15-110 Practice Exam 3

Name:

AndrewID:

Note: this exam is based on the third exam from F19, which aimed to take 2hrs and covered past content in addition to content from the last three units. We have modified the exam to make it better match the new format of Exam3, but the exam length may not accurately represent the actual exam.

Also, the F19 exam was closed book; therefore, some of the questions may seem especially easy if you take this exam open-book. Note that the questions on the actual exam will be designed for an open-book exam.

Problem Category	**Points**
Code Writing	26
Code Tracing	20
Free Response	10
Short Answer	44

Code Writing (26pts)

#1 - Data Parsing (14pts)

You put out a survey to ask your classmates about their favorite food, their 15-110 recitation section, and which dorm they live in. Here's an excerpt of the data you collect. Use the excerpt to help you answer the following questions.

```
pizza,B,Stever\n
donuts,J,Mudge\n
donuts,F,Morewood\n
pizza,E,Donner\n
donuts,H,Stever\n
donuts,A,Stever\n
donuts,I,Morewood\n
pizza,D,Mudge\n
```

A. Write a function `dormFavoriteFoods(filename, dorm)` that parses data of the format shown above from the file `filename`, and returns a dictionary mapping favorite foods to counts for only the students in the given `dorm`. It should create an empty dictionary. It should open the file with name filename, and iterate through each line of the file. For each line, it should parse the favorite food and the dorm, and if the dorm matches the given parameter, it should store counts of the number of people for each favorite food (key to dictionary). Don't forget to check if the key is already in the dictionary and do the right thing in either case. Return the dictionary at the end.

B. Now write a second function `findTheFavorite(dict, dorm)` that takes a dictionary of a `dorm`'s favorite foods as keys and counts as values (e.g., the value that was returned from `dormFavoriteFoods(filename, dorm)`), finds the key with the highest value, then prints the `dorm` name, the string " dorm's favorite food is " and the name of the food that has the highest count. Don't worry about which food is chosen if there is a tie for most popular. This function should return `None`.

   For example, if given the dictionary generated by the data shown above and the dorm "Stever", this function should print "Stever dorm's favorite food is donuts".

#2 - Monte Carlo Methods (12pts)

Write a function `runTrial()` which takes no input, simulates rolling two six-sided dice, and returns `True` if the **first die is exactly one smaller than the second** (and `False` otherwise). You may assume that `import random` has already been called. For example, the function should return `True` if you roll a 4 and then a 5, but should return `False` if you roll a 5 and then a 4.

Now write the Monte Carlo function `calculateOdds(trials)` which takes an integer number of trials and returns the probability that, when two dice are rolled, the first die will be exactly one smaller than the second. You should do this by calling `runTrial()` the number of times specified by `trials`, keeping track of how many times `runTrial()` returns `True`.

Code Tracing (20pts)

#1 - Encryption (10pts)

Given the code below:

```
def encrypt(s, shift):
    result = ""
    for c in s:
        if c != " ":
            result = result + chr(ord(c) + shift)
        else:
            result = result + c
    return result

s = "Hello"
msg = encrypt(s, 3)
```

What string will the variable `msg` hold?

Write a single line of code that will correctly decrypt the message in the variable `msg` and print the result. You may not use the variable `s` in this line of code or hardcode the original message in any way.

Hint: you should call the function `encrypt` again, but what should `shift` be?

#2 - Simulation (10pts)

Consider the following code, which could be written in our simulation framework:

```
def makeModel(data):
    data["val"] = 1
    data["num"] = 2

def keyPressed(data, event):
    if event.keysym == "Space":
        data["val"] = 1
    elif event.keysym == "Return":
        data["val"] = data["val"] * data["num"]
    elif event.char == "Z":
        val = 25
    print(data["val"])
```

If you ran `makeModel()` and then pressed keys in the following order -
`Return, Return, Return, Return, Z, Space, Return, Return, Return, Space`

fill in the table with what would be printed. Not all rows may be used.

Free Response (10pts)

#1 - Pipelining (10pts)

A factory that makes action figures is set up so that every worker does three tasks: collecting the components (5min), gluing them together (5min), and painting the resulting figure (5min). Gluing requires some tidy-up time before switching to a new task (5min), and painting requires both set-up and tidy-up time when switching to a new task (5min each), so the worker's schedule over an hour currently looks like this:

	00:00	00:05	00:10	00:15	00:20	00:25	00:30	00:35	00:40	00:45	00:50	00:55
X	C	G	T	S	P	T	C	G	T	S	P	T
Y	C	G	T	S	P	T	C	G	T	S	P	T
Z	C	G	T	S	P	T	C	G	T	S	P	T

X, Y, and Z are workers. C is collect, G is glue, P is paint, T is tidy, and S is set-up

How many fully-set-up figures can 3 workers currently produce in 1 hour?

Use the concept of **pipelining** to adjust this schedule so that the workers can generate more figures in an hour. Fill in the table below using the same codes we used above. Your new schedule does not need to be ideal; it should just be better than the old one.

	00:00	00:05	00:10	00:15	00:20	00:25	00:30	00:35	00:40	00:45	00:50	00:55
X												
Y												
Z												

How many fully-set-up figures can 3 workers produce with your new schedule in 1 hour?

Short Answer (44pts)

#1 - The Internet (6pts)

☐ True or ☐ False	Websites split up data into a few large packets based on content before sending them through the internet.
☐ True or ☐ False	Packets all arrive at your browser in the correct order, to support buffering.
☐ True or ☐ False	Packets might all take different paths through routers to reach your computer.

#2 - Distributed Systems (4pts)

Which of the following best describes the features of a distributed system? **Select all that apply.**

- ❏ Has many connected computers.
- ❏ Has only one computer with many cores.
- ❏ Can perform multitasking.
- ❏ Can perform multiprocessing.
- ❏ Can perform pipelining of tasks.
- ❏ None of the above.

#3 - Security Attacks (6pts)

Given the following scenarios, determine what type of security attack it is: DDOS or Man in the Middle.

An attacker sets up a router and allows other people to connect to it. The attacker reads every packet that people send and records usernames and passwords.	
An attacker wants to prevent people from receiving website content, so they send many packets to the website's server to overwhelm it.	

#4 - Visualization (6pts)

For each of the following visual variables, select whether it could be used to distinguish different values in categorical data and/or numeric data. You may select both answers.

Hint: you may want to ask yourself:

- "Can __(visual variable)___ tell me if two categories are distinct?"
- "Can __(visual variable)___ tell me if one number is bigger than another?"

Length:

- ☐ Categorical
- ☐ Numerical

Shape:

- ☐ Categorical
- ☐ Numerical

Value:

- ☐ Categorical
- ☐ Numerical

#5 - CS History (8pts)

The following word bank contains important people and technologies that we discussed in the CS History lecture. Each of the questions below can be answered with a word from this bank.

Ada Lovelace	Alan Turing	Analytical Engine	Charles Babbage
Claude Shannon	Douglas Engelbart	ENIAC	GUI
Grace Hopper	Halting Problem	HTML	Information Theory
John von Neumann	TCP/IP	Tim Berners-Lee	Turing Machine

Who wrote the first program designed for a computer?

What was the first physical general-purpose computer that was built?

Who presented the Mother of All Demos, where the mouse and more was shown?

What protocol made it much easier to connect computers to the internet?

#6 - CS Ethics (8pts)

Recall our discussion in class about recent issues with bias in machine learning.

What is one application of machine learning we discussed in class where the resulting algorithm was biased, and how was it biased (by gender, race, income, etc.)?

What introduced bias into the algorithm you mentioned above?

#7 - CS Future (6pts)

12

What is the purpose of the Turing Test?

- ❏ It checks whether a video is a deepfake or unedited.
- ❏ It measures how likely it is that an occupation will be automated.
- ❏ It determines whether a computer looks like it has human-level intelligence.
- ❏ It finds the probability that a quantum computing result is correct.

How does the Turing Test work?