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 Gabrial Darity

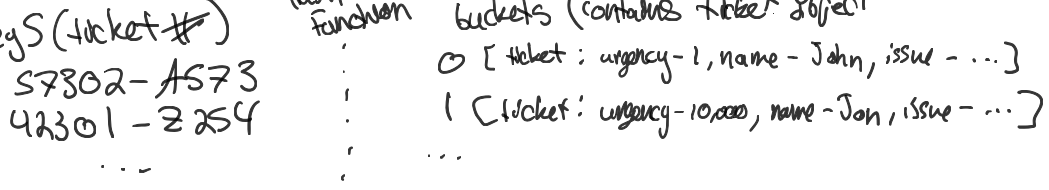
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 believe a Hashtable would best model this situation. Hashtables allow for quick insertion and searching. Being able to store and lookup a ticket using some for of unique information is super valuable. You could also store with the key a ticket object that contains all kinds of pertinent information.

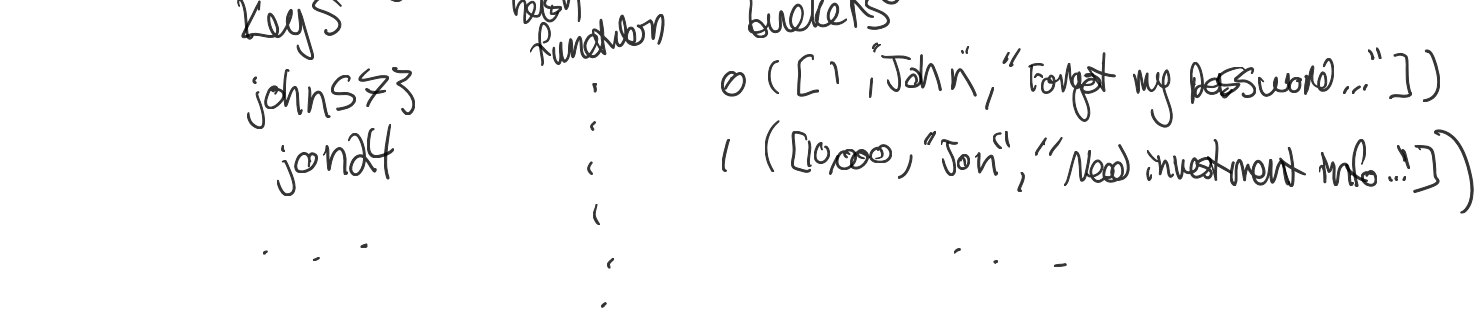
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Hashtable with the key being unique ticket number for customer, the the object stored contains necessary information regarding the ticket including the urgency score.



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

Hashtable with the key being unique customer username, the object stored is an array that holds all necessary information.



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 numChars(String s, char ch){
    int numChar = 0;
    for(char c : s.toCharArray()){
        if(c==ch){
            numChar++;
        }
    }
    return numChar;
}
```

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**. ← much less than n

Best case time complexity of algorithm:

O(1) O(k)

Explanation of best case time complexity:

insertion into a linked list takes O(1) time given we know where we are inserting. The best case, if we start searching at the head of the linked list, is that every element in k is less than the element at the head of the list. That means k is ordered in descending order. This also means we don't need to search through the linked list. So if we are inserting 1 element the best time is O(1). If inserting k element each insert is O(1)

Worst case time complexity of algorithm:

O(kN)

Explanation of worst case time complexity:

Searching through a linked list is costly. The cost to reach the element we are looking for is O(n) The worst case is that for each element in k we have to search through the full length of n and the insert.

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.

Algorithmic bias is where an algorithm gives unfair advantages to a specific group of users. It can also cause AI to gain human bias based on training data provided and missteps in logic.

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

An example could be how an algorithm organizes applications. Say the algorithm sorts based on name length. People with longer, multiple, names will be looked at last.

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: More revenue to Oracle. More companies that want to use that code would need to go through Oracle.

Second possible impact: Reinforcing a standard of what copyright and patent infringement is.

Third possible impact: Shares within Google would have gone down. A loss of networth in Google could have reduced the amount of google owned tech we see today.

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: people losing jobs due to self-driving cars being used instead. You don't have to pay robots.

Second type of harm: people being hurt by a self driving car malfunctioning or being released without proper safety measures implemented

Third type of harm: Software used for unintended purposes. Using pieces of software for longstanding systems.

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 plan applying to larger companies, Google, Amazon, etc. I want to apply to any position within these companies involving programming / software development. I have not received any offers. I also do not plan on going to graduate school.

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)*
Projects Multidisciplinary Engineering Design	25 hrs
Website development	75hrs

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:

GitHub

Non-trivial feature 1: Cloud based repositories, allows us to share and revise code as a team.

Non-trivial feature 2: Repositories - These contain all of our projects files and the revision history. We are able to roll back changes based on information from each revision history on each merge.

Non-trivial feature 3: Projects. This a spreadsheet tool. These project tables allow users to organize group issues and pull requests. Makes an easy way to schedule, backlog, and all around organize a project.

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)*
Web development	90 hrs
Game Server Creation and Management	75 hrs

Best wishes wrapping up the semester and in the future! 