Montana State University Computer Science Department

Graduating Senior Exam

Fall Semester 2021

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.

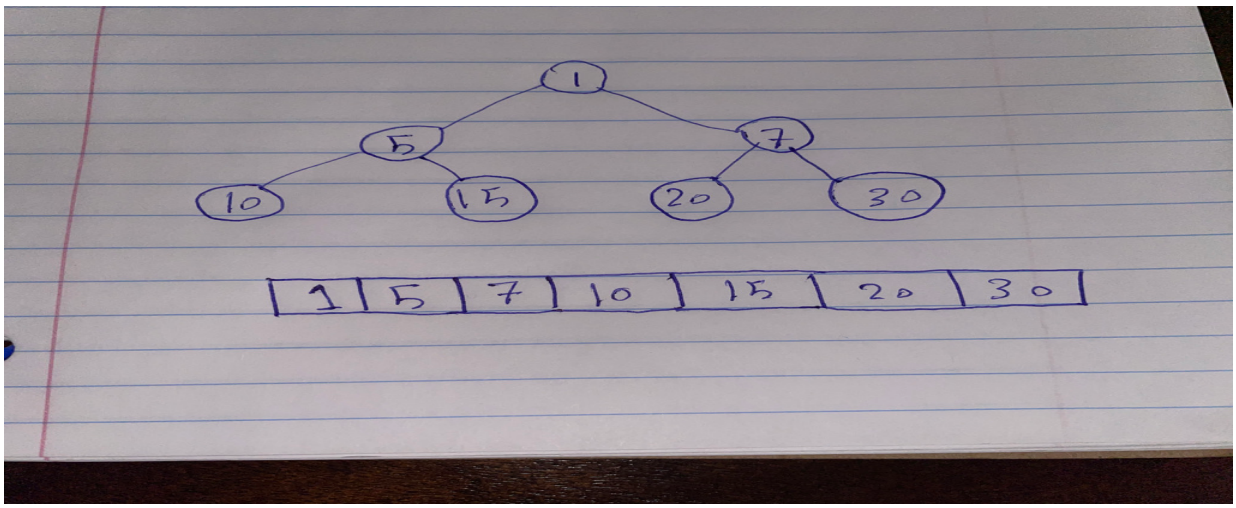
Name: **Abdulaziz Alghamdi**

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.

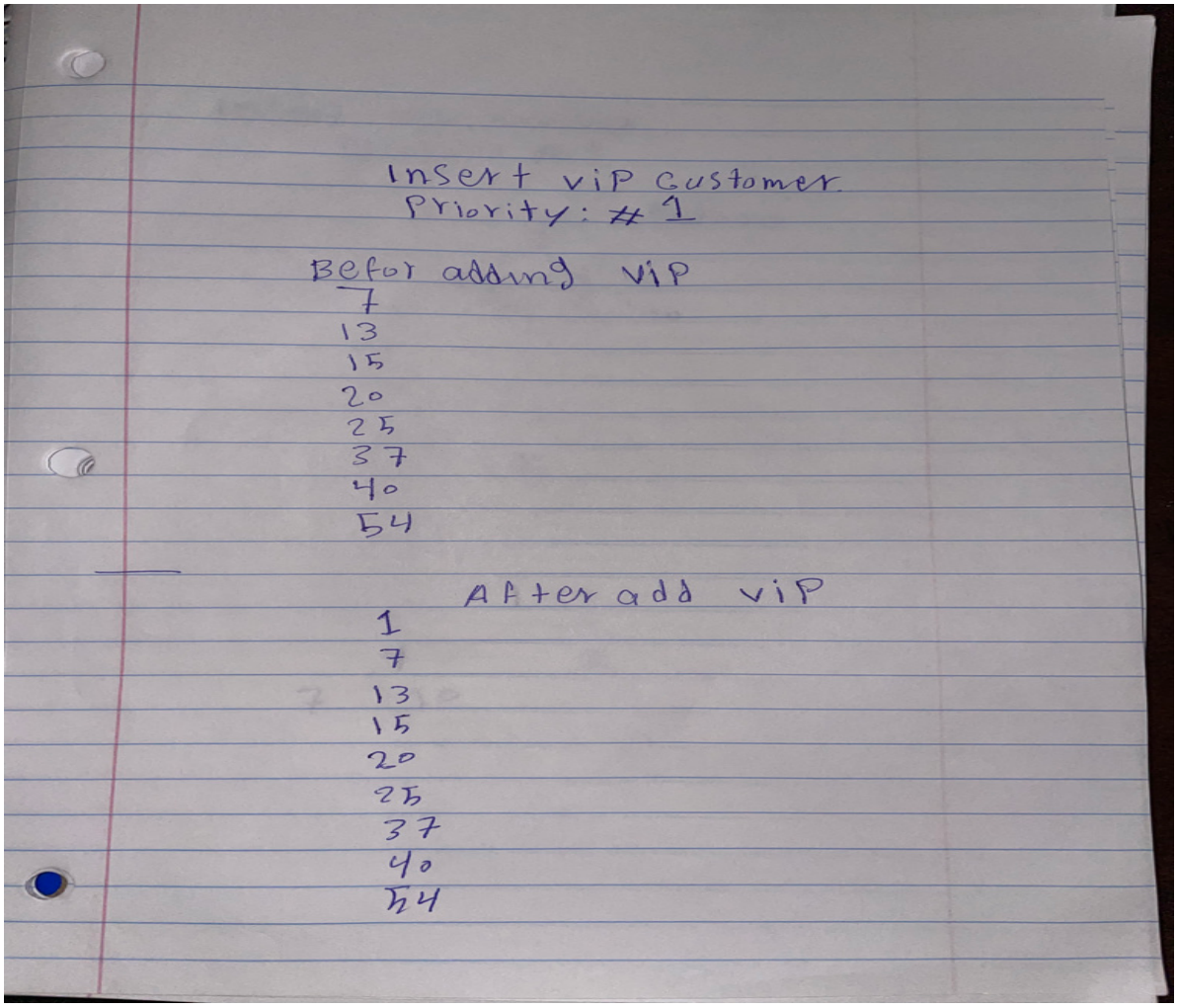
A) What simple data structure would best model this situation? Explain.

In this scenario, we are asked to use a data structure that can be modified based on priority. Thinking about the different data structures that I've covered during my study of computer science; I believe that the priority queue is the best choice. Priority queues are good because items can be added and removed from the queue based on their priority. For example, every item has a priority associated with it. Moreover, the element with the highest priority is on top of the list. That way, the list would be organized in order of the highest priority on top, and items with less priority are at the bottom.

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



C) Describe a second way in which this data structure could be implementedand draw a picture of that data structure



As shown in the picture above, the once the VIP customer was inserted to the queue, s/he were added to the top.

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):

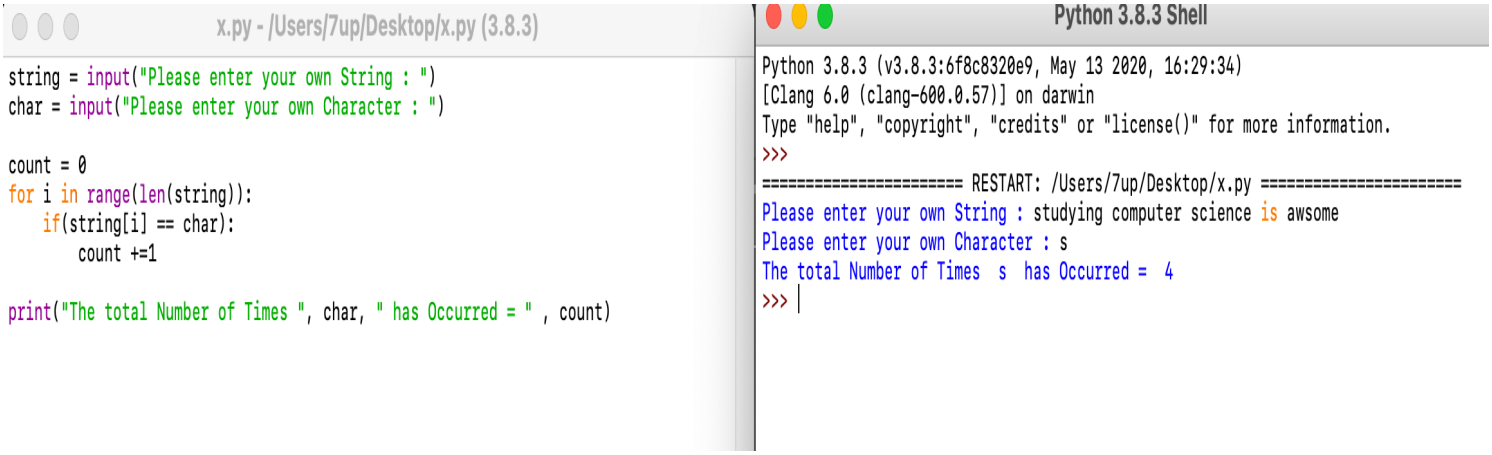
Your solution:

Language used is python. This program will ask the user to enter a sentence and a litter that they want to be count in that sentence.

```
string = input("Please enter your own String : ")
char = input("Please enter your own Character : ")

count = 0
for i in range(len(string)):
    if(string[i] == char):
        count +=1

print("The total Number of time ", char, " has occurred is " , 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:

O(k)

Explanation of best case time complexity:

Since all elements on k are less that the once on n, and the elements in n are in ascending order, the elements of k will be added to the beginning of the list. Making it an order of k operation.

Worst case time complexity of algorithm:

O(nk)

Explanation of worst case time complexity:

If both n and k are in ascending order, and the elements of k are greater than n, the algorithm would have to iterate through the elements of n and k to get the value.

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)*
N/A	N/A	N/A

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when an algorithm makes an error that creates unfair outcomes. In the past decade, we have seen a lot of ways that algorithms have been used to help decision-making. However, since these algorithms use a large set of data to make these decisions, there could be some bias in making those decisions.

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

This could happen when a computer is used in the administration office where the algorithm would be learning from a dataset that is given by the school. For example, let's say that the data had 100 people in it. Out of the 100, there were 60 male students and 40 females. Moreover, 40 males were accepted to the college while only 20 females were accepted. The algorithm might use this data next time students apply and give males higher priority because there were more males than females from the previous data it had.

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: I pick Oracle to win

First possible impact:

I think that Google should have talked to Oracle for their permission before using that code. Oracle has paid a lot of money researching and implementing the code. Allowing Google to use that code without paying or asking for permission could lead to huge losses.

Second possible impact:

It wouldn't be fair to the programmers and engineering teams that have worked on this project to allow Google to copy their code. They have worked hard to get the result they wanted with the code and allowing other companies to that code would not be fair. Doing so would make engineers feel less productive to work since anyone would be able to claim their work without their permission.

Third possible impact:

Allowing companies to copy code from other companies without paying them would lead to making the industry less productive, and programmers would feel less motivated to do their

jobs. Moreover, since everyone would be copying code from one another, creativity levels would be significantly lower.

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 first danger that might come to mind is having that car hacked. Hackers can access the car's system and take control over what the car does. For example, a hacker can hack the car and have it drive to a specific location while the driver is inside. This could lead to having people's lives in danger.

Second type of harm:

One other problem is that roads are not ready for that to happen. Road conditions can feel a bit challenging for even experienced drivers, and it might take more time to have the perfect autonomous car. Driverless cars are the future, but I think that we are still not there yet, and if done wrong, it would lead to catastrophic accidents.

Third type of harm:

Finally, making moral decisions. Let's say that an autonomous car was going its way on the road where a random person crossed the street illegally. The car now has two options. Option number one is to ensure the safety of the people in the car and keep going forward, even though this means running the person on the street over. On the other hand, option number two is to avoid running over that person, but this means that the passenger's life is in danger now. Since both options are unpleasant, what choice would the car choose? Does it save the life of the pedestrian or the passenger?

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've not been home in over five years, so the first thing to do after graduating is going back home and spend some time with my family. Moreover, I've applied for a few jobs, and now I'm waiting for their answers. Some of the places that I applied to were, Microsoft, Apple,

Google, and Amazon. I would like to work for one of these companies because it would help improve my skills giving me a better chance of having a good career.

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.

Activity Description	*Hours Spent (estimate)*
Saudi Arabia Cultural Club	~150

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)*
N/A	N/A

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:

For the past two years, I've been using git for some of my classes. Using GitHub has helped me work with different group members and allowed each of us to make changes to the code then push it into the project.

Non-trivial feature 1:

Github can help group members manage and keep track of each person's task. For example, this semester, I've been working with a group on a website. We first made the git repo then divided the work amongst ourselves. After we were done with the code, we pushed it to our repo, and each had a copy of it.

Non-trivial feature 2:

Pushing and pulling code is simple. Moreover, the site has different copies of your work, so you can know what changes happened and when.

Non-trivial feature 3:

Git is a great place where I was able to upload all my programs and code there. This has helped me during a lot of interviews because I was able to show them what I've been working on.

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)*
Taught myself GmaeMaker Studio	~150
Taught myself how to use Git	~40
Taught myself how to use VirtueBox(VM)	