Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 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 Connor Parrott

Major (Circle One): Computer Science B.A. or (Computer Science B.S.)

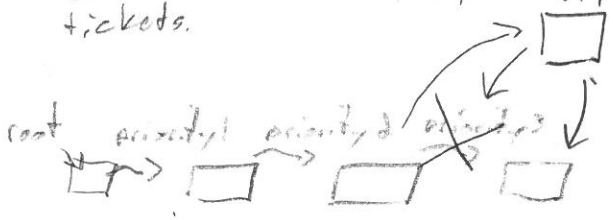
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 could work, w/ each ticket pointing to the next ticket. This would allow for insertions into the list allowing VIP customers to be inserted higher of given priority.

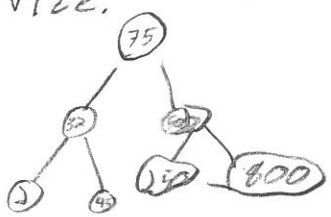
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

W/ access to the root you would have access to each customer in priority order w/ easier adding. Could get away w/ singly linked if you don't need to access previous VIP customer tickets.



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

Originally I thought of a Queue, but the vip nature of it makes a Queue tricky to implement. Instead you could go with a binary search tree & print out an in order search of the tree.



↳ this would be effective as it would be fast to search through, though it is probably suboptimal to the

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 numOccurrences (string, char):
    counter = 0
    for a in string:
        if a == char:
            counter ++
    return counter
```

1

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(c) constant time

Explanation of best case time complexity:

The best case is all k additions are added to the beginning of the list in order. The highest # first, then decreasing for every additional k. This would require k checks against the 1st element aka O(k)

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

For each of the k additions, you would have to iterate through & check against every one of the n floating point #s

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)*
Miltech	Debug, web dev & ticket verification.	500 - 750
Space Science Engineering Lab	Worked on REAL ground station	300
Chess Club	played chess	25

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

when an algorithm is more likely to favor or unfavor people of a specific race, religion, socio-economic background, gender, etc. Usually on the basis of training data used or biases, intended or not of the programmer.

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

An AI is fed all the students at MSU, it is given their state of birth, gpa, activities they like to do. Now when the AI is accepting people to MSU, it primarily accepts students born in the North West who enjoy outdoor activities. Now the AI has excluded people from Texas, Virginia or other US states as well as a number of smart people who don't like outdoors activities from the choice to attend as they weren't 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: All I remember on this case was it

First possible impact: allowed us to use API code freely w/o copyright concern. This made coding significantly more collaborative & sped up development. I think Google won.

Second possible impact:

Third possible impact:

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 harm

The car may run over pedestrians due to faulty sensor or extenuating circumstances.

Second type of harm: Environmental harm

There could be a bug that causes the car to remain on for long periods of time causing large amount of gas/fossil fuels to be consumed

Third type of harm: Informational Harm

The car might keep tracks of where you go most often & that information could be tracked or sold unknowingly to the customer.

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 only offer is at the SSEL as a Software lead. I have applied to NAVSEA, JPL, Maxar, Blue Origin, & several others w/ 0 acceptance / interviews yet.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
NA & that I did the entire time.	

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)*
Honestly, that is just college in a nutshell. No specific activities	

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/ GitLab

Non-trivial feature 1:

fairly intuitive & solid online resources to understand/ learn

Non-trivial feature 2:

Non-trivial feature 3:

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)*
None	

Best wishes wrapping up the semester and in the future!

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Name Fletcher Phillips

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 hash map with key:value pairs at O(1) time for search, remove, add, etc.

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

Key would be ticket and number would be the value

ticket	Priority
key	1
key	2
key	3
key	4

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

Key would be priority and value would be the ticket

key	value
1	ticket
2	.
3	.
4	.

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:

```
public Integer getCharCount(str, character){
    int count = 0;
        for (int i=0; i < str.length() -1; i++){
            if (str.charAt(i) == character){
                countit;
            }
        }
    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(n)

Explanation of best case time complexity:

Will need to find the last node to update pointers and will search through all nodes to get to the end.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Similar case where it will need to go through the entire list.

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)*
Tutor - MSU	CS Tutor	~5/hrs weekly
Zoot Enterprises	Software Eng. intern	40/hrs weekly
Landid	Software Eng. intern	40/hrs weekly
↓	Associate Product Manager	40/hrs weekly

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Where an algorithm is trained to search out a certain type of data and may miss other dat not expected.

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

Say a Student had medical problems and their GPA suffered... An admissions algorithm may not account for edge cases such as this that was out of the student's control.

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 opensource code.

Second possible impact:

Less worry of copyright on code, code is not owned by the company.

Third possible impact:

Less likely for future lawsuits in the software space.

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:

Bodily harm.

Second type of harm:

Not accounting for a driver's possible disabilities.

Third type of harm:

Could cause harm to the auto industry and insurance rates increase.

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 accepted a position as a Product Manager at Landid.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent. N/A – None attended

Organization Name	*Estimate Total Hours Spent*

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. None attended

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: SVN 2 Git

Non-trivial feature 2:
Branching

Non-trivial feature 3:
Version Rollback on branches/remove commits.

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)*
Leet Code	~100 hrs
Geeks4Geek	~100 hrs
Reading Books	~500 hrs

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Name Caleb Philipsek

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 is easy to implement and allows you to insert anywhere within the list. We can then use the urgency score to determine where to insert a new ticket with most urgent being on one end & least urgent on the other.

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

Having a linked list, iterate through until Urgency score is less then current & insert at that spot



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

Same as above but add a time field to prioritize older tickets



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): C

Your solution:

```
public int numOcc (char* string, char c) {
    int count = 0;
    int length = length (string);

    for (int x=0; x<length; x++) {
        if (c == string[x]) {
            count++;
        }
    }

    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:

k [whatever (k)] is inserted at the head of the linked list every time, meaning only k operations need to be performed

Worst case time complexity of algorithm:

$O(k \cdot n)$

Explanation of worst case time complexity:

We have to search through the entire list only to place k[x] at the end, meaning we search ln (~~times~~) k-tim

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)*

Question 5: IEEE P7003 defines the Algorithmic Bias Standard. ← Don't remember being taught this

a) Describe briefly what algorithmic bias is.

Algorithms tend to take on the biases of their creators

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

The creator thinks X group has a better standing or "we" need more of X group at the school so we we weight X group's applications favorably in determining admissions.

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: Code acquired online (even if open-sourced/"readily available") will require the owner's consent

Second possible impact: Code that is similar but created independantly could be challenged as infringement

Third possible impact: Large portion of software will be temp. unavailable until explicit consent is obtained or those parts rewritten

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 passengers due to function or malfunction of the code or peripherals.

Ex. Function: prioritize pedestrian safety, hurting passengers instead

Second type of harm: Injury to pedestrians due to function or malfunction of the code or peripherals.

Ex. Function: pris. passenger safety (hurting pedestrians instead)

Third type of harm: Injury to property (and owners of said property) due to function or malfunction of code or peripherals

Ex. Function: prio. life by damaging property if given the choice

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.

Little is currently available for someone without internships or experience in state, will probably have to work for a year at my current job & move out of state if my USGS, Sandia Labs and Los Alamos labs don't accept my app.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*

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:

github

Non-trivial feature 1: Download code onto any computer

Non-trivial feature 2: Upload code to your project from any (trusted) computer

Non-trivial feature 3: Merge different branches of a project

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)*

Best wishes wrapping up the semester and in the future!

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Name Sam Pierce

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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.

VIP customers could recieve a high score (e.g. 5,000) and regular customers could recieve a low score, each time a new ticket arrives, the scores of the existing tickets could be increased

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

Same as previous answer, however the score could be increased the longer the ticket stays in the system.

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 charCount(char, string):
    count = 0
    for i in string:
        if i == char:
            count = 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:

assuming all K elements are added to the linked list in ascending order and are higher than the nth entry, then they could just be added to the end of the list.

Worst case time complexity of algorithm: O(n log n)

Explanation of worst case time complexity:

given the K elements are random values, you would have to pick the middle value, then use half of the list from there depending on if K was lower or higher than the middle value.

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)*
Bobcats Esports club	CS:GO league	≈ 40 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias occurs when algorithms prioritize certain data features over others.

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

Admissions software could exhibit bias when factoring traits of applicants such as race, gender, or financial background.

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:
small snippets of code would be easier to patent / protect

Second possible impact:
It would be harder to use Java API methods for your own uses

Third possible impact:
It would be easier for companies to copyright the kinds of systems / algorithms they develop.

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:
Cars could crash into pedestrians

Second type of harm:
Cars could go off road and potentially kill passengers

Third type of harm:
Cars could fail to recognize other cars on the road and cause car crashes.

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 to work as an IT specialist for the Yellowstone Club. I have recieved an offer and will start work next Thursday

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Bobcats Esports Club	≈40 hours

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)*
N/A	

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:
backing up work and recording work history.

Non-trivial feature 2:
Collaboration with other people remotely

Non-trivial feature 3:
publishing work for the public / peer review.

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)*
YT tech videos	unknown >50 hrs
YT code tutorials	>50 hrs
Unity game development	>50 hrs

Best wishes wrapping up the semester and in the future!

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Name Jacob Rivers

Major (Circle One): (Computer Science B.A.) or Computer Science B.S.

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 priority queue. Priority queue's are able to process customers in a first in/ first out way but also alter the FIFO logic by assigning higher or lower priority to each customer.

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

A slow but "technically" correct solution:
create a 10,000 index empty array. Each new customer is assigned to the index of their priority score. The array is traversed each time a new ticket is to be removed, the first index with a customer in it is the highest priority customer.

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

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: Something like...

```
// a java fuction that performs a search for a character
// in a string and returns the number of times that
// character occurs.
public int howManyOfLetter(String s, char c){
    int count = 0;
    for(i=0; i= s.length; s++){
        Char currentChar = s[i];
        if(currentChar == c){
            count ++;
        }
    }
    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:

$O(n)$

Explanation of best case time complexity:

If the K floating point numbers being added are all ordered biggest to smallest and are all smaller than every number in n then every number can be inserted at the front of the SLL without traversing it. The number of operations will be n as there are K numbers to be inserted, and complexity changes linearly with the size of K so we expect O(n) for best case runtim

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

Each number in K is ordered from smallest to largest and every number in K is larger than every number in n. Then every number in K will have to traverse the entire SLL before being inserted at the end.

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)*
AWC	attending meetings	≈80 hrs
Undergrad Courses Assistant	Spring 2024 CA for CS145 Web Design	≈140 hrs

1 hr / wk
8 semesters x
16 wks

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias has many many possible definitions / interpretations but one way to describe it is that an algorithm (set of instructions) can only produce results which are based on the quantifiable inputs which the algorithm receives, biasing it against unquantifiable or other ignored data that it cannot treat in its calculations

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

If a college admissions software heavily favors, for example GPA of applicants, to the exclusion of other metrics (sports, volunteering, work or extracurricular activities) because GPA is more easily measured / quatified, then this particular algorithm would be said to be biased against applicants who have lower GPAs. This can be either accepted or rejected as a useful algorithm by the school's administration, but it doesn't change the fact that the alg. can only treat the inputs that it is given, and excludes the non-quantifiable aspects of candidates,

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 and explain 3 possible impacts to the computing industry of this win.

Side you choose to win: Google

First possible impact:
Code is not copyrightable and businesses begin taking entire codebases from other businesses, slapping their name on another company's code with a few name changes, and start selling duplicate services.

Second possible impact:
Companies become very serious about guarding their codebases and protecting them from being leaked or shared with the public.

Third possible impact:
Private companies are regularly eaten up by larger companies who copy their codebase but can afford more marketing.

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 pedestrians, who the car fails to detect and runs into.

Second type of harm: Harm to passengers who are injured / killed in any accidents caused by faults in the navigation system.

Third type of harm: Harm to property damaged by collisions stemming from the navigation system failing to detect / avoid objects in its environment.

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'm honestly burnt out by school and don't feel confident in the CS education I've recieved at MSU. I've applied to a teaching program in Japan (JET) to teach english as a forcign language again (something I did when I was younger). I have not recieved a reply yet. I also have applied to a Mandarin language program in Taiwan and hope to get a schdarship to study there for a year. If these options don't work out I will try to find work in tech/computing but I don't really feel that I am likely to pass interviews or find a software dev. job. I've get the sense that I'm not really prepared to work in the field of CS.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Chinese Culture Club	120

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)*
AWC	160

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:

I just use regular old Git.

Non-trivial feature 1:

Branching - ability to create copies of the project where changes can be segregated from the rest of the project for experimentation and merged later.

Non-trivial feature 2:

Reversion - ability to roll back to earlier commits/versions of a project.

Non-trivial feature 3:

Cloning - can clone code repositories from other sources to the local machine.

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)*
Courses on brilliant.org	200 hrs
courses on LLM architecture/training	50 hrs
taught myself linear algebra from online Textbooks	80 hrs
JetBrains academy tutorials	100 hrs
Lots of Youtube tutorials various topics	250 hrs

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 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 Colby Roberts

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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.

An array

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

make an unsorted array of the ticket objects, then sort by the ticket urgency parameter



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

make something else

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 countOccurances(string, character)
    strArray = string.split("") <- empty char
    occCount = 0
    For letter in strArray:
        if letter == character:
            occCount += 1

    return occCount
```

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:

If the correct position of the floating point value is the first position checked, then the relationship between number of inputs and the run time will have a linear relationship.

Worst case time complexity of algorithm:

$O(k \cdot n)$

Explanation of worst case time complexity:

If the correct position of the floating point number is the last value checked, then you will be checking all n values for each k value. This results in a time complexity of $O(k \cdot n)$

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)*
TechLink intern	Test engineering	2,000

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The ways in which an algorithm tends to favor certain outcomes, making them more likely.

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

They are probably biased towards high GPA scorers.

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:

A higher level of scrutiny when it comes to the application of copyright on code.

Second possible impact:

Google paying out millions/billions of $

Third possible impact:

Don't know, don't care

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 harm to those that get hit by malfunctions/accidents

Second type of harm:

mental trauma of those who are in accidents

Third type of harm:

Emotional harm to those who lose Friends/ family

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've applied to roughly 30 places. I don't want to go to grad school. I have recieved 0 offers.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
None, your clubs suck	

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)*
Video games	Lots

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 Bash
I use it from the command line because I know how it actually works

Non-trivial feature 1:
Bash scripting

Non-trivial feature 2:

Non-trivial feature 3:

why would you ever want a "sophisticated" (read: bloated) version control system?

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)*
N/A	

I have a life outside of working part time and being a full time student

Best wishes wrapping up the semester and in the future!

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Name Matthew Rolls

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 way oldest issues are solved first but those that are important can't skip the line to some extent.

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

Tickets could be given priority grades. A grade 1 hops to the front while subsequent numbers such as 2, 3, etc are at the front but behind priority 1.

A, M] priority 1
C] priority 2
K] priority 3
Z, F, R, O] general priority appearing in order of creation

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

A priority 2 could skip say half the line and a priority 3 could skip 1/3rd of the line.

A, M] 1
C
K] 2
Z
F] 3
R
O

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 int count (string S, char C):
    int C = 0
    for K in range(len(S)):
        if S[K] == C!
            C = C + 1

    return C
```

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:

$\Theta(k)$

Explanation of best case time complexity:

If the first... number in "k is smaller than the number of the head element and subsequently becomes the new head and every following k number is smaller than the previous and repeats the process of becoming the new head the time would simply be k.

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

comparing k to n items k times, has the potential to be exponential.

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 All through MSU	*Main Activities*	*Hours Spent (estimate)*
495 Lecture TA	assisting students with in class activities	30
Smarty cats	tutoring students in 127 and 132	30 - 35
NSF REU intern	research project	400+

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithm will lean towards producing a result more often than it should or produces a result that is misleading due to not taking into account all factors.

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

weighting the importance of GPA over test score would possibly end up benefitting students from schools where a high GPA is easier to attain. Either through more lax standards or over inflated weights for some high school classes.

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:

Software products become incredibly expensive

Second possible impact:

Oracle holds too much power over software market

Third possible impact:

Software in critical infastructure may be put in a legal grey area or deemed illegal for using Java API.

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:

Software bug causes a crash and fatality

Second type of harm:

Software routing through roads not built for high traffic could increase upkeep cost of a road

Third type of harm:

Car could be hacked and control could be lost.

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 trying to get a job. So far I have applied to a large number of positions and have few results so far. A few interviews without landing the job is the best I have done.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
photography Club	10
ACM	very minimal less than 2 probably

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)*
Honors seminar courses	100

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: checkout

show branch

Non-trivial feature 2: commit

Stage changes for push

Non-trivial feature 3: push

Send changes to remote repo

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)*
miscellaneous resume/interview prep	50

Best wishes wrapping up the semester and in the future!

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Name Bennett Sampson

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 HashMap would be best. You can grow + shrink the entries in the map dynamically, and map ticket numbers to urgency

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

	ticket #	urgency
0	1	1
1	2	100
2	3	10,000

Can be implemented by hashing ticket numbers as the key, urgency as value

if selected, remove

c) Describe a second way in which this data structure could be implemented and draw a picture of that data structure.
This could be implemented in reverse as well. (However this way is much worse)

Urgency	List of associated ticket #'s
1	1, 4, 8, 22489
100	2, 6, 9, 12
10,000	100,000, 100, 10,000

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): Java

Your solution:

```
Private int myfunc(String S, C){
    int timesOccured =0;
    int StrLength = S.length();
    for(int i=0; i< StrLength; i++){
        if(S[i] == C) {
            timesOccured ++;
        }
    }

return timesOccured;
```

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:

$\log n$

Explanation of best case time complexity:

When numbers are added they are done so in a fashion where they are doing a binary search of the list for their position.

Worst case time complexity of algorithm:

n^2

Explanation of worst case time complexity:

Every item in the list is searched to find the new number's place

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)*
ACM	Career fair prep	8
Onx Maps Intern	Front-End Web dev	480
Nucor Corp Intern	Full-Stack Dev	480

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Unintentional bias in software instilled by the dev. making it.

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

Accepting students of any protected class. (Title nine)

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:
Companies/people may become weary of open source software (bad)

Second possible impact:
Google develops own platform to compete with Java & oracle (good)

Third possible impact:
Google goes bankrupt (bad)

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:
Loss of life (crash)

Second type of harm:
Selling location data

Third type of harm:
Breaking traffic laws

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.

Last Summer I interned with Onx Maps as a front End web-dev. I was fortunate to recieve a return offer and will be returning to intern again this Summer in hopes of staying full time.

Other places applied as a backup:

1.) Workiva
2.) Coinbase
3.) Oracle
4.) Land ID
5.) So Fi
6.) Brightvine

I have not even heard back from any of these companies. It's a tough world out there

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*

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)*
Class / Class Projects	∞

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

— not sure what you mean by "non-trivial"

Non-trivial feature 1:

git rebase

Non-trivial feature 2:

git fetch

Non-trivial feature 3:

git clone

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.

I came into C.S. completely raw. No coding before msu.

Activity Description	*Hours Spent (estimate)*
Youtube	a lot... too many for a number

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

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Name Rory Schillo

Major (Circle One): Computer Science B.A. or Computer Science B.S.

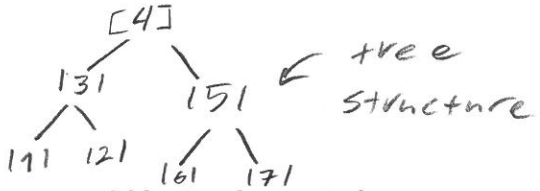
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

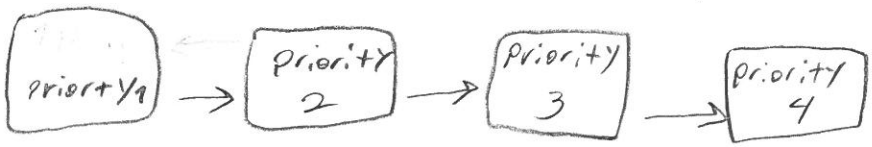
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Any self-balancing tree structure could be used where the tree is balanced base on priority. This tree could then be used to find the highest priority item in $O(\log n)$ time.



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

A linked list where when new items are added they are placed at a spot in the matching the items priority level. For example, a high priority item would be placed near the front and a low priority one near the back



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 charCount(str, charToCount):
    var count = 0
    for letter in str:
        if (letter == charToCount):
            Count++

    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:

If each new number was the new highest number then each insertion would only require the first item of the list to be checked. Since each addition would only have 1 step the time would be O(K)

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:

if each new number was the new smallest number then the whole list would need to be traversed in order to be added. This would lead to O(n) 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)*
Chi Alpha	campus ministry	12 (per week)
	bible study	
	worship	

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

when an algorith unfairly favors certain people due to an intentional or unintentional part of its design.

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

If the software looked at high school GPA it might neglect those not privledged enough to attend a highschool

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 easier for people and companies to use others code to maintain consistancy and improve user-experience

Second possible impact:
People could get away with stealing code easier.

Third possible impact:
Google would become more powerful.

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: bodily harm in a crash

Second type of harm: emotional harm also in a crash.

Third type of harm: death also from crashing

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.

To move back to Billings with my family and work for 32 Hrs a week at Computers Unlimited where I already accepted a Job offer at.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Chi Alpha	12 (per week)

not sure what this question is asking...

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)*
None ???	

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 and merging which allows work to be done without effecting the main branch till it is time to merge

Non-trivial feature 2: Forking which allows users to create their own copy of the repo.

Non-trivial feature 3: Conflict mangsment allowing users to see and fit merge conflicts

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)*
Desished and published a –	200
– video game in unity	
which required me to	
learn C# on my own.	

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 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 Brian Schumitz

Major (Circle One): Computer Science B.A. or (Computer Science B.S.)

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.

(PQ)

a) What simple data structure would best model this situation? Explain.

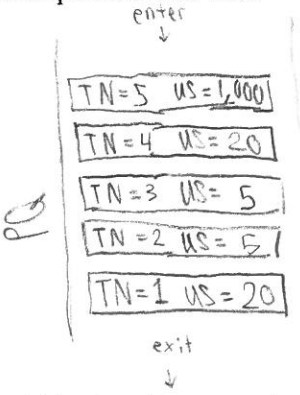
A Priority Queue would be a good way to go. This works well because a queue is a FIFO (first in-first-out) data structure, the same logic as a ticketing system. Additionally, we use a PQ in order to account for the urgency level associated with the tickets.

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

```
class PQ {
    int size;

    func PQ()
    func add (new_ticket)
    func pop (ticket)
}
```

ticket is comprised of:
- number
- urgency score

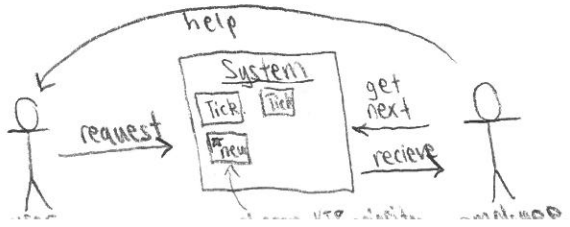


TN = ticket numbe
US = urgency sco

Order of exit:
5 (highest US)
1
4
2
3

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

Each time a customer service ticket is requested, a new ticket object is created. A ticket is comprised of a number and an urgency score. Each time a request is addressed, the employee runs a search for the next ticket of the highest urgency level. If two match, the smaller (waiting in line longer) ticket number is chosen.



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): Java

Your solution:

```
public static int numberOfOccurences(String s, Char c){
    int counter = 0;
    for (int i=0; i < s.length(); i++){
        if (s.charAt(i).equals(c)){
            counter++;
        }
    }
    return counter;
}
```

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:

n = size of LL

In the best case, only one comparison is necessary. The new floating point number from set k is less than the head, so it becomes the new head. (1 comparison)

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:

n = size of LL

(head to tail)

In the worst case, the entire LL must be traversed for every insertion. In other words, each node in the set k becomes the new tail when it is added. (n comparisons)

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)*
Spirit of the West Marching Band	Football performances, campus event performances, music rehearsal	280+ hours over the last 4 years.
HackerCats	CTF practice, cybersecurity skills	7ish (only went a few times)
DOE Omni Technology Alliance	Assisting with teaching a cybersecurity summer camp.	700+ hours (starting summer 2023 – present)
MSU SECL undergrad research	Snort IDS/IPS cyber tool research	11
Pickleball club	Play pickleball every Sunday	30ish

together

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Intentional or unintentional bias added into software systems that can cause unjust/anomalous results.

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

If the software was created with bias, intentional or unintentional, then it might reject more admissions from prospective students of a certain ethnicity than another, relative to total number of admissions from each ethnic group.

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 interactivity between software development companies without fear of legal action for using openly available code.

Some idea

Second possible impact:

More open source software systems created using professionally distributed code that is already known to be efficient and effective.

Third possible impact:

Absolute messes of patchwork software systems where code is taken from too many places to track.

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 passenger

Second type of harm:

Harm to pedestrians

Third type of harm:

Harm to self (the car)

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 pursuing a master's degree in cybersecurity.

I applied and have been accepted at Montana State University.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Rock climbing (if you count that)	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)*
Group projects in classes	100+

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:

Windows 10 Operating System (?)

Non-trivial feature 1:

Release new updates and features

Non-trivial feature 2:

Handles process handling

Non-trivial feature 3:

Memory allocation

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)*
YouTube videos	10 hours
Reading Computer Science/Cybersecurity news	10 hours

Best wishes wrapping up the semester and in the future!

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Name Dillon Shaffer

Major (Circle One): Computer Science B.A. or Computer Science B.S.

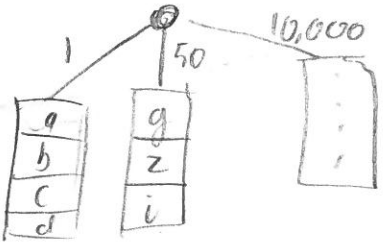
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 priority queue would be useful because it pops items based on a priority weight (urgency score here).

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

You could implement this with a b-tree of queues



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

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): Rust

Your solution:

```
fn x(s: &str, c:char) -> bool {
   s.contains(c)
}
```

Or

```
fn y(s: &str, c: char) -> bool {
   s.chars().any(|o| o == c)
}
```

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: k is the smallest value in the list and can be put at the front

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity: Assuming k can mean that this is extremely improbable but k could be larger that the $(n-1)^{th}$ element.

10
×18
×2
= 360 hours

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.

40
×10
400

Organization	*Main Activities*	*Hours Spent (estimate)*
Hackercats	Attending Meetings	10
AWC	Meetings + Events	40
ACM	Meetings + Events	20
Undergrad Research	Working	~440
Quia Internship	Programming	400+216=616
REU Research	Statistics + Programming	400

12×18
=216

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when an algo. misaccurately answers a problem because it has not been trained to, or incorrectly trained, to respond.

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

Race, socioeconomic status could have historical correlations with acceptance rates and cause individuals in these groups to not be admitted.

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: Api appearance cannot be copyrighted.

Second possible impact: Small pieces of boilerplate code cannot be owned by a single entity forcing developers to pay for licenses.

Third possible impact:

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: Crashing into pedestrians

Second type of harm: Intentionally crashing a car to save the lives of pedestrians over the lives of passengers.

Third type of harm: Being unable to recognize obstacles or traffic signals and failing to stop the vehicle.

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 have an internship with Itude Dynamics over the summer before I return for my PhD at MSU. I will be continuing to study computer science.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*

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)*
Internship Onsites	24

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 vcs

Non-trivial feature 1: code stashing – being able to temporarily store changes without committing them.

Non-trivial feature 2: cherry-picking. selecting changes from certain commits to apply to the working branch.

Non-trivial feature 3: patching – being able to change small parts of an externally maintained codebase with a collection of patch files that are applied with every external update.

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)*
learned C++	120
learned Rust	700+ maybe
learned GO	40
programming competitions	20

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Name Josiah Shirley

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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: Puts tickets in order of urgency with highest urgency at the top.

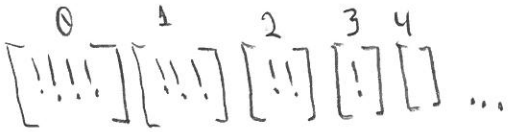
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A linked list where new tickets are inserted at the correct position (highest urgency first, etc.)



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

this would be bad! → An array with the highest urgency tickets at the front



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 char_counter(phrase, letter) -> int:
    occurences = 0
    phrase = str(phrase)      # make sure the phrase
    for char in phrase:       #is a string.
        if char == letter:
            occurences += 1
    return occurences
```

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:

All values are smaller than all previous values and are added to the front each time. k operations occur.

Worst case time complexity of algorithm:

$O(kn)$

Explanation of worst case time complexity:

All values are the largest in the current list; the entire list is searched through each time. For each insertion, n operations are performed.

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)*
undergraduate scholars program	Research	60 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias occurs when the intended probabilities of outcomes do not match the actual probabilities of outcomes (i.e. an algorithm may be biased towards certain outcomes

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

An algorithm may admit more students with lower GPA's than intended due to algorithmic bias towards those 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.

Having a decision on this realistically would require much more information.

Side you choose to win: Google

First possible impact:

More code (even some Proprietary code) is considered Publican domain.

Second possible impact:

Companies put greater security/secrecy around their software.

Third possible impact:

Software companies use proprietary software more freely than before.

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:

Destroying pedestrians or property

Second type of harm:

Injuring the passengers

Third type of harm:

Stranding the passenger(s) in the middle of nowhere.

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 have applied to work at Heritage Christian School as a teacher.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Church	400 hours
Chess club	50 hours
Cru	100 hours

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 (in class)	50 hours

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 Hub

Non-trivial feature 1:

Branch merging

Non-trivial feature 2:

Cloud-Based Repository Sharing

Non-trivial feature 3:

Continuous integration Compatibility

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)*
Building systems (hardware and software for clients)	30 hours

Best wishes wrapping up the semester and in the future!

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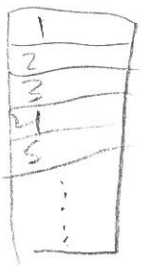
Name Ezra Skoog

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 Ranked queue, The most urgent ticket would live at the top of the queue and be popped off

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



The queue holds the tickets & the rest is explained above,

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

could be implemented the reverse way.



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 foo(myStr, myChar):
    count = 0
    for c in myStr:
        if c == myChar:
            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: $O(n)$

Explanation of best case time complexity:

Worst case time complexity of algorithm: $O(n^2)$

Explanation of worst case time complexity:

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)*
CACI	Internship	800 - 1200

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.
algorithems making bias based on the input it has recived.

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

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: Help society become better as a whole

Second possible impact: Better code standards

Third possible impact: Can help small companies compete.

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: Hurt a pedestrian

Second type of harm: Stressfull to the user

Third type of harm: Take jobs away from people

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 have been applying to software jobs in montana. I have an upcoming interview with epic but no current offers.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*

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	100

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: "git rebase -i" - an interactive rebase

Non-trivial feature 2: "git merge" - for merging branches

Non-trivial feature 3: "git stash save 'stash name'" - stashes a commit that can be brought back w/ git stash pop <stash_hash>

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)*
Reading CS books	150
Projects	50

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Name Cole Smith

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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.

Dictionary with key's of integers

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

Implement the dictionary to hold names of tickets and assign urgency as needed

if VIP;

{key : 5000+ : name}

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

Could have multiple names for key's

{key 5000+ name1, name 2.}

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 fun(string, character)
    for i in range(len(string)):
        if character:
            num += 1
        end
    end
    return num
```

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:

$O(n)$

Explanation of best case time complexity:

you add floats in ascending order to list

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

you have to add nodes to make it ascending in value.

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)*
TA 127	Assist Students	40

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithmic bias is how logic predicates the result and how the sampling enforces certain attributes

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

Men > Women if more men request entrance into college.

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:

Ownership of Software issues

Second possible impact:

Defects Could affect Both companies

Third possible impact:

Vulnerabilities are now 2x likely.

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:

Not rendering the Software PI safe

Second type of harm:

Not applicable to all weather types

Third type of harm:

Not applicable to all driving situations and causing collisions.

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'd like to work for anyone.
NSA, Digital forensics, Security,
Haven't applied

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*

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)*
Robotics 455	300
Capstone	100

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:

Commits

Non-trivial feature 2:

Branches

Non-trivial feature 3:

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)*

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

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Name Justin Smith

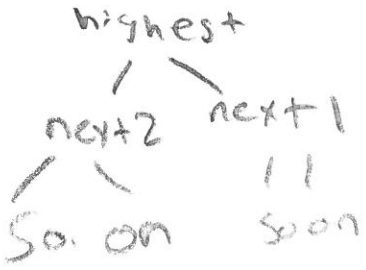
Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 que, You need a que with ranked importance

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.

highest -> next -> next1 => so on

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:

```
int fun (char c, str s) {
    int count;
    for char i in s:
        If (i == s) {
            count ++;
        }

    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:

The first item checks is the correct spot
So you just have to go through k.

Worst case time complexity of algorithm:

O(k·n)

Explanation of worst case time complexity:

You have to go through all values of n
for every k.

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)*
Course assistant	help students / grade	8/wk

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

favoring a certain demographic via the code.

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

having a bias towards gpa over extra curriculars and sat scores. or a preference via ethnicity.

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 strict future copyright claims

Second possible impact:
less advancement in overall tech

Third possible impact:
less competition inthe tech space

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:
Could cause crashes in event of an error

Second type of harm:
Could Malfinction and shut down car without reason

Third type of harm:
Could rely on sensors too much and cause accidents due to poor data collection

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 to work, I already accepted an offer to be a sales force dev.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Work	20 hr/wk

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)*
Class room Projects	unsure, a lot

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:

Not sure

Non-trivial feature 1:

Non-trivial feature 2:

Non-trivial feature 3:

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)*
Self app Development	120 hr Plus

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Name Nicholas Sulzbacher

Major (Circle One): Computer Science B.A. or Computer Science B.S.

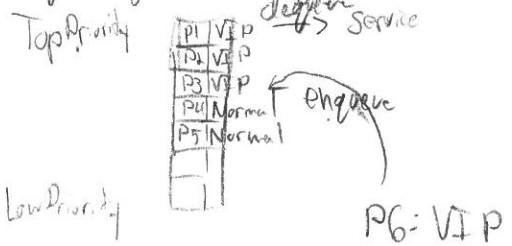
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 priority queue. Just a standard queue wouldn't handle VIP customers. This would allow first-in, first-out routine (assuming VIP is handled)

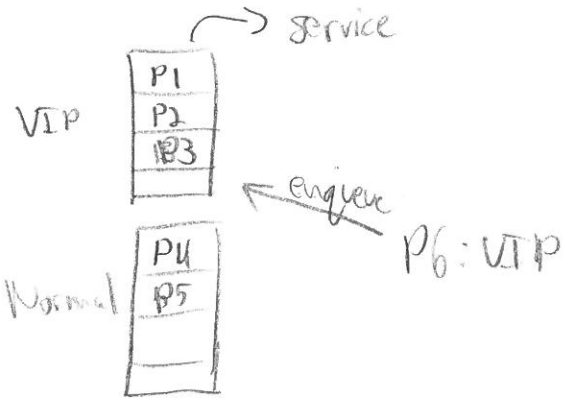
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Providing weights or flags to each customer and their status.



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

Creating two different queues could work, when VIP is empty, move to Normal



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): Java

Your solution:

```
function count(String, char) {
String word = String;
String char1 = Char;
Int Count = 0;
    for (int i, i ≤ word.lagth, i++){
        if (char1 == word.index){
            count = 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(nk)

Explanation of best case time complexity:

Best case,

Worst case time complexity of algorithm:

Explanation of worst case time complexity:

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)*

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Cant recall

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

I assume possibly taking a variable of a student a using it in priority to others.

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:

Allowing APIs to be copied can allow other (possibly start ups) to create their own API with similar form.

Second possible impact:

One step closer to open-source, how almost all (besides confidential) software should be.

Third possible impact:

Sets a standard on the amount of copiable 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:

Physical, harming passengers by driving into a unidentified wall.

Second type of harm:

Reputation, for some reason people hate companies that use this type of tech.

Third type of harm:

Industry harm, possibly outlawing the use of these technologies

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 attending GCU and getting my MBA in project management.
I have been in contact with an advisor there but have not applied yet due to special timing.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*

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 / Github

Non-trivial feature 1:

Pull-Requests

Non-trivial feature 2:

Authentication Tokens

Non-trivial feature 3:

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)*
Youtube	Countless

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Name Trey Thompson

Major (Circle One): Computer Science B.A. or Computer Science B.S.

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. Since the word urgent is tied to a score in a line system it will handle both values & priorities.

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

An array of a class "Ticket" could be used where each ticket holds customer ID and a priority value of 1 to 10,000

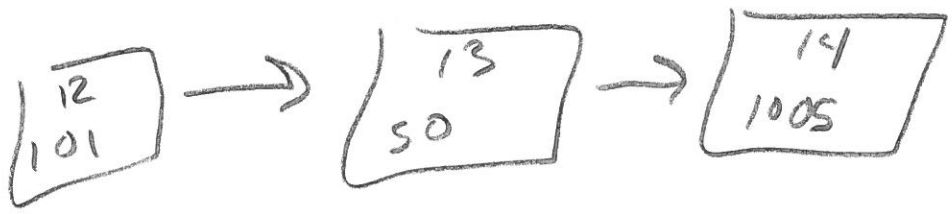
Top is ID
Bottom is urgency score

Tickets

[12 / 743 , 13 / 1001 , 14 / 5,000]

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

A Linked list could also work, the insert method would be more complex



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): Java

Your solution:

```
public int occurance(string word, char c) {
int count = 0;
  Array wordArray = word.split(" ");
  for(i=0, i< wordArray.size(), i++) {
    if(wordArray[i].equals(c) { count++; }

  }
  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:

If $k=0$ $O(1)$

Explanation of best case time complexity:

If we don't add numbers to the list, then it is $O(1)$.

Worst case time complexity of algorithm:

$O(n)$

Explanation of worst case time complexity:

If we add the maximum amount of numbers, then it will only go to the n number of 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)*
MSU Roundnet Club	Travel, Competing, Founding	500+ hours
MSU concessions	Basketball events	150+ hours
MOA Referee (wrestling)	Local + State Tournaments	300+ hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is Algorithms that take a shortcut to find the easiest possible path to still do a job.

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

Numbers may be miscalculated if they are skipped over.

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:

Open source APIs are accessable to the public

Second possible impact:

Not everyone has to write their own language to code & monotice

Third possible impact:

Possible Educational impacts within Universities

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:

Not reading a person at a crosswalk and continue driving

Second type of harm:

Speeding in work zones when speed limit is temporely changed

Third type of harm:

Not reacting to other self-driving cars

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 have accepted a Implementation consultant at FAST Enterprises.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Roundnet Club	500+ hours
IM Volleyball	20+ hours
CS Kickball Squad	2+ hours

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)*
Roundnet Club	500+ hours
Software Application side project	40+ hours

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: Bitbucket

Non-trivial feature 1:

Continuous Integration auto setups

Non-trivial feature 2:

Pipelining

Non-trivial feature 3:

Works with Atlassian Jira Boards directly

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)*
Github workshop	1+
Code Academy Tutorials	10+
Custom Family Feud Game	5+

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Name Brady Underwood

Major (Circle One): Computer Science B.A. or Computer Science B.S.

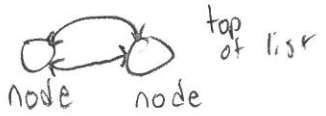
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

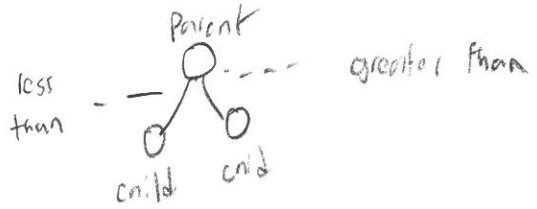
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Could be Implemented as a linked list



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

Could be implemented as a binary tree



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): Java Script

Your solution:

```
let numCharsInString = (str, char) => {
    let count = 0
    for(let i = 0, e = str.length; i<e ; i++){
        if (str.charAt(i) == char) count++;

    }

    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:

klog(n)

Explanation of best case time complexity:

The best case inserting k floats into a sorted list multiplied by the current number of floats (n)

Worst case time complexity of algorithm:

nk

Explanation of worst case time complexity:

Looking at every n for each k insertion to find optimal spot

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)*
Envestnet	Internship	400 (40h/week : 10 weeks)
Black Stone Launchpad	Pitch Competitions	25

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is the potential for algorithms to unintentionally elicit bias toward a group programmatically

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

It could lead to a certain race or gender being unfairly reduced in applications

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:

Looser ownership of publicly shared code. Potential for people to distribute code off of github without permissions

Second possible impact:

Greater open source support

Third possible impact:

Popular Languages being viewed as owned by the people

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 Harm - Bug or coding decision could lead to people getting hurt in a crash

Second type of harm:

Industry Harm - Taxi, Uber industry would take a big hit financially, Job loss

Third type of harm:

Emotional Harm -

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 planning to continue applying for jobs in and around Seattle

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Intermural Soccer	25

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:

github

Non-trivial feature 1:

Commit historys with commit messages

(commit, push, pull)

Non-trivial feature 2:

Branching for diverging work

(branch, merge, checkout

Non-trivial feature 3:

Pull requests to have peer-reviewed code

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)*
Codecademy	24
Self taught Javascript - react - svelte	50

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Name Robert Van Syk

Major (Circle One): Computer Science B.A. or (Computer Science B.S.)

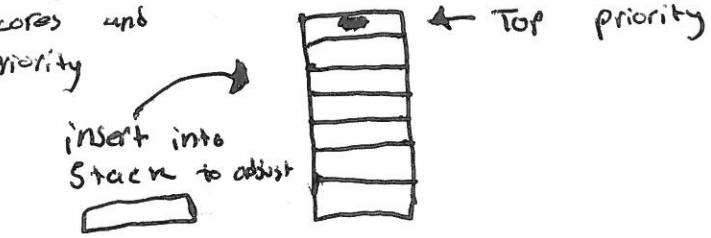
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

To best model this you can use a [redacted] Stack in which you order by priority

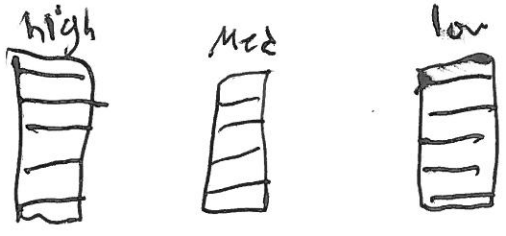
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

You can have a sytem which takes the scores and stacks them by priority adjusting the stack with inserting



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

Another way to do this is with multiple Stacks in which each stack can take diffierent priorities or actions



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 printOccurs(stringIn, charactIn):
    occursCount = 0;
    for char in StringIn:
        if charIn.equals(char):
            occursCount++;

    return occursCount
r
```

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(n)

Explanation of best case time complexity:

In our best case we are able to insert K floating point numbers perfectly for each insertion. The computation needed would be inserting and checking neighbors which can be done in O(n) time

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Worst case is still O(n) since our list is ~~Pee~~ maintained in order and we are just checking which values we can insert our new value between

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)*
CySer	cyber security	30 hrs
Swing Cats	dancing	15 hrs
Debate Judging	MHSA Debate Jude	5 hrs
Country Dance MSU	dancing	20 hrs
Montana Farmers Union	policy work	200+ hrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithms that may unfairly affect a particular group of people intentionally or unintentionally.

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

One particular example could be an algorithm that gives preference to smaller class size for an algorithm that determines a ~~grade~~ score for ~~a~~ an applicant automatically. This may make sense to account for smaller class sizes but would present significant bias.

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: Strained relations

Second possible impact: Software may be harder to develop

Third possible impact: Google will gain more security benifits from in house developed

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: False sense of security

Second type of harm: poor programing leading to bugs

Third type of harm: poor programming leading to security vurnabilities

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.

Air force cyber training

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Swing Cats + Country Dance MSU	35 hrs
Church	20 hrs
MSU TKD	50 hrs

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)*
Gosser	30 hrs

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: Desktop functionality

Non-trivial feature 2: Easy collaboration

Non-trivial feature 3: [redacted]

contribution history

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)*
Misc self projects	50 hrs

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 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 Emma Veldhuis

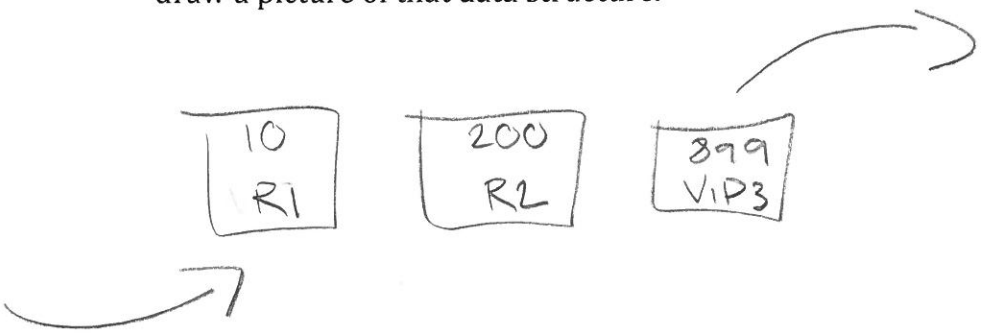
Major (Circle One): Computer Science B.A. or Computer Science B.S.

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.

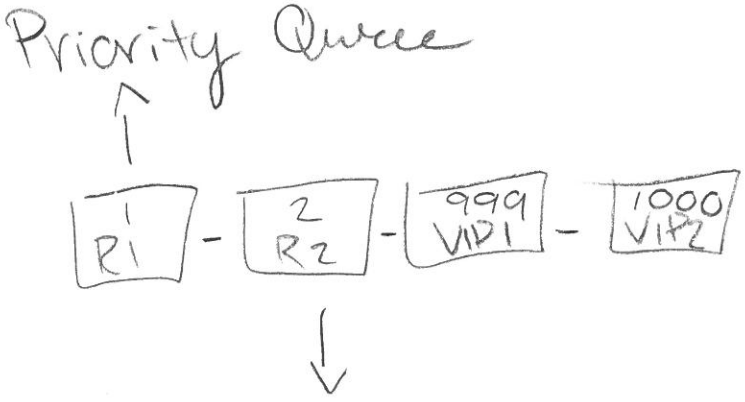
a) What simple data structure would best model this situation? Explain.

Hashmap, key value pair and is dynamic

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.



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:

```
Public int numtimes (string word, char c) {
  int count = 0;
  for (int y = 0; y < word.length; y++){
     if ( c.isequal(word.charAt(y)){
        Count++;
      }
  }
  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^2 ?

Explanation of best case time complexity:

time Complexity is an area I think could be focused on more.

All honesty I have no idea on time complexity questions

Worst case time complexity of algorithm:

Explanation of worst case time complexity:

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)*
Chi Omega	President	2-25hr/week
ePALs	member for 3sem	2hrs/week
Dean of Students office	front desk	15hr/week
SPS Commerce	SWE Intern	40hr/week in summer
AWC	member	1 hr/every other week
Honors college		

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithmic bias is when a algorithimic could be favoring one outcome over another impacting results.

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

Placing applications in a specific order for further examination based on a data point like GPA

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:

So much code is reused this would cause many more lawsuits in industry

Second possible impact:

would lead to lots of code being taken from companies

Third possible impact:

would cause major impact to public coding sites

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:

Car accidents

Second type of harm:

higher pollution in atmosphere

Third type of harm:

Could blow up from heat

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've accepted an associate software engineering 2 year rotational program at SPS Commerce in minneapolis, MN.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
intermurals	1hr/week (3 seasons)
Swing dancing	
Study abroad	

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 in class!	
Major madness volunteer	
ePALs	

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:

Visual Studio Code

Non-trivial feature 1:

lots of cool plug ins!

Non-trivial feature 2:

auto fixes for errors

Non-trivial feature 3:

easy terminal integration

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)*
linked in learning	topics
GHC	

Best wishes wrapping up the semester and in the future!

Thank you!
I'll always cherish my time at MSU! I wish it wasn't ending so soon! Time flys!
Best wishes!

Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 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 ERIC WANNER-GARCIA

Major (Circle One): Computer Science B.A. or Computer Science B.S.

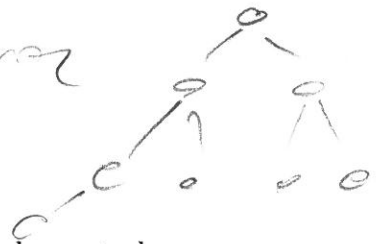
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 : PRIORITY 1ST.
ARRIVAL TIME 2ND

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

COULD BE A TREE THAT REBALANCES ITSELF UPON INSERT/REMOVE (W/ PRIORITIES)



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

AN ARRAY THAT REBALANCES AS WELL (W/o PRIORITIES)

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 COUNTOCCURRENCES(INFO, TARGET):
    COUNT = 0
    FOR CHAR IN INFO:
        IF CHAR == TARGET:
            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:

BEST CASE THERE IS NO SEARCH & ONLY HAVE TO INSERT k TIMES.

Worst case time complexity of algorithm:

O(n+k)

Explanation of worst case time complexity:

MUST SEARCH THROUGH ALL OF n BEFORE TO INSERT.

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)*
AWC	MEMBER	~1-2 HR / WEEK
House of Cards	HOST / ORGANIZER	5 + HR / SEMESTER
Math Shadow Day	HOST	~3 HR / SEMESTER

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

BIAS THAT MANIFEST FROM AN ISSUE IN ALGO PROCEDURE.

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

INFO FROM HISTORICALLY MINORITY NEIGHBORHOODS MAY LEAD A BANK TO GIVE INDIVIDUALS THERE TODAY LESS OPPORTUNITY.

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:

LESS STRICT C-RIGHT/PATENT LAWS FOR CODE

Second possible impact:

NO C-RIGHT/PATENT RIGHTS FOR CODE

Third possible impact:

LESS HONORABLE BUSINESS TACTICS.

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:

HIT PEDESTRIAN

Second type of harm:

WHIPLASH FROM POOR BRAKE MANAGEMENT (OR ACCELERATION)

Third type of harm:

(CATASTROPHIC)

TAKE JOBS / HURT TAXES INDUSTRY ETC

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.

APPLIED TO MANY, GHOSTED FROM MOST.

WORK ON PERSONAL PROJECTS.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
NOT	

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)*
WORK A JOB	~ 4 THOUSANDS

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:

COMMIT : PUT MODIFICATIES ONTO BRANCH

Non-trivial feature 2:

BRANCH : SPLIT FROM A CURRENT STATE OF ANOTHER BRANCH

Non-trivial feature 3:

MERGE : TAKES 2+ BRANCHES & CREATES A COHESIVE SINGULAR BRANCH

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)*
008 DONE. WHAT KIND OF QUESTION IS THIS.	

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 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 Jace Cavanelli

Major (Circle One): Computer Science B.A. or Computer Science B.S.

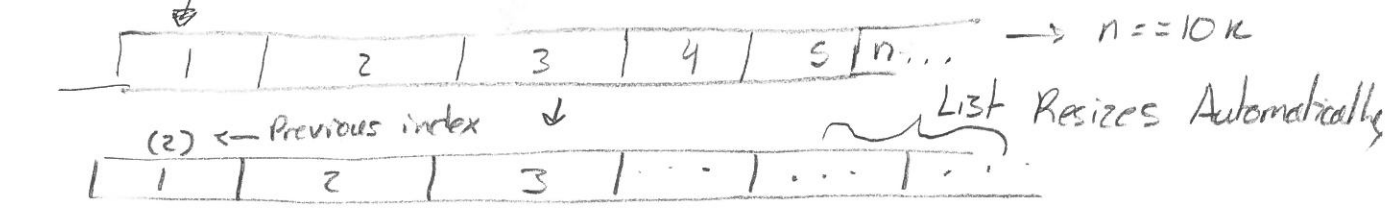
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Linked List, due to the ability to sort by urgency, with other data, you can always remove it once its done easily.

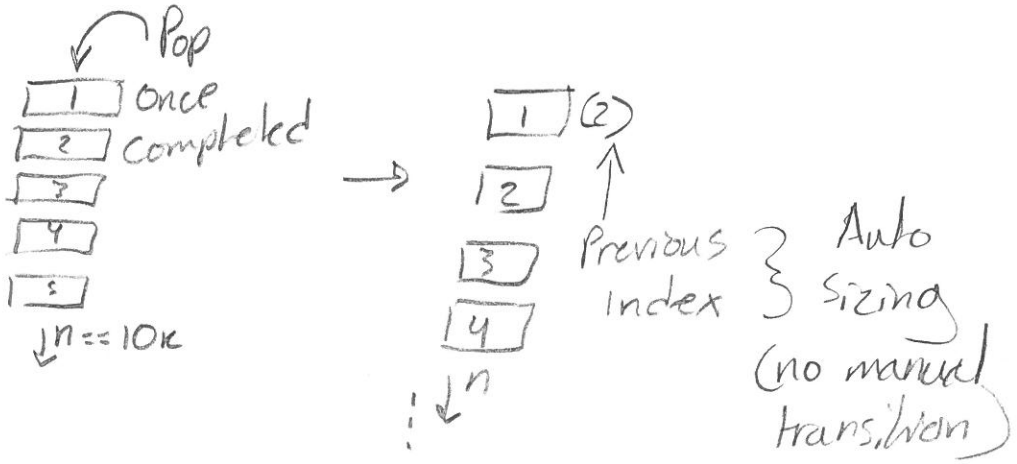
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Linked List



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

Stack



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): Java

Your solution:

```
public int returnStringCount (string str, char ch)
{
    int numberCh = 0;

    for (int i = 0; i < str.length(); i++)
    {
        if (str.charAt(i).equals(ch))
        {
            numberCh ++;
        }
    }

    return numberCh;
}
```

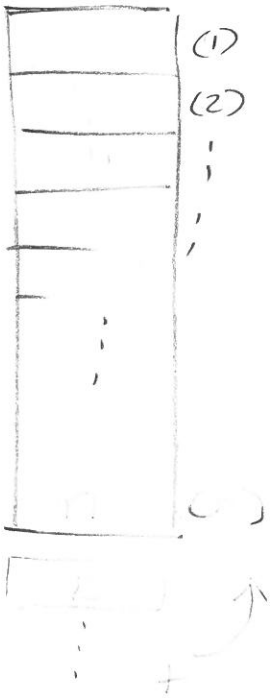
Question 3: Consider a singly linked list that contains **n** floating point numbers and is maintained in ascending order. An additional **k** floating point numbers will be added to the list, one at a time. You may assume that **k << n**.

Best case time complexity of algorithm:

$(n^2) \rightarrow \Theta(n)$

Explanation of best case time complexity:





Worst case time complexity of algorithm:

$n(\log(n)) \longrightarrow O(n)$

Explanation of worst case time complexity:



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)*
HiLab (MSU)	Unity Developer	100 + Hrs
AWC	General Attender	~10 Hrs
ACM	General Attender	~10 Hrs
HEMA	sword training	~20 Hrs
IBIO	General Member	~60 Hrs

<Internship

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

I do not know this standard

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

N/A

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:

Java remains open source and free of liscensing fees.

Second possible impact:

No other languages can be copyrighted or patented in the future.

Third possible impact:

Other industries can now use large archives of code without repercussion.

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, the car, if not tested enough, could have a life threatening crash if bugs or programming errors are present.

Second type of harm:

Mental, the car could cause hesitation and general distress from other drivers, or distress from the driver learning

Third type of harm:

Infrastructural, some of these vehicles could experience disuse or privacy exposure, due to hacking, update corruption, or interfacing error that could cause transportation issues.

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 trying secure state and federal jobs in admin, database, programming, and software engineering work.

I have a game company L.L.C I am working on. I hope to make the company a success post-college.

Question 9: List any organized social activities (e.g. SwingCats, church, a residence hall volleyball team) that you were involved with during your entire time at MSU. For each activity, (1) **provide** the name of the organization, (2) **estimate** the total number of hours you spent.

Organization Name	*Estimate Total Hours Spent*
Langford Hall Council	~5 Hrs

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)*
N/A	N/A

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:

Forking

Non-trivial feature 2:

Branch Implementation

Non-trivial feature 3:

Quick merge Plugins

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)*
Self-Taught Languages	~20 Hrs
Indie Game Dev.	~30 Hrs
App Desktop Dev.	~10 Hrs

Best wishes wrapping up the semester and in the future!