CSCI 3022 **PRACTICE Exam 1- Spr 23**

Write **clearly** and **in the box**:

Name:	**Student ID:**

Exam Rules:

DO NOT TURN THIS PAGE OVER UNTIL THE EXAM BEGINS.

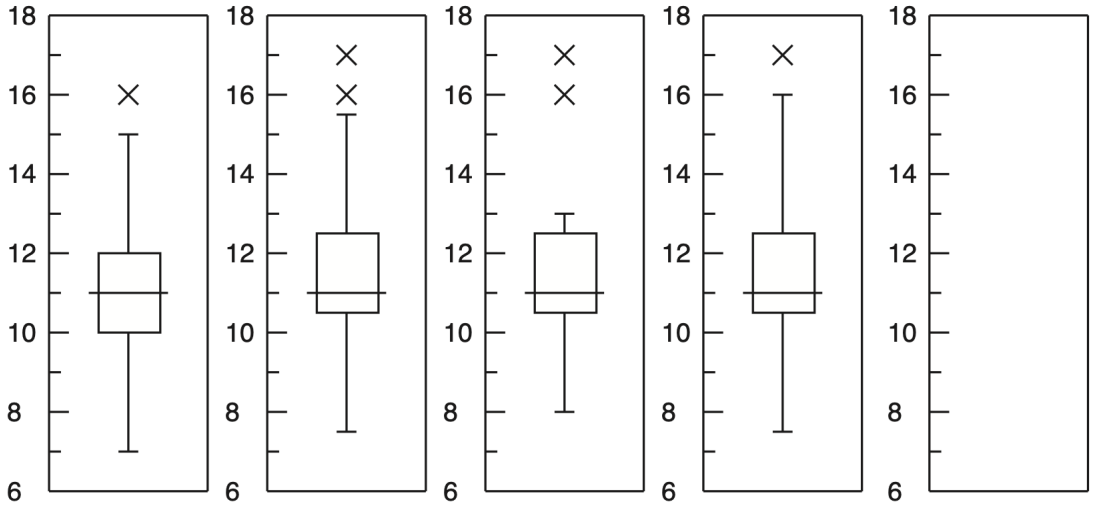
- All cell phones must be stored in your backpack. If you have a cell phone anywhere on your body or at your desk during this exam you will receive a 0 on this exam.
- You are allowed a one-sided 8.5" x 11" crib sheet with hand-written (not typed) notes.
- No other outside resources including calculators, tablets, smartphones, smartwatches or any other electronic devices allowed.
- No collaboration with other students is allowed during this exam.
- **Show all work and simplify your answers!** Answers with no justification will receive no points.
- You have **50 minutes** for this exam.

CSCI 3022:
Part 1: Free Response Questions
Show all steps and explain your work for the following questions.
If your answers do not fit on a given page MAKE A NOTE of where the work is continued or it will NOT be graded!

1. Consider the following two datasets:

$$X = \{8, 8, 10, 11, 11, 11, 11, 12, 13, 16, 17\}$$

$$Y = \{7, 8, 10, 10, 11, 11, 12, 12, 12, 12, 16\}$$



(a) There are 4 boxplots and one empty plot above. For each dataset, X and Y , identify which boxplot, if any, represents that dataset. If the correct boxplot for one of the datasets is not provided, please correctly draw it in the blank axes. Use the conventions for boxplots introduced in class, and fully justify your choices using the space provided. Be sure to address all aspects of the boxplot.

(b) Classify each dataset, X and Y , as symmetric, positively skewed, or negatively skewed. Clearly justify your response.

2. Suppose the probability of heavy snow tomorrow is 50%, the probability of strong winds is 40%, and the probability of heavy snow or strong winds is 60%.

   Based on these probabilities, are the events heavy snow tomorrow and strong winds tomorrow independent or dependent? Justify your answer mathematically.

3. You have a box with 10 six-sided dice in it. As it turns out, two of the dice are misprinted and have faces $\{4, 5, 5, 6, 6, 6\}$. What a mess! Also, the power is out, and you have no flashlight, so you can't even look at the dice. Ugh. The point is, Professor Oscamou is there for you, and she agrees to tell you the results of any rolls (using her department-issued night-vision goggles).

   (a) You choose a die at random and roll it 3 times in a row. What is the probability that Professor Oscamou tells you that you rolled two 6s and one 5? You can leave your answer unsimplified.

   (b) You choose a die at random. You roll it four times and Professor Oscamou tells you two rolls were 6s, 1 roll was a 5 and 1 roll was a 4. What is the probability that the die that you chose was one of the **misprinted** dice? You can leave your answer unsimplified.

CONT'D ON NEXT PAGE

.

CSCI 3022: Final Exam
Part 2: FILL IN THE BLANK/MULTIPLE CHOICE QUESTIONS.
Show all work for these problems. Write final answers in the boxes provided. You may use the provided blank pages for any scratchwork.

ANSWER

4. Suppose you have a list consisting of all the first generation Pok?emon and their types (Water, Ground, Fighting, etc.). You are conducting a study of how many of them are actually stronger than Mudkip - the cutest Pok?emon ever - by drawing a sample from his Pok?edex, which you have sorted alphabetically. You write a loop that will randomly pick two Pok?emon of each type and compares those selected Pok?emons statistics to Mudkips. What type of sample did you collect?

5. If y can be any real number, what values can the median of this dataset take?
$[1, 2, \pi, y, 5]$

- ◯ $[1, 5]$
- ◯ $(-\infty, \infty)$
- ◯ $[2, \pi]$
- ◯ $(2, \pi)$
- ◯ In this case the median is undefined because π is irrational
- ◯ None of the above

6. The probability that a midterm exam question is about the Kansas City Chiefs is $3/4$ if Professor Oscamou is tired and $1/2$ if she's not tired. Professor Oscamou is tired with probability $1/4$. Given that this problem is about the Chiefs, what is the probability that Professor Oscamou is tired?

7. Consider the sample data sets: X $= \{x_1, x_2, x_3, x_4, ...x_n\}$, and $Y = \{y_1, y_2, y_3, y_4, ...y_n\}$, where $y_k = 5x_k + 10$.
If the sample standard deviation of $X = 3$, then what is the sample standard deviation of Y?
.

CONTD ON REVERSE

8. The following simulation estimates a specific probability:

```
box1 = {'balls' : np.array(["green", "red", "purple"]), 'probs' : np.array([2/14, 7/14, 5/14])}
box2 = {'balls' : np.array(["green", "red", "purple"]), 'probs' : np.array([4/12, 3/12, 5/12])}
box_choices = {'boxes' : np.array([box1, box2]), 'probs' : np.array([2/3, 1/3])}

def funtimes(box_choices):
    b = np.random.choice(box_choices['boxes'], p = box_choices['probs'])
    return np.random.choice(b['balls'], p = b['probs'])

NumSamples=1000
m = np.array([funtimes(box_choices) for ii in range(num_samples)])

print(np.sum(m == 'purple') / NumSamples)
```

a). What theoretical probability is this code estimating?

b). Calculate the exact probability for the quantity you listed in part (a). i.e. what number should this code output approach as you increase NumSamples?

---

9. After hearing that you have been researching disaster prevention in CSCI3022, FEMA has reached out to you to try to get a better understanding of the odds of a major hurricane hitting New Orleans. They estimate that any given year, theres about an 8% chance of having a major hurricane hit New Orleans. What is the probability that in the next 10 years there are at least 2 years with a major hurricane that hits New Orleans? You can leave your answer unsimplified.
.

---

10. The following function $f(x)$ is a pmf for a discrete random variable X:

$$f(y) = c\left(\frac{1}{4}\right)^y, \text{ where } y = 1, 2, 3, ...\infty \text{ (i.e. } y \in Z^+)$$

What is c?

END OF EXAM