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