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.

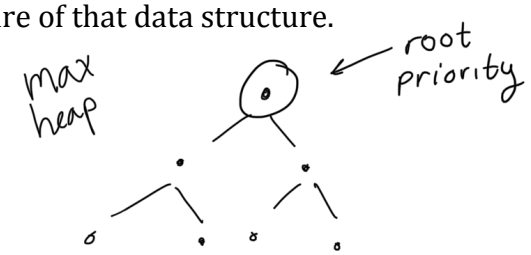
Name William Popp

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.

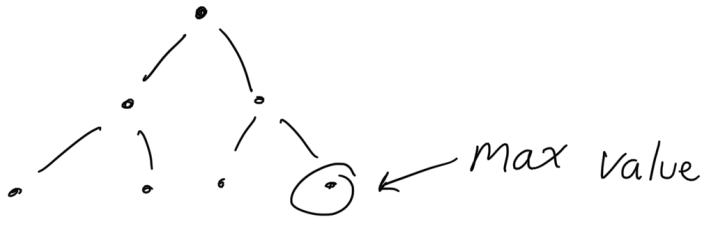
Priority Queue that prioritizes maximum values at the root node and pops and rotates the root node efficiently.

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



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

Balancing Binary Tree - search right until null



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_char(string, char):   # case sensitive
    Count = 0
    for c in string:
        if c == char;
            Count += 1
    return count
```

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:

$O(K)$

Explanation of best case time complexity:

Case where $\{K\}$ is descending and $K_0 < n_0$

K : 

n : 

n.push(K.pop)

Worst case time complexity of algorithm:

$O\left(\frac{K}{2} \cdot (n+1 + n+k)\right)$

Explanation of worst case time complexity:

K : [5, 6, 7]

n : [1 2 3, 4]

Case where $\{K\}$ is ascending and all elements of K > all of n.

n.push(k.pop)

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)*
MSU	Course helper	30

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithm bias is when the results tend to become specific to certain input due to the testing input not being generic.

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

The software could lean toward specific ethnic groups that the algorithm was tested on.

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: I support Google

First possible impact:
Software developers will now be able to use pre-existing Java SE code as Fair Use in order to use as a base for new innovation of future creative work and not be in jeapardy of copyright infringement.

Second possible impact:
Software developer companies will not have to buy a software license from another software company to use foundational Java SE code for fair purposes which provides a tremendous amount of time and monitory saving by not writing new code as the foundation of new software.

Third possible impact:
Software companies like Oracle will not be able to charge license fees.

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:
Technology errors may cause harm to passengers of pedestrians

Second type of harm:
Transportation related jobs may be reduced due to the lack of demand for transportation services

Third type of harm:
The increase of self driving cars will cause congestion on the road from the decrease of public transportation.

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.

My plan is to complete my research position in Marsh Lab on campus doing web development through summer. I have tempory web development job set with R-Cubed Consulting based out of Washington where I have done graphic design for them in the past.

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)*

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)*
CSCI 495	~ 30

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:

Tracks history

Non-trivial feature 2:

Allows for branching code

Non-trivial feature 3:

Collaboration

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)*
Develop full stack website	100 hours

Best wishes wrapping up the semester and in the future!