**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 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 Geri Viallon -00039898

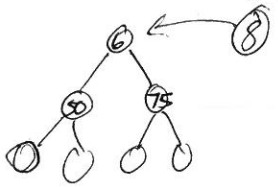
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's 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 heap would sort the highest urgencies to the top of the heap, and ~~it could~~ customer service ~~would take~~ would address the top of the heap each time.

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

binary heap

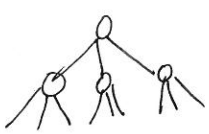



8 comes in, is bigger than 6, goes to the left, smaller than 50, takes 50's place & 50 moves down.

c) Describe a second way in which this data structure could be implemented and draw a picture of that data structure. Data Structures was 2 years ago!!

Maybe a ~~red-black tree~~ heap?

A ~~tree~~ heap that isn't binary.

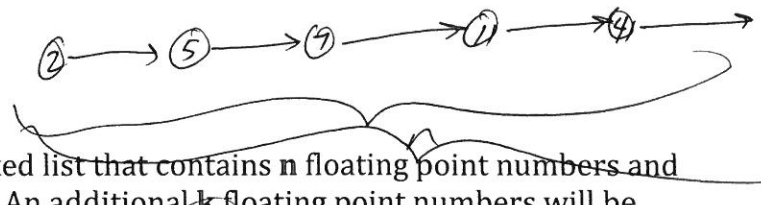


**Question 2:** Write a function in a language of your choice that has two parameters: a string and a character. The function should return the number of times that the character occurs in the string.

*Your language of choice (e.g. Python):*

*Your solution:* Java

```
int countLetter(String string, Char ch){
    int count;
    for(int i =0; i < string.length(); i++){
        if (string[i] == ch){
            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:* $k\left(\frac{n}{2}\right)$

*Explanation of best case time complexity:*

~~$k+k\left(\frac{n}{2}\right)$~~ $k\left(\frac{n}{2}\right)$

each of the k numbers will step through, on average, half of the numbers on the list.

*Worst case time complexity of algorithm:* $k \cdot n$

*Explanation of worst case time complexity:*

If, by terrible luck, the new numbers were all higher than those on the list, each one would traverse the entire list before finding its spot.

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

| *Organization* | *Main Activities* | *Hours Spent (estimate)* |
|---|---|---|
| MSU | Undergrad TA (45) | 45 |
| MSU | paid TA for 127 | 120 |
| Longfellow School | art/reading volunteer | 20 |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Our software is only as smart as the data it uses.

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

College admissions software could analyze what kinds of students end up having personal success later in life. If it then weighted those kinds of students ~~kan~~ higher in the admission process, it could be ~~reenforci~~ reinforcing the unfair social attitudes and pressures that ~~allowed~~ benefitted the "successful" people in the first place (money, social capital etc.)

**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:* I don't know the Java license. It must be proprietary, otherwise Oracle would have no grounds. Let's say Oracle should win and tradition be upheld.

*First possible impact:* [illegible]

*Second possible impact:* More proprietary software slows innovation across tech industries.

*Third possible impact:* "small companies" like Oracle get paid for work that huge companies want to use, helping more grow and thrive.

There is less free and open software available.

**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

Just as real drivers do, there will be accidents, and people will still likely die in car crashes.

*Second type of harm:* legal harm

This situation, where "no one" is at fault, will put new strains on the justice system. New systems of ethical planning and legislating will need to be imagined.

*Third type of harm:* misappropriating technology

All powerful technology has the potential to be misused. Theoretically, a self driving car could be used as a weapon, or to cause mayhem.

**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 hoping to stay in Bozeman and find a job, locally or remote.

**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. ~~none, busy with family obligations~~

| *Organization Name* | *Estimate Total Hours Spent* |
|---|---|
| French conversation | Monthly potluck + conversation ≈ 100 hrs |
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**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)* |
|---|---|
| EGEN 310 is the only "activity" that fits this description | |
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**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:*

merging

*Non-trivial feature 3:*

reverting to previous versions

**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, tutorials + building games | 400 |
| Blender | 80 |
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Best wishes wrapping up the semester and in the future!

**Montana State University Computer Science Department**

**Graduating Senior Exam**

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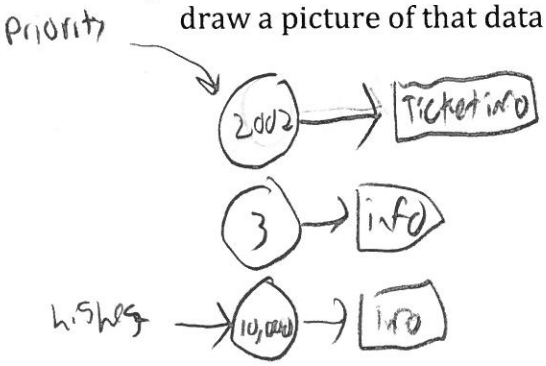
Name Zach Wadhams

**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.

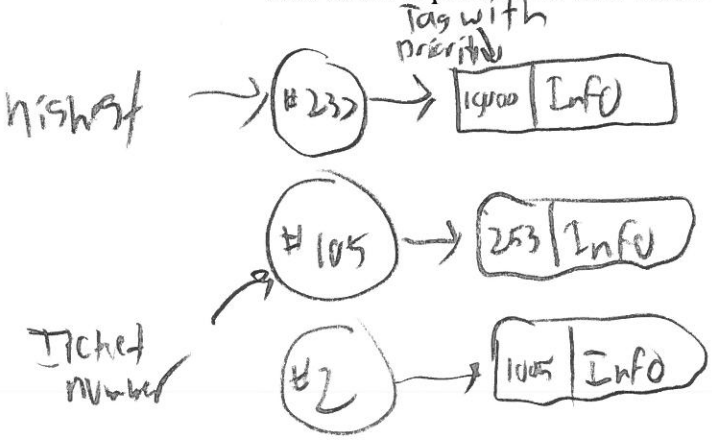
Hash map, would allow for many different types of data to be stored and accessed quickly

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




The key would be the Priority and the highest would be chosen to be worked on.

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




The key is the ticket number and there would be a tag with the Priority attached but optimal for searching

**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 CharCounter(S, C)
    Count = 0
    for i in S:
        if i == 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:*

O(k)

*Explanation of best case time complexity:*

If all of the K numbers added so perfectly onto the end of the list, no shuffling needs to be done so it is dependent on K.

*Worst case time complexity of algorithm:*

O(k^n)

*Explanation of worst case time complexity:*

If each number K added requires shuffling, the time would grow exponentially based on how many existing numbers n are in 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)* |
|---|---|---|
| ACM | meetings, Spring break | 70 |
| A2TS | internship, IT | 500+ |
| Los Alamos | internship, HPC | 400 |
| Course Ass. Stant | Labs, Grading | 100+ |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when a system is unfair to any people of a certain group.

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

If a person recieved a lower GPA in high school, the algorithim could immediately discard these applications without looking at other parts of it.

**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:*

Companies can't sue over using their open source API

*Second possible impact:*

Companies can use any amount of code from open source projects to profit from.

*Third possible impact:*

Companies make it harder, or impossible to access their source code.

**Question 7:** In the ACM Code of Ethics and Professional Conduct, one ethical principle stated is to ***avoid harm***. Describe three different types of harm that the software of an autonomous, self-driving car might cause.

*First type of harm:*

Physical - Someone could get injured or killed.

*Second type of harm:*

Monetary - Accidents always end up costing someone money.

*Third type of harm:*

Societal - if the car is scanning pedestrian faces and adding them to a facial recognition database, the whole of society is hurted

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

I was accepted into the C.S. graduate program at MSU and will be doing that for the next 2 years.

**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* |
|---|---|
| RoboCats | 100+ |
| ACM | 70+ |
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**Question 10:** List any activities that you were involved with during your time at MSU that prepared you to work more effectively with teammates whose backgrounds are significantly different than your own. For each activity, (1) **describe** the activity and (2) **estimate** the total number of hours you spent.

| *Activity Description* | *Hours Spent (estimate)* |
|---|---|
| Robotics, different majors | 100+ |
| Los Alamos internship, scientists | 400 |
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**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 allow for feature development without impacting other developers

*Non-trivial feature 2:*

Master branch allows for a view of the working code that should be bug free.

*Non-trivial feature 3:*

Issues allow for easy bug fixes and tracking of problems with code

**Question 12:** During your time at MSU, list any major non-classroom, non-paid activities that you engaged in to help prepare for your computer science career. For example, you might have taught yourself a programming language or attended a workshop on a CS topic. For each activity, **estimate** the number of hours spent.

| *Activity Description* | *Hours Spent (estimate)* |
|---|---|
| Unity game development | 20 |
| CodeCademy | 50+ |
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Best wishes wrapping up the semester and in the future!

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Name William Walkusk

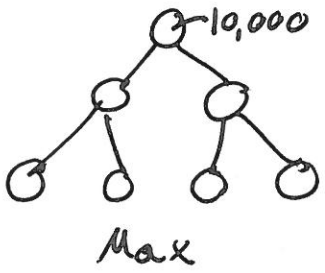
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer service team needs a way to find the most urgent ticket in the system and remove it when it has been addressed. New tickets can arrive at any time.

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

This is essentially a priority queue

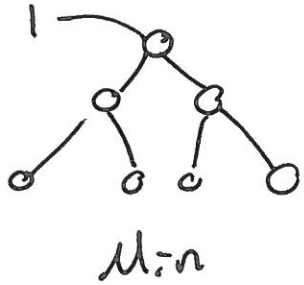
A heap could be a good way to store this information. It is easy to sort into either max or min so it could be frequently reordered to always have access to the highest priority ticket.

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




You could make a max heap assuming the bigger value is higher priority. New tickets could be quickly added and sorted As you descend the heap the priority values decrease.

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

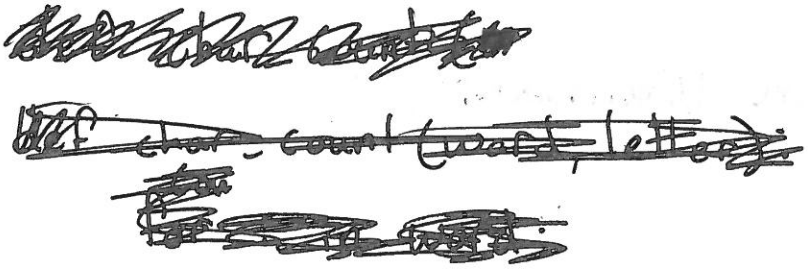



You could make a min heap assuming the smaller value is higher priority. New tickets could be quickly added and sorted. As you descend the heap the priority values increase.

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

*Your language of choice (e.g. Python):* Python

*Your solution:*



```
def char_count(word, letter):
    count = 0
    for i in word:
        if i == letter:
            count = count + 1
    return count
```

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

*Best case time complexity of algorithm:*

O(1)

*Explanation of best case time complexity:*

Insertion into a singly linked list is O(1).

If k=1, then it would be O(1).

Any more than k=1 would be O(n)

*Worst case time complexity of algorithm:*

O(n)

*Explanation of worst case time complexity:*

Insertion into a singly linked list is O(1).
Doing this k times gives O(n) time.

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

| *Organization* | *Main Activities* | *Hours Spent (estimate)* |
|---|---|---|
| ~~Teaching~~ | ~~Building computer~~ | ~~~15~~ |
| MSU | Undergrad course assistant | ~32 (2hours/week) |
| Ski coaching | Teach family friends to ski | ~30 |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

~~Algorithmic bias is when an algorithm~~ Algorithmic bias is when an algorithm favors certain data/input more than it should or vice versa.

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

For example in this scenario, assuming this software is accepting/rejecting applicants, it could begin to only accept applicants with a certain financial background or from a certain region regardless of academic success. This could happen if those factors are considered first and immediately decided based on those results.

**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:*
More similar lawsuits are made of people claiming copied code. How big does the code have to be to be considered intelectual property?

*Second possible impact:*
Assuming Google would pay the settlement, could other companies just pay a lump sum to copy and reuse code?

*Third possible impact:*
It becomes very difficult in certain scenarios to write code that can't claim to be copied. Almost exact code [redacted] blocks deffinitely exist.

**Question 7:** In the ACM Code of Ethics and Professional Conduct, one ethical principle stated is to ***avoid harm***. Describe three different types of harm that the software of an autonomous, self-driving car might cause.

*First type of harm:* Harm to pedestrians
If it is about to hit a car, does it decide to swerve and miss the car? Especially if pedestrians are around and could be hit.

*Second type of harm:* Harm to vehicles
If the software fails to detect a car in front of it it would cause an accident that might not otherwise have happened.

*Third type of harm:* Harm to driver
The self driving aspect may give the driver too much confidence in it. The driver could entirely lose focus [redacted] and for whatever reason the car goes off the road causing an accident. The driver would have paid more attention without the so

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

I plan to work. I have applied to Intel, GM, Raytheon, Fast, and Zoot. I don't remember the exact positions with Intel, GM, and Raytheon right now. They would be junior developer positions. Fast is for the Tech Team position and Zoot is for the solutions developer position. I am in the final interview stages with Fast and Zoot.

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

| *Organization Name* | *Estimate Total Hours Spent* |
|---|---|
| Church (Resurrection) | 50-100 |
| | |
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**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)* |
|---|---|
| Ski instructing at Big Sky | 300+ |
| Working at Golf Course | 700+ |
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**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:* The social aspect. The ability to view, contribute, and explore public pages.

*Non-trivial feature 2:* The educational aspect. GitHub has a ton of useful tutorials and tools included for students. For many different disciplines within CS.

*Non-trivial feature 3:* GitHub also has a lot of easy integration with third party tools to build and deploy robust projects.

**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)* |
|---|---|
| Texbase, built computers, CMS training | ~48 |
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| AWS | A bunch |
| React | |
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Best wishes wrapping up the semester and in the future!

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Name Cameron Watson

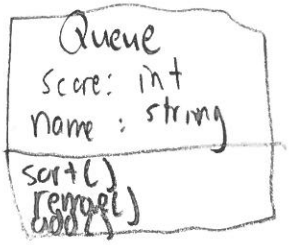
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a) What simple data structure would best model this situation? Explain.

A queue would be the best way to do it.

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

I would start by creating a linked list and add all of the tickets with their corresponding urgency score. After entering in the data, I would sort it from descending order. The ticket first in line is the most urgent.




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

I think the first option is the best, but you could also use a stack. You would have to sort the values before adding to the stack though.

**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:*

```
numOfTimes(String S, Char C)
{
 int num =0
 for(i=0; i< S.length; i+=1)
 {
  if(i.equals(C)
  {
   num+=1
  }
 }

 retur  num;

}
```

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

*Best case time complexity of algorithm:*

O(n)

for(

*Explanation of best case time complexity:*

from my understanding, it is going through the list one at a time. If each value in the list had corresponding values it would be $O(n^2)$, but it doesn't.

List: [0, 1, 2, 3, 4, 5

*Worst case time complexity of algorithm:*

The worst case is the same.

*Explanation of worst case time complexity:*

No matter what you are stepping through each element of the list, so it shouldn't change on run time.

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

| *Organization* | *Main Activities* | *Hours Spent (estimate)* |
|---|---|---|
| I wasn't involved in | any extracurricular | activities. |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when the algorithm has set values and can only interpret data in one way.

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

An example is being denied to a college because the college admissions software is not able to recognize students over a certain age.

**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:*

You are no longer able use libraries

*Second possible impact:*

Quality of code will diminish. People will have to create work arounds to already solved problems.

*Third possible impact:*

Code is no longer open sourced.

**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: Getting injured in an accident

*Second type of harm:*

Enviromental harm: Causing harm to the enviroment via $CO_2$ emmissions

*Third type of harm:*

Economic / financial harm: People who drive for a living will be impacted.

**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.

Computers Unlimited: Applied and currently talking with HR.

Department of Transportation: Applied

CIA app developer: I've looked at this, but they are currently not accepting applicants.

**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* |
|---|---|
| I wasn't apart of any social | activities, the main |
| social interactions I've had | were going to the |
| gym with friends | |
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**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 | ? |
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**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:*

SSH key support for security measures.

*Non-trivial feature 2:*

It is possible to to have different branches for the same repository. (master / main)

*Non-trivial feature 3:*

You are able to roll back changes made by others.

**Question 12:** During your time at MSU, list any major non-classroom, non-paid activities that you engaged in to help prepare for your computer science career. For example, you might have taught yourself a programming language or attended a workshop on a CS topic. For each activity, **estimate** the number of hours spent.

| *Activity Description* | *Hours Spent (estimate)* |
|---|---|
| Leet Code | 4-5 hours a week |
| Topological Spaces (fall 2022) | 1-2 hour a week |
| | |
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Best wishes wrapping up the semester and in the future!

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 80 minutes.**

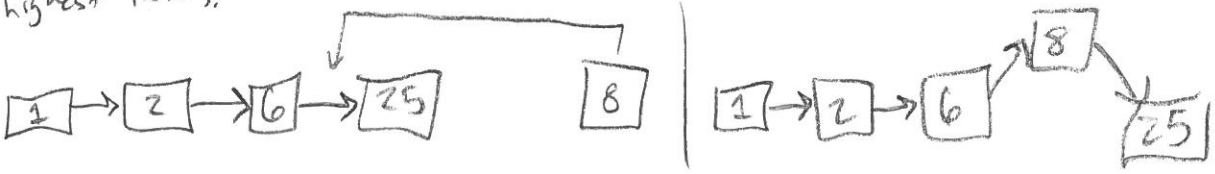
Your performance helps us assess how well we are meeting our stated learning outcomes for computer science majors. To pass this exam, spend at least 45 minutes in order to provide a carefully reasoned answer to each question. This information will help us make improvements.

Name Megan Weicle

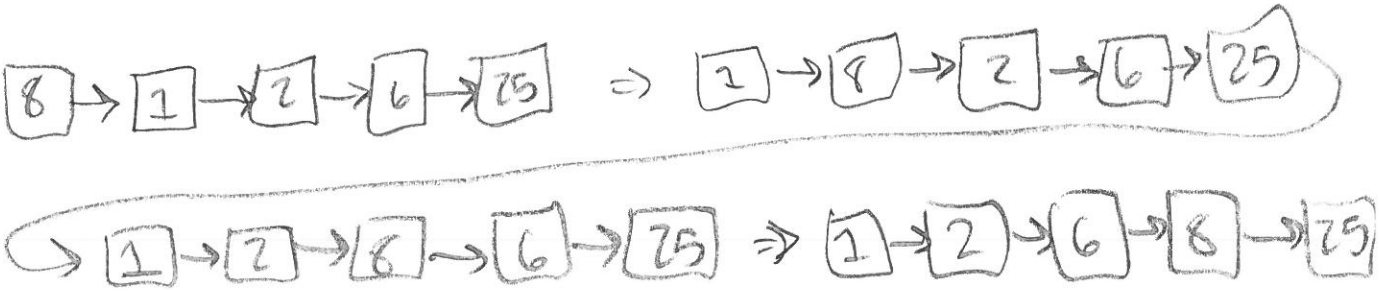
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's 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.
I think a linked list would best model this situation. It would allow the system to place new items in order of urgency score, making it easy to find the most urgent one, and you can add/remove nodes with ease.

b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.
When a new ticket comes in, the system should identify the urgency score and place the ticket in the linked list behind the item currently closest to the score (behind the next highest item).




c) Describe a second way in which this data structure could be implemented and draw a picture of that data structure.
They could also have tickets automatically join the list and sort the list constantly.



**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 TimesCharInString(String str, char c){
    Integer i = 0;
    Integer count= 0;
    for( i; i< str.length(); i++){
        if ( str.charAt(i) == c){
            count ++;
        } else{
            continue;
        }
    }

    return count;
}
```

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

*Best case time complexity of algorithm:* O(k)

*Explanation of best case time complexity:* best case is the numbers k are already in order and only need to be added to the end, so it would take as long as there are numbers to add.

*Worst case time complexity of algorithm:* O(kn)

*Explanation of worst case time complexity:* worst case is each number needs to go through the entire list of n before being placed. Doing so are at a time means for each number k it will take n time to add the number.

**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)* |
|---|---|---|
| GVMA | coaching/training | 3,500+ |
| Hoplite Industries | SOC Analyst | 1,000+ |
| Course Assistant | Help students in 107 | 32 |
| | | |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.
I'm not sure, to be honest. I guess when an algorithm tends to favor certain data over other data that would be algorithmic bias.

b) Provide a hypothetical example of how algorithmic bias could manifest itself in college admissions software.
If it was provided historical data to base decisions on, it could choose to admit students based on the likelihood that the people who chose students in the initial data would have chosen them. That is to say the algorithm could take on the biases of previous admission staff.

**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:* Freedom to continue borrowing and expanding upon the code of others.

*Second possible impact:* Other tech companies are less likely to sue smaller companies for doing the same thing (which helps prevent monopolies and encourages greater diversity)

*Third possible impact:* Protect other people who use the API from the same situation.

**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 kill or injure someone.

*Second type of harm:* If something fails to work it could result in someone being trapped in their car, which would certainly do some psychological damage.

*Third type of harm:* If someone is in the car and they got into an accident that killed someone that would be pretty traumatic.

**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 likely continue to work at Hoplite Industries. I may end up moving out of state, which could change that plan.

Hoplite has expressed interest in keeping me on and making me part of their senior team upon graduation. I'd be working in cybersecurity and management of customer 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* |
|---|---|
| N/A | N/A |
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**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)* |
|---|---|
| EGEN 310 | 60 |
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**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:* collaboration

*Non-trivial feature 3:* diff

**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 | N/A |
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Best wishes wrapping up the semester and in the future! 

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 80 minutes.**

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Name JARED WEISS

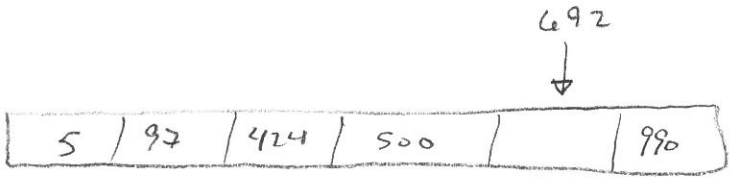
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's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

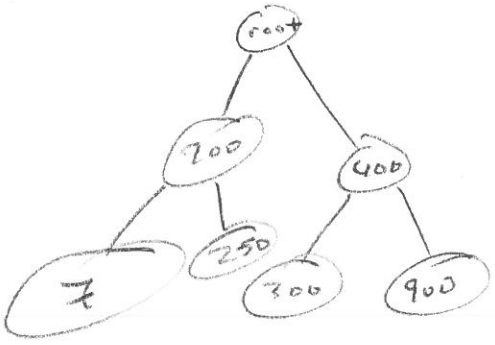
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Implemented via Linked List or Array List




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

A tree / 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):* Scala

*Your solution:*

```
def characterOccurrences(haystack: String, needle: Char): Int =
{ // iterates through all chars and checks for equality
    var i: Int = 0 // counter
    haystack.foreach( straw => {
        if( straw == needle) {
            i += 1
        }
    })
    i // Scala returns last expression
}
```

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

*Best case time complexity of algorithm:*

O(k)

*Explanation of best case time complexity:*

k=1 and the number(s) are ≤ all numbers in the list, just insert at beginning, update 1 pointer

[small #'s][list]

*Worst case time complexity of algorithm:*

O(kn)

*Explanation of worst case time complexity:*

may have to traverse entire list to find correct place to put the number

[list][large #'s]

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

| *Organization* | *Main Activities* | *Hours Spent (estimate)* |
|---|---|---|
| Quig | Software Eng. Intern Backend | 30 - 40 hours/week |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is ~~using~~ developing an algorithm against biased data.

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

Algorithm only accepts people with yellow shoes, all others rejected.

(silly, but think racism)

**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:*

Android takes a hit, causing Android users to be sad :(

*Second possible impact:*

Google doesn't make so much money (oh no)

*Third possible impact:*

Oracle makes more money, as their propreatary code can only be liscenced by 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:*

(death / bodily injury) inadvertantly kill a human being

*Second type of harm:*

(crash) cut off another driver and cause them to be miffed all day

*Third type of harm:*

Public mistrust of autonomous drivers

**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 start work at a local company called Quiq. I have already received an offer and begin full-time work in January while I finish school. I'll be working on the backend team with a focus on data + analytics.

**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* |
|---|---|
| Connect Church | 1½ hours every Sunday |
| | |
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**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)* |
|---|---|
| Core classes | Soo many (200-300?) |
| TA - Operating Systems | 30-40 |
| | |
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**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:*

Maintaining different branches of code so you can develop a feature w/o screwing w the main branch

*Non-trivial feature 2:*

Stashing changes for later, if they aren't useful right now

*Non-trivial feature 3:*

Merging changes from an upstream repo

**Question 12:** During your time at MSU, list any major non-classroom, non-paid activities that you engaged in to help prepare for your computer science career. For example, you might have taught yourself a programming language or attended a workshop on a CS topic. For each activity, **estimate** the number of hours spent.

| *Activity Description* | *Hours Spent (estimate)* |
|---|---|
| learned Rust | 20 - 30 hours |
| learned √ | 10 - 20 hours |
| python experiments | 20 - 50 |
| general programming learning | a lot, 100+ hours |
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Best wishes wrapping up the semester and in the future!

Thank you!

Gonna miss you guys

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 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 IKE WESSEL

**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.

doubly-linked list - you can pop off the back

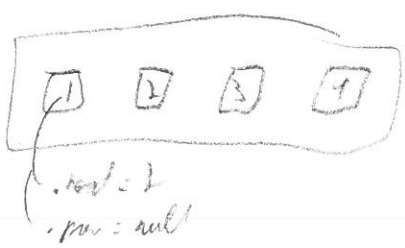
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

you import the OCC library for your program



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

use an array of nodes and set the ".next" and ".prev" manually



**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 foo(String a, char b) {
int counter = 0
for char i : a {
if (i == b){
    counter++;
}
return counter;
}
```

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

*Best case time complexity of algorithm:*

$O(n)$

*Explanation of best case time complexity:*

if each new float is greater than the one at the end of the list, then you just perform k operations in appending them w/ no need to re-order

*Worst case time complexity of algorithm:*

$O(n^2)$

*Explanation of worst case time complexity:*

if every float is less than the one at the start, then you need to do n operations sorting it to the front, n 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)* |
|---|---|---|
| Swing Cats | Dancing | 10 |
| Zoot Suiters | Development | 360 |
| | | |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

When an algorithm is trained to show disproportionate pass/fail action when subject of a certain kind

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

If students of a certain race were to have historically higher drop-out rates, then a biased admin software could flag all incoming students as high-risk drop-outs and deny admission.

**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:*

APIs become more closely guarded

*Second possible impact:*

Production of original code decreases as devs realize they're safe to copy APIs

*Third possible impact:*

Code-gen bots begin to train more + more off APIs

**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:*

driving off cliff as a "shortcut", crashing car + hurting person

*Second type of harm:*

choose to hit pedestrian to save cargo

*Third type of harm:*

always follow speed limit, even when that disrupts traffic flow

**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.

Got a job - FAST Enterprises

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

| *Organization Name* | *Estimate Total Hours Spent* |
|---|---|
| Swing Cats | 10-20 |
| ~~the~~ church | 100s |
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**Question 10:** List any activities that you were involved with during your time at MSU that prepared you to work more effectively with teammates whose backgrounds are significantly different than your own. For each activity, (1) **describe** the activity and (2) **estimate** the total number of hours you spent.

| *Activity Description* | *Hours Spent (estimate)* |
|---|---|
| Class Labs | 100s |
| $ EGEN 310 | 80 |
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**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:*

auto-resolves merges

*Non-trivial feature 2:*

integrates directly into IntelliJ

*Non-trivial feature 3:*

can copy repo from a URL

**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 | 0 |
| | |
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Best wishes wrapping up the semester and in the future!

Thanks!

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 80 minutes.**

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Name Riley Williams

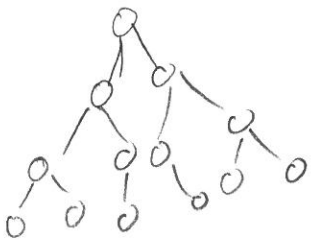
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's 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 binary search tree could be used. Simply follow the path to the right until there are no more children to get the highest urgency score

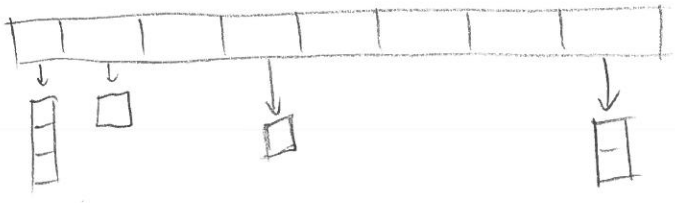
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Could use a red black BST



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

Could use a hash map with key value pairs, key being urgency value being a ticket 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):* Java

*Your solution:*

```
Private int func (String str, Char char ) {
    int count=0;
  Char[] arr = Str.split();

  for (i=0; i<arr.length(); i++) {
      if(arr[i] == char) {
          count++;
      }
  } return count;

}
```

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

*Best case time complexity of algorithm:*

O(k)

*Explanation of best case time complexity:*

If each Element of K is the proper Value to add to the front of the list and still maintain order, then all that needs to happen is reasigning pointers after doing the comparison.

*Worst case time complexity of algorithm:*

$O(n \cdot k)$

*Explanation of worst case time complexity:*

Each element of K has to be appended to the list. Which means You have to traverse the n elements K times. (each traversal is n + the number of previous elements added in length)

**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)* |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

I don't Know.

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

Unsure

**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:* Payment from google to Oracle for the damages caused.

*Second possible impact:* Google must stop using the code in Production.

*Third possible impact:* Saved business relations between the two companies could lead to a falling out.

**Question 7:** In the ACM Code of Ethics and Professional Conduct, one ethical principle stated is to ***avoid harm***. Describe three different types of harm that the software of an autonomous, self-driving car might cause.

*First type of harm:* Bodily harm in the form of possible accidents caused by the software.

*Second type of harm:* Emotional/Mental Harm caused by the software making the car seem like it will crash, when it won't actually. This could scare passengers/ bystanders.

*Third type of harm:*

If the software was used on vehicles meant for war/ fighting.

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

I am planning on seeking a job. I have applied to Teledine, and also have some communication with FS and Teledine.

**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* |
|---|---|
| Magic The Gathering: FNM | 1000 |
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**Question 10:** List any activities that you were involved with during your time at MSU that prepared you to work more effectively with teammates whose backgrounds are significantly different than your own. For each activity, (1) **describe** the activity and (2) **estimate** the total number of hours you spent.

| *Activity Description* | *Hours Spent (estimate)* |
|---|---|
| Work at Rooks | 10,000 (30 hours a week) |
| Magic Judging | 400 ~ 1hr a week |
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**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, Multiple collaborators.

*Non-trivial feature 2:* Tracking Commits and merges

*Non-trivial feature 3:* Non local repositories.

**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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Best wishes wrapping up the semester and in the future!

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 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 Mason Williamson

**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.

Create a "priority" variable. Assign it to a place in the queue based off of the number of that value.




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

Create multiple queues for different priority levels and pull from the higher priority queues first and more often than the lower 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:*

```
int count = 0
str my_string = "hello world"
char my_char = "l"

    for i in my_string {
        if (mychar == my_string(i)) {
            count++
    33
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:*

*Explanation of best case time complexity:*

I don't remember any of this

*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)* |
|---|---|---|
| Heart of the Valley | Dog walking volunteer | ~ 10 hrs |
| UIT Service Desk | Job: User Support Associate | ~ 800 hrs |
| | | |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithm that, due to the way it was programmed, comes to a biased ~~thing~~ conclusion.
↑ by human standards

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:*
Code cannot be copied by large organizations without prior legal agreement, making the coding process harder.

*Second possible impact:*
API's must all be distinctly different from now on.

*Third possible impact:*

**Question 7:** In the ACM Code of Ethics and Professional Conduct, one ethical principle stated is to ***avoid harm***. Describe three different types of harm that the software of an autonomous, self-driving car might cause.

*First type of harm:*
Any type of malfunction in the code can lead to serious injury of driver

*Second type of harm:*

*Third type of harm:*

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

I am hoping to go into project/program management in a technical field. I have a few connections in my network keeping an eye out for positions. But so far no offers.

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

| *Organization Name* | *Estimate Total Hours Spent* |
|---|---|
| N/A | |
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**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 | |
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**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:*

None.

*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)* |
|---|---|
| Ongoing - IT Certification through Coursera | ~10 hrs |
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Best wishes wrapping up the semester and in the future!

Thank you

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 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 Wood

**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.

List models this situation. Find the max element, get the index of the element and remove the element at the index. The list will adjust its size unlike an array so no need to fill a spot with a zero or -1. Size will also be adjusted when new elements are added.

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

You could simply just use the plain data structure built into the programming language.

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

You could create an Object and write the necessary methods to satisfy the requirements.

**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 character_counter(the_string, character):
    counter = 0
    for(c in the_string):
        if(c == character):
            counter ++
    return counter
```

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

*Best case time complexity of algorithm:*

O(1)

*Explanation of best case time complexity:*

K is smaller than the current tail. k points to the current tail and becomes the new tail, having null pointing to it.

*Worst case time complexity of algorithm:*

O(n)

*Explanation of worst case time complexity:*

Each floating point number k becomes the head when added, meaning we had to traverse the entire linked list to add the element

**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)* |
|---|---|---|
| Cru | Student leader | >100 |
| MSU | UCA | 30 |
| | | |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

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:*

Other lawsuits may arise between other companies

*Second possible impact:*

Code bases would need to be reworked

*Third possible impact:*

**Question 7:** In the ACM Code of Ethics and Professional Conduct, one ethical principle stated is to ***avoid harm***. Describe three different types of harm that the software of an autonomous, self-driving car might cause.

*First type of harm:*

Physical harm - failure to stop

*Second type of harm:*

*Third type of harm:*

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

Accepted into Montana Bible College in Bozeman for a One-year certificate in Biblical Studies

**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* |
|---|---|
| Grace Bible Church | 50 |
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**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)* |
|---|---|
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**Question 11:** Name the most sophisticated version control system that you use and describe three nontrivial features it has.

*Name of most sophisticated version control system:*

Git

*Non-trivial feature 1:*

git add [file_name]

add a file that is intended to be committed

*Non-trivial feature 2:*

git commit

take the file(s) that were staged for a commit and put it on the head of the branch so that it can be pushed

*Non-trivial feature 3:*

git push [dest] [src]

Push changes made locally to a remote destination

**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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Best wishes wrapping up the semester and in the future!

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 80 minutes.**

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Name Henry Wright

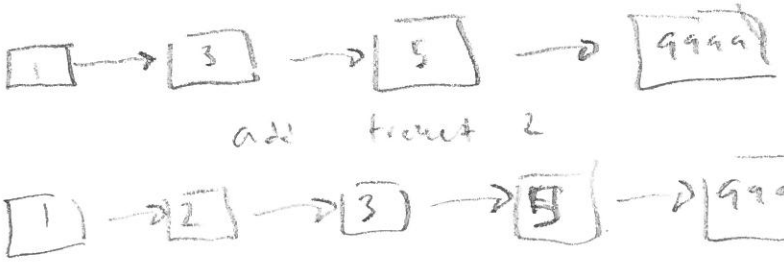
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer service team needs a way to find the most urgent ticket in the system and remove it when it has been addressed. New tickets can arrive at any time.

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

Priority queue. First in first out, but with higher priority tickets able to skip ahead

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

Linked list to store tickets.




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

Self-Balancing Binary Search tree. Get leftmost node and remove.



**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:* (Java)

```
countCharInstances (String s, char c){
    int count = 0;
    for (int i; i < s.length; i++) {
        if (s.charAt(i) == 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:*

O(1) / O(k)

*Explanation of best case time complexity:*

K numbers are added in when each of the K numbers is smaller than everything on the list.

*Worst case time complexity of algorithm:*

O(N)

*Explanation of worst case time complexity:*

Always need to add to end of L.L.

**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)* |
|---|---|---|
| N/A | | |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Bias in an algorithm.

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

If there are 2 students, Aaron and Zach, ~~they are equal chance~~ who are equally qualified for the last spot in college, Aaron may be favored by the algorithm since his name comes first alphabetically

**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:*

No/weak case for copyrighting code; Code is not protected under copyright.

*Second possible impact:*

Other companies may 'steal' code from other companies

*Third possible impact:*

APIs may become private / companies may keep their work more private.

**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:*

May fail and harm a human pedestrian

*Second type of harm:*

May fail and damage property (buildings, other cars)

*Third type of harm:*

Someone could put a bomb in the car and have it drive it to a school or something.

**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.

Plan to work as a junior software developer. Currently have 1 offer from a American Credit Acceptance, continuing to apply elsewhere.

**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* |
|---|---|
| IM Basketball, Kickball, Soccer | 20 |
| IM Referee | 100 |
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**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)* |
|---|---|
| ?. 12K | |
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**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:*

N.I sure what this is

*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)* |
|---|---|
| Leetcode | 30 |
| Youtube | 10 |
| | |
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Best wishes wrapping up the semester and in the future!

Thanks!

**Montana State University Computer Science Department**

**Graduating Senior Exam**

**Academic Year 2022-2023, 80 minutes.**

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Name Hayden Xavier

**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 best data structure to model this situation is a linked list because it allows for easy list sorting, it allows for the most urgent data element to be pulled, and allows new elements to be added to the end of the pulling order.

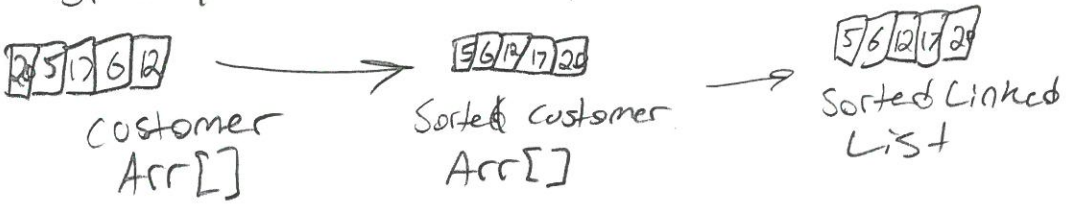
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

The linked list could be implemented by adding variables of class customer (with value urgency_score), sorting the customers based on urgency score, and then add new tickets as necessary




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

The linked list could be implemented by creating it out of a pre-sorted array of customers



**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 countOccurances(String inputString, Char inputChar):
    int charOccurance = 0;
    for(Char character: inputString);
        if (character == inputChar):
            charOccurance++;
    return charOccurance;
```

**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:*

In the best case of this algorithm, each addition of a floating point # takes one operation.

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

*Explanation of worst case time complexity:*

In the worst case of this algorithm, each float n within the linked list must be iterated through in order to find the correct spase for each 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)* |
|---|---|---|
| N/A | | |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when an algorithm's results are biased due to deciding factors of the algorithm being in relation to some biased concept.

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

- The admissions software favors students with extra-circular activities
- Those activities may be easier to do in high-income school districts
- The software therefore favors high-income students.

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

*Side you choose to win:* Google

*First possible impact:*
Companies may now use other companies' code when creating software

*Second possible impact:*
The lack of code copyright protection encourages more open-source development

*Third possible impact:*
Open-source development allows for faster progression of new technological inventions.

**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 - Hits another car, killing the driver

*Second type of harm:* Moral Harm - Makes a decision to swerve from pedestrian, injuring driver.

*Third type of harm:* Emotional Harm - Decides to protect driver and hit pedestrian, scarring the driver.

**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 Plan - Spend the year taking a gap and developing personal coding projects in order to boost my resumé.

**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* |
|---|---|
| Spirit of the West marching Band | 100 |
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**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)* |
|---|---|
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**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:* pip

*Non-trivial feature 1:* install new packages

*Non-trivial feature 2:* Update packages

*Non-trivial feature 3:* display currently installed packages & versions of those packages.

**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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Best wishes wrapping up the semester and in the future!