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 Ransom Bowman

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.

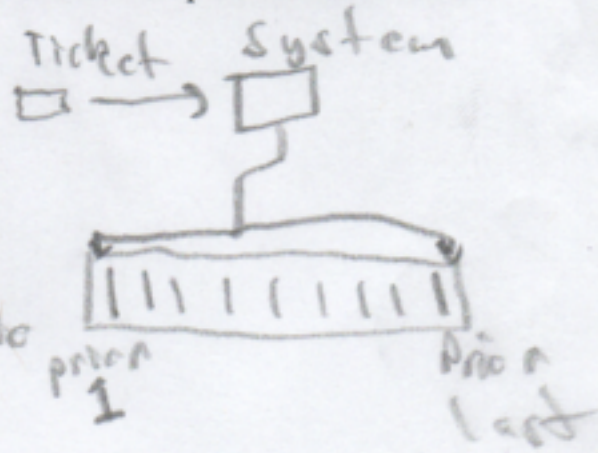
Ticket → System
√ Placed
Tick
lck

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

PriorityQueue, once the tickets are entered into the system, they will be given priority and then entered into a queue.

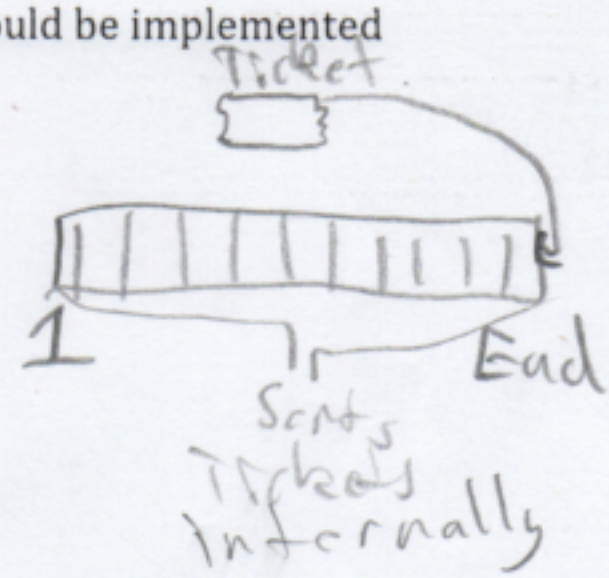
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

The priority queue could operate by having the system first apply an urgency score to the ticket and the ticket would get sorted into the queue. then



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

Another way the priority queue could work is that tickets are entered in at the bottom and then sorted to the proper rank.



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 char_counter(charac, stri):
    count=0
    for ch in strl:
        if charac == ch:
            count+=1
    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:

$\Theta(n)$

Explanation of best case time complexity:

The described scenario would be $\Theta(n)$, since how long the process takes scales with how many numbers k contains. $\Theta(n)$ is the best case scenario if the inserted numbers are inserted and don't need sorting because they are in the correct spot already.

Worst case time complexity of algorithm:

$\Theta(n^2)$

Explanation of worst case time complexity:

If sorting N required, it would likely be an insertion sort, which should be $\Theta(n^2)$

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)*
Chi Alpha	Jesus Following; Fellowship	1500 - 2000
Helix Business Society	Web dev. intern	670
ACM	Shared up to meeting	10

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic Bias is bias within a system/data set that results in a disperate treatment of different people within the system.

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

The college admissions software could end up with a bias towards a demographic if that demographic consistently performs well or poorly. It could then be biased towards who it accepts and rejects* based off of the demographic's performance instead of the individual's.

* for admission

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:
If Google wins, it would make it incredibly hard to copyright code in the future.

Second possible impact:
While copying something entirely would likely still be illegal, this would enable companies to start "borrowing" code from each other without any communication between parties.

Third possible impact:
Companies wouldn't need to license software anymore, and could instead look at the products they want to use and build their own using that products code.

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:
The car may experience a code failure and crash into something or someone.

Second type of harm:
If the code crashes, the car could stranf someone

Third type of harm:
If the pathing gets messed up, the passengers may have a longer than necessary trip, or end up in the wrong location

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'm hoping to enter the workforce quickly, but the timeline is variable depending on my current internship. I'm in talks with Helix: Business Solutions about getting hired as a web developer after graduation, but if that falls through, I plan to take a month off and search for another position elsewhere. I'm also currently working on some game design ideas, and plan to pursue that idea in my spare time.

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)*
Chi Alpha	1500 - 2000
Code 24	24
Misc MSU Events	20

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)*
Coding project for Cpe 24	24
Random CS Group projects	50
EGEN 310	100-150
Math Group projects	20
Digital Rhetorics Final	20

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:

Merge conflict resolution

Non-trivial feature 2:

Branches and branch management

Non-trivial feature 3:

Code review and QA tools

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)*
Began Self taught hosting/C#	20
Misc Python Coding	50
Misc Java	20
Independent Game Dev Proj	100

Best wishes wrapping up the semester and in the future!