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.

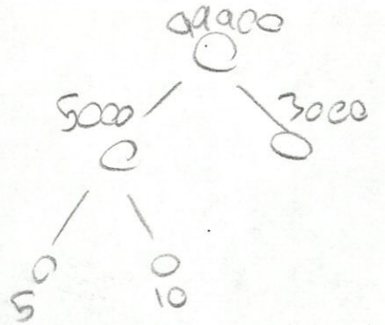
Name Caleb Hayes

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.

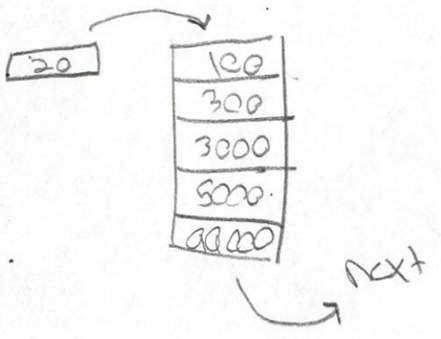
priority queue because it is set up to handle tasks that have various priorities. The urgency stat is what would be the prority

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



It could be done with a tree where the root is the node with the highest urgency

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



It could be done with a sorted stack based on priority

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 occ(str, chr):
    count = 0
    for c in str:
        if c == chr
            count ++
        end if
    end for
    return count
end func
```

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:

This is if k gets added to the front of the LL every time

Worst case time complexity of algorithm:

$O(n)$

Explanation of worst case time complexity:

This is if k gets added to the end of the LL every time

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)*
First	volunteer	200
Alpha Sigma phi	volunteer	100

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

when an algorithim produces an outcome that is not equall accross all groups

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

An algorithm could evaluate application with race and income and accept applicants that fall into groups differently

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:

removes possibity for Oracale to make money

Second possible impact:

given devs the ability to copy code from oracle

Third possible impact:

Invalidate other API's from copy writing code

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:

It could error and colide with its enviornment

Second type of harm:

In emergency it could be faced with a loose-loose situation where it need to pick something to hit

Third type of harm:

Can not adapt to situations like a human can and again could injur its enviornment

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 working for the United State missile defense core. I will be moving to colorado. Once there I plan on starting a side project with the intension of starting a company

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)*
E-sports club	500
Alpha Sigma phi	1000

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)*
Capstone	100
E of capstone	50
Egen 310 robot	90

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:

saves versions of code giving devs a history of code changes

Non-trivial feature 2:

branches for multiple devs to work on the same project in different locations

Non-trivial feature 3:

reverting change, if code breaks the project the we can go back to a version that works

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)*
phone game	50
robotics mentor	250

Best wishes wrapping up the semester and in the future!