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 Michael Belmer

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 it would put the highest priority items at the top to be addressed first. i.e. those customers with a higher urgency score would be addressed first.

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

This data structure could be implemented in a programming language such as java and I'm fairly certain that it is built in.



↑ Priority goes up as you move up the structure

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

You could also create this data structure with some sort of list or array, assigning values to the variables you put into the list (such as the score), then iterate through the list to sort by highest value (i.e. 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 int return_num_occurance(string s, char c) {
    s.tolower();
    int counter;
    for(int i<s; i=0; i++){
        if(c.equals(i)){
            counter++;
        }
    }
    return counter;
}
```

and

```
c.tolower();
```

(I forgot)

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 we are doing is adding to the list in constant time regardless of the size of the linked list, all we would have to do is check that we are appending/adding to the last node in the list and to do that we would just check the node with no additional pointers.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:

we may have to loop through the entire list to find the node with no additional pointers. If we are given an extremely long list, the running time will take forever as opposed to a short list, the running time depends entirely on the size of the list if we have to loop through and locate the last node.

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)*
D.A. Davidson	Wealth management intern	1000 hours - 2 summers plus part time
The Navigators	Bible study leader, service, worship leader	1000 hours - every wednesday for 2 hours since freshman year plus extra
American Marketing Association	Director of Web Development	40 hours
Eagle Mount	Ski Instructor	100 hours
D.A. Davidson	Software Engineer Intern	1000 hours
		↓ will be for MIS next summer as I technically don't graduate
		till the fall but I'm done
		w/ C.S.

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

When an algorithm messes up and allows something or does something it shouldn't.

Idek

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

A college admission algorithm that looks to see if people meet all requirements that they input into a form, however it parses some forms wrong and therefore some people are accepted when they should be rejected while others are rejected when they should be accepted.

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

Side you choose to win: Google

First possible impact:
API code will now be public access so people can use other peoples public code.

Second possible impact:
People will be able to collaborate more freely with API keys and writing

Third possible impact:
People stop writing APIs so as to get ahead and keep people in the dark thus making them more dependy.

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

First type of harm:
Could kill someone or cause physical harm to someone because of an error

Second type of harm:
Could cause damage to vehicle because of an error

Third type of harm:
Could cause damage, mental or emotional to someone in our outside car. because of a minor 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.

I technically won't graduate this semester but I am all done w/ my C.S. reqs after this sem. I plan to finish my last few credits this next year of my second degree while interning as a Software Engineer at D.A. Davidson. Then after I graduate - pending I did well during my internship, I plan to work full-time as a Software Engineer at D.A. Davidson. I technically haven't signed an offer letter yet but they told me I would start in May and that I was the top candidate.

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 Adult Hockey	100 hours
American Marketing Association	40 hours
The Navigators	1000 hours
Redeemer Church	160 hours
Perfect Ten Podcast	50 hours

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

Activity Description	*Hours Spent (estimate)*
All my internships/job experience	2000 hours between jobs/companies
All the clubs/ministries I'm apart of	1000 hours
My group projects during all of college	100 hours
Hockey and soccer teams	100 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

Non-trivial feature 1:

branching → I can create my own branch of a repo to mess with and break code

Non-trivial feature 2:

pulling → I can pull updated versions of code repos to my local machine

Non-trivial feature 3:

pushing → I can push my own updates of code to main branch and then submit a pull request to have it merge with code base for use in production.

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)*
I read cracking the coding interview	150 hours
I browsed through youtube and watched tutorials on anything I didn't understand during my 4 years here	70 hours

Best wishes wrapping up the semester and in the future!

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Name Turner Burchard

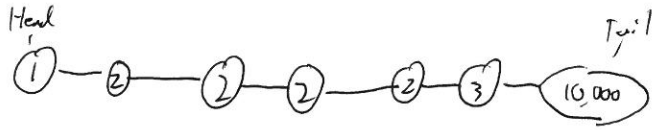
Major (Circle One): Computer Science B.A. or (Computer Science B.S.)

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

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

Linked list. A hashmap would be difficult when finding the most urgent ticket. An indexed array has issues with duplicate urgency scores.

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

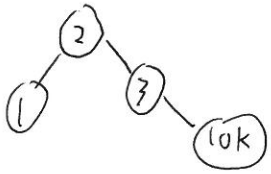


Insertion: Follow links until find correct placement for node by finding greater score.

Access: Follow links by popping head when addressed.

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

A tree would be ideal for access but more complex and potentially harder for insertions. In this case duplicates might be stored in an unordered list in the node's data.



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(str, char):
    count = 0
    for letter in str:
        if letter == 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:

k

Explanation of best case time complexity:

If each num in the set k is less than all in n,
only 1 number in n needs to be checked before insertion.

Worst case time complexity of algorithm:

$n \cdot k$

Explanation of worst case time complexity:

If each num in the set k is higher than all in n,
the list must be fully traversed each 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)*
ACM	Treasurer	40
D.A. Davidson ~~MT Risk Intern~~	IT Risk Intern	360
Brightwire	Data / Frontend Intern	1000
Quiq	Conversational AI Backend Intern	1500
~~Under~~ MSU	Undergrad Course Assistant	160
MSU Wiedenheft Lab	Research Scientist	80

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Never heard of it

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

By selecting top performers it could accidentally only select wealthy white students from good high schools rather than the smartest 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:

Improved incentives for companies to produce IP

Second possible impact:

lower incentives to steal / copy

Third possible impact:

Accidental negative impacts on open source ideals

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:

Reducing driving jobs

Second type of harm:

injuring people in the case of bugs

Third type of harm:

Increased inequality

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

I have an internship at onX Maps, then I am planning on attending MSU grad school for CS.

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

Organization Name	*Estimate Total Hours Spent*
ACM	60

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)*
ACM	60

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:

Ability to branch with different states

Non-trivial feature 2:

Ability to maintain a complete history of changes

Non-trivial feature 3:

Ability to host data which can be accessed & edited by an arbitrary # of people.

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)*
Personal Website turnerburchard.com	20

Best wishes wrapping up the semester and in the future!

thanks!

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Name William Cade

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

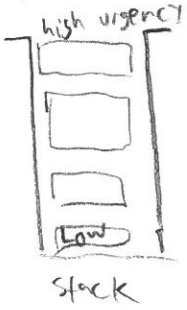
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

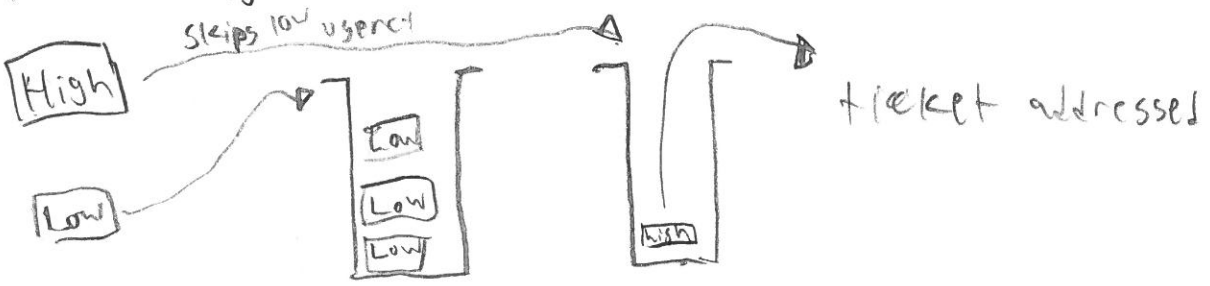
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A system that reads urgency score & pushes high scored tickets to the top of the stack.



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

A 2 stack system that does not push low urgency tickets to the main stack until high urgency tickets are no longer in main stack



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

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

Your solution:

```
def countChars(character, string):
    count = 0
    for i in len(string):
        if (string.charAt(i) == character):
            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:

$O(n)$

Explanation of best case time complexity:

iterate through list until $k > k-1$.

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

randomly shuffle list until it is in the right order.

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.

Algorithms search a data set for a certain key word ignore data that does not contain that keyword.

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

The algorithm could ignore applicants in a certain GPA range.

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:

Sets precedent of anti-plagiarism.

Second possible impact:

ensures work cannot be stolen

Third possible impact:

Guarantees software cannot be created with stolen 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:

can cause harm to the driver in the event of a system crash

Second type of harm:

can cause harm to pedestrians if there was a portential bug.

Third type of harm:

could cause property damage.

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 my current job + begin the job search. I will be staying in Bozeman + searching for jobs in Bozeman or jobs that can be worked remotely.

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:

VScode command pallette

Non-trivial feature 1:

opens terminal

Non-trivial feature 2:

changes language interpreter

Non-trivial feature 3:

Links to git

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

Activity Description	*Hours Spent (estimate)*
misc. Raspberry Pi projects	~ 20-30
building computers	20
building/maintaining server PC	10

Best wishes wrapping up the semester and in the future!

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Name Michael Clearwater

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

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

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

A hash map could be used as the problem needs a tuple data structure to store the name and urgency score.

The name would be the key and the score would be the value.

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

name, score

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

score, name

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

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

Your solution:

```
public int countChars(String str, Character c) {
  int num = 0;
  for (int i = 0; i < str.length; i++) {
    if (str.charAt(i) == c) {
      num++;
    }
  }
  return num;
}
```

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

Best case time complexity of algorithm: O(n).

Explanation of best case time complexity:

You may only need to traverse the list and add k to the end if the situation is correct.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:

I think at worst you have to traverse the list until you find where k has to go, then you just have to change the pointers.

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)*
none		

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The algorithm can be programmed to behave a certain way, which may be influenced by the bias of the programmer.

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

The software could have a higher chance of accepting applicants of a certain race.

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 protects any user who uses code similarly from being sued.

Second possible impact:
It could make people think copyright and patent infringement is alright.

Third possible impact:
It allows users to be safe from unknowingly copying 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:
It could be programmed to protect one life instead of the other.

Second type of harm:
It allows people to be negligent drivers.

Third type of harm:
All software can fail, and in this situation can kill bystanders.

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 upon graduation.
I have applied to Fast Enterprises as an Implementation Consultant.

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

Organization Name	*Estimate Total Hours Spent*
none	

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

Activity Description	*Hours Spent (estimate)*
none	

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

Name of most sophisticated version control system:

Github

Non-trivial feature 1:

History of commits

Non-trivial feature 2:

Collaboration

Non-trivial feature 3:

cross-platform

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 Rory Donley-Lovato

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

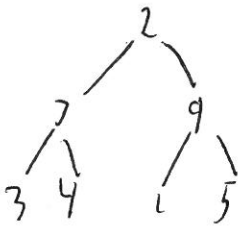
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

priority queue

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

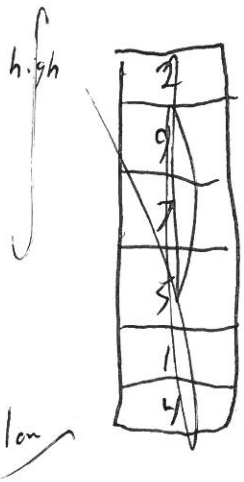
Priority queue allow for tickets to be sorted based on their priority. When a ticket is received with high priority, it will be inserted based on its ranking

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

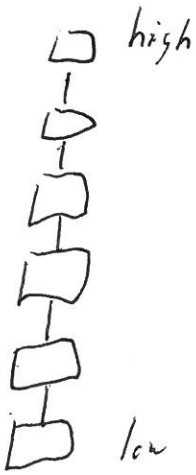


This can be implemented using a heap that rebalances based on priority every time something is added.

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



This can also be implemented with a linked list. The functionality of nodes would allow the system to inject a new node at any point.



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 string check (testchar, teststring):
    count = 0
    for char in teststring:
        if char == testchar:
            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:

The node is added at the bottom or ~~the top~~
and that would be its position in the ranking.
The new node is the smallest number and doesn't need to move.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:

Assuming the node is added at the bottom,
if the new node has the new greatest value, it would need
to check its value against and swap with every other node
until it reached the top.

3x

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.

20x7
140 x 4

Organization	*Main Activities* food bank habitat for humanity	*Hours Spent (estimate)*
Sigma Phi Epsilon Fraternity	~~Planned/executed events~~ community service	~~500~~ 50
~~Robert Experts~~	~~Content for experts team~~	~~700~~
FYRE internship	setup Volumetric video system for Dr. Stanley	50

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithm is (hopefully) unintentionally designed to favor or discriminate against groups of people.

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

If the software is taught using sample data of predominantly white Montanans, it will build a profile where one of the stronger characteristics is white skin. So then during the application process, white applicants would be favored and non-white applicants would have a lower chance of acceptance.

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: Transformative content

Any company could take another companies API and use it in their software. Depending on how much the api is used, the api owner would have no rights to their code

Second possible impact:

Use of API's will be expensive and require payment up front before allowing another company access.

Third possible impact:

Production would slow down as companies would need to make their own API's for their products, or get tied up in long legal battles.

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: Crashes

If any sensor is miscalibrated or code is bugged, people could be hurt and killed by the car if it crashes.

Second type of harm: privacy

Sensors would record data outside and potentially inside the car.

This would allow a company to remove everyone's privacy if the car is nearby.

Third type of harm: Control

Assuming these are fully automated and self-driving, anyone inside the car would not be able to manually take over if the computer was wrong or missed something, or if the person just wanted to drive.

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 received no job offers. Currently, my next likely plan is to work as a Regional Director of Sigma Phi Epsilon Fraternity.

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*
Bobcat esports	560
Sigma Phi Epsilon fraternity	500

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)*
Sigma phi epsilon fraternity	500

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: branch

Allows groups to ~~be~~ make a copy of the current code and work with that to prevent competing work in development.

Non-trivial feature 2: ~~Fork~~ Merge

Allows to compare incoming code with old code to predict how the rest of the system will react.

Non-trivial feature 3: Commit/push

Allows users to download a copy of code from their current branch and send it back with their changes without instantly breaking the main repository due to unknown bugs.

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)*
Unreal Engine Game Dev w/ C++	300

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 Kaitlin Flinn

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.

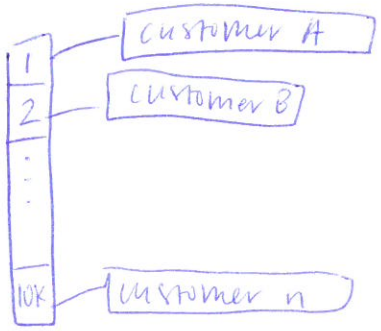
a) What simple data structure would best model this situation? Explain.

hashmap, can map # to customer & put it in order

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

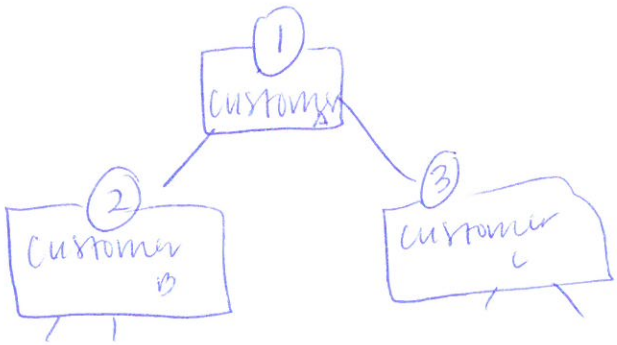
initiate hashmap w/ <int, customer object>

sort by int (key value)



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

priority queue, with customer objects, each customer has priority int attribute



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

```
                    String - int
public ~~int~~ CountNum(String s, char c){
    int count=0
    for(int i=0; i<s.length; i++){
        if(s.charAt(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:

Log(n)

Explanation of best case time complexity:

linked lists have time complexity of log(n), if k was relatively small time would stay same

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

if k is larger it will take 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)*
Eagle Mount	ski volunteer	20
AWC	participant / member	50
MSU club volleyball	player	200+

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithms that intentionally or not are created w/ a bias that can favor some outcomes more than others

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

if an algorithm automatically discarded applications of applicants w/ a GPA lower than 3.0 for example, you could miss equally strong applicants w/ a lower GPA & more activities

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 people use Java API to develop marketable or personal products

Second possible impact:
alternatively Oracle is more private about their API & other resources

Third possible impact:
people are more aware of APIs online & use the ones 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: lack of accountability, if no one is driving who is responsible for accidents?

Second type of harm: self driving cars are designed to navigate the world as-is, what if there are many automonous cars & they don't know how to interact w/ each other

Third type of harm: & human error result in crash

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.

- offers: Micron Technologies, DRAM Product Test Engineer
- multiple applications out
- end goal: work w/ tech communications (ie: technical consultant, product management, sales engineer, etc.)

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*
intramural volleyball	20
club volleyball	

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 activities + discussion	
real world problems (CS432)	
planning out project (ESOT 322)	

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:

intellij

Non-trivial feature 1: debugging feature

Non-trivial feature 2: auto-fill in

Non-trivial feature 3: command click into other functions

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)*
GHC in Florida w/ AWC	
~~Lunch~~ socializing @ career fair	

Best wishes wrapping up the semester and in the future!

Thank you! I have loved everything about MSU ♡♡

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Name AUSTEN HARRELL

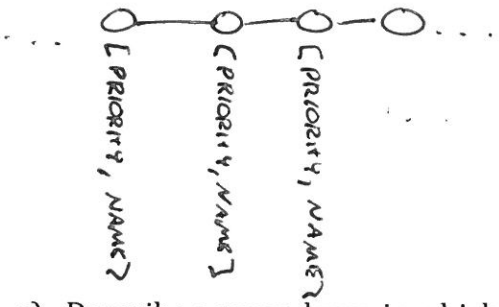
Major (Circle One): Computer Science B.A. or Computer Science B.S.

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 BE BEST SINCE TICKETS ARE CONSTANTLY BEING REMOVED FROM THE MIDDLE. AN ARRAY WOULDN'T WORK AS WELL BECAUSE THERE WOULD EITHER BE GAPS OR A DATA SHIFT WOULD BE REQUIRED

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.

USE A 2D ARRAY INSTEAD. DOUBLE ITS SIZE WHEN YOU RUN OUT OF SPACE.

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:

PYTHON

```
function QUESTION2(inputString, inputCharacter)
    COUNT = 0
    for (character in inputString)
        if (inputCharacter == 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:

O(1)

Explanation of best case time complexity:

YOU'LL HAVE TO WALK OVER THE WHOLE THING (WORST CASE) TO PLACE EACH NUMBER.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

YOU MIGHT GET THE PLACEMENTS IMMEDIATELY IF ALL k VALUES ARE SMALLER THAN n VALUES

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.

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:

PEOPLE CAN'T STEAL WHAT DOESN'T BELONG TO THEM.

Second possible impact:

SOFTWARE/LANGUAGES THAT ARE MONITIZED/NOT OPEN SOURCE ... STILL CAN'T BE STOLEN.

Third possible impact:

GOOGLE CREATES SOME NIFTY LANGUAGE CALLED GO (FOR EXAMPLE) THAT'S BETTER THAN JAVA ANYWAY. IT COULD EVEN HAVE A CUTE LITTLE GOPHER LOGO.

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 THE DRIVER

Second type of harm:

KILLING SOMEONE BESIDES THE DRIVER.

Third type of harm:

SPEEDING

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 CONTINUE TO WORK AT MY ENGINEERING FIRM, DOING MECHANICAL ENGINEERING & SOFTWARE ENGINEERING.

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:

MICROSOFT DEVOPS

Non-trivial feature 1:

GIT REPOS

Non-trivial feature 2:

PIPELINES

Non-trivial feature 3:

PROJECT MANAGEMENT FEATURES / PROJECT PLANNING

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 ROST	40 HRS
SELF-TAUGHT GO	40 HRS
SELF-TAUGHT C#	80 HRS
BUILT C# AZURE FUNCTION FOR COMPANY	120 HRS

Best wishes wrapping up the semester and in the future!

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Name Avery Jacobson

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. Tickets with a higher Priority (urgency score) would be sorted to the beginning of the queue

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

```
Class Ticket{
int urgency score;
str ticket request;
}
```

Sorted into a List of Ticket objects

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

(ticket ID, urgency score). Tuple value to link ticket ID with urgency, Sort tuples by urgency, get IDs

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(string, char):
    count = 0
    for character in string:
        if character == 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(1)

Explanation of best case time complexity:

It is possible that every K floating point number will be placed at the head of the list, and that is it's correct location. It will know this by checking its neighbor using the single link.

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

It is possible that upon adding K numbers, you will need to iterate through all N inorder to place K in the correct location. If this is possible for every K, that is worst case scenario

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)*
Raytheon Missiles & Defense	Software Products Engineering	480
HackerCats	attended 1 meeting	1.5

10.40

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

If an algorithm is developed on a knowingly or unknowingly biased dataset, or unbiased dataset the algorithm can be developed in a way that benefits certain types or values of data more than others.

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

If an image processing software was implemented to weed-out fake/computer generated college admission photo ID's, it may come across an image with different skin tone or lighting that it is unfamiliar with, and reject the application even though it is valid

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:

copyrighted code becomes open-source, exposing every companies code to the public.

Second possible impact:

Oracle goes out of business and thousands of programmers lose their job

Third possible impact:

companies will need to find new ways of keeping their code 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:

Run over baby because car thought baby was trashbag !!

Second type of harm:

Your autonomous vehicle may break the law and void your flawless driving record.

Third type of harm:

Mental Health damage since driving is great stress relief for some individuals

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

I have applied to work with Tesla, I have not heard back. Raytheon offered me a full-time position in Tucson, I will not be taking the offer.

Continuing to apply to work.

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*
Racquet Ball Club	3.0

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)*
Group work in classess	500

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:

Git stash: stashes changes locally in order to pull from remote while not losing your local files.

Non-trivial feature 2:

Git restore: restore to last given commit

Non-trivial feature 3:

Pull Requests: upload your work to a pull request, which must be approved before your changes are merged.

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)*
Personal Projects	20
Creating game mods	20

Best wishes wrapping up the semester and in the future!

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Name Dawson Jordan

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

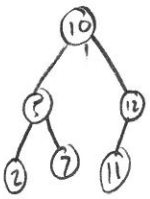
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

Linked List to quickly order tickets and be able to access them in descending order.

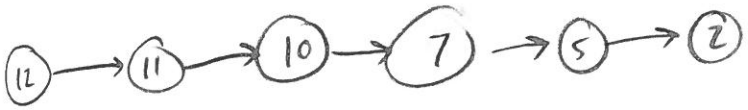
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Tree - Each ticket is a node and is connected to up to 2 children and has a parent (except for root node). When a new ticket is added, it descends the tree moving left if less than and right if greater than.



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

Straight list where the first node is highest score. when a new ticket is inserted it is placed in 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:

Python

```
def fun(string, char):
    occur = 0
    for c in string:
        if c == char:
            occur += 1

    return occur
```

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:

each item when looping through k was the smallest value in n, so it was placed in the front of the linked list.

Worst case time complexity of algorithm:

$O(k \cdot n)$

Explanation of worst case time complexity:

each item where looping through k was the greatest value in n, so n was iterated all the way through for every k.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Last Best Builders	Framing (not CS related)	3000

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

When creators of an algorithm create it for their personal needs and overlook the needs of other potential users.

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

If the creators of the software favored high school GPA over SAT scores, and students applying who took harder classes in highschool and got a lower GPA, but better SAT score was outranked by a student who took easy classes, got a good GPA, but had a far worse SAT score.

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: Avoids more lawsuits over code that was generated for use of creating software.

Second possible impact: Helps future growth of software by allowing people to build off of existing code.

Third possible impact: Promotes the use of open source software

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: Running into pedestrians and injuring/killing them.

Second type of harm: Crashing causing injury/death to passengers.

Third type of harm: Emotional harm of having no one to blame when injury/death does occur

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 become a firefighter and am waiting to hear back after applying to Spokane. If I am not hired as a firefighter by graduation, I will begin applying to CS and sales jobs around Spokane.

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)*
Framing	3000
Outdoor Activities w/ others	2000

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 to work on different versions of a project

Non-trivial feature 2:

repository management - push, pull, commit changes to collaborate with others on a single project

Non-trivial feature 3:

Merge conflict control - provides insight on conflicting code between local and main 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)*
leet code exercises	40
Discussions with Friends	10
Youtube learning	50
Podcasts	10

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 Bryce Lehnen

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's first in first out nature dictates a normal line order and it being a PQ means that weights can be given to push up the most urgent VIPs.

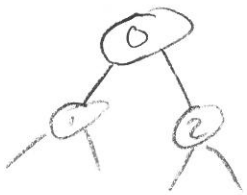
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A linked list where the indexes change based on place in PQ.



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

A heap where urgency score is used to sort



...

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, c):
    count = 0
    for x in string:
        if (x == c):
            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:

$\Omega(k)$

Explanation of best case time complexity:

Essentially the first place we look for each float is exactly where it needs to be placed.

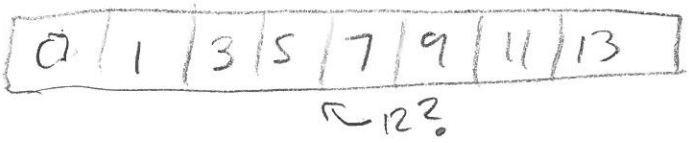
Worst case time complexity of algorithm:

$O(k \log(n))$

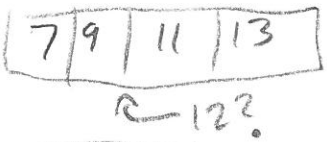
Explanation of worst case time complexity:

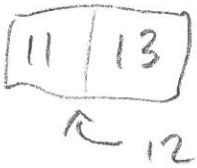
Using special search tactics we can place each float in k into the list for log(n). Diagram is simplification of method.

n



k=12





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)*
none (-9)		

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

A program that discriminates in some manner against users by either race, sex, or some other metric.

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

If the software was made to pick younger students over older ones in the admissions process.

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:

First possible impact:

Google loses money and goes out of business !!

Second possible impact:

Readily available code and open source projects could stop publicly

Third possible impact:

It sets precident that any lines of code you write can not be taken by anyone (low code sharing)

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.

Second type of harm:

Property damage.

Third type of harm:

Price of stock plummeting after IS car pick-up

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.

- Working for my brother (Canon - CS)
- Plan on looking for any CS jobs
- Find something to make enough money to live without roommates

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

Organization Name	*Estimate Total Hours Spent*
none :)	

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

Activity Description	*Hours Spent (estimate)*
none? really vague question	

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 and Github

Non-trivial feature 1:

Seemlessly work on projects w/ others

Non-trivial feature 2:

Even if stuff breaks, can go back to an old version

Non-trivial feature 3:

Easily share open source software

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)*
Built personal wallpapers	15+ hours
Self taught JS	20+ hours
Built own PC x3	10+ hours
I forgor 💀	∞

Best wishes wrapping up the semester and in the future!

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Name Kaden Morris

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

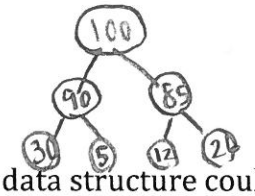
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 binary tree would work well where each node is sorted in the tree based on its urgency score.

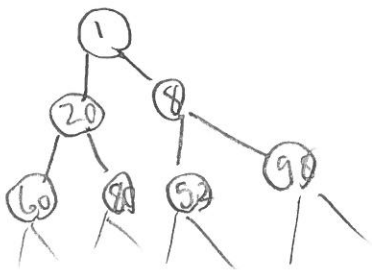
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

The first way to implement this could be making the root node have the highest urgency value and then each leaf node have the next highest value.



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 just be the inverse of the first, where the lowest urgency score is the root and the higher values are the leaf 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): java

Your solution:

```
private int charCount(String str, char c){
    int count = 0;
    for(int i=0; i< str.length; i++){
        if( str.charAt(i).equals(c)){
            count ++;
        }
    }
    return count;
}
```

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

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

Explanation of best case time complexity:

The best case is that each time a new value is added, it's the smallest value and gets added first. So, each value in k would be added at $O(1)$, or $O(k)$ for all values in k.

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

Explanation of worst case time complexity:

If each value is the largest in the list, it has to check every value in n, resulting in a time complexity of $O(n)$. For each value of k to be added, this would take $O(n)$ k times or $O(n^k)$.

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)*
PNNL	intern, software development	15 hrs/wk – 480 total
MSU	TA for Web Design	10 hrs/wk – 160 total

32
· 15
160
320
480

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithm can be biased due to any bias/development quirks from its developer.

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

If a developer placed a strong emphasis on SAT scores over GPA or involvement, some excellent candidates may be overlooked by the software because of the bias.

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

Side you choose to win: Oracle

First possible impact: Code copying is strictly enforced in courts

Second possible impact: Code is less frequently reused

Third possible impact: Developers must spend more time rewriting existing code rather than just borrowing it.

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: Faulty software could lead to collisions with pedestrians

Second type of harm: The car might drive into a hazard and harm the driver

Third type of harm: A bug could cause the car to stop working, preventing the driver from reaching their destination

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'll likely continue my internship at PNNL to continue building experience before looking for a full time position

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)*
Web Design TA	160

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

Name of most sophisticated version control system:

Not sure what a version control system 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)*
Github side projects	50

Best wishes wrapping up the semester and in the future!

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Name Rory Myer

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.

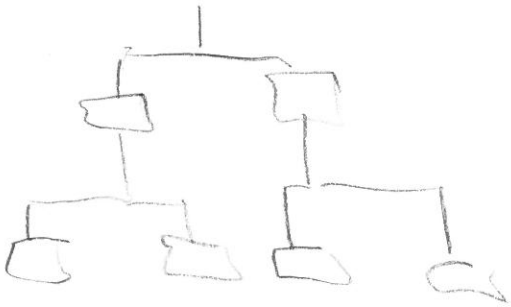
no clue - haven't had to look at a data structure/choose one in over 2 years

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

a tree where nodes with highest urgency customers are moved to the top.



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): C

Your solution:

```
int frequency(char c, string s) {
    int length 0;
    s.length() = length;
    int freqiuence =0;
    for(i =0; i <=length; i++) {
        if(c = current) {
            frequency ++;
        } c++ ← advance to next char somehow
    }
    return frequency;
```

another char current

make c point at first char in s somehow

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:

good question O(n)

Explanation of best case time complexity:

linear time is ideal

-no nested loops?

Worst case time complexity of algorithm:

$O(m+n)^4$

Explanation of worst case time complexity:

sounds bad

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 ECE dept	TA for EELE 371	50 -70
Advocats	campus tours	30? 1 semester
RadPC lab	Undergrad researc	3 semesters

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

using one alg. over another because you like it more even if the other is ideal?

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

good question

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

Side you choose to win: Oracle

First possible impact: companies might not use efficient already established code because they don't want to be sued

Second possible impact: employees will be hired by other companies to sabotage their current employer to expose copied code.

Third possible impact: people just won't share code - maybe good for security of a product but sad if you can't replicate an efficient method that saves time & money because it already exists.

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

First type of harm:

hit an old person instead of a young one

train track problem variants

Second type of harm:

hit a person of color because it was coded by self centered white people in SFO who don't think of people other than themselves (not trained on poc)

Third type of harm:

sacrifice another driver on the road to save its passenger who isn't paying attention to the road.

majority of knowledge used came from my computer engineering minor

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 an offer to work for Raytheon Technologies and am waiting to hear back on my counter offer. I interned for them and was offered the job at the end.
The career fair (FA 23) was only looking for interns. No job opportunities making Raytheon my only option.
BRING TECH COMPANIES

The CS networking event the night prior had companies who didn't need CS and didn't know why they were in that room

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*
Hall Council	15
Advocats	1 semester - 30?

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)*
Nothing from MSU	
all off campus jobs	hundreds
internship included	

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:

push

Non-trivial feature 2:

pull

Non-trivial feature 3:

merge

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)*
nothing	
I did spend lots of time on youtube for Binhai & Lloyd classes since they taught me nothing	

Best wishes wrapping up the semester and in the future!

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Name Jake Ripley

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 priority queue could be implemented using a b tree with left branch being higher priority and right being lower



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

We could also use an sorted array of objects that is sorted based on 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):

Your solution:

Python

```
fun (String, Char)
    count = 0
    for i in String
        if 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(1)

Explanation of best case time complexity:

We need to traverse the linked list one node at a time looking for where n ≥ k which will take O(1) if the first node is greater than k

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

if k is greater than all n then we will need to traverse the whole linked list which will be O(n) n being number of nodes in 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)*
N/A	wasn't really in activities	

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

It is a bias caused by an algorithm

(I don't remember learning too much about algorithm bias)

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

if software is looking for students with a highschool gpa of 3.57, but only looking for 50 students, it might choose students with lower gpas over higher depending on the algorithm

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

Side you choose to win: Oracle

First possible impact:

Companies might be more prone to charging for using software

Second possible impact:

Open and free source software might become more scarce

Third possible impact:

lawsuits on these situations might become more common

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:

if the software is not sufficient, a self driving car could hit someone crossing road

Second type of harm:

if software is not sufficient, it could cause car to crash, harming driver

Third type of harm:

if software is not sufficient, car could drive into other cars, potentially harming both 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 am currently talking with someone at Gtrit, which is a company that uses technology to make systems like flare capture devices in the oil industry, about doing an intern slip over summer and then working for them full-time after. I am also considering Master degree in cybersecurity.

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 I was not involved in any social activities	

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 i was not	
in any activities	

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

Name of most sophisticated version control system:

git

Non-trivial feature 1: remote branch support

Non-trivial feature 2: simple commands

Non-trivial feature 3: widely supported

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)*
NA	

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 Cooper Senior

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

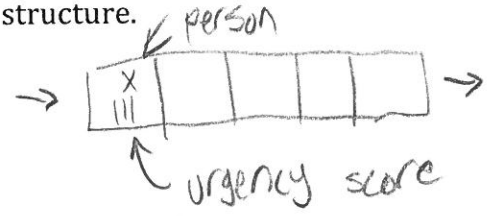
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 work best for this situation since it is simple and orders people in line, while taking into account the urgency score.

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

priority queue



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

Linked list with position based on urgency



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

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

Your solution:

```
def count_occur(str, char):
    count = 0
    for c in str:
        if (c.equals(char)):
            count = count + 1
    return count
```



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

Best case time complexity of algorithm: O(n)

Explanation of best case time complexity:

each time a new item is added the whole array has to shift

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:

still each time the array must be appended and copied over

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 Ass.	TA for Lab, grading	160
PFL	Software Intern	500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Choosing something based on how the developes subconsously programmed it

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

admissions software could prefer a specific race or religion.

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

Side you choose to win: Google

First possible impact: code could be copyrighted

Second possible impact: innovation would be slowed by legality

Third possible impact: smaller companies wouldn't be able to start/ succede.

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: choosing to kill one vs a number of people (trolley problem)

Second type of harm: put innocent lives at risk

Third type of harm: Developers could be charged with manslaughter

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

I plan to work as a software engineer. I have applied to over 50 different positions and have heard very little back, just some rejections.

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*
An honor society	5

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)*
Rock climbing	100
skiing	100
Business classes	100

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

Name of most sophisticated version control system: Github

Non-trivial feature 1: Commit history

Non-trivial feature 2: revert features

Non-trivial feature 3: Pull requests require approval

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	50
Youtube	30

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 Jacob Tanner

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

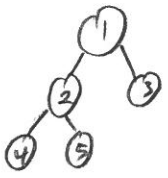
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

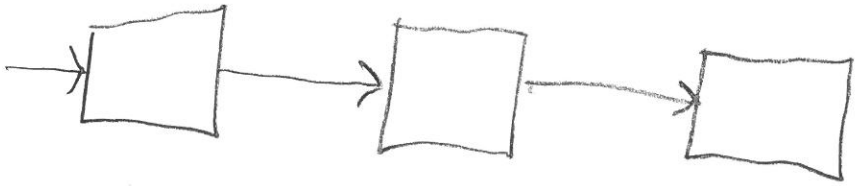
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A Binary tree could be used to sort nodes by urgency.



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

A linked list could also be used but will take more time to add a new node



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 (str, char):
    count = 0
    for c in str:
        if c == 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:

k

Explanation of best case time complexity:

If all k floating point numbers are in decending order and less than the floating point numbers already in the linked list, then all inserts can be in constant time since you can point the new node at the root node and then make the new node the root node. Only 1 comparison will take place for k new nodes, so the time complexity is k.

Worst case time complexity of algorithm:

n · k

Explanation of worst case time complexity:

If all k floating point numbers are in acending order and greater than the floating point numbers, then each new node will need to be compared with all existing nodes before being inserted at the end. n comparisons with k nodes will occur, so the time complexity is n · 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)*
Hacker Cats	Learn cybersecurity	30
ChemE Car	Control a start and stop reaction w/ Arduino	150

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is the tendancy of an algorithm to favor certain outcomes.

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

It could manifest by favoring groups of people with a certain ethnic background over others.

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

Side you choose to win: Google

First possible impact:

Laws involving Patenting code may need to change.

Second possible impact:

Companies will be discouraged from gatekeeping code

Third possible impact:

Google won't have to change Andriod API

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

First type of harm:

A Self-driving car could hit a Pedestrian if saftey measures are not taken.

Second type of harm:

A self-driving car could risk the lives of Passengers

Third type of harm:

A self-driving car could damage 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 have been accepted at MSU as a graduate
Parsuing a M.S. in Computer Science.

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

Organization Name	*Estimate Total Hours Spent*

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

Activity Description	*Hours Spent (estimate)*
working with Chemical Engineers in ChemE lab	150

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:

forking

Non-trivial feature 2:

branching

Non-trivial feature 3:

automated testing

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!