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 Rory McLean

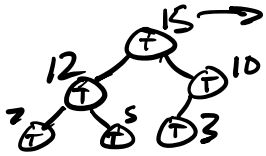
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 be best because it would allow high urgency tickets to be dealt with as soon as they come in without disrupting the existing order

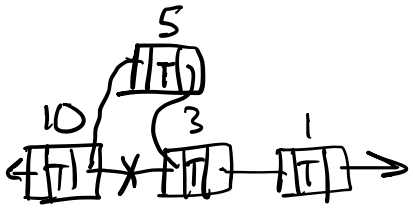
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A heap is one way to implement it with each node being a ticket and higher priority tickets floating to the top or bottom depending on whether a min or max heap is used



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

Another way to implement it is to just use doubly linked list. the tickets coould be defined as nodes and can be inserted where proper.



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 occurrence(search_char, str):
    num_occ = 0
    for char in str:
        if char == search_char:
            num_occ += 1
    return num_occ
```

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:

If each number in k is smaller than the first number in n and they are added in descending order they would each be added to the front of the list.

Worst case time complexity of algorithm:

O(k·n)

Explanation of worst case time complexity:

If each number in k is larger than the last number in n and they are added in ascending order they would each be added to the end of the list.

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)*
Smarty Cats	Tutored Students	60

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.
Algorithmic bias is where algorithms will see specific type of data more favorably, with regards to the aim of the algorithm, comparatively to other data of different origin or contents.

b) Provide a hypothetical example of how algorithmic bias could manifest itself in college admissions software.
For college admissions software, an outstanding student with a 3.5 GPA who does many things in the community and competes in all of their schools sports team might get overlooked when compared to a student that has a 3.7 and only went through high school half heartedly.

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: Idea of open source programming gets restricted and more companies get copyright on code and programming languages

Second possible impact: monopoly on programing and smaller businesses will have a harder time starting up

Third possible impact: It will be harder to get into the field of programming as exposure to it will be at an all time low

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: Physical Harm

If the autonomous cars are not coded well, they could cause accidents either with other cars or with pedestrians

Second type of harm: Industrial Harm

If Autonomous car systems flood the market, businesses that use humans as drivers, or at least the drivers, will lose work

Third type of harm: Legal Harm

Since the legality of AI and responsibility is grey, the programer could be at fault for a bad decision made by the AI, like murder.

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. I have applied for numerous positions but I have gotten the most traction for the position, Implementation Consultant at Fast Enterprises. Some of the other companies I have applied to are EA, Bethesda, Respawn Entertainment, and Bungie to name a few. All of these applications were for junior game developer positions.

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)*
Anime Club	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)*
EGEN 310R	50

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: Version History
Github is able to keep a history of versions of a repository, so that if need be, the version of that repo can be reverted to a previous one

Non-trivial feature 2: Auto matic test suite
Github can automatically test code as it is pushed up to the repo from branches

Non-trivial feature 3: Issues
If there is a bug in one section of code, one user of a repo can submit an issue for another person on the repo to solve when convenient

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)*
Deepdive into NLP	50

Best wishes wrapping up the semester and in the future!