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 Wyatt Wright

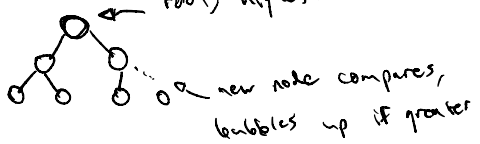
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

This is a good use case for a priority queue because tickets arrive at any time and we want to address the highest urgency tickets first.

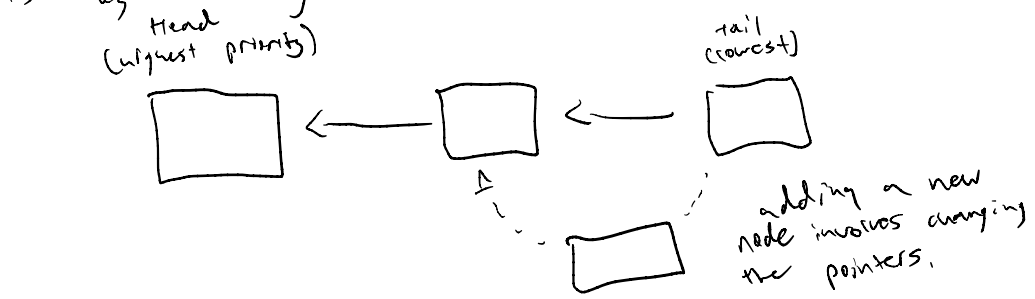
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

One possible way to implement a priority queue is by using a heap.



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

Another way to implement a priority queue is by using a linked list.



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 occurencesInString(str, target):

    return str.count(target)


#assumes valid input
```

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 the best case, all ks can simply be added to the front or back of the list, which is as simple as updating one line.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity: In the worst case we have to loop through the list for each k, a linear process.

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 web & Digital	web page remediation	100 - 200

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithmic bias is when, due to design, training data that's incomplete, or flawed implementation, algorithms have a more preferential outcome for a subsection of their user population.

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

An example of algorithmic bias in the context of college admissions would be a system that has been entirely trained on American standardized test scores. This system would not be effective at evaluating the achievements of incoming foreign students.

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: It becomes more difficult to protect intellectual property

Second possible impact: It is easier to build new products based on existing technology

Third possible impact: open source software becomes more popular in a business setting.

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: Injury to the occupants of the car

Second type of harm: Injury to other drivers

Third type of harm: Injury to pedestrians

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 will be attending Swansea university in Wales where I will be studying cybersecurity. I have already received an offer.

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)*
Hackercats	15 - 20

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)*
Group Projects	200
Honors discussion seminars	400

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: Branching

Non-trivial feature 2: remote repositories

Non-trivial feature 3: commits & checkout

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 projects	150
CTFs	30
cybersecurity reading	25

Best wishes wrapping up the semester and in the future!