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 __Jada Bryant_____

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 simple linear data structure.

b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.
The tickets must be listed from 1 to 10,000 by priority. Tickets are added to a linear array based on their urgency score and the customer service team can view them from most to least urgent. Tickets may be inserted to the array at any time with any urgency.

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

The tickets must be listed from 1 to 10,000 by priority. Tickets are added to a linear linked list based on their urgency score and the customer service team can view them from most to least urgent. Tickets may be inserted to the linked list at any time with any urgency.

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 stringThing(sentence, character):
    sentence = sentence.lower()
    return sentence.count(character)
```

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:

In this case, the floating point number would be added to the list at the end or the beginning of the list. If the beginning, the new value would become the head and link to the old head, and if at the end we just create a new connection to the new value. This requires minimal effort.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

In this case, we would be inserting a value into the middle of the linked list. Since a linked list stores values scattered throughout memory with a pointer to the net value, there is no need to rewrite over data to insert into the sequential list. We simply create a new Node, link the node that comes before it to that node and destroy the old link, then link the next Node to the new one.

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)*
Resnet Helpdesk	Student Computer Consultant	640
Wildfire Defense Systems	Technical Support Specialist	2880

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Wildfire Defense Systems	Software Quality Assurance	800
AWC	Grace Hopper	20
MSU	Undergraduate Course Assistant	75

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is bias in artificial intelligence towards different groups of people.

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

Algorithmic bias could manifest itself in college admissions software based on a student's name or location.

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:

Technology will be able to continue to improve in the ways we know.

Second possible impact:

Developers may use many APIs from many vendors in one project rather than only being able to rely on one vendor's APIs.

Third possible impact:

Software developers don't have to start from scratch when creating new tools.

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:

Decision making, such as making decisions in situations that are not usual road conditions (car wrecks, icy roads, rock fall, etc.) The car may make a decision that is harmful to another human being or that is greatly more dangerous to the passengers than another option.

Second type of harm:

Cyberattacks, all technology comes with the risk of cyberattacks. An attacker may take control of the car to intentionally endanger its passengers.

Third type of harm:

Technical failure, the car may fail to operate as expected and endanger passengers or other people outside of the car.

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 currently working at Wildfire Defense Systems as a Software Quality Assurance I and plan to continue working there after graduation. I have worked with the company since June 2020 and started as a Technical Support Specialist. They have offered me a promotion to Software Developer upon graduating. If the raise tied to this promotion does not meet my standards, I plan to apply to other companies for a job either in frontend development or as a software engineer. Within the next year or two, I will move away from Bozeman and potentially be looking for new work.

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)*
none	

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)*
Interdisciplinary Engineering Design	60
Partner coding projects	60

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:

Azure Devops

Non-trivial feature 1:

Sprint planning

Non-trivial feature 2:

Ability to link work items to commits and pull requests

Non-trivial feature 3:

Ability to filter branch history by several categories including author

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)*
Personal Java project	10
Creating a personal website	20

Best wishes wrapping up the semester and in the future!