Montana State University Computer Science Department

Graduating Senior Exam

Spring Semester 2022, 80 minutes.

Your performance helps us assess how well we are meeting our stated learning outcomes for computer science majors. To pass this exam, spend at least 45 minutes in order to provide a carefully reasoned answer to each question. This information will help us make improvements.

Name ___Philip Gales_____

Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer service team needs a way to find the most urgent ticket in the system and remove it when it has been addressed. New tickets can arrive at any time.

a) What simple data structure would best model this situation? Explain.

Priority queue

b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

customers are given an urgency score and added to the priority queue and customers at the top are helped and removed

c) Describe a second way in which this data structure could be implemented and draw a picture of that data structure.

Maybe something with async in terms of should work stop to add people to the queue or should the software auto update the screen since it can be disorienting to try and click on a supoport ticket only for another to popup in its place.

Question 2: Write a function in a language of your choice that has two parameters: a string and a character. The function should return the number of times that the character occurs in the string.

Your language of choice (e.g. Python): Java

Your solution:

```
public int myMethod(String text, char c) {
        int count = 0;
        for(int i = 0; i < text.lungh();i++) {
                if(text.charAt(i) == c) {
                        count++;
                }
        }
        return count;
}
```

Question 3: Consider a singly linked list that contains **n** floating point numbers and is maintained in ascending order. An additional **k** floating point numbers will be added to the list, one at a time. You may assume that **k << n**.

Best case time complexity of algorithm:

O(1)

Explanation of best case time complexity:

Added to the end of the list which would require no moving of pointers

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Add element to the start of the list and having to move every pointer

Question 4: List any extracurricular community involvement (e.g. the Gallatin Valley Food Bank or coaching), extracurricular university involvement (e.g. Engineering Ambassadors, Swing Cats, AWC or ACM) or paid internships (e.g. Workiva intern or Undergraduate Course Assistant) that you were involved with during your time at MSU. For each activity, (1) **provide** the name of the organization, (2) **describe** briefly your main activities and (3) **estimate** the total number of hours you spent.

Organization	*Main Activities*	*Hours Spent (estimate)*

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

When an application unintentionally is biased against a group of people.

For example if you use a dataset in machine learning that isn't very diverse.

b) Provide a hypothetical example of how algorithmic bias could manifest itself in college admissions software.

The software could accept more people from a certain zipcode since it was trained with a dataset showing that area provides better applicants. So MSU might be biased against rural students.

Question 6: In 2010 Oracle sued Google claiming copyright and patent infringement for 11,500 lines of Java API copied code. Google used this small subset of code from the JAVA API for their mobile platform operating system. Pick a side (Google or Oracle) to win this lawsuit and explain 3 possible impacts to the computing industry of this win.

Side you choose to win: Google

First possible impact:

Reusing aspects of an API was upheld. Because of their importance this could have been a huge blow.

Second possible impact:

Copying lines of code or having similar code was partially upheld since an Oracle win may have presented major questions about what is copying.

Third possible impact:

Using Java to write an operating system(?)

Question 7: In the ACM Code of Ethics and Professional Conduct, one ethical principle stated is to ***avoid harm***. Describe three different types of harm that the software of an autonomous, self-driving car might cause.

First type of harm:

Not enough safeguards to where the car hits people

Second type of harm:

Driving information is

Third type of harm:

Question 8: Describe your one-year plan following graduation. If you plan to work, list where you have applied (the company and the position) and mention whether you have received any offers. If you plan to go to graduate school, list where you have applied (the school and the area of study) and mention whether you have received any acceptances.

I do freelance work now and will probably apply to some places in the fall.

Question 9: List any organized social activities that you were involved with during your time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Hours Spent (estimate)*
Catapalooza	4

Question 10: List any activities that you were involved with during your time at MSU that prepared you to work more effectively with teammates whose backgrounds are significantly different than your own. For each activity, (1) **describe** the activity and (2) **estimate** the total number of hours you spent.

Activity Description	*Hours Spent (estimate)*
Personal projects	300
Freelanced for agencies	800

Question 11: Name the most sophisticated version control system that you use and describe three nontrivial features it has**.**

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

Branching

Non-trivial feature 2:

Commit with comments

Non-trivial feature 3:

merging

Question 12: During your time at MSU, list any major non-classroom, non-paid activities that you engaged in to help prepare for your computer science career. For example, you might have taught yourself a programming language or attended a workshop on a CS topic. For each activity, **estimate** the number of hours spent**.**

Activity Description	*Hours Spent (estimate)*
Watch programming tutorials	200
Conferences	40

Best wishes wrapping up the semester and in the future!