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 Abigail Hustis

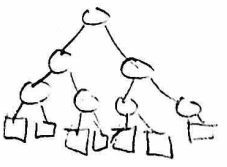
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

I would store the tickets in a tree, because the cost of insertion and searching is relatively faster than other data structure.

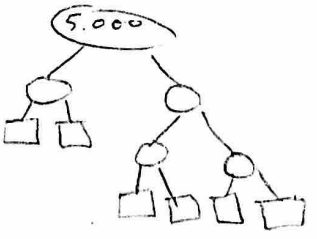
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

I would use a balanced BST where the nodes would be the urgency scores and be connected to the ticket. That way finding the highest score would be very optimal.



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

Another way to implement this would be to have the base node be 5,000 and not balance the tree out.



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 numOfInstances(string, char):
    return string.count(char)
```

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:

Because insertion into a singly linked list is just constant so if the number being inserted in the correct spot it will just be $O(1)$

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

If we use insertion sort, the worse case would be $O(n^2)$ because you might need to traverse over the entire linked list before finding where to insert the new floating point number

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)*
AWC	Grace Hopper 2019	60
ViralHog Internship	Web Development	400

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Systematic errors in software that results in different groups of people experiencing unfair and unequal outcomes.

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

An admissions software could be looking for the best candidates while also trying to give away as little money as possible, which would negatively impact poorer students who are potentially more qualified than others.

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:

There's currently so many API's that are being used that could suddenly be sued for using

Second possible impact:

Progression in the industry would slow way down

Third possible impact:

The ability to integrate different programs would become much more difficult

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:

Pedestrians could get hurt if they weren't detected by the car

Second type of harm:

If the car ever crashed into something or was involved in a car crash would cause property damage.

Third type of harm:

There's the potential that it gets hacked in and then someone else not in the car would have control which could then lead to a lot of bad scenarios

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.

My one year plan is to stay in Bozeman and work at Viral Hog as a Full Stack developer. I got an internship there in October and was offered a full time position in March.

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)*

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)*
MSU Women's Club Ultimate	1,300

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:

branches and being able to work on code that's not in production

Non-trivial feature 2:

merging, combining a branches together

Non-trivial feature 3:

stashing, being able to save code without commiting any changes

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)*
Learned php	30
Grace Hopper Conference	3 day conference

Best wishes wrapping up the semester and in the future!