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 Krauss

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.

We could use a priority queue. Each ticket will be inserted in the queue based on a priority value.

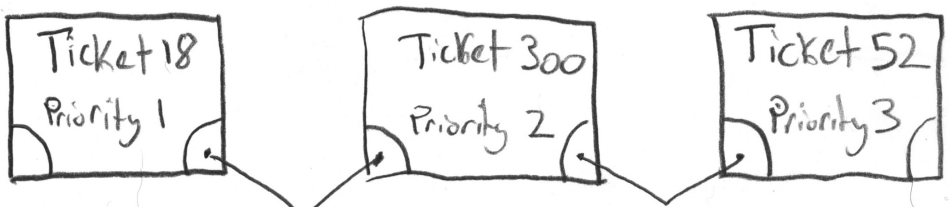
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

One way would be using an array of items that hold a priority value.



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

We could also impliment a similar structure with a linked list.



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:

```
count = string.count(character)

print(comt)
```

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) or constant time.

Explanation of best case time complexity:

Inserting a node at the current or head location only requires constant time.

Worst case time complexity of algorithm:

O(n) time.

Explanation of worst case time complexity:

If we need to traverse to the end of the list. it will take O(n) 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)*
Printing 4 Less	Internship / Job working with Adobe products.	600

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Errors in a computer system that create unfair outcomes and privlages one group over another.

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

algorithmic bias could manifest itself in instances like giving more scholarships to men, denying minority students admission, or generally guiding admissions in a direction unforseen.

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:

People are allowed to include API's in their code.

Second possible impact:

It will make it harder for companies to sue due to code infringement.

Third possible impact:

If an API becomes used enough it becomes public domain / open-source.

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:

Programming errors can lead to possibly lethal failures.

Second type of harm:

Security vulnerabilities can leave them susceptible exploitation

Third type of harm:

Situations where cars have to make a choice on who is harmed lead to legal / moral dilemas.

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 learn as much about music related software as possible (recording enviroments, musical synthesis, etc.). I'll use that knowledge to apply for a job and/or create my own virtual synth.

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)*
Intermural Soccer	30

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)*
Classwork/EGEN 310/CSCI 422	250

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:

Branching to allow for parallel versions.

Non-trivial feature 2:

Create issues and assign them to people.

Non-trivial feature 3:

Automate tests

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)*
Self-teaching of music/gaming/	
modeling software.	500+

Best wishes wrapping up the semester and in the future!