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 Brock Lehnen

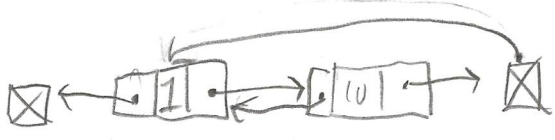
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 linked list would be best in this situation because of it's ability to insert and remove elements inside of it.

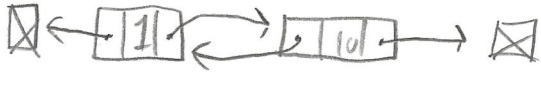
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A doubly circular linked list could be used going down the list in order and restarting the list when a new node is added or the list to when I say restarting, I mean going to the node with most urgency.



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

A doubly linked list could also be used with the only downside being that if the list reaches the end it can't go back to the start like a doubly circular 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 count_function (words, letter)
    print (words.count(letter))
```

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:

$\Theta(n)$

Explanation of best case time complexity:

If k is already in ascending order, then all the algorithm needs to do is run through n once.

Worst case time complexity of algorithm:

$O(n)$

Explanation of worst case time complexity:

If k is in descending order then this requires the algorithm to go through n, k times.

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)*
IM Leagues	Intramural Soccer	6
ACM	volunteering	3

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when there are repeatable errors that can make unfair outcomes for a person or group.

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

If there was a better or worse likelyhood for someone to ge into college if they marked off a certain gender or race in their applicati

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: Oracle

First possible impact: Big Tech companies start suing each other for copyrighted co
If Oracle won, it would set a precedent for this.

Second possible impact: Simple code like "Helloworld" could be copyrighted.
It's difficult to say how much code to be considered copyrighted.

Third possible impact: It could impact smaller businesses by completely pushing them out of the industry if their code is similar enough to the bigger companies 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: Harm to it's user/owner if the owner is in the car and the car crashes.

Second type of harm: Harm to others. If the car hits pedestrians walking across a crosswalk.

Third type of harm: Harm to infrastructure or buildings. If the car crashes into a building.

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 was looking to travel to Japan with either the Jet Program or Interac program. With either of these programs I would hopefully become a ALT (assisted learning teacher). If both fail, then I would look into O-hayo Sensei which also offers jobs in Japan. For right now I just need to graduate for the possibility of being accepted next year, but getting a Japan Studies minor would help me.

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)*
Something Funny Improv	6

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)*
Choir	100
Intramural Soccer	6

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: Hosted runners

Non-trivial feature 2: Webhooks

Non-trivial feature 3: Org dependency insights

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)*
HTML practice & CSS practice	30 hours
Unity Practice	10 hours

Best wishes wrapping up the semester and in the future!