**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Fall Semester 2021, 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 Tristan Stevens

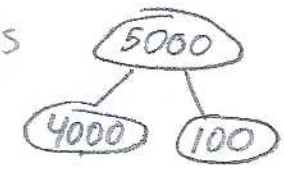
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's 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.

Heaps would be the best data structure as they can easily return the highest or lowest elements.

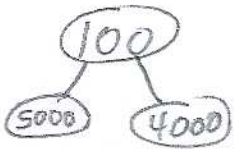
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A Max Heap will always contain the largest element in it's root node. This is the ideal solution to the problem.




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

A Min Heap could also be used. In this case, the maximum value will be contained in one of the leaf nodes. Iterating through the leaf node and storing the highest value encountered will present the maximum element.



**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):* Python

*Your solution:*

```
def Occurs(myString, myChar):
    return myString.count(myChar)
```

**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:*

The best case occurs when the additional number belongs in the first position checked.

*Worst case time complexity of algorithm:*

O(n)

*Explanation of worst case time complexity:*

The worst case occurs when the additional number belongs in the last position checked.

**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)* |
|---|---|---|
| MSU | Lab Assistant | 45 hours |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when an algorithm will prefer an unjustified result based on variables that should not be considered.

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

Algorithmic bias could present as favoring applicants from wealthier families or areas as quality education is more likely to be possessed and college affordability likely wouldn't be an issue.

**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:* Oracle

*First possible impact:*

Discouraging other companies regardless of size or status from infringing upon Oracle's copyright.

*Second possible impact:*

This leaves a grey area of what is acceptable. How many stolen lines of code constitutes infringement? Is it the complexity of code?

*Third possible impact:*

This may affect hobbyist developers or students negatively. They may not be able to code the used system themselves but need it for a project.

**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:*

Medical harm such as harming a person physically or mentally.

*Second type of harm:*

Personal harm such as destruction of property or surrounding environment.

*Third type of harm:*

Professional harm such as revealing company secrets or damaging reputation.

**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.

After graduation I do plan to enter the professional workforce. Currently my personal situation following graduation is rather uncertain and I'm not sure what my circumstances will be afterwards. My plan for now is to work on some personal issues for a month or two after graduation and find employment after I get myself to a more secure place.

**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)* |
|---|---|
| N/A | |
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**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)* |
|---|---|
| RC Car Development | 120 hours |
| RoboSub Visual Navigation | 100 hours |
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**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/Github

*Non-trivial feature 1:* Logging

Presents a log of past actions on the repository. Shows who committed and what changed.

*Non-trivial feature 2:* Diff

Finds the differences between files, commits, and branches and allows developers to apply a specified change.

*Non-trivial feature 3:* Github Pages

Github can be used as a simple web hosting service with Github Pages. Pages allows users to create web pages for their repositories and can be used to create more intricate pages using a paid plan.

**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)* |
|---|---|
| Network Administration | 250 hours |
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Best wishes wrapping up the semester and in the future!