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 Ryan Meier

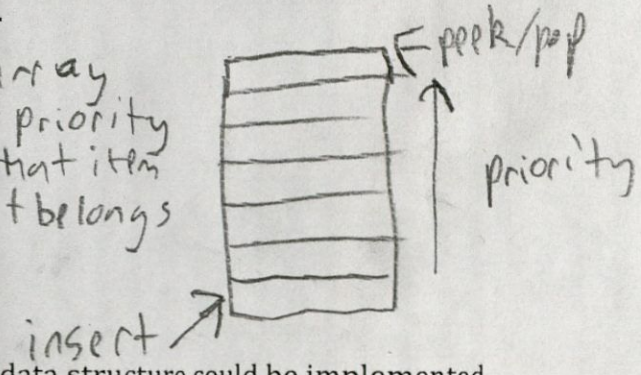
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

A priority Queue would work. The queue can auto sort when new data is inserted and can remove the highest priority.

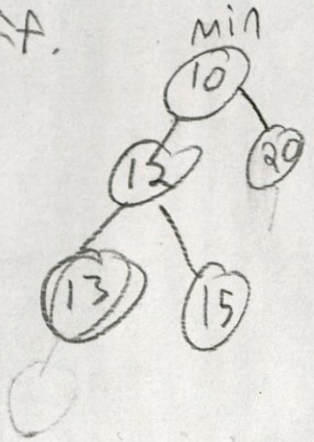
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

You could use an array and insert at lowest priority then it would sort that item until it is where it belongs



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

You could use a binary search tree that sorts and lets you pop the data off.



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 func(string, character)
    i=0
    for x in string:
        if x == character:
            i = i+1
    return i
```

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 there is only one k to be added it will be done in O(1)

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Each item k will take the same time to run no matter what their value and can only be added one at a time.

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)*
Foundant Technologies	Intern	300

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when a computer algorithm or a piece of software has some type of unintended bias in it that can be unfair to a group of users.

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

Algorithmic bias could exist in admissions software through having certain requirements needed to get admitted. Lets say the software requires a certain number of extra curriculars to be admitted. Someone in a low income household may not have any extra curriculars due to needing to work in their free time.

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:
More open source software. Users could copy and improve code and use it for free.

Second possible impact:
If code is shared more freely copycat companies will pop up driving down the cost of software.

Third possible impact:
Code would be much more closely safeguarded and harder to see the source code of software,

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:
Could damage environment if it chooses to idle or take a more fuel consuming route.

Second type of harm:
If software doesn't detect someone it could kill someone.

Third type of harm:
If car drives dangerously could cause mental harm of the passenger if they are scared

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 am in an internship at Foundant technologies and will continue that as I apply for jobs. I have no other plan besides enjoying the summer.

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)*
West Climbing and Hiking	100s

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)*
Cook at Jam, Map and Construction worker.	1000

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:

Can push and pull my code to my local system.

Non-trivial feature 2:

If I make a mistake I can access previous versions

Non-trivial feature 3:

I have the ability to choose who can collaborate on my projects

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)*
Took amazon devops course	200
leetcode	200

Best wishes wrapping up the semester and in the future!