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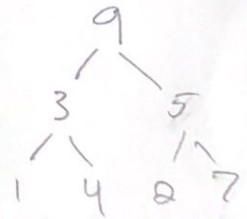
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

A binary heap would allow for the same speed to index but faster input speed. the delete speed would slower but it is still faster overall.

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

a simple tree for quick access



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

Honestly not sure of any other good ways of implementing a binary tree. However a linked list could be used

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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 count(string, query):
    counter = 0
    for char in string:
        if char == query:
            counter += 1
    print(counter)
```

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:

each item k is bigger than the last a bigger than the previous ones and all n values. therefore it is put at the front.

Worst case time complexity of algorithm:

$O(\sum_{i=0}^{k} n+1)$ or $O(kn)$

Explanation of worst case time complexity:

The first input take $O(n)$, the next takes $O(n+1)$, the next $O(n+2)$... because the list keeps growing

Or, if k is insignificant compared to n. then it only take $O(kn)$.

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)*
Bobcat Esports	Team Member, Manager	300
Assistant TA	→	40

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorith making a repeatable error that results in unfair results, creating bias in the outcome to privilege certain groups

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

Because of human bias, majority groups may receive better grades on average. An algorithm would then be more likely to favor these groups with admisson.

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:
Copyright on code would be much less strict, more companies would be "borrowing" other companies code

Second possible impact:
Companies to save money as they don't have to develop already made code

Third possible impact:
code could be stronger, as small companies could take code that was better made.

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:
Program causes a car crash

Second type of harm:
Program decides that hitting a pedestrian is better than hitting a tree

Third type of harm:
Car could use to much fuel because of poorly programmed efficeny. This hurts consumer pockets and the environment

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.

Barring no job offers, the summer will be spent working in Jackson Hole to make money. Currently I have applied to multiple jobs at Riot Games in a large variety of intro level and a few higher jobs. I am still appling to other jobs aswell

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)*
Bobcat Esports	300

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)*
Multidisciplinary Engineering	80

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:
GitHub

Non-trivial feature 1:
Allows users to fetch newest code from a central server

Non-trivial feature 2:
Merging only file changes and not the whole file

Non-trivial feature 3:
Allows for seperate branches for seperate code architecture and work on multiple modules at the same time

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 HTMX	30
Self-Taught Computer Building	25
Self-Taught Game Design	45
Compression Workshop	5

Best wishes wrapping up the semester and in the future!