Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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

Name Kai Doylens

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. 232 with Mimey was not taught at all.

a) What simple data structure would best model this situation? Explain.
Stack, push from bottom highest priority

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



Task 1 has highest priority so it sent to top

Stack

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



Priority stack, have a stack for each 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:

```
int CharChecker(String, char):
    Char[] stringarray = String
    int counter = 0
    for each character in stringarray:
        if (character == Char):
            Counter += 1

    return counter
```

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

Best case time complexity of algorithm:

best case K=1 O(n)

Explanation of best case time complexity:

best case K=1 So adding 1 to the single link list

make K new head and link to old head O(n)

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

for each K $O(n^2)$

  make K new head

  link next = to old head O(n)

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Xtant Medical	IT Technician	30 hrs a week 2yrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Code that targets a certain thing/ group

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

If admissions takes a higher number of students from certain areas that statistically are uniform

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:
would set a code stealing is o/k in the code world

Second possible impact:
would break what a patent means for code

Third possible impact:
Is code something that you can copyright

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

First type of harm:
Cars can be hacked and crash

Second type of harm:
Cars can have a bug and crash

Third type of harm:
~~Cars can have safety systems bypassed~~
taxi and bus drivers would lose their jobs

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

I currently plan to be a DBA for Xtant Medical, they have unofficially offered me 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*
Rugby	120

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

Activity Description	*Hours Spent (estimate)*
Rugby	120

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

Name of most sophisticated version control system:

Github

Non-trivial feature 1:

Pull from a cloud repository making code readily accessible

Non-trivial feature 2:

Can incorporate github into a lot of API's

Non-trivial feature 3:

Can have backup of every change you make and save to github

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!

338 and 246 need to be made not required. They are outdated classes that serve no purpose in the modern workforce.

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Name John Dolph

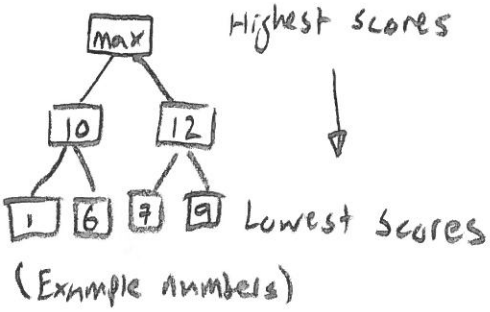
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Max Heap → Largest score will be at top (always)
So the problem is pulling top value and maintaining entries

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

Scores are added to bottom, then sorted up if they are greater than parent. Top is replaced by greatest child when removed (sorted up)



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

simple List → Sort list in ascending & Descending order and pull data out



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

    return count
```



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

Much smaller (insignificant) possibly

Best case time complexity of algorithm:

$O(n)$ Linear Time

Explanation of best case time complexity:

best case is time to solve given data entries n

n entries → Add 1 element up to k (The n entries will be maintained by sort)

↓

Each checked once (linear)

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

Worst case will when sort must check (maintain) element order multiple times.

↓

Example: Sort multiple times (iterations)

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 Music Ensembles	Performance	~120 (A couple years)
MSU Student Success	Programing Job	~100 (About a year)
Tau Beta Pi Meetings	Attending	~10 (A couple years)

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Having bias towards certain data or features to which the algorithm is developed for / data collected.
(Biased data may not cover all relevant cases)

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

Data that correlates good candidates with certain features (such as extracurriculars). These features are common between good candidates but may not be relevant.

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 software freedom (code reuse / copying)

Second possible impact:

Increased Advancement of Software (more use = more software)

Third possible impact:

Decreased drive to create software
(for the company profiting from ownership)

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:

Injuring pedestrians / passengers by malfunction
(Errors)

Second type of harm:

Not allowing users to override control
(Features)

Third type of harm:

Reducing skill of drivers that may be needed in emergencies (over time / new 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 planning on working a job, Contributing to open-source, working on personal projects, and researching graduate programs.

→ I have not yet applied or received job offers. (Have been searching)

→ I have not yet applied for grad School but have been searching and receiving emails from universities (will likely pursue masters in a couple years if I decide to do research or if required for Job)

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*
Campus church group (do not remember name)	~ 10

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

Activity Description	*Hours Spent (estimate)*
Group Projects (For class)	~40

Unsure / cannot remember →

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:

Rebase → Set base of commit to tracked head (For merge issues)

Non-trivial feature 2:

Tag → Tag (Name) commit (versioning) for documentation

Non-trivial feature 3:

branch → build upon repository features with reference to main branch but not directly copying it.

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)*
Taught myself openGL concepts	~60
Taught myself C++ concepts	~30
Worked on a few personal projects (misc.)	~120
Read articles on CS topics	~70
Hacked a microcontroller on cheap drone	~10

Best wishes wrapping up the semester and in the future! ← Thank you

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Name Peyton Dorsh

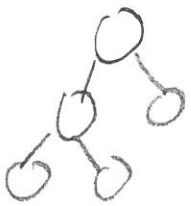
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 tree would be best. It would automatically assign a priority to new tickets where the highest is the tree root.

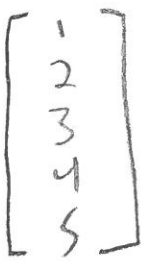
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Each node could be a struct w/ a priority and pointers to the children.



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

dynamic
An array could be used if the max # of children is fixed. Then an offset calculation could be used to add or access tickets.



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

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

Your solution:

```
def num_chars_in_string(string: str, char: str):
    # forgot how to do pythonically
    counter = 0
    for ch in string:
        if ch == char:
            counter += 1
    return counter
```

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

Best case time complexity of algorithm:

O(k)

Explanation of best case time complexity:

Adding in a ll takes constant time. ~~To maintain the sorted order, a binary search could be used if you know~~

This case assumes all k floating point numbers are bigger than the current list tail. So, you only check if the tail is less than the number to be appended.

Worst case time complexity of algorithm:

O(kn)

Explanation of worst case time complexity:

Assuming the k numbers to be appended are unsorted.

For every number to be appended, a linear search needs to be performed until a node with a value less than the number to be inserted is found. Then the number would be placed there.

Assuming you could do pointer arithmetic and treat the ll as an array, you could do binary search instead so the time complexity would be O(klogn)

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	UCA	10 / week (2 sem)
A-dec	SW internship	40/week (4 months)
HP	Data Science internship	5/week (1 year)

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

My guess is preferring certain solutions based off a programmers tuning.
("An algorithm w/o bias can't learn")

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

It could prefer quantitative SAT/ACT scores over more subjective essays.

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

Side you choose to win: Google

First possible impact: All software is now freeware, think GNU public license

Second possible impact: Some software is ok to use in small amounts.

Third possible impact: Patents for SW are now null & void.

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: Injuring the "driver".

Second type of harm: Injuring other drivers or pedestrians to avoid injuring the "driver".

Third type of harm: Taking away the choice of what to do in a collision from the "driver"

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

I have two interviews planned for tomorrow at Raytheon in Tucson and a Navy Contractor near Seattle. I have not yet recieved any others

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*

Nothing organized

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)*
UCA	10/week (2 semesters)

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1: commit history, see all changes in lifecycle

Non-trivial feature 2: branching, keep multiple versions of software eg Test, Dev, Prod

Non-trivial feature 3: By product through Github/lab: remote storage of software for backups and sharing/collab

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

Activity Description	*Hours Spent (estimate)*
Learned Flask	120
"Learned" C++	200
Talked w/ CS students at Card to learn diffs. in curriculum	20

Best wishes wrapping up the semester and in the future!

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Name Grant Dunbar

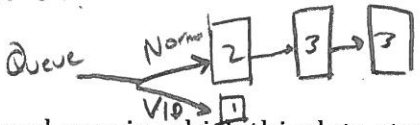
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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, this would put the oldest ticket at the top to be worked on first and then higher priority tickets could be moved to the front to be worked on first.

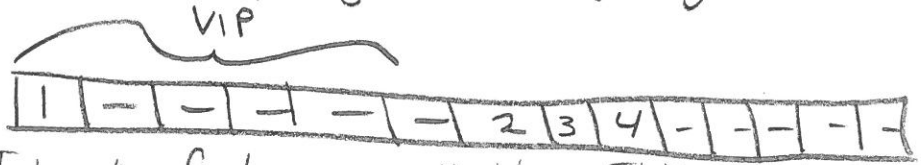
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

This could be done by using two linked lists. One would be the normal tickets and the other would be the VIP tickets. If the VIP list is empty use the other one. Otherwise grab the first VIP ticket.



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

This could also be done using an array with allocated openings in the beginning for VIP tickets



Take the first non-null item. This would require fixed queue size for both VIP and normal tickets.

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

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

Your solution:

```
def findNumChar(input, letter)
    count = 0
    for x in range(0, len(input)):
        if input[x] == letter:
            count = count + 1

    return count
```

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

Best case time complexity of algorithm: k

Explanation of best case time complexity:

Randomly guess the position the number goes in the array and only require the number of numbers added for the number of runs.

Worst case time complexity of algorithm: n^2

Explanation of worst case time complexity:

Check every location for every number added.

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)*
Renovation Brands	Paid Internship	1,000 + hours
	Web Developer	2 full time summers
		2 school years working ~10 hours a week

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The data an algorithm is trained or developed for has inherit bias from the data, programmer, and language.

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

Data used to train admissions calculations had more men accepted than females. This could cause the algorithm to use gender as a metric for acceptance when gender should not determine the acceptance of a student.

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

Side you choose to win: Google

First possible impact: Code can be ripped from other softwares and used without permission.

Second possible impact: The wheel won't have to be reinvented by every company to ensure no toes are stepped on.

Third possible impact: Shared knowledge base to grow from rather than starting new every time

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

First type of harm: Physical harm to the driver or a pedestrian if they are killed.

Second type of harm: Privacy harm if location is hacked and tracked by someone who shouldn't be tracking them.

Third type of harm: Economical harm if a ~~robotic~~ software issue shorts out the car and a building is crashed into and the damages from that.

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

I will be working for Raytheon Defense as a Software Engineer I.

I also recieved an offer from my current company that I turned down.

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)*
Paid Internship	1000 + hours

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

Name of most sophisticated version control system: Git Hub

Non-trivial feature 1: Branching

Non-trivial feature 2: Revert of commits

Non-trivial feature 3: Rebase of branches

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)*
3D Printing	100 + hours
Raspberry Pi Coding	50 hours

Best wishes wrapping up the semester and in the future!

Suggestion for new CS building:

have docking stations to be able to plug your laptop into a monitor or two. I like using my own computer but sometimes want an extra monitor or bigger screen without going home.

Never used the lounge computers but would use the monitor connected to my computer.

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Name Nicholas Dzomba

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 is best, as it's designed in a way such that higher urgency scored are higher in the queue.

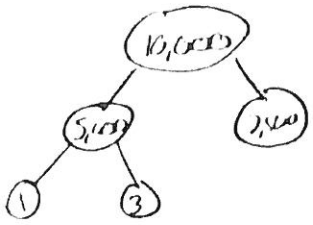
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

A list of tuples with urgency score & ticket info as pairs.



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

A binary tree of the same tuples



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 fxn(inpstr, inpchar):
    num = 0
    for i in inpstr:
        if i = inpchar:
            num += 1

    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:

$\Omega(k)$

Explanation of best case time complexity:

If every k is the smallest number, it will take 1 operation.

so $\Omega(1 \cdot k) = \Omega(k)$

Worst case time complexity of algorithm:

$O(kn)$

Explanation of worst case time complexity:

If every k is the largest number, it will take n operations,

so it $O(kn)$

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)*
NASA Langley Research Center	Internship	400
CAVL	Internship	400
NSF-C BOREALIS	Internship	400
UCA	Teaching Assistant	100

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) **Describe briefly what algorithmic bias is.**

Systematic errors in an algorithm that create unfair results

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

It could potentially admit a certain race or gender at a higher than fair rate

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: Can not copy code for yourself anymore

Second possible impact: Need to add code - plagiarism checking software to workflow

Third possible impact: Can't use APIs anymore

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

First type of harm: The car could kill the driver or others

Second type of harm: Could cause people to become less attentive

Third type of harm: Could result in lower driving skill among the population

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.

Find a job
applied at places like Allen Institute, Boeing, & more
Have an upcoming interview with Utah State Space Dynamics Lab

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*
Tabletop Brigade	200

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

Activity Description	*Hours Spent (estimate)*
All my internships	1200
Volunteering for FIRST Competitions	70

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: Project Management

Non-trivial feature 2: CI/CD

Non-trivial feature 3: Collaboration tools

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)*
Audited grad level CS course	50

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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

Name Devan W. Eastman-Pittam

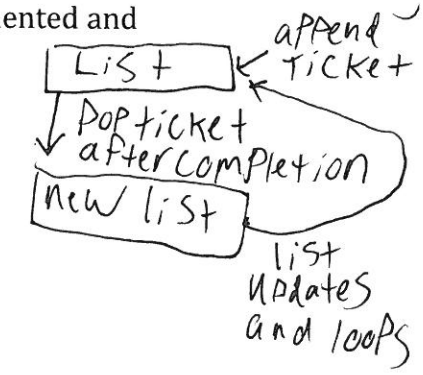
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 List could work as you can keep looping through it anytime something is deleted or added although this could have bad time complexity

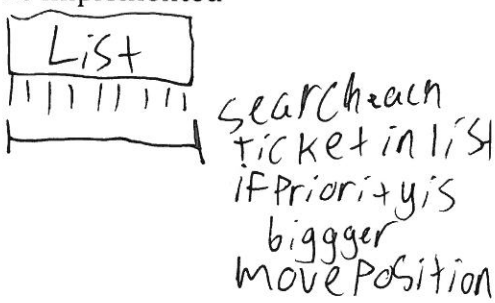
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

append tickets objects to the list and loop continuously until all tickets Handles



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

using a sorting alg



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 Char_String(ch, string):
    count=0
    For c in String:
        ~~if c == ch~~
        if c.equals(ch):
            count++

    return count
```

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

Best case time complexity of algorithm: O(n+k) constant

Explanation of best case time complexity:
Does no multiplication only adds a certain amount of constant vals so its O(n+k) which reduces to O(1). adds in perfect order

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

Explanation of worst case time complexity: Has to loop through all values before reaching the correct placement position

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

Organization	*Main Activities*	*Hours Spent (estimate)*

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.
When developers of an algorithm dont provide neutral data for training which causes algorithms to produce bad/incorrect results. an example would be black individuals not registering on hand swipe ~~dispensers~~ sinks in restrooms

b) Provide a hypothetical example of how algorithmic bias could manifest itself in college admissions software.
~~Adding a "likability" score which~~
Maybe certain individuals with non english sounding, spelled names could get skipped over as the alg was not ~~set~~ prepped for foreign names

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:
could damage open source due to stricter code control

Second possible impact:
Enforce who owns code written

Third possible impact:
Make google not plagiarize so openly

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

First type of harm:
Car, crashes into people

Second type of harm:
Car suddenly losing control and you are at its mercy

Third type of harm:
Steal jobs from taxi drivers causing massive layoffs

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, APPlied to be a Software deva+ onyx Airspace, no offers yet.

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

Organization Name	*Estimate Total Hours Spent*
residentHall Volleyball team	260 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)*

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: Can store both local and Cloud copy of repo to prevent accidents breaking the whole repo

Non-trivial feature 2: Forking a repo

Non-trivial feature 3: Clone a repo

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

Activity Description	*Hours Spent (estimate)*

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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Name Samuel Ertischek

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.

First in Highest out
Inputs go in and the highest at the time is the first out

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

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

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

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

Your solution:

```
int count =0
char look
string input
char[] split = input.split();
for(i=0; i < split.length(); i++)
{
    if(char[i].equals(look))
    {  count ++;

    }

}
System.out.println("The number of " + look + " in the string is " +
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:

It never has to adjust when a new number is added

Worst case time complexity of algorithm:

$O(2^n)$

Explanation of worst case time complexity:

It has to readjust the entire list every time a new number is added

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.

When an algorithm excludes a person or group of people for selection

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

An algorithm is made to choose people for college admission. It is taught to prioritize one group of test scores 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:

Code is taken from a wide variety of sources

Second possible impact:

less lawsuits since you would need more evidence to prove intringement

Third possible impact:

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

First type of harm:

Cause a car accident through wrong data or coding mistake

Second type of harm:

A person is locked in the car unable to get out

Third type of harm:

Someone takes over the car and is now driving for you

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

Work in the video game industry

2k Gameplay engineer No offers

Blizzard

EA

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

Organization Name	*Estimate Total Hours Spent*
Big Sky Sun Esports	80

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

Activity Description	*Hours Spent (estimate)*

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

Name of most sophisticated version control system:
Git / Github

Non-trivial feature 1:
Branches

Non-trivial feature 2:
Code Review

Non-trivial feature 3:
Detecting merge conflicts / shows difference between different version

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)*
Make Video games	400

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

Graduating Senior Exam

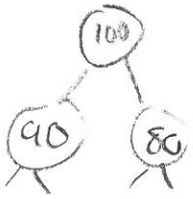
Academic Year 2022-2023, 80 minutes.

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

Name Kristoff Finley 02760698

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.

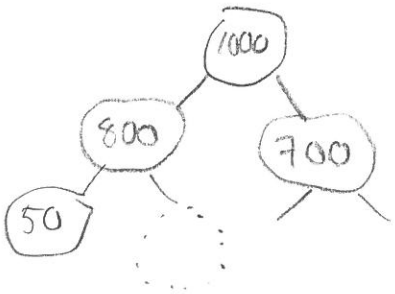
a) What simple data structure would best model this situation? Explain.



priority queue

> organized with a binary tree; the root node is the customer with the highest priority

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



; each parent is greater than all its children.
; I would insert into the tree a value and then sort the tree after placing the element in the tree; sorting involves "switching" nodes with each other

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

Note: I think a red-black tree could work well here, but I do not remember the implementation. (self balancing is very nice).

> a simpler, less efficent way is to insert the element into the array; by finding an index that is bigger to the right and smaller to the left (O log(N)) ↑ binary search

10:

Highest priority

[1000, 100, 10]

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

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

Your solution:

```
fn acc_char (text: &String, find: char) -> usize {
    let mut sum = 0;
    for c in text.chars() {
        if c == find {
            sum += 1;
        }
    }

    sum
}

fn main {
    let word = "Hello world!".to_string();
    let find = 'e';
    let sum = acc_char(&word, find);
    assert_eq!(sum, 1);
}
```

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

less than?

Best case time complexity of algorithm:

O(1)

Explanation of best case time complexity:

→ the numbers you are adding to the list are already in ascending order, so they can just be added to the start; no walking is necessary.

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

for ever addition, you will have to "walk" the whole finding list to append to the linked list.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Undergrad Course Assistat	Lab TA + Grading	10 hours per week x 3 semesters
German Clubs	Organized Meetings	1 hour per week x 6 semesters

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias selects certain attributes and amplifies their impact / performance in results.

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

An algorithm picks students to "check" candidates before their admission is seen by a human. A total "point threshold" is required to pass. The algorithm awards more points for sports than anything else, meaning athletes pass more often.

Kristoff Finlen

Program Assessment Pages 3-4

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

Side you choose to win: google

First possible impact:

\+ Code is more available and open source; the "Hacker ethic" is upheld and code is easier to share

Second possible impact:

\- Companies begin to protect and hide their code bases more and more, preventing "code transparency"

Third possible impact:

\- People stop using google because of their bad ethics

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:

\- Bad decision making: car may not recognize the correct speed and causes a crash.

Second type of harm:

\- Encourage bad driving habits: owners of autonomous cars begin to take their hands off the wheel more than usual

Third type of harm:

\- Hurt peoples recognition of place in their surroundings. They no longer no the "lay of the land" due to never having to navigate themselves.

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 study c++ and work towards a game company position in Seattle.

This will involve participating in game jams, as well as learning Unreal Engine.

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

Organization Name	*Estimate Total Hours Spent*
Magic @ Rooks on Wednesday	Every wednesday for 5 hours during the school year
German Club	2 hours every 2 weeks during school year

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

Activity Description	*Hours Spent (estimate)*
EGEN 310 (class)	3 hours a week for 1 semester
CS Ethics (special version with different majors)	3 hours a week for 1 semester
Public Speaking Class	5 hours a week for 1 semester

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: different versions of code available to edit

Non-trivial feature 2:

Merging: taking two versions of the same code and combining them

Non-trivial feature 3:

Commit history: looking at who updated what in a code base

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)*
Taught Myself Rust	200 hrs
Taught Myself C#	100 hrs
Completed 3 game Jams	100 hrs
Taught Myself Unity	60 hrs
Taught Myself Dyvorak keyboard layout Programming.	50 hrs

Best wishes wrapping up the semester and in the future!

Thank you :)

Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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Name Alexander Fischer

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

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

~~A Binary Search Tree~~

Quick sort because we would be able to find the greatest urgency score first, ~~and then add it to~~

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

we could use Quick sort to find the greatest value recursively and add that value to a list that is first in first out so each time a score is pulled it will be the highest in the list.

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

I forget how to draw Quicksort.

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 main(word, char):
    count = 0
    for i in range len(word):
        IF word == word.index[i]:
            count ++

        else:
            Print("no char", char, " in ", word)
word=inPut("Enter word:")
char=inPut("Enter char")
main(word, char)
```

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:

$O(n^3)$

Explanation of best case time complexity:

$O(n^3)$ is the best because as new nodes are added this is the same process repeatedly and takes up more memory as time goes on.

Worst case time complexity of algorithm:

$O(\log n)$

Explanation of worst case time complexity:

$O(\log n)$ would be the worst because the code for this scenario would not be as efficient as $O(n^2)$

^

Its been a long time since big O stuff.

Also I never got a full indepth explanation of this in the curriculum.

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 Asst.	Answering Questions	24 — 36

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.
This can mean an algorithim will ~~error~~ have a harsh cut off and if users dont exactly meet the algorithim criteria they can be ignored. This is not good when you have/need multiple varibles.

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

If the bias were to toss students out of the admission pool just based off of one statistic and not be able to factor in other criteria this could be Algorithmic 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: google

First possible impact: difficulty protecting software you create

Second possible impact: Open source becoming more common place.

Third possible impact: Java API code will be able to be used for more w/o infringing on rights. (copy)

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

First type of harm: Physical: incorrectly recognize hazards that cause physical harm to users/others.

Second type of harm: Software security: The cars internal systems that would be compromised remotely. IE making the vehicle do things outside of drivers control.

Third type of harm:

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

No grad school

Applying to currently:

Lockheed martin - sys admin

Fidelity - cyber tech

- no offers yet

Plan: working on CEH ~~and~~ certification, and getting a cyber job

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 soccer	50
RA - Res life	hundreds

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)*
RA - Reslife	hundreds
course assistant	24 - 36
eger · 310	100 ish is my guess

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: my VR

Non-trivial feature 1: Using hand normally

Non-trivial feature 2: looking around

Non-trivial feature 3: Voice control

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)*
freeCodeCamp.org (Python, Java, Math)	~300 over 4 years

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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

Name Emily Foss

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.

Max Heap. Higher urgency at the top. can be removed when addressed

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

Create customer object w/ urgency score integer field, organize heap such that higher scores are at the top



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

Make it a max heap of raw integers

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 characterCount(String str, char c):
    count = 0
    for i in range str.length():
     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(1)

Explanation of best case time complexity:

Constant time because it is possible that the floating point numbers are added in sorted order and each time are added to the front which would only require the creation of a new list node and reassigning it to be the head. both constant operations.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Similar to the above situation where a constant time operation of creating a new node is required followed by a traversal of the list to find the correct spot, which could be all the way at the end.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Foundant	intern	750
Soccer	intramural	80
Archery club	member	50

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The tendency for algorithms to favor a particular group or demographic based on (typically) unforseen behaviors of the code.

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

Non-European names being eliminated from the applicant pool despite having similar or even preferable qualifications.

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

Side you choose to win: Google

First possible impact:
Open source software becomes less prevalent

Second possible impact:
Huge companies with lots of revenue are able to swallow up smaller ones

Third possible impact:
Code reusability diminishes and developers have to reinvent the wheel w/ each new application

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:
Failing to recognize a hazard and causing an accident.

Second type of harm:
Software gets hacked and renders the vehicle inoperable.

Third type of harm:
Vehicle senses multiple hazards in its way and has to make a decision regarding "safest" and "least harmful" course. Into the pedestrians or into side of the school?

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

work, ideally at the company I currently intern at, Foundant. I have not submitted any other applications at this time but I would like to be employed at a Bozeman company.

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 Soccer	80

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)*
Soccer, always soccer	250
ski ACT class	25

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

Name of most sophisticated version control system:

Git / Github

Non-trivial feature 1:

push origin main

Non-trivial feature 2:

pull origin main

Non-trivial feature 3:

checkout -b <branch-name>

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)*
made website hosted on	~10
github	
Youtube technical interview	5-10
videos	

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

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Name Gregory Fulbright

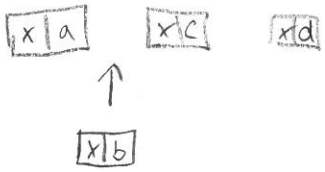
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

2D Array

Contains Customer & Urgency Score

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



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



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

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

Your solution:

```
def occurances(string, pick_character):
    character = pick_character
    count = 0
    for char in string:
        if (char == character):
            count += 1
    return count

def main():
    string = input("Enter a string: ")
    pick_character = input("Enter a character: ")
    result = occurances(string, pick_character)
    print(pick_character, "appears", result, "times.")
```

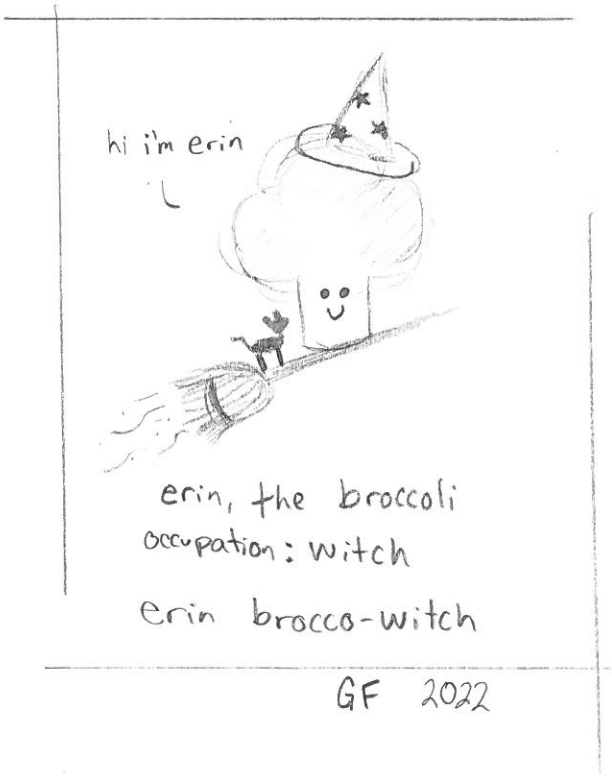
Question 3: Consider a singly linked list that contains **n** floating point numbers and is maintained in ascending order. An additional **k** floating point numbers will be added to the list, one at a time. You may assume that **k << n**.

Best case time complexity of algorithm:

Explanation of best case time complexity:

Worst case time complexity of algorithm:

Explanation of worst case time complexity:



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

Organization	*Main Activities*	*Hours Spent (estimate)*
Sports, Inc Internship Lewistown, MT	Web Development	400 (10 weeks * 40 hrs/week)
Spirit Squad (Athletics)	Community Appearances	20+

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:
Oracle regaining control of IP ownership

Second possible impact:
Google losing credability as a company

Third possible impact:
Other companies attempting to sue Google/other companies for 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:
Driver not being able to regain control of vehicle

Second type of harm:
Requiring software updates to be accurate to geographic/city/weather conditions

Third type of harm:
User's location data being tracked & mishandled

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.

Starting the second week of January 2023, I will begin work as a web developer at Sports, Inc. in Lewistown, MT. I anticipate working with them for 3-5 years. I hope to propose to my girlfriend Feb/March 2024.

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 Catholic / Resurrection Catholic Church	1-2 hrs/week x 9 semesters

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)*
MSU Spirit Squad (Bobcat Athletics)	~1200 (~15 hrs/week x 20 months
Resident Advisor (Yellowstone, Langford, South Hedges)	~1500 (~15 hrs/week x 5 semesters)

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

2005

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)*

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Montana State University Computer Science Department

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Name Kyler Gappa

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.

ArrayList, They can store full objects (tickets) and are easy to sort based on attributes

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

Array list of Tickets, each ticket on its own index



Incoming ticket, gets added to back, sort based on Ticket.urgency

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

Array list of urgency, each urgency has a ticket



Each new ticket is assigned an urgency, then added to the list, sort after each ticket is added

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 countMatchingCharacters(String input, char charToSearchFor) {
    int counter = 0;
    for(i=0; i<input.length; i++) {
        if ( input.charAtIndex(i) == (charToSearchfor) {
            counter ++;
        }
    }
    return counter;
}
```

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

Best case time complexity of algorithm: O(k)

Explanation of best case time complexity:
if k is always the lower value, then it will generate a new head at the front each step.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity: If k is the greatest possible value in the set then it will iterate the entire list each time a value is added.

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)*
Big sky Sun Esports	Coach/Player/ambassador	700

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

A pre set influence on an algorithm, can be caused by poor assumptions, insufficient or biased data, or oversight on training procedures.

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

If an AI was trained on admission data, it could unintentionally become less likely to admit students based on race, gender, or sexuality.

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: Could cause more companies to lean towards open source software, that is easily maintainable,

Second possible impact: Could cause more companies to create, novel, original code so that patents, and copyright holds more firmly.

Third possible impact: Could cause companies to close and obscure their code to ensure it isn't ported/copied

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: Crash and kills drivers/bystanders

Second type of harm: damage lawns, sidewalks, or roadways do to misunderstanding of signals, signage, et.

Third type of harm: Overrides and goes to wrong location, causing physical distress

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 entering the work force as a systems integration engineer at Raytheon Technologies. I recived and accepted an offer.

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

Organization Name	*Estimate Total Hours Spent*
Intermural Soccer	60
Big Sky Sun Esports	700
Youth leadership group	10
Rooks football game night	40

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)*
Big Sky Sun Esports - coaching/player	700
Soccer	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: branch mangement

Non-trivial feature 2: cloud storage

Non-trivial feature 3: Collaboration based on local machine changes

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

Activity Description	*Hours Spent (estimate)*
Learned Python	100
Learned C++	40
Research AI/ML	40

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Name Mike Gotta

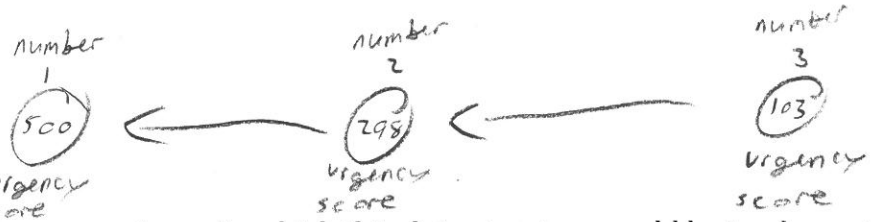
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 do fine. Basically the queue fills based on fifo, but if a certain ticket is more valuable you should push it to the front of the queue

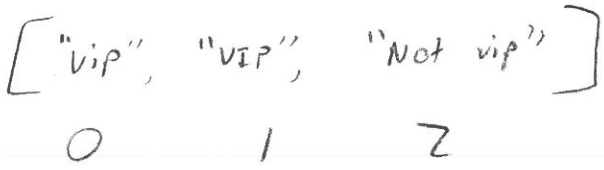
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

create a list of nodes that have a number, and an urgency score.



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

create an array list that holds strings labeled as "vip" or "not VIP", "VIP" would go to the front of the list.



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

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

Your solution: In Java

```
public int NumTimes (string Name, char Character) {
    int Count = 0;
    int lengthName = Name.getCharLength();

    for (int i = 0; i < lengthName; i++) {
        string currentPos = Name.getCharAt[i];
        if (currentPos.equals(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:

I should be honest, I hardly know time complexity.

Explanation of best case time complexity:

Here is all I know about time complexity:

The more looping structures in your program, the more memory your program consumes and the slower it will run.

Worst case time complexity of algorithm:

That's all I know!

Explanation of worst case time complexity:

Thanks for stopping by!

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

Organization	*Main Activities*	*Hours Spent (estimate)*
TechLink	software engineer	~1000 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Thats where you only ever use one type of data structure (probably not, please don't be mad)

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

If you use one sort method for everything you are only ever sorting by one metric. That's 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 you create will be better protected, this should make code sharing less common.

Second possible impact:

Code sharing will become less common.

Third possible impact:

people will be harder-pressed to share industry methods.

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

First type of harm:

physical harm: It could hit somebody and kill them

Second type of harm:

economic harm: Lots of professional drivers would be out of a job.

Third type of harm:

political harm: If government is involved, it will always become political.

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 hope to work at the CHS refinery in Laurel, I got denied this morning though.

So, I will be applying to a lot of remote positions.

I think I will just apply everywhere and see what happens.

So far, no offers.

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

Organization Name	*Estimate Total Hours Spent*
N/A	N/A
man, I probably should	have gone out more...

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)*
Logan Gun Club member	~250

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 (primarily GitLab)

Non-trivial feature 1:

Back-up changes

Non-trivial feature 2:

undo - commits

Non-trivial feature 3:

review code.

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

Activity Description	*Hours Spent (estimate)*
Friends at Workiva	~30

Best wishes wrapping up the semester and in the future!

Reading this last sentence really makes me realize, its almost over. I didn't think I would get this far. Everyday here was a gift. Thanks for everything.

Best Professors:

1. Carson Gross
2. Daniel Defrance
3. Reese Pearsall
4. John Paxton

} I owe them everything!

Montana State University Computer Science Department

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Name Emma Haines

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

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

I'm sorry I really don't remember how to do this, it was a while ago

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

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

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

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

Your solution:

```
string = input("please enter string: ")
char = input("please enter character")

count=0
for i in range((string)):
    if(string[i] = char):
        count = count + 1
```

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

Best case time complexity of algorithm:

Explanation of best case time complexity:

Worst case time complexity of algorithm:

Explanation of worst case time complexity:

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Girl Get After It	Hiking/Skiing/education	35
Blink UX	UX intern	400
WIE	networking	20
ΑΣΦ	recruiting	15

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithmic bias is when AI could have some sort of unknown bias embedded in the system due to either the developer's own biases or the data it was provided.

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

Let's say MSU builds AI software to admit college students, built off of past data. Well, there's a potential that this data from past admissions is missing a large chunk of some group of people. The AI then learns that we don't admit that group of people and now has a bias in its 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:

google looses raport

Second possible impact:

move software is built to detect this in the future

Third possible impact:

code gets more locked down

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:

might not recognize human motions and could not understand to go or stop

Second type of harm:

might not be able to react like a human

Third type of harm:

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

I plan to apply to every UX job I think would be a good fit for me and go where my best offer is.

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*
Bachelor watch club	40
Ski club	100

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

Activity Description	*Hours Spent (estimate)*
football equipment	100
Adventures MSU	80

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

Name of most sophisticated version control system:

Non-trivial feature 1:

Non-trivial feature 2:

Non-trivial feature 3:

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

Activity Description	*Hours Spent (estimate)*

Best wishes wrapping up the semester and in the future!

THANKS!
Had a blast
at MSU ☺

Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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

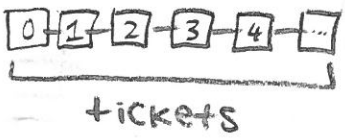
Name Lauren Helbling

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

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

I would use a queue because items can be added and removed in the order they come in but also sorted by urgency

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



This would look like a linked list of tickets

```
tickets = queue()
```

I think this is all you need in python

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

You could implement this as a dictionary with spots 1 to 10,000 as keys and tickets as values

```
1: [ticket, ticket]
2: [ ]
.
.
.
```

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

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

Your solution:

```
def Char_Count (my_string, my_char):
Count=0 for character in my_string:
        If character == my_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:

For each insert, the program must step up to n times through the linked list to get to the correct place in the list. In the best case, it would only add to the front, which is one step per insert.

Worst case time complexity of algorithm:

kn

Explanation of worst case time complexity:

For each insert, the program would step through the entire list.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
InterVarsity	Bible Study	400 hrs
CrossLife	Church Ministry	300 hrs
Brightvine	Intern (Frontend)	300 hrs
REU	Cybersecurity research	400 hrs
AYSS (Student Success)	Success Mentor	30 hrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

This is when you (unintentionally) bias an algorithm by feeding it only certain kinds of data or testing it in only certain use cases.

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

If admissions software were only tested with male applicants, it may be biased towards men and against women.

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:

Software copyrighting must need specific details of when and where code can be reused

Second possible impact:

Design patterns may be protected from proprietery ownership

Third possible impact:

Google will keep on copying code to get ahead

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

First type of harm:

The self-driving car could create a false sense of saftey that leads to more crashes by user misuse

Second type of harm:

A bug could cause a crash by malfunctioning

Third type of harm:

The car could be hacked if security is not well established

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 go into full-time ministry, beginning with an internship with Snow College in Utah, and not directly using my degree.

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*
CrossLife / Grace Bible Church	500 hrs
InterVarsity	300 hrs
Country Dance Club	25 hrs
Honors College events	80 hrs

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

Activity Description	*Hours Spent (estimate)*
REU program	400 hrs
Grace Hopper Conference	24 hrs
Capstone meetings	40 hrs

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

maintains merging of code between users

Non-trivial feature 2:

tracks progress through commits and allows reverts

Non-trivial feature 3:

ignores package lock files as needed

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)*
Honors presents	10 hrs
Self-taught Graphic Design	100 hrs
Met with Sharlyn	10 hrs
Grace Hopper Conference	24 hrs

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

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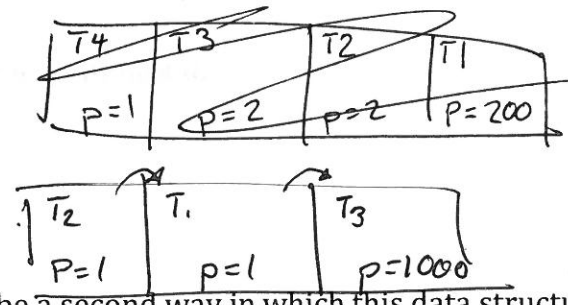
Name Jeremy Heng

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.

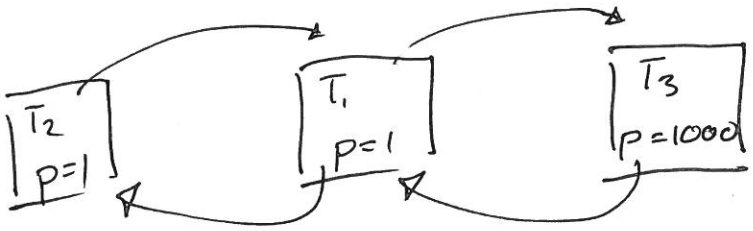
Priority Queue, tickets are enqueued but rearranged by priority

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



P: priority
#: order tickets come in

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): Java

Your solution:

```
{
public int numCharInStr(String why, char c){
 int target =0;
for x in why {
    if (x.equals(c)) {
        target ++;
    }
    return c;
    }
}
```

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

Best case time complexity of algorithm:

O(1)

Explanation of best case time complexity:

Only adding object to a list

Worst case time complexity of algorithm:

O(1)

Explanation of worst case time complexity:

I don't really remember this stuff

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)*
Foundant Technologies	Intern	~400

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

No idea, I don't rember learning this

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

See answer to a)

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

Side you choose to win: Google

First possible impact:
Harder to copyright code

Second possible impact:
Easier for devs to not have to worry about creating or finding code

Third possible impact:
Code becomes more inherently open source

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:
~~Might significantly~~ Car might have logic or code issues that could cause a crash

Second type of harm:
Car autonomy logic might ~~have~~ make a choice to save a driver over a pedestrian.

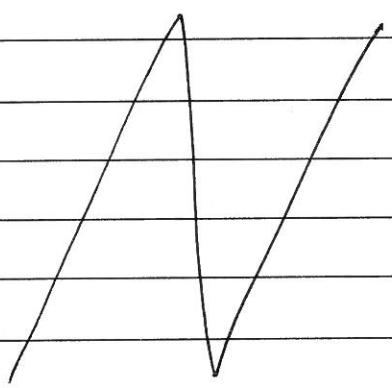
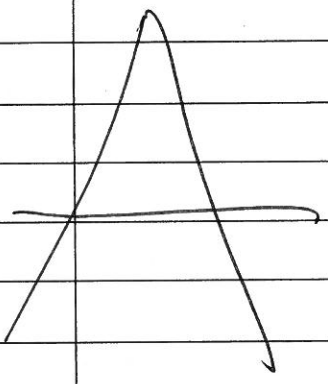
Third type of harm:
~~Might~~ May significantly increase car costs, ~~making~~ harming underprivileged individuals' chances to buy one

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

- Plan to get a job in:
  - sys admin
  - DB admin
  - software dev

- Planning to make this world a place where everyone can smile

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 at Lowe's	
Working at Home Depot	

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

Non-trivial feature 2:

Online repos

Non-trivial feature 3:

Collaboration

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)*
Udemy Courses	~ 10 hours

Best wishes wrapping up the semester and in the future!

Thx!

Montana State University Computer Science Department

Graduating Senior Exam

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Name Gregory Hill

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

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

I would use an array. This would be the most simple implementation as it could be easily sorted by urgency then the first element of that array would be removed after addressing it

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

[1, 2, 3, 4, ..., 10,000]

Inserting the ticket would just take iterating until finding a value greater than the ticket number, inserting it in that spot. The array could be initialized with size 10,000 with null values where tickets don't exist

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

[1, 400, 7 000, 9 550]

In this case the new ticket would be appended to the end of the array and then sorted afterwards, still taking the first value as it would be the highest 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:

```
charCount(string, char):
    count = 0
    for letter in string:
        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:

O(k)

Explanation of best case time complexity:

k's are added to the front of the list as the appear when iterating through, always less than the first number

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

loop through both k list and n list to find the correct position for each float

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)*
Rocketry Club	Learn about rocket	~40 hrs
↳ (can't remember exact-	propulsion and	
ching club name)	build a model rocket	

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Inability to take every factor into account

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

Denying application due to file error not caused by applicant

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

Side you choose to win: Google

First possible impact:
Code becomes more open source allowing more diversity and greater development

Second possible impact:
More options for software become available, increasing competition and overall better softwar

Third possible impact:
Increase efficiency in which software can be built/expanded upon not having to worry about copyright

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:
Malfunction causing a crash

Second type of harm:
Allowing driver to lack awarness which could cause a crash

Third type of harm:
Having to choose between hitting a pedestriar of driving off the road/into oncomming traffi

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

Got offered and accepted a position at Raytheon Missiles and Defense starting this summer as a software engineer

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 basketball	~ 20 hrs

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

Activity Description	*Hours Spent (estimate)*
Egen 310	3 credit hours
Honors texts + Critics	12 credit hours
↳ / Seminar	

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:

Radeon Graphics Control (driver software)

Non-trivial feature 1:

Detect + automatical update drivers based on my system

Non-trivial feature 2:

Monitor and record resource usage

Non-trivial feature 3:

Overclock graphics / GPU

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)*
Occassional Youtube videos	~ 20 hrs total
about cs topics	

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

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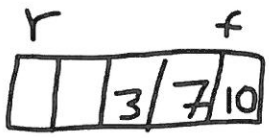
Name Gage Hilyard

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. A queue but it is sorted by a score given to it. We could sort the front of the queue by the highest score.

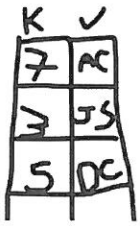
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.



I don't remember learning this data structure in class but I have a rough understanding. You would add an item to the queue and it would be inserted in the correct spot based on it's value. Have the contact info paired with an item in the queue. It then pops of the front (f) of the priority queue.

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

I cannot think of another way to use a priority queue that the one above. Maybe a hashmap with the key being the priority and the value being the customer.



Start with the highest priority search from 10,000 to 1 and pull the first customer that comes up.

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

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

Your solution:

(Java)

```
int countCharacters(String string, ch character) {
  int count = 0;
  for (ch c in string) {
    if c.equals(character) {
      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:

Complete guess. I don't remember much of time complexity at all.

At best maybe all k numbers are given in ascending order so it doesn't have to traverse the linked list.

Worst case time complexity of algorithm:

O(N)

Explanation of worst case time complexity:

Maybe worse caste it takes exactly n times to traverse the whole 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)*
MSU Funk Band 2019	Rhythm and Lead guitar	>32

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.

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:

Intellectual property of code would favor whoever wrote the code first.

Second possible impact:

Copying even code snippets would be intellectual theft.

Third possible impact:

There would be coding monopolies.

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

First type of harm:

Harm to property if the code leads to cars colliding

Second type of harm:

Loss of human life/quality of life in the event an accident kills or injures someone.

Third type of harm:

Psychological harm of those who may lose loved ones due to accidents.

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 studying abroad in Japan. After returning in the Fall I will have one more semester left of school. After finishing my last semester and graduating hopefully I will have found a company that will hire me. Last winter I applied to nearly 50 different companies and did not get a single email or phone call back asking for an interview for a summer internship. This left me quite disheartend despite putting in my best efforts in my cover letters and resumes, tailoring them to what I thought the company was looking for. No one around me understood why I didn't get a single response and they were quite surprised (Is pursuing a CS degree from MSU really not worth a single interview?) but it won't stop me from trying.
With my background in language learning I will try again for the various language learning companies like DuoLingo, RosettaStone, Memrise, etc. whom I think I have the best match.
I have family and friends that work as a software engineer or with software companies and if all else fails I will try to get my foot in the door with their companies.
Idealy I would be able to move back to Japan by working with an International/American company so I can make use of my language ability.
If I really cannot get my foot in the door I will try my shot with coding bootcamps to get certifications.
And if all else fails for me in the software engineering world I will try my shot at an interpretation school.

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

Organization Name	*Estimate Total Hours Spent*

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

Activity Description	*Hours Spent (estimate)*

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

Push/Pull files from just about any machine

Non-trivial feature 2:

Upstream git directories

Non-trivial feature 3:

View old working versions of files

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)*
Making a short Unity Game	80

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

Graduating Senior Exam

Academic Year 2022-2023, 80 minutes.

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

Name Jacob Hofer

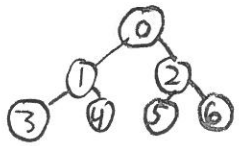
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 heap, since tickets with higher urgency get floated to the top to be found immediately, and can easily be removed.

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

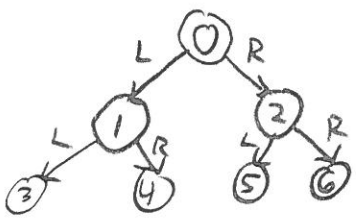
Implemented using a simple array representing a binary heap



$\cong [0,1,2,3,4,5,6,\ldots]$

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

An actual in-memory binary tree rather than a simple array




```
Node {
    Node L;
    Node R;
    int 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): C

Your solution:

```
int charCount(char* str, int strlen, char target){
    int total=0;
    for(int i=0; i< strlen; i++){
        if (str[i] == target){
            total++;
        }
    }
    return total;
}
```

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

Best case time complexity of algorithm:

$O(k)$

Explanation of best case time complexity:

In the best case, each number is less than what is in the list, so they each get added in $O(1)$ time, giving $O(k) \cdot O(1) = O(k)$

Worst case time complexity of algorithm:

$O(nk)$

Explanation of worst case time complexity:

Each element is larger than every other element in the list, so it is inserted at the back. Traversing to the back of a linked list takes $O(n)$ time, so for k elements it is

$$O(k) \cdot O(n) = O(nk)$$

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Chi Alpha	Bible study leader Worship team, etc.	10 to 15/week all 4 years
Foundant	Internship	40/week for 1 summer
Admissions Office	Develop registration for	10 to 15/week all 4 years
	MSU Friday/Orientation	
Emerge School	Robotics teacher	50 hrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Heck if I know

Best guess would be preferring certain outputs over other outputs

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

Admission software displaying first users who registered earlier, higher GPA, etc. before other users.

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 have full right to their own code

Second possible impact:

Need explicit permission to use code, even if it is public.

Third possible impact:

Google loses some money

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

First type of harm:

Harm to person driving if it gets in a crash.

Second type of harm:

Harm to company that is sued when the car crashes.

Third type of harm:

Harm to our own free-will for allowing ourselves to be driven around by an autonomous car.

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

My plan for next year is pretty simple.

1. Pursue my master's degree in CS at MSU through the seamless program
2. Get a job in the industry I can work at while in grad school.

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

Organization Name	*Estimate Total Hours Spent*
Chi Alpha	Lots (≈1000)
Church	Less (≈200)

IDK, probably more, I live there

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

Activity Description	*Hours Spent (estimate)*
Core Leading (Chi Alpha)	≈ 500
EGEN 310	≈ 80

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

Branches/forks

Non-trivial feature 2:

Merging pull requests

Non-trivial feature 3:

Syncing multiple repositories (like upstreams)

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

Activity Description	*Hours Spent (estimate)*
Learned Dart (for you, Carson!)	15
Lego Missing Pieces App	50
Develop Game Engine	200
Attempted Game Jam w/ friends	3

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Montana State University Computer Science Department

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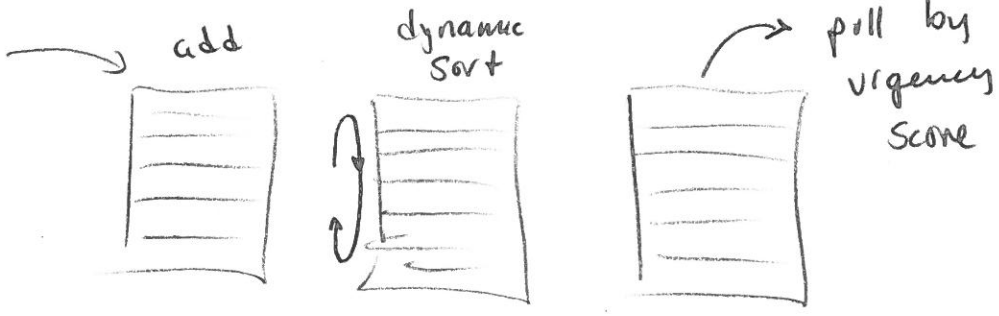
Name Cory Janes

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.

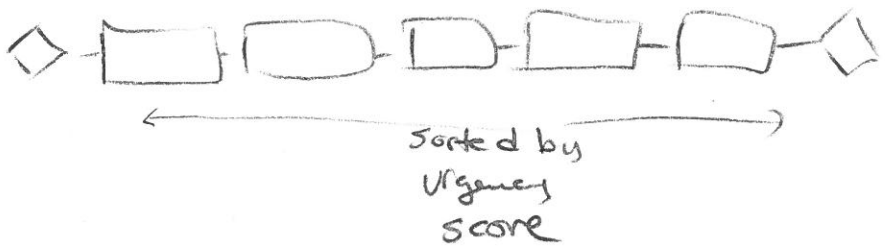
a sorted heap by urgency score

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.

Sorted linked list



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

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

Your solution:

```
public int numCharInString(string word, char letter) {
    int count = 0;
    if (word.contains(letter)) {
        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:

$n(\log n)$

Explanation of best case time complexity:

the quick sort is a "divide and conquer" method that halves the data set for insertion.

Worst case time complexity of algorithm:

$O(2^n)$

Explanation of worst case time complexity:

This sort would compare the two values next to each other for the size of the list

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Techlink	Software Eng. / IT intern	20 hrs / week
Montana Hope Project	Volunteer for charity events	2-5 hrs / week

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithms are designed by humans. Human nature is inherently biased, therefore, algorithms have a tendency to be biased.

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

Whatever the admissions office considers to be more relevant or less relevant for acceptance standards can be biased in itself because it is an opinion, geocentric cultural decision.

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:

intellectual property rights will be weakened

Second possible impact:

more open-source coding will fuel the industry's creativity and ingenuity

Third possible impact:

If Oracles wins, large corporations could stockpiles "IP." snippets and monopolize the market, stifling startups and creativity

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

First type of harm:

physical harm, software failing resulting in death/ injury

Second type of harm:

economical harm, jobs lost to automation

Third type of harm:

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

With my goverment and military background, I plan to enter the DoD industry or government related entities. Job interests with interviews and possible employment include LANL, Lockheed Martin, Pulsara and USGS.

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*
Mental Heath Awareness (during covid)	40+ hrs

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

Activity Description	*Hours Spent (estimate)*
Non-traditional student	
-prior experience includes	
20 yrs of leadership	
and mangerial roles	

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

Name of most sophisticated version control system:

Non-trivial feature 1:

Non-trivial feature 2:

Non-trivial feature 3:

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

Activity Description	*Hours Spent (estimate)*
Rust coding	100 hrs
Modding video games	100+ hrs

Best wishes wrapping up the semester and in the future!