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 Bea Heinze

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

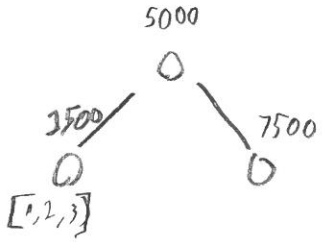
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Since the data is sorted by urgency, a red black tree may be optimal as higher-urgency data will bubble to the top. JK it says simple so binary tree of linked list for same reason

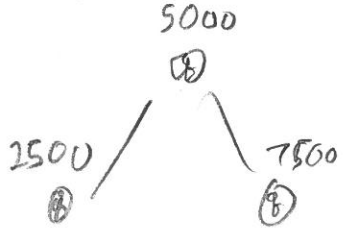
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

O(log(n)+LL)



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

it can be implemented in a binary tree of queues



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 testString(string1, mychar):
    count=0
    for letter in string1:
        if mychar == letter:
            count+=1

    return count
```

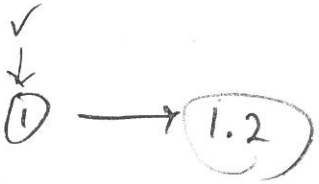
Question 3: Consider a singly linked list that contains **n** floating point numbers and is maintained in ascending order. An additional **k** floating point numbers will be added to the list, one at a time. You may assume that **k << n**.

Best case time complexity of algorithm:

1

Explanation of best case time complexity:

best case is a constant 1. This is because the first node may contain what youre looking for

searching for 1: 

Worst case time complexity of algorithm:

$O(n+K)$

Explanation of worst case time complexity:

if youre searching for the very last node that was added after K nodes have been appended, youll have to travel through every node in the LL

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.

1
14
x3
42

Organization	*Main Activities*	*Hours Spent (estimate)*
AWC	went to meetings when free	9
Undergrad Course Assistant	office hours / hosted labs	3·14 = 42 ish

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithmic bias is the inherent influence an algorithm has through the person who created it

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

algorithmic bias may exist in a college admission software by favoring more priveledged children with impressive backgrounds and ignore children without such opportunities

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: code plagerism is looser

Second possible impact: royalties for algorithms don't exist

Third possible impact: Java is more widely used

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: The software can start and move without passenger seatbelts engaged

Second type of harm: car drives in poor conditions that leads to crash

Third type of harm: car has trouble traversing unusual constructions and makes error

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.

- software engineer or DB guy (official term)
- move to west coast (or anywhere outside MT)
- only go to grad school if job pays for it $
- No job interviews :(

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*
creative writing	20
volleyball	1 (lol)
AWC	9 (I was Jessya lol)

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: Branching

Non-trivial feature 2: Issue Tab

Non-trivial feature 3: rollback

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)*
coding projects	50?
leetcode	25?
messing around	20-40?

Best wishes wrapping up the semester and in the future!

Thanks!

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Name Benjamin Hvotari

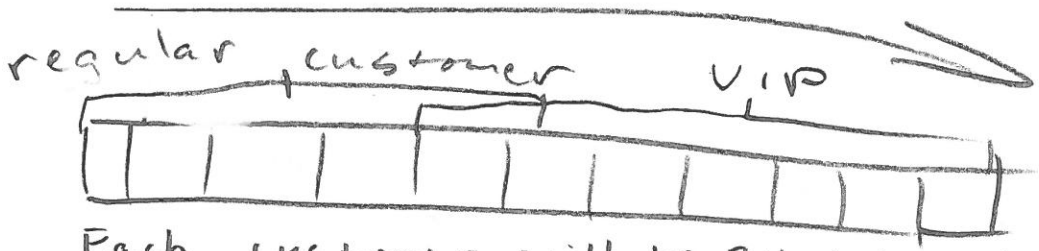
Major (Circle One): Computer Science B.A. or Computer Science B.S.

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.

Queue

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



Each customer will be put into the queue at a position based on urgency of request and VIP status. More urgent requests will be higher on the queue and VIP status also puts users higher.

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

Every request starts at bottom of the queue, but has an urgency multiplier and VIP multiplier. For example; VIP user with very urgent issue might move up the queue with a 2x multiplier for having an urgent issue as well as a 2x



VIP = x2 urgency = 1x - 3x

multiplier for VIP status resulting in a 4x faster rate than a standard user with a less urgent issue.

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:

```
private int charOcc(String str, char c)
    int total = 0
    for n in str:
        if(n.equals(c))
            total += 1

    return total
```

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:

Because the singly linked list is already sorted in ascending order, we can traverse the list to find the correct possition to add to in O(n) time.

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

Explanation of worst case time complexity:

Because k can be any value < n and k is not sorted, the worst case performance could require reaching the last position in the list n−1 times which uproaches $O(n^2)$ 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)*
		0

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The algorithm bases its output on an input that we don't want to consider / shouldn't be relevant.

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

If given access to data about race / sex / economic status, an algorithm might base its admissions off this data rather than merit.

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: Google continues to use patented code

Second possible impact: Sets a precident that patented code is okay to use.

Third possible impact: Companies keep patented code more secret.

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 users

Second type of harm: Harm to others

Third type of harm: Harm to vehicles/property

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.

Still not sure.

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*
	0

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)*
ECEN 310 Project	30

Question 11: Name the most sophisticated version control system that you use and describe three nontrivial features it has.

Name of most sophisticated version control system:

Git

Non-trivial feature 1: Keeps track of previous versions

Non-trivial feature 2: allows large teams to access 1 project.

Non-trivial feature 3: Several ways to access files remotely.

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 teaching various	~ 200 hrs
topics	

Best wishes wrapping up the semester and in the future!

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Name Sage James

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, assigns urgency which would allow for an ordered, highest priority ticket line

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:

```
def numString(s):
    num = 0
    for char in s:
        num += 1
    return num
```

```
print(numString("this is a string"))
```

16

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) n

Explanation of best case time complexity:

a singly linked list would have one variable that would be accounted for in big O, therefore represented by O(n)

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)*
web design TA	assisting lab	2 semesters
msu web+ dig intern	frontend dev	since July 2023, at least 10 hrs per week

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

a bias unintentionally written into code

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

perhaps the code shows only the canidates with the best ACT score on the top and therefore gives them a more likely chance to be admitted than students placed below them

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:

protects original code for companies,

Second possible impact:

potentially companies make existing code harder to view, so if they are collecting "ideas" from elsewhere they might not get caught

Third possible impact:

bad code! developers are lucky to have so many resources available, if it becomes more secretive or risky we could risk having lots of bad 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:

potentially harm humans physically if error is made

Second type of harm:

take jobs from taxi, lyft, uber etc. drivers, might harm their way of life $$

Third type of harm:

might force software Engineers to make unethical choices while coding → where to swerve in critick Situation
→ harm self
→ a bus of kids
→ motorcycle

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 one year plan is to find a job in web design, UX/UI design or potentially frontend

Ive started applying via jobboards (linkedin, handshake, etc) but havent heard back (upwards of 25+ applied for so far)

I interviewed for a role on the communications team @ msu but didnt get it due to other canidates having much more experience

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*
N/A	

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)*
having a background and passion for design made me constantly feel that i had a different viewpoint than my peers / teammates this allowed me to both shine and learn from others	

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:

work with teammates easily

Non-trivial feature 2:

desktop app that allows quick pushs, pulls, commits etc

Non-trivial feature 3:

integrates w VS code easily

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)*
Google ux workshop on coursera	~2 months
portfolio building on different CMS websites (wix, shopify, Squarespace etc)	countless hours, I've been creating my own for 5+ years, constantly re-iterating)

Best wishes wrapping up the semester and in the future!

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Name Nathan Johnson

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

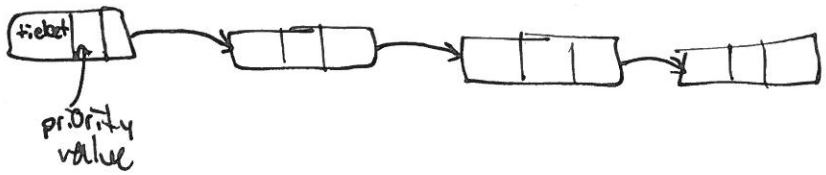
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

~~ArrayList~~ LinkedList



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

Array[Tickets]

[Ticket1, Ticket2, Ticket3...]

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(string, charVal):
    count = 0
    for character in string:
        if(character == charVal):
            count += 1
```

0

Sorry for the change in ink color. my pen died :/

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:

If all values of k are less than all values of n, the first value of k will only need to be inserted at the front of the list.

Worst case time complexity of algorithm:

O(k)

Explanation of worst case time complexity:

If the last value of k to be appended onto the linked list is the greatest value of k, it will need to traverse over all values of k to be added to the 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)*
MSU Student Housing	Assistant Community Director	600
MSU Student Housing	Resident Advisor	1000
SECURA Insurance	Software Developer Intern	500
Shadow Valley Golf Course	Landscaper	300

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithms may place some set of data/criteria in higher regards.

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

Give in-state students a higher chance of a recommendation for admission than out-of-state students.

Question 6: In 2010 Oracle sued Google claiming copyright and patent infringement for 11,500 lines of Java API copied code. Google used this small subset of code from the JAVA API for their mobile platform operating system. Pick a side (Google or Oracle) to win this lawsuit and explain 3 possible impacts to the computing industry of this win.

Side you choose to win: Oracle

First possible impact:

Copyright holding

Second possible impact:

Google can't use code they didn't write.

Third possible impact:

Google will have to spend more company resources $ in order to create their own version.

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 Crash

Second type of harm: Driver Negligence

Third type of harm: Death

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 a position w/ Fast Enterprises for implementation after graduation. I eventually want to get into Data Engineering, but I'm excited for the experience and networking opportunities at Fast.

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*
Residence Hall Association	50
Hyalite Hall Council	50
Yellowstone Hall Council	100

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)*
Interdisciplinary Project	100 ish (so far)
Housing DEI Committee	30

Question 11: Name the most sophisticated version control system that you use and describe three nontrivial features it has.

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

Code sharing

Non-trivial feature 2:

Code save/revert

Non-trivial feature 3:

IDE Integration

Nathan Johnson

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)*
Machine Learning Seminars	20
Industry Methods	10 (so far)
Job Shadowing	10
Career Fair	5

Best wishes wrapping up the semester and in the future!

Thank you MSU! I've loved my four years and will miss it!

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Name Carlee Joppa

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

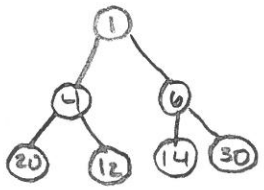
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

The simple data structure that would best model this situation is a priority queue because it allows prioritization of tickets.

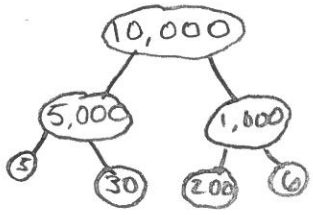
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Min Heap - where the lowest values are higher up in the tree, so the higher urgency score is lower in the tree.



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

Max heap - where the highest values are higher in the tree, higher urgency scores are higher in the 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

Your solution:

```
private int countChar (String word, char x) {
        int count = 0;
        for (char curr : word) {
            if (curr == x) {
                count ++;
            }
        }
        return count;
```

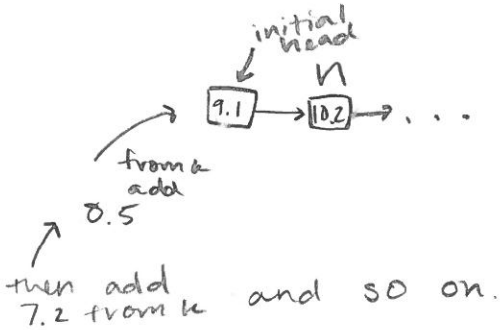
Question 3: Consider a singly linked list that contains **n** floating point numbers and is maintained in ascending order. An additional **k** floating point numbers will be added to the list, one at a time. You may assume that **k << n**.

Best case time complexity of algorithm:

O(k)

Explanation of best case time complexity:

If the floating point numbers in k are added in descending order, and the head of n is > the first number in k, then it will only take O(k) time.

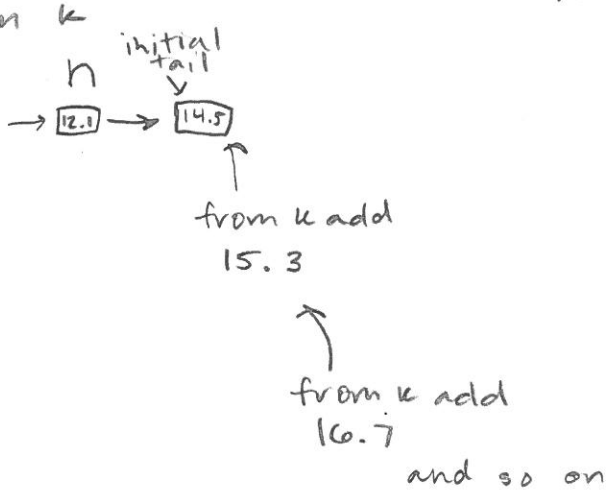


Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

If the floating point numbers in k are added in ascending order, then the algorithm must go through the entire linked list of n each time to add a value from 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)*
AWC	Participation	70
Liberty Mutual	Internship	480

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when there are unfair practices "baked" into an algorithm that may- intentionally or unintentionally - impact its outcomes

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

A hypothetical example is if college admissions software was less likely to admit equally qualified minority students because of factors in their 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: Relatively small subsets of code can be copyrighted

Second possible impact: Small developers can't use snippets of code written by large companies because of patents

Third possible impact: The computing industry / community become less focused on opensource

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: Driver harm - if the software for the car has descisions based on number of people harmed in a unavoidable crash situation, it may choose to harm/kill the driver over hitting others

Second type of harm: Environmental harm, if the software for the car does not consider nature (habitats, animals, etc.) and harming it

Third type of harm: Harm to Pedestrians - if the software cannot identify if there is a pedestrian in the path, it may hit pedestrians

Question 8: Describe your one-year plan following graduation. If you plan to work, list where you have applied (the company and the position) and mention whether you have received any offers. If you plan to go to graduate school, list where you have applied (the school and the area of study) and mention whether you have received any acceptances.

I received and accepted an offer from Liberty Mutual Insurance and will be moving to 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*
Hannon Hall	50
Connect Church	200

Question 10: List any activities that you were involved with during your time at MSU that prepared you to work more effectively with teammates whose backgrounds are significantly different than your own. For each activity, (1) **describe** the activity and (2) **estimate** the total number of hours you spent.

Activity Description	*Hours Spent (estimate)*

Question 11: Name the most sophisticated version control system that you use and describe three nontrivial features it has.

Name of most sophisticated version control system:

Git

Non-trivial feature 1: branches, teammates can work collaboratively on different branches

Non-trivial feature 2: pull requests, teammates can review each other's changes

Non-trivial feature 3: commit messages, can detail what was changed

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)*
Grace Hopper Celebration	24

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 William Jordan 02715953

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.

P-queue a priority queue takes in items and places the most important (highest score on top.

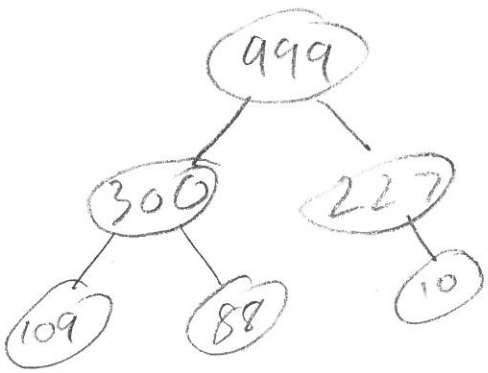
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

an array list of objects with a score attribute



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

a tree of ascending nodes



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:

```
static int countChar(String S, char c){
    int x=0;
    for(int i=0; i< S.length; i++){
        if(S.charAt(i)==c)
            x++
    }
    return x;
}
```

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 numbers in k are in ascending order and all larger than the numbers in n then they will be added to the front of the list every time so $O(k)$

Worst case time complexity of algorithm: $O(n \cdot k)$

Explanation of worst case time complexity:

you must iterate over all numbers in n to place a k that is less than all nums in n and do this for every k so $O(n \cdot k)$

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)*
Mens Ultimate frisbee	Ultimate frisbee	~6h/week
Swartycats web dev (chief change)	full stack LAMP dev	~16h/week

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithmic bias is when an algorithm consistently preforms worse/better on a set of inputs given biased training data.

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

if admissions officers denied students based on economic status and then all admissions data was given to an algorithm it would also be biased based on economic status.

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:

all java code is publicaly usable.

Second possible impact:

Oracle is less incentivised to maintain and update java.

Third possible impact:

google starts swiping other code they want.

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:

damage to pedestrians

Second type of harm:

damage to vehicle exhabitants

Third type of harm:

damage to vehicle itself

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.

Woodworking School.

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

Non-trivial feature 1:

working tree

Non-trivial feature 2:

branches

Non-trivial feature 3:

line by line blame

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)*
Selenium browser automation	~ 30 h

Best wishes wrapping up the semester and in the future!

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Name Michael Kadoshnikov

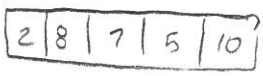
Major (Circle One): Computer Science B.A. or (Computer Science B.S.)

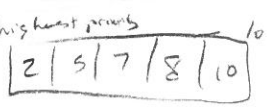
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

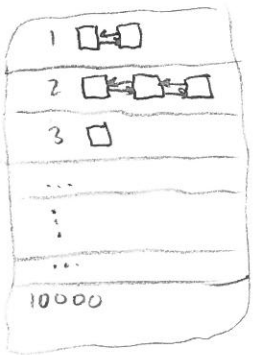
have an array of values in queue form → 

then sort by priority we will assume lower is more urgent → 

then "pop" the value once its done

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

make a linked list for each priority level then add the ticket to the corresponding list for this example our priorities will be 1, 1, 2, 2, 2, 3 once completed they will be removed from the list. For more context, its an array of linked lists so the priority is the index for the list



Question 2: Write a function in a language of your choice that has two parameters: a string and a character. The function should return the number of times that the character occurs in the string.

Your language of choice (e.g. Python): for fun Java

Your solution:

```
public int occurance(String str, String char) {
    int val = 0;
    for (int i=0; i< str.length, i++) {
        if (str[i] = char) {
            val ++;
        }
    } return val;
}

public static void main(String[] args) {
    int ocur = occurance("test", "t");
    System.out.println(ocurr);
}
```

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**.

iterate n 2, if checks for sort
add K times

Best case time complexity of algorithm:

$O(n)$

Explanation of best case time complexity:

we just add to the list from front or back already sorted

Worst case time complexity of algorithm:

$O(2n \cdot k)$

Explanation of worst case time complexity:

we will iterate over K objects n times and check twice for sorting

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)*
Hacker Cats	hacking related topics	~45 hours
Chem-E Car	build a chemical powered car	~ 180 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithms that result in a skewed output

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

if they only checked GPA to let students in, that would stop students who did more extracurriculars at a lower 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:

reused code cant be copyrighted

Second possible impact:

code rights won't be invented by companies

Third possible impact:

oracle loses

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, can run people over

Second type of harm:

mental, while its running someone over it's traumatizing the driver

Third type of harm:

could lock people in an emergency situation leading to more

severe situations

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.

Graduate School at Montana State University, primarily focused in cyber security but going for Phd, yes I accepted the offer

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*
N/A	0

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)*
ChemE Car	~ 180 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 mostly with GitHub so I will talk about that

Non-trivial feature 1:

commit history

Non-trivial feature 2:

changes in the commits

Non-trivial feature 3:

stashing changes before merging / branching

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.

everything I did was school related

Activity Description	*Hours Spent (estimate)*
N/A	0

Best wishes wrapping up the semester and in the future!

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Name Rohen Kanat

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 ability to automatically sorted in least complex time

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

Just add to it and Pull the lowest value which would be the highest priority

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

The second way would be to sort for tickets with priority ten and under and then add to the Hashmap

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 test(string, char):
    count = 0
    for x in string:
        if(x == char):
            count += 1
    return count
```

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

Best case time complexity of algorithm:

O(n+k)

Explanation of best case time complexity:

to search through all the numbers it would take at the best case the length of n+k

Worst case time complexity of algorithm:

O(n*k)

Explanation of worst case time complexity:

at worst it would take n*k long to search through the linked 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)*
Vision period	Software eng.	3 months
MSU	Software eng.	3 months
PFL	Software eng.	7 months
Ohx	Software eng.	3 months

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when a system makes a bad decision without considering all points of data

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

It could manifest by seeing that there are already more Asian students than black students and factoring the Asian students out

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:
Google starts to copyright every single line of code they ever touched

Second possible impact:
everyone starts to sue Google over any small thing

Third possible impact:
People start to copyright their code in order to bait people into a lawsuit

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:
Wallet harm

Third type of harm:
Mental Trauma

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 one Year Plan outside Graduation is to work and make money

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	3 months
internship	3 months
internship	7 months
internship	3 months

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:

ease-of-use

Non-trivial feature 2:

well known

Non-trivial feature 3:

easy to fix mistakes

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 Matthew Keck

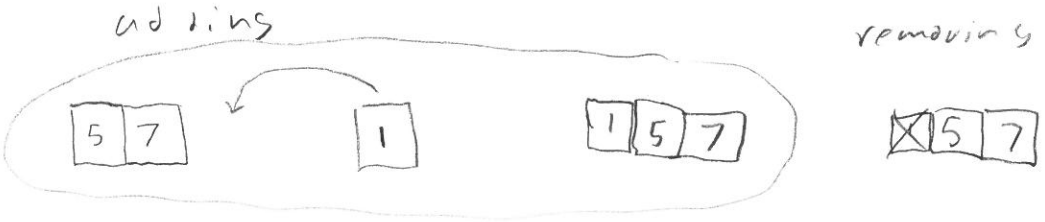
Major (Circle One): Computer Science B.A. or Computer Science B.S.

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.

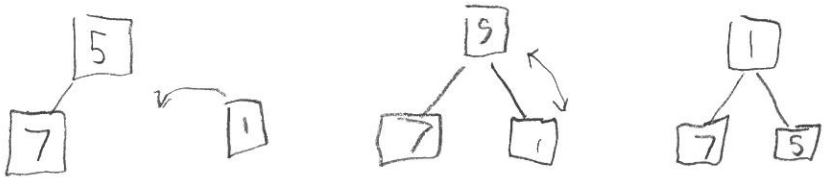
a) What simple data structure would best model this situation? Explain.

Priority que Heap

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): Python

Your solution:

```
def func(string, char):
    counter = 0
    for (character in string):
        if char == character
            counter += 1

    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: it thakes constant time to add to a linkedlist

Worst case time complexity of algorithm: O(1)

Explanation of worst case time complexity: it still takes constant time to add to a 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)*
ren Bozeman	undergrad research	400

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is. when a program creats a bias algorithem intentionaly or unintentionaly

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

if the program sellects admitns in a biased way

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 makes software easier for others to use

Second possible impact: it makes code easyier to access and understand because its harder to be property

Third possible impact: it makes starting a software company eiser because less risk of using code thats not yours

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: it could kill some one

Second type of harm: it could destroy property

Third type of harm: it could make rodes less safe

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:

Nsa
roblox
Amazon
USG

Nsa made me an offer

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	NA

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)*
school work	10+5

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: cloud storage

Non-trivial feature 2: version control

Non-trivial feature 3: commit 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)*
under graduat reasenrch	400
personal projects	80

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

Academic Year 2023-2024, 80 minutes.

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Name Emma Keeley

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.

Merge Sort

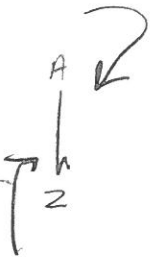
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Data structure used to sort & rank items in the list in decreasing order



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

Data structure used to sort & rank items in the list in ascending order



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:

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

Explanation of best case time complexity:

fastest time complexity

Worst case time complexity of algorithm:

N log N

Explanation of worst case time complexity:

Slowest 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)*
Wealthvest	Business Analyst Intern	1000
Exchange Club → Butte	Volunteer / member	50
Food Bank of Butte	Volunteer (summer)	200
Finance Club	member	50
Women in Engineering	member	100

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when a algorithum looks for specific items rather than something as a whole. Algorithums lack judgement & look for key indicators

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

algorithmic bias can be present in this situation because the algorithums used are looking for key attributes of the prospective student rather than looking at the student as a whole. This process could lead to the acceptance & rejections of the wrong people

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: Establish rules for Leagal Access to the API's

* Google is allowed to use

Second possible impact:

Set standards for patent & copyright infridgement

Third possible impact:

The winner of this case will be able to be used as an example in similar cases to follow

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

* Software malfunctions can hurt passengers pedestrians or other passengers in other vehicles

Second type of harm: Security Harm

Malfunctioning security systems could cause owner data leaks or something as major as stolen car if proper owner information isn collected

Third type of harm: Ethical Harm

* Software doesnt not have feelings or ethics, so in situations when judgement is necessary, the software will not know how to proceed & may malfunction

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.

One-year from now I plan to be working. I am a double major w/a BA degree in CS + a BS degree in Finance I have had sereral offers the finance field. Unfortunatly, I have had to turn those down (DA Davidson, Fisher, Edward Jones, + New York Life) because I am planning on staying in Bozeman. Currently, I am working as an Intern at Wealthvest as a Brssiness Analysist working in Salesforce. I am expecting an offer from them + plan on accepting it. I am currently getting my Saleforce Admin certification. I have thought a bit about Law school and may choose that route later on

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*
Catholic Church	200
Cycling Studio	200
Skiing	200
Softball	700
Running club	50

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)*
Finance Club	50
Web Dev w/ Business Partner	200
Sports Clubs	50
Internship	1000
Study Abroad	1000 (6 months)

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:

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)*
Code Academy	500

Best wishes wrapping up the semester and in the future!

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Name Jack klist

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

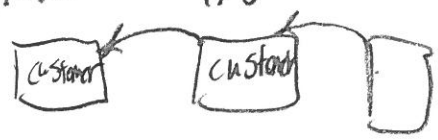
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 most effective because it is ordered and you can grab things fifo, and also sort by priority

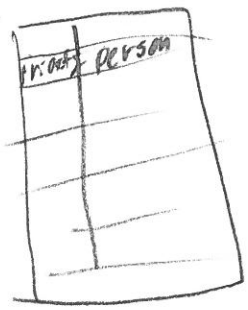
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A linked list



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

Hash table



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:

```
counter (string, char)
    count = 0
    for each ~~char~~ i in string:
        if i equals char:
            count += 1

    return count
```

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

Best case time complexity of algorithm:

$O(n \log n)$

Explanation of best case time complexity:

If you use a quick sort algorithm, it will have that time complexity if everything added is already in order

Worst case time complexity of algorithm:

$O(n^2)$ n log n

Explanation of worst case time complexity:

for a bad sort, it will be a slow time and have complexity of $O(n \log n)$ for a quick sort at worst

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)*
UIT	IT consulting	600
fast intern	Software intern	500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Bias built into algorithms by the creator of the Algorithim

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

By admitting ~~only~~ more wealthy students than low income ones because of higher GPAs

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: Oracle wins, open source is more scary

Second possible impact: Slow development down because of cross referencing existing code

Third possible impact: cause less people to try and create competion in the industry

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: killing a bunch of people because it goes rogue

Second type of harm: using Algorithic bias making unethical decsions while driving

Third type of harm: taking ojobs from truckers

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 working at Fast Enterprises indenvers as a part of their data analytics team

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*
Back country ski club	2

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: Historical ability to roll back a code repo to a point in time

Non-trivial feature 2: allows controlled access to commit to a code base

Non-trivial feature 3: Ability to maintain branches of code that differ from eachother and easily switch between them

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)*
Code Academy	20

Best wishes wrapping up the semester and in the future!

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Name Coleman Lewis

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

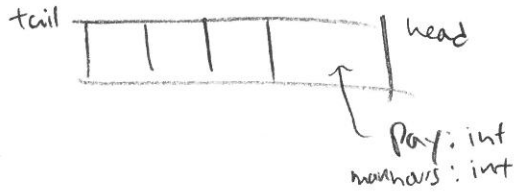
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

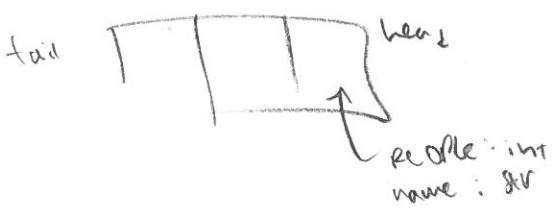
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

a job Scheduler Scheduling high pay jobs first



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

Taking reservations where you want to have large parties first



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

~~k log(n)~~ = log(n) O(1)

Explanation of best case time complexity:

You pick the middle of the list and compare it to k_i, and it is equal to k_i, so you insert k_i there, and this occurs for all k_i in the best case.

Constant time for each k.

Worst case time complexity of algorithm:

$k \cdot \log(n) = \log(n)$

Explanation of worst case time complexity:

Use binary search as the list is ordered. In the worst case, for each new float, you make log(n) comparisons to floats from the 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)*
Center for Biofilm Engineering	USP | develop Python GUI	100 (ongoing)

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

don't know

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: Oracle

First possible impact:

Copying code for commercial use is illegal (without permission/royalties)

Second possible impact:

Companies are incentivized to write their own code, coders ~~developers~~ must be compensated for code if they want it

Third possible impact:

Software becomes more expensive to create

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:

the car could mistakenly hit a pedestrian, someone who did not agree to ~~the~~ the risks of ~~be~~ having autonomous cars

Second type of harm:

a crash could hurt the driver, although they likely understood the risks of the car

Third type of harm:

insurance companies would have increased costs and might have trouble getting liability figured out

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.

work - no offers but I have talked to U.S.G.S on their Cloud services

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*
Bozeman Amature Hockey Association	150

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)*
Robot vision class	

Question 11: Name the most sophisticated version control system that you use and describe three nontrivial features it has.

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

Branching

Non-trivial feature 2:

Rollback

Non-trivial feature 3:

Change tracking

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)*

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Name Charis Liddle

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

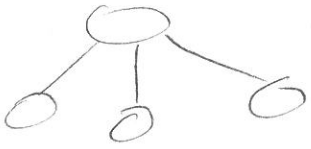
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

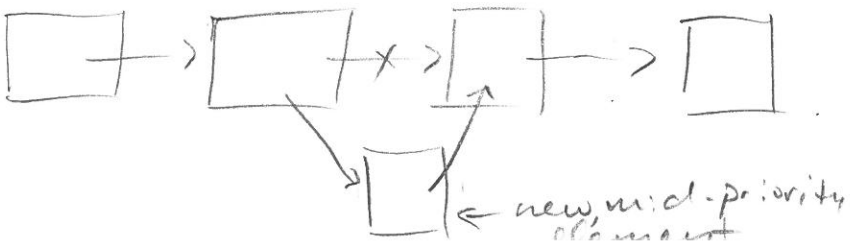
It could be implemented as a heap



higher priority —> lower priority (as far as I can remember)

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

It could be implemented as a linked list where new items are inserted based on their priority



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 void charAppears(String str, char c) {
    int count = 0;
    for (int i=0; i<str.length; i++) {
        if (str[i] == 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: $\Theta(k)$

Explanation of best case time complexity:

If you add to the front of the list, you simply have to add a link from the new element to the front element, which is $\Theta(1)$, k times, so total is $\Theta(k)$

Worst case time complexity of algorithm: $\Theta(nk)$

Explanation of worst case time complexity:

If you add to the back of the list, then you must iterate through the entire list every time you add a new element, which is $\Theta(n)$, times k, so the total is $\Theta(nk)$.

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)*
Eagle Mount	Downhill Ski Program	15
MSU	Web Design Undergrad course assistant	150
MSU	Microeconomics TA	250
American Simmental Association	Software Development Intern	800

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when an algorithm has not been designed or trained to handle certain scenarios, so it has bias against them.

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

It could reject someone based on grades but overlook a disability

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 protection for programmers using already-written code

Second possible impact:

More open-source projects

Third possible impact:

Harder to copyright 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:

Crashing & injuring passengers

Second type of harm:

Running over pedestrians

Third type of harm:

Damaging property

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 currently work at the American Simmental Association, and I plan to stay there for at least a year.

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*
Big Sky Christian Fellowship	250
Venture Church	50

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	50

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 history

Non-trivial feature 2: Branches

Non-trivial feature 3: Differences in working 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)*
N/A	

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Name Kian Lynch

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 as you need to order tickets by high precidence customers

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

This can be implemented with an array

highest priority ↓ lowest priority ↓

[0, 1, 2, 3 . . . . .]

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

You can use a dictionary with the key being the priority number and the value being the ticket

{ key: 10,000, value: ticket, ... }

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 Integer charOccurrance(String S, char a) {
int i = 0;
For (int j =0; j++, j < S.length) {
    if (S[j].equalls(a)) {
      i++;
    }
}
Return i;
}
```

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:

If your only have 1 floating point number, you can compare with the first, lowest node, and K is lower than n

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

If K is not lowering than any other node than 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)*

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

This is when algorithms are coded in a way that can change an outcome because of a persons unintentional bias.

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

If a college wants to admit more minorities, but then the algorithm only chooses minorities, to other groups are not chosen: Ex: Harvard.

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:
using any small amount of code could be grounds for getting sued.

Second possible impact:
You have to create new ways that do the same thing that other companies already do.

Third possible impact:
Whatever company owns the patent becomes the only company people can use and have to pay them.

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 like hitting someone.

Second type of harm:
Social harm: people know how to drive because the cars do it for us.

Third type of harm:
Psychological harm: People become numb to crashes because it would be the AI's fault so nothing would get fixed if there is an issue.

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 working after graduation in computer security. I have not applied to any companies.

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:

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)*

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 ALEX MALIZIOLA

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

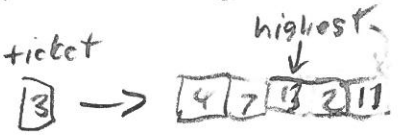
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 would keep track of score/ticket associations and allow for popping of completed tickets and value ordering

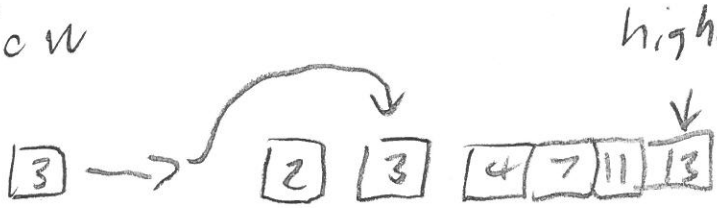
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

You could push them in chronologically, and search through for high values. Longer search time but shorter push time



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

You could push them into an ordered list from highest to lowest, making searching fast but pushing slow



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): yeah let's say "python"

Your solution:

```
string s = "string"
int x = count
for(s.length)
   if (s.contains(" i "))
      x ++
print ("count:", x)
```

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:

All k numbers are immediately in the right order when pushed.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

All k numbers must traverse the entire list to find the correct position.

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. Disregard

Organization	*Main Activities*	*Hours Spent (estimate)*
Drawing & painting club	Drawing	~8
Fiber arts club	Sewing	~10
Climate ninjas (I think?)	Pumpkin carving	4

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

I would if I could
Maybe, unintended bias to the result of a program based on the specific operations of an algorithm?

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

Wcof,

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. oh no not ethics, this was three years ago.

Side you choose to win: Oracle

First possible impact:
Google must pay Oracle royalties for the code used

Second possible impact: OR
Google must rewrite their code to be original

Third possible impact: OR
hm, this would set a dangerous precedent, especially given how unoriginal code can be 11,500 lines is a LOT to copy, but still.

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:
Fails to identify a pedestrian at a crosswalk, hitting them

Second type of harm:
fails to avoid an obstacle, crashing.

Third type of harm:
Fails to maintain proper turn speed, and loses control.

Question 8: Describe your one-year plan following graduation. If you plan to work, list where you have applied (the company and the position) and mention whether you have received any offers. If you plan to go to graduate school, list where you have applied (the school and the area of study) and mention whether you have received any acceptances.

I will be taking an online CS master's at Georgia Tech, UT Austin, or ASU (whoever accepts me) while working an entry IT position at Miller (Molson?) Coors.

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*
Drawing and Painting club	8
Fiber Arts club	10
Climate Ninjas	4

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:

Efficient group controls

Non-trivial feature 2:

Issue manager

Non-trivial feature 3:

~v(')v~

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)*
Unity Development	30+

Best wishes wrapping up the semester and in the future!

Thanks <3

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Name Jared Matury

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

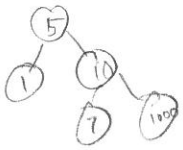
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Binary Search Tree you can find most urgent matter quicker

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

add ticket to the tree by score left is least urgent and right most urgent once completed, remove it



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

if you want time to effect the score, update nodes value.



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 count_occurance(st,c):
    count=0
    for s in st:
        if(s==c):
            count+=1
    return count
```

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

Best case time complexity of algorithm:

1

Explanation of best case time complexity:

first thing you add to the list

Worst case time complexity of algorithm:

n

Explanation of worst case time complexity:

Have to traverse the whole list to add 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)*
Smarty Cats	tutor	150 hr?
TA	teacher assistant	90 hrs
Deeptree	Cyber sec. intern.	20hrs / week

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithms that are bias

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

Colleges only accept students who have wealthy families they tend to have higher Act/SAT scores since they can retake it multiple times

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:
Buy to write code

Second possible impact:
Time effectiency down
make sure you didn't plaguerize anyone

Third possible impact:
less programming jobs

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:
hitting someone

Second type of harm:
moral compass of an individual might decide horrible software decision
ie should the car swerve and hit a pedestrian or hit the car infront of them

Third type of harm:
justice system since there isn't any laws for these possible scenario's it might ruin someone's life if software isn't flawless

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 for now. I got applications from companies to fill out yet.

I don't have enough time to do so however.

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*
Country Swing Msu	27 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)*
Country Swing MSU	27 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:

pull information

Non-trivial feature 2:

push info

Non-trivial feature 3:

fetch

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 Layton McCafferty

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

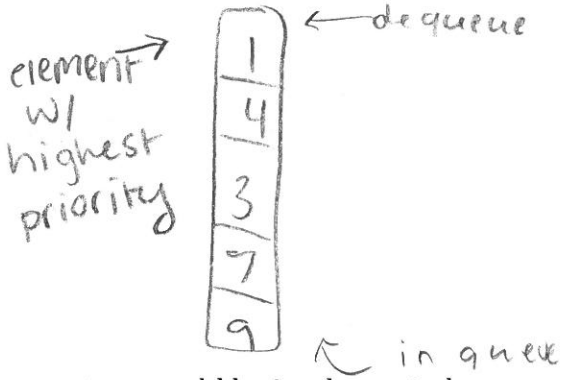
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

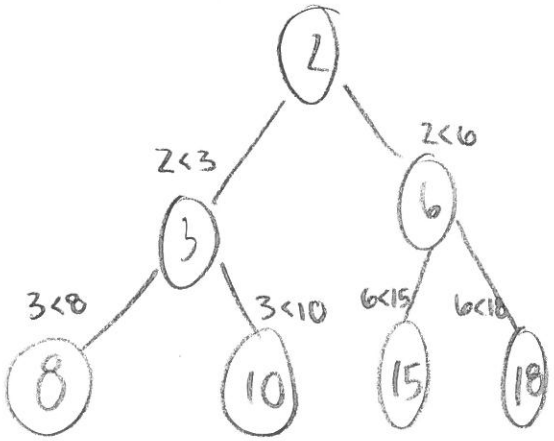
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

array



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

heap



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 CharsInString(string x, char y)
{

    for z in x:
        if z == y:
            i+=1

    print i
}
```

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:

you can just insert at the beginning of the list which can be done in constant time.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

if inserting in the middle or at the end of the list, this would require list traversal which would take significantly longer

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	vice president secretary	100
ACM	member, attended meetings	20
Hackercats	vice president secretary	100
French club	member, attended meetings	20
STEAM Day	leader, volunteer	40
FIRST LEGO league	leader, judge	15
TechLink Intern	software engineer	1500
LAIVL Intern	undergrad research assistant	1500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is the idea that unfair outcomes from algorithms are usually due to the input data not having enough variety.

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

hypothetically, if there is not a large enough variety within the data, the college admissions program might accept more males / females, depending on the data pool.

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:
Other companies would be allowed to use small subsections of code from other APIs

Second possible impact:
potential patent and copyright infringement could happen anyways & be excused accidentally

Third possible impact:

11.

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

car could malfunction and harm those involved physically

Second type of harm: Emotional Harm

could result from a case of physical harm

Third type of harm: Psychological Harm

users may not understant 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 applied at Raytheon & a few other companies. I might go to grad school here at MSU, but unsure as of yet. My current plan is to mostly go with the flow and enjoy being out of school!

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*
Women in Engineering	10
Career Fair	60
Networking Events	20
Esports club	100
Society of Women Engineers	10

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)*
being a leader in MSUSTEAM Day	40
AWC - being in leadership	200
HackerCars - being in leadership	100
FIRSTLEGO league - judging w/ others	15

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: easy collaboration

Non-trivial feature 2: supports non-linear development

Non-trivial feature 3: merging code and files together

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)*
National Cyber League	20
LinkedIn Learning Courses	40

Best wishes wrapping up the semester and in the future!

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Name Emmett Osborne

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

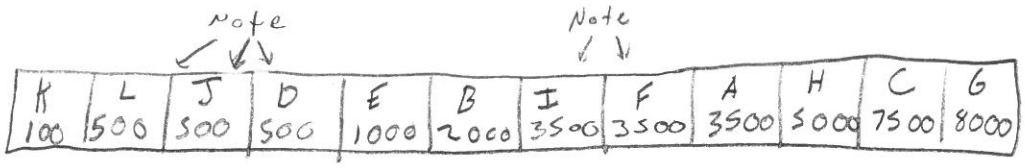
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

Assume tickets coming in are labeled with letters, ascending: A, B, C, D, E, F, G...
Each have a priority, the higher priority values are always ahead.



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

Not sure I would implement this any other way given the info provided.

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 countChar(inputString, inputChar):
    return inputString.count(inputChar)
```

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: $O(k \log k + n(\frac{1}{2}k)) = O(k \log k + \frac{1}{2}nk)$

Explanation of best case time complexity:

Sort k, in assending order
Start at head, iterate over K and insert all values less than current value behind it, move to next. Repeat until K is empty

Worst case time complexity of algorithm: $O((n + \frac{1}{2}k)k) = O(nk + \frac{1}{2}k^2)$

Explanation of worst case time complexity:

Start at the head, while new value V > current value, move onto next value
insert new value V,
Repeat for all values of 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)*
Undergrad Course Assistant	Guide Lab, Grade	450 hrs
Advanced Electronic Design	Engineering Intern	5000 hrs
FLL Assistant	Setup, Judge	10 hrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The ability for an algorithm to make an unintended or biased decision based on individual characteristics about a person that the algorithm is not supposed to account for.

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

A less common first or last name may include a symbol like an apostrophe that causes the submission to exclude the inputted name, voiding the elgibity of the application.

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: Up held basic patent law with regards to software.

Second possible impact: Further establish precident for similar cases.

Third possible impact: Potentially degrade services on some products as alternates to copyrighted code is replaced.

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: Explicit, Soft ware fails to observe Pedestrian, Pedestrian is hit.

Second type of harm: The car stops operating in a blizzard without notifying emergency services, passenger is stranded.

Third type of harm: The biggest and most overlooked one in my mind:
Developers are far too careful rolling out autonomous driving software and delay 1 extra year to make sure it's perfect instead of killing 1/100,000,000 so they don't get sued.
1,000,000 People die in human driven crashes that year,
Even if autonomous cars save 99% of all fatal crashes you will not receive 990 are there

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 working for a company somewhere in texas, Preferrably in the manufacturing industry. I have not applied but have several opportunities lining up.

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*
Bridger Solar Team	100 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)*
Personal Project with friends	600 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: SVN

Non-trivial feature 1: Difference checker across versions

Non-trivial feature 2: Runs on local server for security reasons

Non-trivial feature 3: Mentor oversight, work can be verified remotely before merging.

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 CS	300 hrs
Personal CS Projects	600 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 Nathan Parcell

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

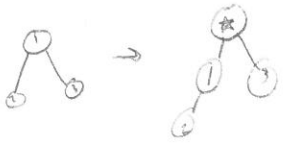
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Graph,
each node can be given a priority and it would settle itself

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

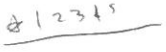
Give each ticket a priority.
Add ticket to tree.



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

Priority Queue.

1 2 3 4 5 5



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:

```
int occurrences (string str, char c){
    int count=0;
    for (int i=0, i< str.length(), i++){
      if{ str[i] == 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(1)

Explanation of best case time complexity:

The numbers are always inserted to the start, or k is ≤ 1

Worst case time complexity of algorithm:

O(kn)

Explanation of worst case time complexity:

the algorithm has to run to the end of the linked list, k times.

Question 4: List any extracurricular community involvement (e.g. the Gallatin Valley Food Bank or coaching), extracurricular university involvement (e.g. Engineering Ambassadors, Swing Cats, AWC or ACM) or paid internships (e.g. Workiva intern or Undergraduate Course Assistant) that you were involved with during your time at MSU. For each activity, (1) **provide** the name of the organization, (2) **describe** briefly your main activities and (3) **estimate** the total number of hours you spent.

Organization	*Main Activities*	*Hours Spent (estimate)*
Workiva (I-term)	Full-stack development	1.5 years ~ 30 hr/wk
Bridger Ski Foundation	Web App Development	40-50
Big Sky Sun Experts	Smash Ultimate	10
Pick-up Sports	Soccer, Hockey	100+

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic Bias is when groups are under/over represented by use of an algorithm

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

For example, the software could overly favor those coming from wealthy backgrounds because of their connections

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:
Push for everything that can be, to become open source.

Second possible impact:
As less proprietary code will be needed, potential for economic downturn.

Third possible impact:
Java API becomes even more standardized

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, it could hit something

Second type of harm:
Social- How would the car decide who to protect?

Third type of harm:
Economic- put public transit at or business or become too unaffordable

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 200+ jobs, both new grad and SWE 1 roles, and have recieved no offers / interviews.

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*
Pick-up sports (Tues + Thurs)	100+
Intramural Sports (soccer, dodgeball)	50
Montana Smash	50

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)*
Working Intern - Working with team	600
Soccer - Different teams each game	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 / Github

Non-trivial feature 1:

Github Actions:
used for automation of CI/CD processes
such as testing

Non-trivial feature 2:

Rebasing: effective way of incorporating vastly differing
versions of a file

Non-trivial feature 3:

Branching:
Way for everyone to have multiple working versions of same 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)*
Leetcode	25+
UWashington online course content	20+
Kubernetes Key-notes	2

Best wishes wrapping up the semester and in the future!