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.

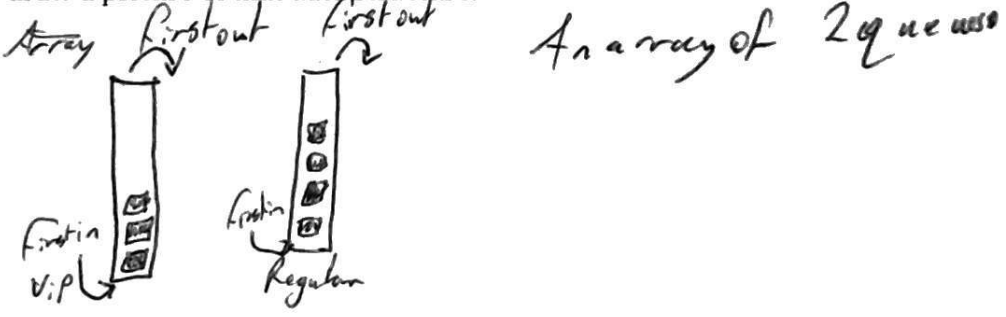
Name William Christopher Rosler

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.

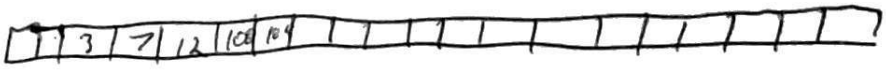
An array works best. The VIP tickets prevent the use of queues

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 implemented and draw a picture of that data structure.

An array with len 10,000.
It can sort while they do other tickets



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:

```
occurences = 0
def occurencesCount(str, chr):
    if str.find(chr) != -1:
        occurences += 1
        occurencesCount(str[str.find(chr)], chr)
    else: return occurences
```

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:

The best case is that k is sorted and we are adding to the end by simply changing 2 pointers and adding elements

Worst case time complexity of algorithm:

$O(\sqrt{N})K$

Explanation of worst case time complexity:

Adding the element to the middle of the list we have to search for where the element goes. Then simply change the surrounding pointers

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)***
ASM LLC	Intern	300
RHA	Attend Meetings	50

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Unintentional or intentional exclusion or preference that largely stems from a lack of diversity

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

The algorithm searches for a list of programs that exclude equivalent opportunities with different names.

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: Recognition of Open Source or permission to use software.

Second possible impact: Devaluing of Intellectual Property in the CS field.

Third possible impact: CS professionals have a right to use any programming language.

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:

Injury to people

Second type of harm:

Ability to work

Third type of harm:

Mental distress

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 accepted an offer from Fast Enterprises. I will be working for them wherever they decide to send me.

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)*
Lyess (Job Fair)	12

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)*
ROTC	1200
New Hire Coach - TSA	~~300~~ 1400

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:

Rollback

Non-trivial feature 2:

Branching

Non-trivial feature 3:

Bug Tracking

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 Taught Flash	16
Self Taught C#	12

Best wishes **wrapping up the semester and in the future!**