Montana State University Computer Science Department

Graduating Senior Exam

Fall Semester 2021, 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 Ben Gueriche

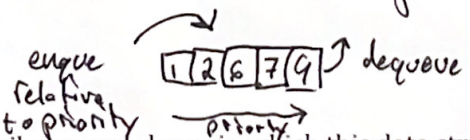
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

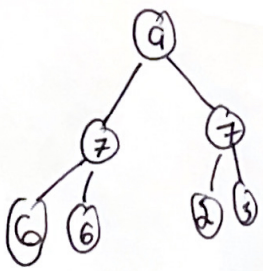
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Have a regular queue but assign each element a priority value and adjust the queue so that the end has the highest priority



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

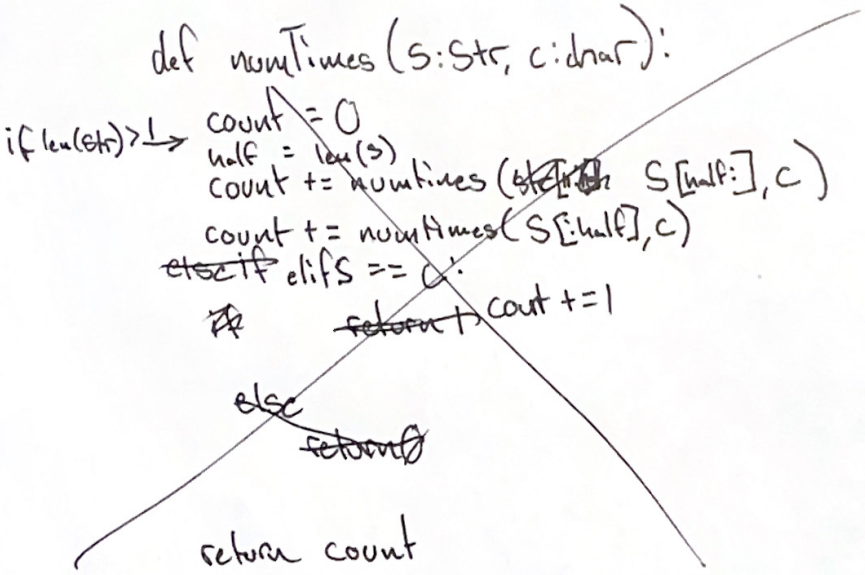
Use ~~a graph~~ tree so that the top node is the most important to create a highrarchy



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):

Your solution:




```
def numTimes(s,c):
    count = 0
    if len(s)>1:
        half = len(s)//2
        count += numTimes(s[half:],c)
        count += numTimes(s[:half,c)

    elif s==c
        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:

$\Omega(k)$ or $\Omega(1)$

Explanation of best case time complexity:

In the best case it can be done in constant time because each add will not have to find proper placement

Worst case time complexity of algorithm:

$O(nk)$ or $O(n)$

Explanation of worst case time complexity:

Because for each k it could potentially have to iterate through the entire list to find the proper placement.

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)*
Big Storm Inc.	HTML and CSS with some wordpress dev	1000 +

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is primarily negative bias introduced into an algorithm based on bias data.
typically

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

It could happen in college admission if theoretically they wanted students with higher SAT scores but typically wealthier students do better because they have more support systems so a disproportionate number of wealthier students would be accepted.

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:
More emphasis on open source, code

Second possible impact:
Less lawsuits allowing for better new software

Third possible impact:
Anarchy with anyone being able to use any other code without consequences

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:
Physical: Could crash harming the passengers

Second type of harm:
Economical: Could disrupt the economy by reducing the number of cars needed and other automotive industries ie Uber driver

Third type of harm:
Emotional: loss of job or fear of robot uprising. Also, for developer if the car harms someone they could feel responsible.

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 plan on traveling for a month then working.

Applied:		status:
Microsoft	SDE	pending review
Amazon	SDE	~~code~~ skills assessment
Zoot	SDE	Pending final decision
Atrium AI	Consultant	In the interview process
A lot of other places		rejected
Some others		pending review

no offers yet

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)*
Intra mural sports	40+

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)*

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:

revisions

Non-trivial feature 2:

branches

Non-trivial feature 3:

commit histories

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)*
HackerRank / Leet code problems	30ish

Best wishes wrapping up the semester and in the future!