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 Lealem Amedie

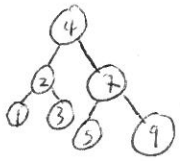
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

A binary tree. When a ticket gets added, it will be placed on the tree according to it's urgency. The lower-right most ticket must always be the one being worked on next.

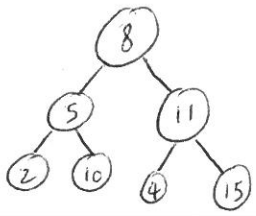
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

It could be implemented with each node having a left branch and a right branch, with left being less than and right being greater than, the current and all previous nodes.



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

It could be implemented with each node having a left branch and a right branch, with left being less than and right being greater than the current node ONLY.



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 letterCount(word, letter):
    return word.count(letter)
```

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

Best case time complexity of algorithm:

O(K)

Explanation of best case time complexity:

If all of the new numbers being added are less than the numbers in the list, and each new number being added is less than the previous one, it will take O(K) to complete adding them all,

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

We may have to traverse the n-long list K times worst case scenario if the numbers we're adding are all larger than the ones in the list.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Engineering Ambassador	Tours, meetings	35
Undergraduate course Assist	Grading labs, projects	160
wolf SSL Intern	features, testing, porting	500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Training algorithms on inaccurate data or data that doesn't represent the actual population.

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

[redacted]

The algorithm could perhaps develop a bias against students from certain locations or backgrounds because some factors were over or under represented in the training data.

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 will be a lot more weary of using copyrighted code.

Second possible impact: Companies will seize any opportunity to sue upon any patent infringements of code.

Third possible impact: More companies will start hiding their source code to avoid any lawsuites.

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

First type of harm: Bodily harm or harm to people.

Second type of harm: Harm to property and the belongings of others

Third type of harm: Harm to the car itself and the cost that damage incurs.

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

I've accepted an offer to work at [redacted] wolf SSL as a Software Engineer. I also applied to positions at Circle, Oracle, microsoft, Atrium and Benchly. I recieved offers from circle & Benchly.

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	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)*
Residence Desk Clerk	200
Egen 310	60
Capstone class	100

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

Name of most sophisticated version control system: Git

Non-trivial feature 1: git format-patch, turns commits into diffs,

Non-trivial feature 2: git rebase, apply your commits onto master branch,

Non-trivial feature 3: git cherrypick, extract certain changes from a branch,

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

Activity Description	*Hours Spent (estimate)*
Coding videos on Youtube	30

Best wishes wrapping up the semester and in the future!

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Name Michael Buffington -02196371

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.

- maxheap tree

- tree structure where high value nodes always "bubble up" to top of list

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

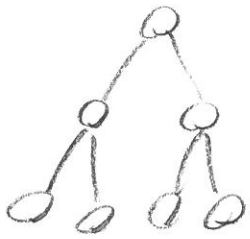
heap = Array where left child is (parent index)·2+1
right child is (parent index)·2+2



Array[0] is always highest val

next = array index where next value pushed will go

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



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

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

Your solution:

```
def repeted(str, char):
    if type(str) != list | type(str) != str:
        Throw Error

    if len(str(char)) != 1:
        Throw Error

    count=0
    for element in str:
        if element == str(char):
            count += 1

    return count
```

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

Best case time complexity of algorithm:

$\Omega(k)$

Explanation of best case time complexity:

if every value k is larger than the last element of the linked list, then it gets pushed on to the end. $\Omega(1)$

if all values of k are already sorted, then they all get pushed for $O(1)$

therefore; $\Omega(k)$

Worst case time complexity of algorithm:

$O(nk)$

Explanation of worst case time complexity:

if every value of k is smaller than any value of the LL, and they're introduced in descending order, then its a long search!

LL: Lastnode: Node

push()

pop()

Node: Value: float

prev: Node

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Hyalite Rural Fire District	Firefighter → Captain	20 hours/week for 3 years
Enterprise R.A.C.	Detailer	20 hours/week for 2 years
Alosant	Intern	40 hours/wk for 1 summer
Gallatin health Dept	Contact Tracer	20 hrs/wk for 6 months
AWC		3 meetings?

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Biased training data => Biased AI

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

MSU admitting mostly white people For the first ~80 years of existence skews the Admissions dataset

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:
- Strengthening Copywrite laws

Second possible impact:
- ~~A~~ ∆ to open source copywrite like BSD, MIT, etc

Third possible impact: Google hires people to patch code to remove infringing software

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

First type of harm: Comprimising softey of others in favor of passengers

Second type of harm: bad code for icy conditions causes unsafe speeds in winter weather

Third type of harm: Compliance From Driver doesn't alert them for when they need to take over the wheel

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

applied
- Enterprise RAC. IT division
- Zoot
- Fast Enterprise

will apply
- Drudger Aerospace
- Onx
- Submittable

→ Target job titles: Soft. Eng. or Data science

. If all else fails, I'll apply to grad school for Fall '24

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:

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)*
Guest lectures	
MT High Tech Business Alliance	

Best wishes wrapping up the semester and in the future!

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Name William Cook

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, I don't remember why.

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 main():
    S = "checke"
    C = "c"
    counter = 0
    for i in S:
        if (i == C):
            counter = counter + 1
    return counter
```

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

Best case time complexity of algorithm:

$O(1)$

Explanation of best case time complexity:

I don't really have a good explanation for it.

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

It is exponential and time consuming.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Swing Cats	dancing	40
Softball amatur league		20
SmartyCats	tutoring	25
TA	CSCI112	20
Tutoring	not with SmartyCats	40
Job at Zoot	this last semester	500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

I have never heard of Algorithmic Bias Standard.

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:

First possible impact:

Oracle has intellectual rights to this code, allowing google to steal the code could allow them to steal small companies code causing them to go out of business.

Second possible impact:

Could give google an advantage that will threaten oracle.

Third possible impact:

Security breach could occur.

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:

Hurting the driver.

Second type of harm:

Hurting a pedestrian protecting the driver.

Third type of harm:

Could mistake things and cause accident.

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.

Currently, I am working full-time at Zoot Enterprises as a Service desk technician.

I am currently deciding whether to move within the company or go onto other opportunities.

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

Organization Name	*Estimate Total Hours Spent*
Swing Cats	20
Smarty Cats	20

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)*
ESOF 423	80
ESOF 422	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:

Github

Non-trivial feature 1:

issues tab

Non-trivial feature 2:

backlog / Time

Non-trivial feature 3:

History roll back feature

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)*
Cs lounge	500+

Best wishes wrapping up the semester and in the future!

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Name LOGAN DOLECHEK

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.

Could use a hash map/hash table.
use the urgency score as a key to look up and pull info.

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

You would store all customer names and then relate them to the score it's self. You could then search through that table to Pull out the highest most score.

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

Could give the value to the ticket itself and just look up which one has the highest weight.

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

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

Your solution:

```
def foo(string, char)

for i in range(len(string)):
    if char is in string:
        Print("Number of occurences:" string[i] is
            in char.
```

Could also boolean flag it

```
def foo(string, char)
    Occurance=0
    Char_is_found = False:
for i in string:
    If char is in string
        Char_is_found = True
            Print(Char.occurence)
occurence+=1
```

what's a "singly" linked list

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: $O(N)^2$

Explanation of best case time complexity:

The previous floating pant numbers would be one k value shorter. So over time the floating point number would be getting expenentially bigger knowing that we could build it in such a way to adjust for that.

Worst case time complexity of algorithm: $Log(N)$

Explanation of worst case time complexity:

Hard coding this at its lowest level would expenentially take longer and longer to run if we werent taking length into account.

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 (CSCI 127)	Course Assistant	2 hrs - 3hrs a week for the semester

I spent all my time at FVCC in Computer Club, Student Gov, And Other Clubs.

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

The argument over which algorithm would be best suited for seperate situations. The positives and negatives of them.

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

Let's consider one team of developers who designed the admission software. They designed it to be effective in A, B, and C ways. Well now let's consider that Another team comes in later on decides A & B are inefficient and keep C and then Add on D, E, and F ways. They end up relatively the same but designed differently.

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: JAVA API AS FAR AS I know IS open source or available to the public. If oracle was to win this would change the ability for many people to use code that isn't protected by code patents.

Second possible impact: Developers would find new ways to work around these code patents. As far as I can remember patenting code IS very difficult and can be "easily" worked around.

Third possible impact: More companies would begin to start throwing lawsuits at each other and potentially hinder our technological advances moving forward.

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

First type of harm:

Could malfunction and injur or kill a pedestrian, cyclist, animals. Where a human operator might be able to avoid.

Second type of harm:

Could malfunction and crash into another car, berrier, building, structure, etc. Causing harm to the driver or other people involved in the accident.

Third type of harm:

Could cause harm to the open market. If one company in particular figured out the software as an ace in the hole. Patented it. Prevented other companies from developing their own. They could then potentially monopolies the autonomous driving industry.

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.

Not continuing education after my Bachelors.

I have applied to FAST – No offer
BNSF – Haven't heard back yet
NW ENERGY – Haven't heard back yet
Lockheed Martin NGG – OFFER ON ITS WAY.

My Plan is to accept the offer from Lockheed Martin NGG when it comes through in the next week or two. Then my plan is to move to Colorado sometime in January and begin working for LM. My plan is to work for LM for at least the next 8-10 yrs since I will be getting my security clearance with them.

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	—
N/A	—
N/A	—
N/A	—
N/A	—
N/A	—
N/A	—

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

Activity Description	*Hours Spent (estimate)*
Group Projects	Im not sure

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: Pull down from Repo

Non-trivial feature 2: Update local files & commit them

Non-trivial feature 3: push up to Repo after updates are good to go.

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)*
Practicing Java	IDK Atleast 1 hour
Practicing Python Scripting	IDK Atleast 1 hour
General Studying	Countless hours.

Best wishes wrapping up the semester and in the future!

Thanks.

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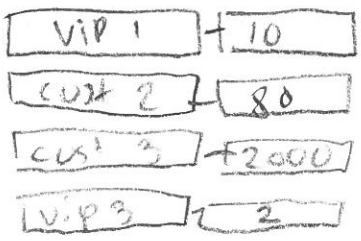
Name Megan Fehres

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 dictionary would be best, you can assign the customer type as the key, and urgency as a value. This allows you to find the most urgent tickets easiest

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



search for most urgent customer type, and which has the highest score, then search next customer type and find the higher urgency score.

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

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

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

Your solution:

```
def num_char(string, char):
    counter = 0
    for i in string:
        if i == char:
            counter ++
        else:
            pass
    return counter
```

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

Best case time complexity of algorithm:

$O(n \log n)$

Explanation of best case time complexity:

Worst case time complexity of algorithm:

$O(n^2)$

Explanation of worst case time complexity:

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

Organization	*Main Activities*	*Hours Spent (estimate)*
DA Davidson	Software engineer intern	~360 hours
Symphony orchestra	played the flute	~ 60 hours
flute lessons	played the flute	~ 60 hours
flute choir	played the flute	~ 20 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

is it a preffered result of an algorithm that might not be totally representative/fair?

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

if certain traits are favored in a student by the algorithm, it could select a less qualified student over a more qualified one based on that trait.

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 / publicly available code helps the industry grow.

Second possible impact:

code wouldn't be considered intelectual property

Third possible impact:

people can profit off code they don't write.

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: if a car makes a mistake, it could hurt or kill it's occupant.

Second type of harm:

legal: if someone were to sue for those medical costs, who would they hold accountable? how could punishm. be administered?

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 will be working as a new-grad software engineer at DA Davidson, doing full stack web dev.

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

Organization Name	*Estimate Total Hours Spent*
Resurrection Parish	~20 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)*
symphony orchestra flute	~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:

github

Non-trivial feature 1:

push

Non-trivial feature 2:

pull

Non-trivial feature 3:

commit.

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 Node + React JS	~35 hours
personal website	~20 hours

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 Tanis Hadwin

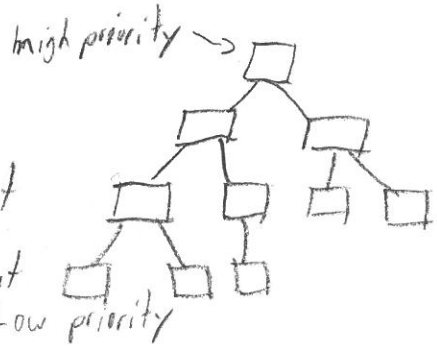
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

A priority queue would be best to use as a model in this situation. It allows for easy storage of information where one ticket can be popped off at a time, as well as effective prioritization.

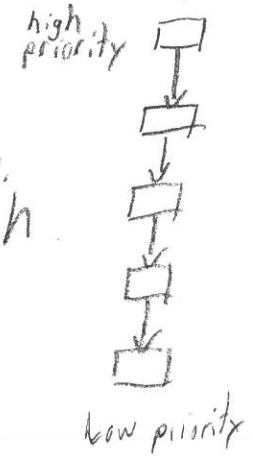
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

This is a tree like structure, where each parent node has two children, When a child is entered, if it is higher priority than its parent the parent and child switch. When the high priority is removed the more important child will move up.



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

This has basically the same idea as the previous, where it will be sorted by priority as tickets enter and leave. But as more of a linked list rather than tree. It is much less efficient.



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 charOccurances(word, char):
    count = 0
    for c in word:
        if c = char:
            count += 1
    return count
```

word: string
char: character (string with length 1)

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

Best case time complexity of algorithm:

$O(k)$

Explanation of best case time complexity:

For each of the K new numbers, the best case scenario is that the first comparison is correct. This means that each new number only requires constant time to place.

number		time to add
1	1	
2	+ 1	
3	+ 1	
⋮	+ ⋯	
K-1	+ 1	
K	+ 1	$= K \cdot 1 = K \rightarrow O(K)$

Worst case time complexity of algorithm:

$O(kn)$

Explanation of worst case time complexity:

Each of the K new numbers will always be placed at the last possible comparison, meaning that each number will be compared to each original number, plus each number that has been added

number		time to add
1	n	
2	$+ \; n+1$	
3	$+ \; n+2$	
⋮	$+ \; \cdots$	
K-1	$+ \; n+K-2$	
K	$+ \; n+K-1$	$= O\left(kn + \frac{(K)(K-1)}{2}\right) = O(kn)$

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)*
MSU-Course Assistant	Help underclassmen in labs	30 hours
Pulsara Intern	Angular Web developer	1,800 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias will be shown by which algorithms/models an individual has chosen to solve/represent problems, and how that can force a deviation from truth.

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

Accepting or rejecting candidates based on demographics, rather than abilities.

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: The proper developer receiving deserved credit for his/her work

Second possible impact: Financial burden for Google potentially reducing their ability to innovate.

Third possible impact: Forcing Google to redo work that has already been done, also reducing innovation.

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 pedestrians in the event of an unnecesary crash caused by software bug.

Second type of harm: Physical harm to people in the event the car must choose between victims.

Third type of harm: Economic harm if the vehicle doesn't choose an optimal route

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

I have received an offer from Pulsara and plan to work there for the foreseeable future.

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

Organization Name	*Estimate Total Hours Spent*
Church	200
Residence Life	1500

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 310R	150
Pulsara Intern	1500

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: Github actions to automate testing and ensure consistency

Non-trivial feature 2: Effective cli

Non-trivial feature 3: High security for private data

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)*
Helping friends with code	100

Best wishes wrapping up the semester and in the future!

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Name Brayden Hunt

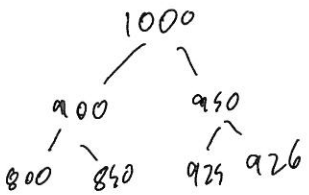
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

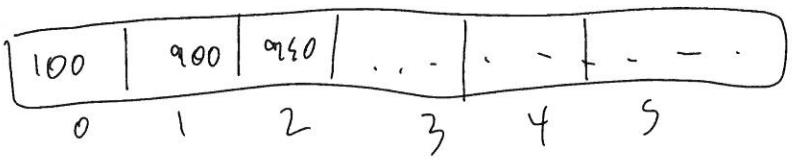
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

It could be done with a tree



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

It could also be done with an array with the first index being the head and the child elements being in indexes 2 if and



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 find(string, character):
    count = 0
    for c in string:
        if c == character:
            count += 1

    return count
```

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

Best case time complexity of algorithm:

$O(k)$

Explanation of best case time complexity:

Every new value is a new minimum in the list, so the algorithm just adds a new element at the front of of the list, updating the pointer to the start of the list ($O(1)$) k times.

Worst case time complexity of algorithm:

$O(kn)$

Explanation of worst case time complexity:

Every new value is at the end of the list, so we have to find the location of insertion k times, and this process takes $O(n)$ time.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Missoula Robotics Team	Software mentoring	200
Manhattan Robotics Team	Mechanical mentoring	100

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

A particular inclination towards producing a certain result.

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

An algorithm may be framed to look at applicants' personal essays and determine that the length of the essay alone is the best indicator for acceptance / future performance rather than the content of the essay itself.

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: Developers are more willing to reuse parts of open source software like the Java API

Second possible impact: API's will see more innovation as developers can claim fair use when making modifications

Third possible impact: Oracle and Google have a falling out and no longer work together on projects creating forks in popular APIs.

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

First type of harm: Physical harm to the driver or pedestrians, through the car getting into an accident.

Second type of harm: Economic harm by displacing workers such as taxi drivers.

Third type of harm: Environmental harm by continuing pollution and waste through disincentivizing cleaner public transportation.

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

I have accepted a software engineering position at Microsoft starting July 10th

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*
TAG	5 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)*
NA	

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:

Commits that let you roll back and review changes over time.

Non-trivial feature 2:

Branching, which allows multiple features to be developed at the same time.

Non-trivial feature 3:

Automatic merging of branches, bringing in changes from multiple branches at once.

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)*
Created some mobile apps.	15

Best wishes wrapping up the semester and in the future!

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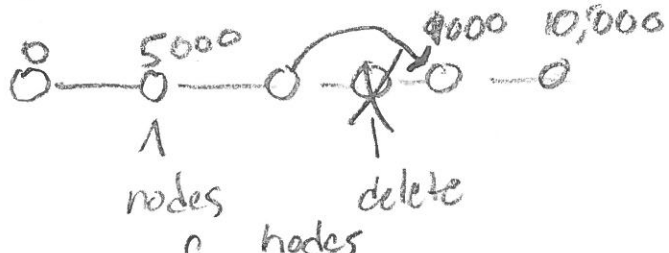
Name Justin Kerr

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 with weights being the data score meaning when one is deleted it gets deleted and add it can be added

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



A list of nodes with weights associated with the nodes

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

A list of lists with each index going up to 10,000 for score level

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 function(s, c):
    counter = 0;
    for(i in s):
        if i == c:
            counter ++

    return counter
```

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

Best case time complexity of algorithm:

Explanation of best case time complexity:

O log n because of how it is searched?

never really understood time complexity



Worst case time complexity of algorithm:

n^2?

Explanation of worst case time complexity:

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Advanced electronic Application	App dev	20 hr / week
Navigators	Student mnin	4 hr / week

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

No idea what this is never learned this

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

Rely to much on the algorithim?

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

Side you choose to win: Google

First possible impact:
Oracle loses money

Second possible impact:
Oracle gets walked on from now on when people copyright

Third possible impact:
Oracle and Google have no further involement

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:
Accidentaly hit someone

Second type of harm:
Mental stress of watch the car be in control

Third type of harm:
Mental harm on the person responsible for hitting someone

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 for Advanced electronic applications here in the valley

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*
Journey Church	10 hr / week
Navigators	4 hr / week
Gaming League	10 hr/week

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	A lot

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

Name of most sophisticated version control system: never heard something called this

Non-trivial feature 1:

N/A

Non-trivial feature 2:

N/A

Non-trivial feature 3:

N/A

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 Swift	All summer
taught myself react/native	100 + hrs

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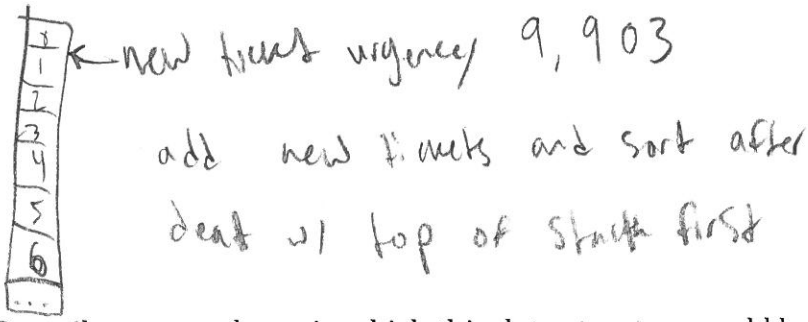
Name Max Linebarger

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

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

A stack would work well, if could be sorted and have tickets popped when they are done

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 function(String x, char y){
    int count = 0;
    for(i in len(x)){
        if(x[i]==y){
            count++;
        }
    }
    return count;
}
```

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

Best case time complexity of algorithm:

O(k)

Explanation of best case time complexity:

if they all get placed perfectly

Worst case time complexity of algorithm:

$O(n^k)$

Explanation of worst case time complexity:

if they all get placed at the opposite end and have to be sorted all the way through 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)*
Ultimate Frisbee (Men's Club)	practice, tournaments	6 hrs/week, 5 years
C.A.P (Thrive)	Volunteer w/ a elementary schooler	30 hrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Unintentionally adding bias to an algorithm so it favors specific demographics

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

It could favor students from a specific town if it saw a lot of people from there had good GPA's

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: fair use benefits since they used API code

Second possible impact:

Api code may be hidden from public domain

Third possible impact:

someone may be able to get away with stealing code

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

First type of harm:

It could favor the drivers safety unfairly over pedestrians

Second type of harm:

It could not recognize danger ahead and harm the driver

Third type of harm:

It could not obey traffic laws

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

I plan to work for a semester at my current job while doing sound engineering for my roommates band (and ski). Over the summer I plan to apply for computer science jobs.

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*
30 Zeman Ultimate frisbee	200 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)*
Ultimate frisbee	500 hrs
Group projects	100 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:

Merge

Non-trivial feature 2:

rebase

Non-trivial feature 3:

ignore

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)*
learning linux installs/use	30
building computers	20 hrs.

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 Ben Miller

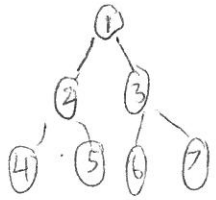
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer 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 or heap would be the best. The highest priority ticket is always first and the whole queue is ordered. Tickets can be reprioritized occasionally if the queue is never exhausted.

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

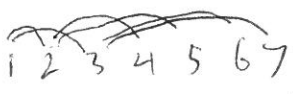
Use a heap. Tree/graph structure



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

Array.

Each index of the array maps to a tree, so inserting and popping behaves identically to the tree.



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

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

Your solution:

```
def count_occurrences(string: str, character: str):
    count_ = 0
    for c in string_:
        if c = character:
            count_ += 1
    return count_
```

Could also use a filter or the counter module.

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

Best case time complexity of algorithm:

O(k)

Explanation of best case time complexity:

If all of k are less than the first element of the list, and every element is less than the one before it, the numbers will all be added to the front. where each add is O(1).

Worst case time complexity of algorithm:

O(nk)

Explanation of worst case time complexity:

If the opposite of the above occured where each added element is added to the end of the list, the list is traversed each time a number is added, so each add is 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)*
Undergrad CA	for CSCI 7, labs, grading	160
Undergrad Research Assistant	Audio fingerprinting and alignment	400 - 600
Brightline	DevOps, Kubernetes, Terraform, go...	800
Amazon (AWS)	Backend Java, Design Docs	500

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Confounding variables, non representative training data, or incorrect assumptions lead algorithms to misclassify or skew predictions or outcomes.

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

If one town had a really good CS high school teacher and all their students did well in Computer Science, the algorithm might incorrectly prefer students from that school even if they weren't in the challenging CS courses.

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

Side you choose to win: Google

First possible impact:

API's are not copyrightable.

Second possible impact:

Black box implementations/copies are not copyrightable.

Third possible impact:

Companies are free to copy another company, even if there are no differences in use or appearance of a product as long as it's not a copy-paste.

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, injuring or killing people.

Second type of harm:

If we're reliant and it doesn't work or breaks down, we might be stranded or unable to go anywhere.

Third type of harm:

Break traffic laws like parking or other laws that don't cause injury but cause major inconvenience or destroy property.

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

I received a return offer from my AWS internship last summer, so I'll start in Seattle with the RDS team this summer as a Software Development Engineer I.

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)*
Internships	1000+
Classes (Honors)	a lot

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

git worktrees - checkout a branch to a brand new directory so that I can have multiple branches checked out at once.

Non-trivial feature 2:

Rebase - go back through my commit history and reorder or rename commits so that the importance or relevance of the change is more apparent.

Non-trivial feature 3:

tags - track specific states of the program or trigger workflows based on tag info.

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)*
AWS courses	30
Messing with Rust, Hugging, other	200
Google open source Days	30
Py Image Search	50

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

Graduating Senior Exam

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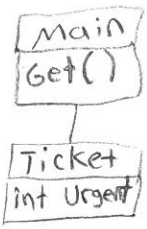
Name Nathaniel D. Priestley

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.

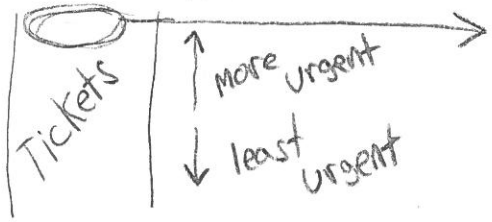
a) What simple data structure would best model this situation? Explain.

A queue or stack. Tickets can be placed in this queue/stack and added or removed based on the urgency score.

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



Store ticket objects that each contain an urgency then have method for adding/removing.



GetTicket()
grab most urgent then remove it

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: Python solution

```
CountChar(input, target):
    count = 0
    for character in input:
        if character == target:
            count = count + 1

    return count
```

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

Best case time complexity of algorithm:

O log (n)

Explanation of best case time complexity:

With a list of size n you can start in the middle. then disregard one of the two halves based on whether the float being added is larger or smaller than the float from the middle of the list. then repeat by going to the center of the remaining values until the float is where it should be.

Worst case time complexity of algorithm:

Either random or iteration with $O\ n^K$

Explanation of worst case time complexity:

Iterate through the list of n floats K times, one for each number in the list of k numbers. Goes over all n numbers until the added float is correctly placed.

Alternatively, randomly place the number into the list and check if it's correctly ordered. If not, randomly place the number again. Repeat for all K numbers.

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)*
Promiliad internship	Web design	~ 60

Not part of MSU internship. Personal internship

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:
copyright laws may become more strict.

Second possible impact:
Even single lines of code may be seen as copyright.

Third possible impact:
code is less likely to be used/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: Physical harm, errors in design may lead to accidents and other dangers.

Second type of harm: The driving path may not be time optimal or the best path to take costing people time

Third type of harm: A self driving car would be very expensive initially and any problems could also be expensive.

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.

Before and after graduating I plan on applying at various industries to hopefully start a career involved in : game design, AI design/engineering, or software development.

I haven't really looked into companies dealing with game development but I have done some research on defense industries.

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*
Rooks Game Store tournaments	~ 30 or ~ 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)*
Working as team: Olive Garden busser	20 weekly for 1 year
Wendys crew member	20 weekly over summer

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:

The ability to fully utilize Git through either terminal, or visual (website + apps).

Non-trivial feature 2:

Can check status when committing and can clearly see all changes made, even on previous commits.

Non-trivial feature 3:

Developing with forking, branching, merging as tools to use before altering a main branch.

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

Activity Description	*Hours Spent (estimate)*
Self taught C#	2015 to present
Unity game design + tutorials	2016 to present
Experimented with COBOL	~ 40 hours

(1000's hours)
(1000's hours)

Best wishes wrapping up the semester and in the future!

1

Montana State University Computer Science Department

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Name Isaac Schmidt

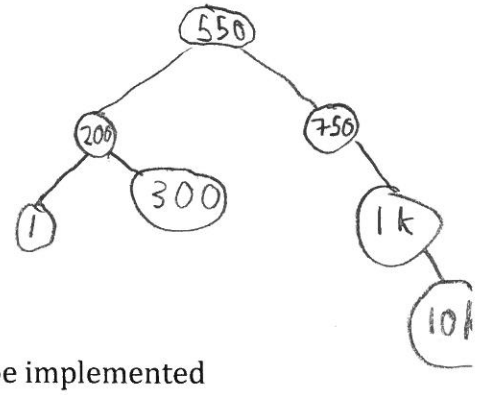
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

A binary search tree could be used to efficiently order and identify the highest priority ticket.

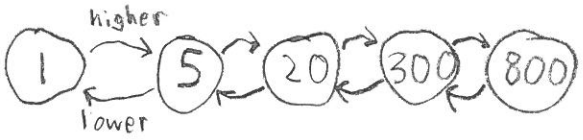
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

when a ticket is created, it is compared against the root and subsequently children nodes, always being sent to the right if higher priority, left otherwise.



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

A linked list could be used to allow new tickets to be passed through the chain until they find their place in the urgency order.



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

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

Your solution:

```
def occurenceCount(src: Str, char: Str):
    count = 0
    for c in range(src.length()):
        if (char == src[c]):
            count++
    return count
```

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

Best case time complexity of algorithm: O(k)

Explanation of best case time complexity:

Every number added fits correctly at the first position it is compared against.

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

Explanation of worst case time complexity:

Every number added must traverse the full list before finding the correct place.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Robo Cats	President, robotic software	400
PFL Intern	backend software eng.	720
Danza Latina	latin dancing	40
Swing Cats	vintage swing dancing	20
AWC	Professional development	10

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Systematically allowing a personal factor to impact algorithm output

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

Software could give higher priority to students whose names have specific ethnic roots.

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

Side you choose to win: Google

First possible impact: Less proprietary code and more standardization.

Second possible impact: Easier to communicate with APIs

Third possible impact: Reduced monetization of 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: damage to property in a crash

Second type of harm: killing people

Third type of harm: traffic congestion → productivity loss

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 want a job in backend software engineering or robotics, in industry.

I have not yet applied to any (been fairly busy) but plan to apply to various companies in Minneapolis, Denver, Salt Lake, and Seattle, as well as FAST, PFL, and Zoot from the career fair.

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	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)*
Track and Field / XC team	4,300

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 for separate tasks

Non-trivial feature 2: commit: saving snapshots/saves of the codebase

Non-trivial feature 3: cloning repositories onto other machines and servers

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)*
Codingame AI Challenge (made a bot)	30

Best wishes wrapping up the semester and in the future!

Montana State University Computer Science Department

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Name Riley Slater

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. Can assign V.I.Ps but defaults to a queue.

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

user 1: p-score = 10 Regular users
user 2: p-score = 9 will have their priority score
user 3 = VIP: p-score = 1 reduced when a VIP is added moving the VIP to the highest priority.



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

An algorithm could be used to optomize the priority assignment for VIP users so that it is more balanced. (Don't place VIP at end of queue but in the generous middle.)



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 myFn(inStr, inChar):
    counter = 0
    for letter in inStr:
        if letter == inChar:
            counter += 1
    return counter
```

n floats + k floats

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

Best case time complexity of algorithm: ~~log(n)~~ or n

Explanation of best case time complexity: If adding the numbers one at a time it implies looping through set k and appending each value to set n.

Worst case time complexity of algorithm: n^2

Explanation of worst case time complexity: You could increase the time complexity by double checking set 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)*
II - VI	Test Engineer Intern	720
Smarty Cats	Tutor	200
C.S. T.A.	Help students	400

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

An algorithm that intentionally or unintentionally discriminates against a particular person or groups of persons.

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

If the algorithm only practices/tunes itself with a biased database

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: Less free access code. more privitization

Second possible impact: This could call other instances of code sharing into question.

Third possible impact: Other instances of this code being used would need to be addressed.

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

First type of harm: Hitting a pedestrian.

Second type of harm: Hitting another car.

Third type of harm: Hitting anything really...

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

I plan on taking sometime to myself to enjoy the winter before job hunting.

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 Esports	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)*
Web deve course	50
Capstone project	100

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

Name of most sophisticated version control system: GIT

Non-trivial feature 1: repositories to store code publicly

Non-trivial feature 2: excellent documentation

Non-trivial feature 3: Works from command line or UI.

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)*
Wrote some code	
for a friend in Chem	10

Best wishes wrapping up the semester and in the future!

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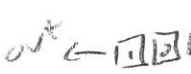
Name Steve Vought

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 - Allows access to a urgency score.

b) Describe one way in which this data structure could be implemented and draw a picture of that data structure. Use a queue data structure and add a priority number to each user, in this case ranging from 1 - 10,000.



c) Describe a second way in which this data structure could be implemented and draw a picture of that data structure. You could use a linked list where the element of the node contains the customer and the position in the list is the priority.



This would take forever

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:

```
myFunction(string, char) {
    int count = 0
    for element in string {
        if (element == char) { count += 1 }
    }

    return count

}
```

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

Best case time complexity of algorithm: O(1)

Explanation of best case time complexity:

Best case is it is in the first positional first element in the list. Have to create new node and point to the original header node. Not itterating through data, thus constant time.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity: worst case is it is the last element in the list, have to itterate through entire list, n itterations. Then add node to the end and have previous tail point to it. Thus it would take O(n) time.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
N/A		

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is. Bias built in to an algorithm originating from creater without knowledge.

b) Provide a hypothetical example of how algorithmic bias could manifest itself in college admissions software. Person developing has core religious beliefs and thus they dont think to add things for gays, not because they dont want to but because they dont think about it.

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

Side you choose to win: oracle

First possible impact: Google looses a lot of money in lawsuit. Google cuts back on employees and slowing our advancement.

Second possible impact: Google makes it right financially, hires more developers to remake the subset of code, create something better and faster.

Third possible impact: Google goes bankrupt, students fail everywhere.

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 from bad code.

Second type of harm: Physcological harm from intimidation (aggresive behavior).

Third type of harm: Financial harm from destruction of property,

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

I plan to get a job in Software engineering App development, or game development. I hope to find something in the area, then look at remote opportunities after getting some experience. May look into starting my own company or going freelance after a few years.

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

Organization Name	*Estimate Total Hours Spent*
N/A	

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

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

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

Name of most sophisticated version control system: GitHub

Non-trivial feature 1: Ability to collaborate on large code base with large teams.

Non-trivial feature 2: Ability to have version control for large Project.

Non-trivial feature 3: Ability to track history of project and see who has added to the project.

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

Activity Description	*Hours Spent (estimate)*
self taught Unity (before taking class)	20 - 30
self taught Arduino	30 - 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 Cameron Wilcox 02674024

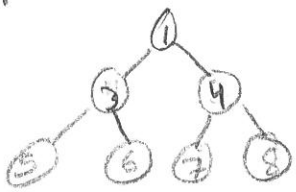
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

Priority Queue. It will allow higher priority tickets to move to the front.

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

One way could be a min heap. Smaller scores get higher priority



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

Another way could be 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): Python

Your solution:

```
def occurrance(input, char) -> int:
    num_occ = 0
    for character in input:
        if char == character:
            num_occ += 1

    return num_occ
```

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

Best case time complexity of algorithm:

O(1) / O(K)

Explanation of best case time complexity:

If the number being added at the end is already in order then its a matter of simple insertion for one at a time (O(1)), but for everything it may be O(K)

Worst case time complexity of algorithm:

O(n) / O(n·K)

Explanation of worst case time complexity:

You may have to sort through the entire list before finding the appropriate place

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Ascent Vision Technologies	Software intern	~1000's?
Tau Beta Pi	meetings	~5?

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when a particular algorithm promotes/favors one group over another

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

For instance if there is a large population of some particular group already in that college, it may favor them more, or if its looking at something like GPA, it may only let in students who look like they have nicer GPAs.

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

Side you choose to win: Oracle

First possible impact:
More scrutiny of open source software

Second possible impact:
Other companies will likely have taken code, so this may impact them and bring lawsuits to them

Third possible impact:
Oracle makes more money off the lawsuit

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

First type of harm:
Death due to incorrect training

Second type of harm:
injury due to poor driving practices (e.g. whiplash)

Third type of harm:
Monetary, property damage

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

I am interning with AVT currently, so I anticipate working for them. However I am looking at Cambrian Works, Quig, Raytheon, Boeing, Civilian Engineer in the Air Force, I will take a year to work then apply to 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*
im leagues/intermural	~ 20 ish
Church	~ 40-50

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

Activity Description	*Hours Spent (estimate)*
Math classes	~ 100s - 1000s
Love classes	~ 100s

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:

rebasing

Non-trivial feature 2:

Cherry-picking

Non-trivial feature 3:

interactive fix-ups

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)*
Messing w/ Raspberry Pi	~10-20
learning Rust	~6-10
Testing different distros	~5-10

Best wishes wrapping up the semester and in the future!