15-110 Check6-2 - Written Portion

Name:

AndrewID:

#1 - Choosing Visualizations - 8pts

Given the description of the data below, what visualization(s) could you use? Select all that apply.

Graph Exam1 numerical grades on one axis and Exam2 numerical grades on the other.
- ☐ Bar Chart
- ☐ Box and Whiskers Plot
- ☐ Bubble Plot
- ☐ Colored Scatter Plot
- ☐ Histogram
- ☐ Line Plot
- ☐ Pie Chart
- ☐ Scatter Plot
- ☐ Scatter Plot Matrix

Graph final letter grades, Exam1 numerical scores, and Exam2 numerical scores.
- ☐ Bar Chart
- ☐ Box and Whiskers Plot
- ☐ Bubble Plot
- ☐ Colored Scatter Plot
- ☐ Histogram
- ☐ Line Plot
- ☐ Pie Chart
- ☐ Scatter Plot
- ☐ Scatter Plot Matrix

Graph counts of the numbers of A's, B's, C's, etc in the class.
- ☐ Bar Chart
- ☐ Box and Whiskers Plot
- ☐ Bubble Plot
- ☐ Colored Scatter Plot
- ☐ Histogram
- ☐ Line Plot
- ☐ Pie Chart
- ☐ Scatter Plot
- ☐ Scatter Plot Matrix

Graph the final numerical grades of students by recitation section.
- ☐ Bar Chart
- ☐ Box and Whiskers Plot
- ☐ Bubble Plot
- ☐ Colored Scatter Plot
- ☐ Histogram
- ☐ Line Plot
- ☐ Pie Chart
- ☐ Scatter Plot
- ☐ Scatter Plot Matrix

#2 - Matplotlib - 7pts

For each of the following lines of matplotlib code from lecture, write a short statement that explains **at a high level** what the code does. Some lines of code have been modified slightly.

```
ax.hist(data, bins=5)
```

```
flavors = [ "vanilla", "chocolate", "strawberry" ]
ax.set_xticklabels(flavors)
```

```
menMeans = [20, 35, 30, 35, 27]
menStd = [2, 3, 4, 1, 2]
mensInd = np.arange(5)
rects1 = ax.bar(mensInd, menMeans, width, color='r', yerr=menStd)
```

#3 - Monte Carlo Methods - 9pts

For each of the following questions, use **Monte Carlo methods** to find the answer to the given question. You can use the `monteCarlo(trials)` function from the notes to average results over `100,000` trials; you just need to update the `runTrial()` function for each question.

Please submit your answer as a decimal probability (1 = 100%, 0.5 = 50%), and round your answer for each question to have only 2 digits after the decimal point.

What is the probability that, if you roll a die twice, the second roll will be either 1 larger or 1 smaller than the first?

For example, you could roll a 4 and then a 5, or a 4 and then a 3.

Pick a random odd number between 1 and 99. What is the probability that that number is a multiple of 7?

Hint: make a list of all odd numbers between 1 and 99, then use `random.choice()`

Make a list with six values (two `"red"`, two `"green"`, two `"blue"`) and shuffle it. What is the probability that the first two values in the list are both `"red"`?

Hint: use the destructive function `random.shuffle()`

#4 - Advanced Simulation - 6pts

Recall the zombie outbreak simulation we wrote in class. The following questions test your understanding of how all the code works together.

Which of the following segments of code set up the original number of zombies?

```
☐ for zombie in range(5):  data["creatures"].append(...
☐ move = random.choice([[-1, 0], [1, 0], [0, -1], [0, 1]])
☐ creature[2] = "zombie"
```

Which of the following segments of code made a zombie move in a random direction?

```
☐ row = creature[0] ; col = creature[1]
☐ creature[0] += move[0] ; creature[1] += move[1]
☐ zombiePositions.append([creature[0], creature[1]])
```

Which of the following segments of code determined whether or not a specific human was infected?

```
☐ data["rate"] = 0.5
☐ if creature[2] == "human":  color="purple" ; else:  color="green"
☐ odds = random.random() ; if odds < data["rate"]:  ...
```

#5 - Machine Learning Process - 7pts

Imagine a scenario where Bill wants to train a machine learning algorithm to identify which pictures on the internet have cats in them. He downloads 1,000 pictures of cats from the internet, decides to use a basic image recognition algorithm, trains on all 1,000 pictures, then tests his on a quarter of that dataset (250 pictures). He finds that his algorithm has a 97% success rate, which he publishes on his blog.

Bill made a few mistakes in this process. **What was his biggest mistake?**

#6 - Game Trees - 8pts

Nim (https://en.wikipedia.org/wiki/Nim) is a simple game for two players. The game starts with a pot containing some number of marbles on the table. Players take turns removing marbles from the pot. Each player must choose to remove 1, 2, or 3 marbles on their turn. Whoever removes the last marble loses.

Assume you want to build a basic AI that can play Nim using a game tree. In this game, the pot will start with 16 marbles, and the **state** of the game is the number of marbles in the pot. On the next page, draw the root node and the first two levels of the game tree for this AI (you do not have to draw any levels past that). Annotate your game tree to show which actions are taken by the AI vs. the opponent. The AI moves first.

You can do this with a picture of a physical drawing or an online image editing tool (like Google Drawings). To upload the image, use the same approach you used on Hw5.

What is the maximum **depth** of this game tree? (A node with only the root has depth 0).

Assume that the algorithm uses minimax to find the best action to take. Should the algorithm **maximize** or **minimize** the results of the first non-root level of the tree?
- ❏ Maximize
- ❏ Minimize