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.

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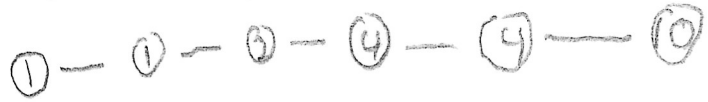
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Something like a linked list may work and perhaps it could be sorted by urgency score on tickets when added one put in the correct place.

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

On adding a ticket a loop goes through the structure finds where to put the ticket based on urgency score.



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

Another way would be to switch to 2-D annay that use the urgency score as an index to another annay.

urgency 1 urgency 2 urgency 3

[[ticket 1, ticket 4], [] , [ticket 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 character_count(inp, query):
    occ = 0
    for char in inp:
        if char == query:
            occ += 1
    return occ
```

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:

$\Omega(k)$

Explanation of best case time complexity:

If the additional k floating point numbers are in the correct order and all k are greater than n then they can simply be prepended to the list k times.

Worst case time complexity of algorithm:

$O(kn)$

Explanation of worst case time complexity:

If all k numbers need to be added at the end of the list the entire list n needs to be gone through k times.

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)*
N/A		

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algoritmic bias is where an algorithm shows favoritism for a specific group of users.

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

Say that an algorithm selects individuals to admit to a college. This algorithm is feed data that is taken from students that are in the computer science program. Since that data only focuses computer science students, students applying that are interested in computer science are more likely to get admit than any other degree.

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: Goosle

First possible impact:
Code is not protected by copyright and patent laws.

Second possible impact:
It is legal to completely steal pants off on software, essential everything would be open-source

Third possible impact:
Since everything is open-source it would be impossible to make money off of software but software could be better developed.

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:
Could potentially record data without users' knowledge.

Second type of harm:
Software doesn't ensure the safety of the user. Such as it is willing to crash to avoid pedestrians but sacrifice the user in doing so.

Third type of harm:
Software will cause damage to individuals or property when it is being used in the intended way. Such as it runs over law abiding cars.

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.

Plan to work and have applied and recieved an offer from Montana Dakota Utilities to work as a Systems Analyst.

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	

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)*
Multi-Dis Eng. (EGEN 3PR)	25

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:

Ability to easily create and manage code bases.

Non-trivial feature 2:

Allows seperate branches and the ability to merge them.

Non-trivial feature 3:

Easily pull and push changes to code.

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)*
Learning Rust	4
Started a LAMP Server	10

Best wishes wrapping up the semester and in the future!