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 Alex Ekstrom

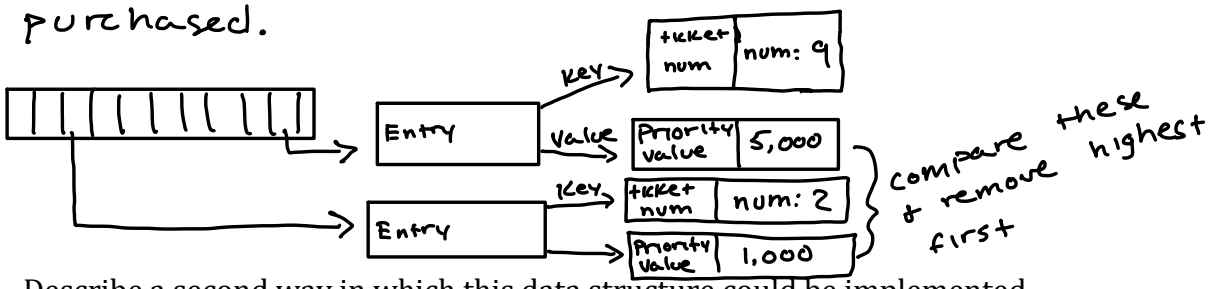
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

You could use a hash map for this situation because you can look up each ticket that has been purchased and get its priority, it is much faster using a map over a list for this.

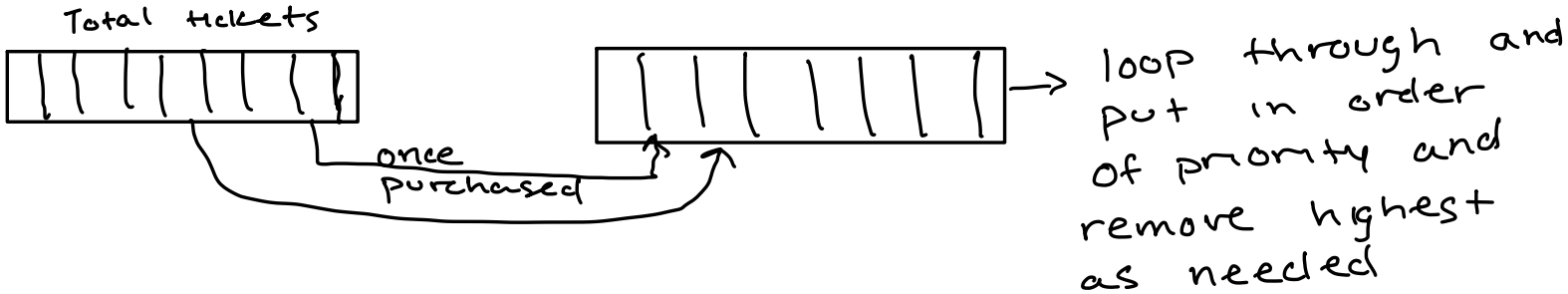
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

You can look up a ticket and get its attached priority and compare it to other tickets purchased.



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

You can look up each ticket purchased and add them to an array and loop through purchased tickets to remove tickets in order.



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 countChar(String str, char c) {
        int count=0;
        for(int i=0; i<str.length(); i++){
            if(str.charAt(i)==c) {
                count++;
            }
        }
        return counti
}
```

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:

If we were to add the k numbers using add head, it would be O(1) because we only need to add the number to the front of the list.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

If we have to add a number at a specific position, we will need to go over the whole list to find the position to add the element.

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)*
Reliable Plumbing	plombed houses	3,000 - 4,000

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithm bias is different bias (gender bias, racial bias) that is within an output of an algorithm.

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

Algorithmic bias could manifest itself in college admissions software by accepting males at a higher rate than females.

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:

Android operating system would not exist or would be substantially different.

Second possible impact:

Google would have lost a ton of money and as a result the company would have struggled, and google would not be as powerful.

Third possible impact:

Oracle could have instead developed the Android 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:

Eliminating jobs from people who are drivers as their career.

Second type of harm:

Putting people in danger by harming or killing people if the software fails.

Third type of harm:

The software not correctly taking into account of the weather conditions and causing wrecks because of it.

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 on going right into work after graduating. I have applied to Zoot Enterprise as a software developer in their microservices department. I have had 1 interview with them and am awaiting results from it. I plan on working here in town for the near future.

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)*
None	None

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)*
Worked as a plumber	3,000 - 4,000

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:

Share projects with group or to the public

Non-trivial feature 2:

Allows you to track changes in projects

Non-trivial feature 3:

Team-management features

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)*
Talked with people in industry	10

Best wishes wrapping up the semester and in the future!