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 John Jubenville

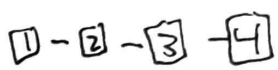
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

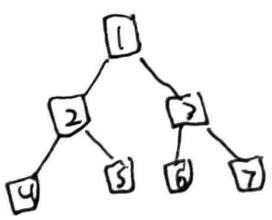
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Linked list



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

B-tree



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 count_Character(string, character):
    cnt = 0
    for char in string:
        if char == character:
            cnt += 1
    return cnt
```

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:

$O(n)$

Explanation of best case time complexity:

Every new number in k is greater than all the items in list, so no sorting required.

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

Insertion sort, all items in list need to be resorted for every new point.

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)*
Yellowstone Ecological Research Center	Unpaid Intern	500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Developers bias is represented in algorithm.

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

Accepting only people whos parents graduated college.

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:

Can't steal closed-source code.

Second possible impact:

More companies will start using open-source code.

Third possible impact:

As a result more companies will be forced to make their code open source as per license.

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:

Bug could cause accident.

Second type of harm:

Software might fail to recognize pedestrian or other vehicle.

Third type of harm:

Software may be vulnerable to security breach, leading vehicle owner to harm.

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'll be working as a dev-ops developer for USGS.

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)*
NA	

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)*
NA	

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:

Branching

Non-trivial feature 2:

Issue tracking

Non-trivial feature 3:

CD

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)*
NA	

Best wishes wrapping up the semester and in the future!