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 Kaylee Fong

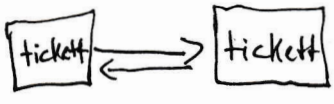
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Priority Queue, because it is a queue which serves priorities, like tickets with a priority.

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

Doubly linked list



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

Array

$[T_1, T_2]$

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 charOccurs (Str, letter):
    count =0
    for i in len (str):
        if i == letter:
            count +=1

    return count
```

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:

It is the first one.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Because worst case it will have to traverse the entire 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)*
Physics Help Group	Doing physics concepts with groups	30 hrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithm bias is bias that can, intentionally or unintentionally, be added to an algorithm because of the writers biases.

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

Maybe someone who is a male writes the software and inadvertantly writes it to prefer male applicants over female applicants. This could eventually, if left to continue acting on this bias, could change the demographic of an entire school.

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:

It is hard to have propriatary code in industry/pattents.

Second possible impact:

Code could become more open for use by anyone.

Third possible impact:

larger companies could take code from smaller ones and use it in conjunction with what they already have and cause the smaller business to loose business.

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 to pedestrians due to malfunction.

Second type of harm:

Physical harm to 'driver' due to malfunction.

Third type of harm:

Mental/emotional harm to the creator if something tramatic happens to a user.

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 moving to a different state with my husband and we are going to apply for jobs in the months after graduation.

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)*
N/A	N/A

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)*
Mod Crew	160 hrs

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:

Saving changes

Non-trivial feature 2:

Highlighting changes

Non-trivial feature 3:

Merging

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)*
Helped Small business with website	5 hrs

Best wishes wrapping up the semester and in the future!