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 Alonso Darias

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 best model this situation because it would allow the higher urgency scores to be served before the lower urgency scores.

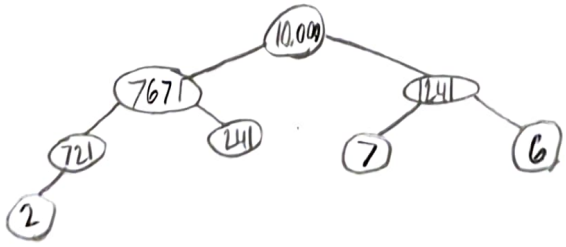
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

This could be implemented as a dynamic array that is reordered whenever a new value is added. This way, the highest urgency score will always be at the front



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

Alternatively, this could be based on a heap. This way the highest urgency score is always at the root



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:

```
def charOccurances(word: str, char: str) -> int:
    var occurances = 0
    for (candidate in word):
        if (candidate == char):
            occurances += 1
    return occurances
```

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:

$\Theta(k)$

Explanation of best case time complexity:

In the best case scenario, the k new elements are lesser than the n elements already in the list & added in descending order. In this case each new element will get added to the front of the list.

Worst case time complexity of algorithm:

$O(kn)$

Explanation of worst case time complexity:

In the worst case scenario the k new float values are greater than those in the list & also sorted in ascending order so that each element has to be compared before each new element can be added

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)*
MSU Mens Club Soccer	Starting player	180
TechLink	Software Engineering Intern	1200
Mad River Glen Freeride Team	Guest Coach	40

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The ability for a computer system to favor certain groups or characteristics over others.

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

If an admissions algorithm is trained to favor higher test scores & the standard that it trained on is from a majority group. In this case, the algorithm will be negatively biased against minority groups

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 (assuming they extended the functionality of what they used enough that it serves a new function)

First possible impact:
It would be easier to borrow & reuse code from other sources

Second possible impact:
Greater innovation due to more code sharing & info sharing

Third possible impact:
Companies may also become more secretive with their work

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:
May run over a person & harm them.

Second type of harm:
May swerve to avoid an accident but strike a cyclist in the process.

Third type of harm:
May fail to detect a red light & go thru it, causing an accident & harming 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 plan to work as a beginner software developer at D.A. Davidson. I plan to stay in Bozeman while I work remotely. I also plan to continue competing in Freeride World Qualifiers competitions.

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)*
IFSA Freeride World Qualifiers	600

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)*
My TechLink Internship	1200
EGEN 310	120

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:

GitLab

Non-trivial feature 1:

Issue Ticket planning

Non-trivial feature 2:

Collaborative code reviews for new code (merge requests)

Non-trivial feature 3:

Automatic testing of new code (merge requests)

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)*
N/A	

Best wishes wrapping up the semester and in the future!

Thank You