Stack
Queue

Montana State CS Graduating Senior Exam

Academic Year 2025-2026, 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 to provide a carefully reasoned answer to each question. This information will help us make improvements.

Name Sylvia Hutzler

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

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

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

Priority Queue would be the best model because it allows the user to add, remove items based on priority rather than order it was put in the system.

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

The first way would be a system that automatically adds an item to the priority queue where it falls in reference to other items.

10,000 : George Straight
5000 : Luke Bryan
100 : Top House
↑ Old

add 1000: medium priority

10,000 George Straight ← first called
5000 Luke Bryan
1000 : Zach Top
100 Top House

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

The second way could be a system that just adds the item to the top of the priority queue then when a user is called it looks for the highest priority number

1000: Zach Top
10,000: George Straight → add a new item →
1000: Zach Top
10,000 George Straight → call item
100: Top House

↓

search for highest →

return
10,000 George Straight

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 number_word ();
stringword = "paramater" ;
string character = "a ";
 for i in word (){
    if i = a {
       number - word ++
             }
             }
  return number_word()
```

result: 2

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

Best case time complexity of algorithm: O(1)

Explanation of best case time complexity:
If integrated correctly the K floating points can be integraded relatively quickly.

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:
If integrated with multiple additional steps the K floating points could take longer to be added resulting in a greater 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)*
AWC	meeting	1h

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithm bias is bias towards something that is written into the program by the user.

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

An algorithmic bias in college admissions software could present its self through a certain filter applications would run through that only accepted people with certain things & answers on their resume.

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: Java API can be used by anyone, open source.

Second possible impact: More strict requirements to copyright or patent code.

Third possible impact: Companies will have to work harder to create software that is more innovative so it can be copyrighted & patented

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

First type of harm: Harm to individuals driving the car and others if it were to cause a wreck.

Second type of harm: Harm to the driver if the self driving car does not require the drivers attention due to greater reliance on technology & loss of attention span.

Third type of harm: Harm to the driver if any of the software fails causing the car to stop working or drive to somewhere other than its intended destination.

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

I have applied to speridian for a Buisness Analyst position and am on my second round of interviews.

Question 9: List any organized social activities (e.g. SwingCats or some other MSU student club, church, a residence hall volleyball team, etc.) that you were involved with during your 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	16
Softball Team	20
Brownie club	10

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

Activity Description	*Hours Spent (estimate)*
Group Projects	50
Capstone	20
Job as teller	400

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: Problem: When working with other people you can identify a problem & send it to github so others are aware of it.

Non-trivial feature 2: Merge when working with other people in one repo you can merge changes they have commit since youve pulled to the changes you have made

Non-trivial feature 3: Host: You can host a website on github pages.

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)*
Talks (guest speakers)	5
personal research	10
personal projects	5

Best wishes wrapping up the semester and in the future!

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Name Nathan Mosher

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

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

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

Priority Queue: depending on the value of the ticket either 1 is highest or 10,000 is higher Priority the queue would "FIFO" order based on which Priority tickets enter then be resorted in order based on highest Priority either highest or lowest score.

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

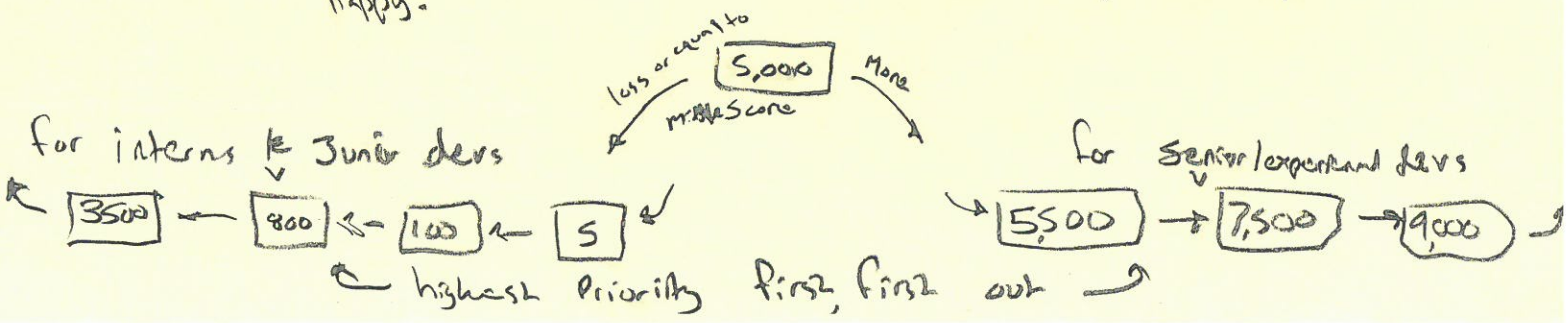
have the queue order then reorder queues based on priority.



Highest priority in first, first out.

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

alternative option could be a btree / Priority queues where you have two priority queues for two staff teams maybe senior devs & junior devs/interns where Priority queues are split in half. based on difficulty so both VIP and non vip clients are happy.



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

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

Your solution: Python :

```
def _sentence_ ( word, char ):
    self . word = "ajenda";
    self . char = "a";
        i = 1;
for char in word:
    i += 1

return i;
```

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

Best case time complexity of algorithm:

O(1)

Explanation of best case time complexity:

Since k can be added to the beginning of the list this would be O(1) because the list does not need to be parsed through when adding to the head of the list

e.g 0.1 requires only one action



Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

if a number is searched somewhere in the middle of the list it can take n times to parse through meaning if there are 1000 floating point numbers majority will need to be parsed through to find the searched number.

e.g. find (0.357)



n times parsing through to find

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)*
~~Internship:~~ 3Tech Communications	Ux design to development	120 hours
ESOF 423 Independent Study	worked as a designer and assisted with development/git usage for HRDC Intranet.	30 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithms cannot determine if data is biased or not.

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

Perhaps two users with the same student ID based on generating IDs filling old ones, but if a student returns there could be two copies of the same ID.

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: Pieces

Java API code could have been built by someone else not Oracle and was reused for the API, arguing against their IP

Second possible impact:

The usages of the code is used in a different context different artist same tool, not a conflict of Intellectual Property not the same artwork which is

Third possible impact:

Since its a subset of the code its not a exact copy of the entire API more of a sample similar to music sampling bits and pieces for different creations altogether, not technically illegal.

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

First type of harm:

If a user in the vehicle is protected but a pedestrian is hit, the car may be set to protect the driver over the Pedestrian still causing harm

Second type of harm:

If the car is light responsive Police lights or strobe lights could cause brakes to activate causing whiplash to and breakchecks on the user which could cause some injury.

Third type of harm:

battery failure if a battery dies at highspeed the vehicle could shut down causing a 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.

I have had no job offers but. I have applied at a few places; Workiva, adobe, Valve, only. I plan on keeping up on practice for Programming skills by doing freelance web design & UX work as well as software engineering. I want to orient myself towards computer hardware such as computer engineering & fiber optic, self Practice and maybe schooling later on if I enjoy working with it. I don't think I'll go to grad school after already completing dual degrees.

Question 9: List any organized social activities (e.g. SwingCats or some other MSU student club, church, a residence hall volleyball team, etc.) that you were involved with during your 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*
MSU Outdoor Recreation Program	150 hours
Intermural Soccer/ultimate frisbee	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)*
Freelance logo/web design	100 hours
MSU School of ART	≥300 hours
Networking events e.g career fairs	10 hours
Independent Study for ESOF 423 (GDSN)	30 hours
JTECH Communications UX design job	120 hours

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

Using forks allows for having my own copy of a repo and making Pull requests for changes.

Non-trivial feature 2:

Github desktop compatability, a clean GUI version of git useful for shorthand Pushes, Pulls, and commits.

Non-trivial feature 3:

GPG key Usage; really nice to help determine if commits are verified before accepting a Pull request.

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)*
hand coding my own design Portfolio	40 hours
Simple Python application building	20 hours
modding video games/designing textures	100 hours
Using Godot to build games	20 hours

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Name Sierrah Paul

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

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

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

priority queue - gives ability to give each data entry (customer) a priority & would rank based on that

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

pop high priority customers to top & remove when adressed

when new customer arrives send through queue to correct spot

when removed increase priority of all else by 1 / when added decrease all previous customers behind by 1



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

Push from lowest priority place new data in correct priority place & decrease priority of all above

POP from bottom w/ highest priority increase all other priority when dealt with



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:

```
String newString = user.input;
char newChar = user.input;

function int numAppears (String word, char c) {
    for (int i=0; i < word.length; i++) {
        int counter = 0;
        if (word(i).contains(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:

O(1)

Explanation of best case time complexity:

if k is the second larger number than n, than k is inputted on 1st check and is constant

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

if k is the largest number in the linked list than every point is checked that coould make the runtim linear.

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)*
Advocat	Give campus tours	100 hours
Code Girls United	mentor middle schoolgirls	70 hours
Orientation	Orientation Leader	3 years
Peaks & Potentials	Camp Counselor	120 hours
Housing	Resident Advisor	6 semesters, 70 hours a week
TA	Phot 113	100 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

algorithmic bias is when the algorithm is made with some form of bias that causes certain outcomes to be more probable due to the biases of the programmers

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

the algorithm gives priority to those ranked in top half of their class, but doesn't account for small schools with small class sizes.

i.e.
student 1 is 3 out of 4
Student 2 is 74 out of 150

student 2 is given priority but there exist 73 more students better than them
student 1 is not given priority but only 2 students rank higher

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:

standarizes that public API's can be used by anyone including companies

Second possible impact:

allows large companies to be able to use any public API w/o needing to liscens it, meaning small company APIs loose profit

Third possible impact:

copyright / patents for public APIs don't matter likely making less API's public use

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
- gets in crash due to missing that someone was crossing a street

Second type of harm:

environmental harm
- crashes into a field to swivel out of the way an object in road, causes fire in field, etc.

Third type of harm:

social-ecomical harm
autonomous car is deemed "safer", laws change & only allow for autonomous cars, certain populations cannot afford new cars

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

Looking to work - preferably in front-end web dev, ux, hci

I have applied to 63 jobs & counting
- no offers
- ~ 14 days
- rest have been no response
- only 2 coding assements

Companies included
- Adobe
- Micron
- IBM
- Roblox
- any lots of others

Question 9: List any organized social activities (e.g. SwingCats or some other MSU student club, church, a residence hall volleyball team, etc.) that you were involved with during your 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*
Housing RHA	90 hours
WIE	10 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)*
Resident Advisor	6 semesters, 20 hours a week
Orientation Leader	3 years
Camp Counselor	120 hours
Advocate	100 hours

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

Name of most sophisticated version control system:

GitHub

Non-trivial feature 1:

issue tracking

Non-trivial feature 2:

push notes describing version changes

Non-trivial feature 3:

web hosting

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

Activity Description	*Hours Spent (estimate)*
Leet code	20 hours
Building my own personal websites	100 hours

Best wishes wrapping up the semester and in the future!

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Name Elliot Roberts ← took remotely (Norway)

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

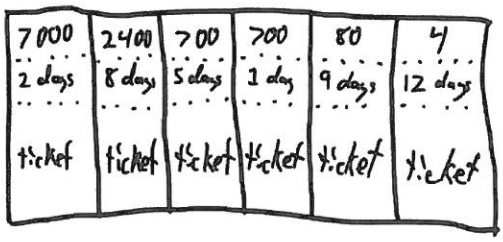
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

A priority queue would work best for this situation. It would allow the highest urgency tickets to always be handled first, with the oldest tickets also having a relative urgency based on their location in the queue. Oldest tickets will be found first unless there are tickets that have a higher urgency.

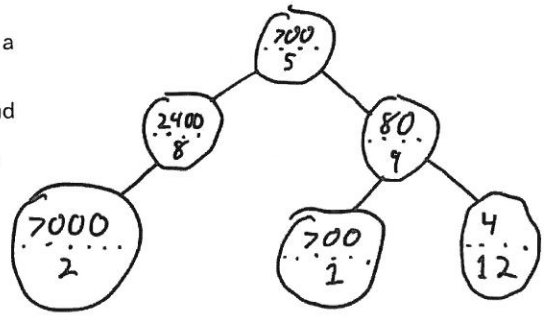
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Though not the most efficient, this structure could be implemented in a sorted array, with every node having its ticket data, ticket urgency score, and ticket creation time (though this is not entirely necessary). When adding a ticket, search through the list for tickets of a greater urgency and add below those, also adding behind any tickets of the same urgency. When completeing a ticket, simply remove the first in the array.



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

The data structure could also be implemented using a BST, specifically a red-black tree to maintain efficiency. The nodes would store the same information as before, sorting first by the urgency, and then by ticket creation time if two tickets have the same urgency. It is a more complex implementation, but it is faster to add new tickets. But it is less efficient to remove a completed ticket.



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

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

Your solution:

```
def countChar(inputString, inputChar):
    charCount = 0
    for ch in inputString:
        if ch.lower() == inputChar.lower():
            charCount += 1
    return charCount
```

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) or O(1)

Explanation of best case time complexity:

In a perfect best case, all k values are smaller than the first node in the linked list and also smaller than the value added before it. This would mean that each of k values is always added to the head of the linked list, preventing any searching through the list, but still maintaining the ascending order.

Worst case time complexity of algorithm:

O(n*k) or O(n)

Explanation of worst case time complexity:

In a worst case, all k values are larger than all values in the linked list and are larger than the value added before it. This would mean that each of k values is always added to the end of the linked list which requires searching through the entire list every time to find the end of the linked list. This is required to maintain the ascending order of the list.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
Scouting America Troop 676	Assistant Scoutmaster	300 hours
Blackthorne Consulting	Worked on various internal and external projects	1146 hours
MSU Networking/Telecom	Worked on many networking, WiFi, and phone porjects	784 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when computer algorithms, specifically ones using AI, produce or examine data in a way that may, purposefully or not, conform to societal biases along the lines of gender, race, or other identifiable details.

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

One potential, hypothetical example of how algorithmic bias could manifest is if an AI model was trained on current data from higher education institutions, which have a significantly higher proportion of women than men as well as statistics that show women are more likely to finish a degree that they start. If this bias is not accounted for in an algorithm or model, then it could admit an even higher proportion of women, even if there are men with better qualifications.

(Please don't think I am saying that there should be more men in higher-ed, these are just statistics that I already knew about. 😅)

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

Side you choose to win: Oracle

First possible impact:

Using application/code APIs would no longer be considered fair-use and developers would be required to pay to liscense anything using those APIs. This could increase cost for consumers or harm open-source projects.

Second possible impact:

Developers would have to create more hyper-specialized code to avoid external APIs, increasing complexity, development time, and maybe application size. This may lead to more innovation, but may also lead to more centralized software control in the industry.

Third possible impact:

Developers shift away from using Java to develop their applications entirely, and switch to other environments that already exist, or create more new ones. We already see new languages every few years, but this may lead to the creation of even more.

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 may cause harm to the passengers or others on the road from an error or other mistake that causes the vehicle to collide with another car, pedestrian, structure, etc.

Second type of harm:

Similar to other forms of automation over the past centuries, autonomous cars may harm the businesses and livelihoods of cab/taxi companies and drivers.

Third type of harm:

Though this harm is much more personal, it may harm the joy of driving. Personally, I really enjoy driving, whether around town or on a highway through a canyon. But a fully autonomous car would prevent me from being the one in control of the vehicle.

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.

When I graduate in December, I am moving into my Grandmother's house back in Great Falls so I can save money. When I get back to the US from Norway I am going to start applying for jobs. If Blackthorne, where I did my internship last year, has any job openings, I will apply there first. Otherwise, I am hoping to find a job locally in Great Falls. I have done some basic searching, but I have not sent any job applications at this point. Though only a one-year plan is asked for, I will say that I am planning on going to graduate school, but that I am going to work for two or three years to build some experience and save money to pay for graduate school. The only two schools currently on my list that I will apply for when that time comes is MSU and the University of Oslo, where I am studying at now.

Question 9: List any organized social activities (e.g. SwingCats or some other MSU student club, church, a residence hall volleyball team, etc.) that you were involved with during your 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*
MSU Eagle Scout Alumni	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 Project	80

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

Name of most sophisticated version control system:

Git is the only version control system that I have used

Non-trivial feature 1:

Supports distribution of version control using tools like Github and Gitlab

Non-trivial feature 2:

Though somewhat difficult to learn, Git has great tools for merging and branching. This allows developers to work on different systems/parts of code simultaneously and then combine them into one single codebase.

Non-trivial feature 3:

We certainly take it for granted, but Git being fully open source may be one of its best features. This means that anyone can use it and the community can continuously improve and update it.

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

Activity Description	*Hours Spent (estimate)*
Cisco U. course to renew my CCNA	30

Best wishes wrapping up the semester and in the future!

Montana State CS Graduating Senior Exam

Academic Year 2025-2026, 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 to provide a carefully reasoned answer to each question. This information will help us make improvements.

Name Matthew Wheeler

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

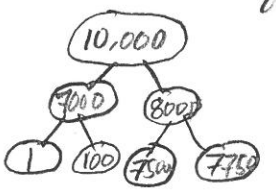
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

Priority Queue. It will put the most important tickets in the front and then tickets of the same priority will be handled as first in, first out.

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

Max Heap with the highest priority at the top. Numbers will represent the priority score



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

Linked list where the ticket is inserted by priority



insert another 7000



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

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

Your solution:

```
private int characterRecurrence(String s, char c){
    int counter = 0;
    for char d in s {
        if (d.Equals(c)) {
            counter += 1;
        }
    }
    return counter;
}
```

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

Best case time complexity of algorithm:

O(k)

Explanation of best case time complexity:

In the best case all of the numbers are added directly to the front. This means that the run time is only equal to the number of inserted numbers.

Worst case time complexity of algorithm:

O(k×n)

Explanation of worst case time complexity:

In the worst case each number is added to the back and so you have to iterate through the entirety of the linked list for each insertion.

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)*
No organization, at teacher request	tutoring & study session host	6 hours

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is when the data fed into a model creates a bias that doesn't accurately reflect the truth.

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

If the software gathered data on the applicants location, it could be trained that applicants from certain areas are better to approve than others.

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

Side you choose to win: Oracle

First possible impact:

The precident is set that borrowed code and systems are infringement.

Second possible impact:

All tech companies return to using solely propriatary technology and systems.

Third possible impact:

Individual employees can't transfer to new companies since their skills are not broadly applicable.

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 harm the driver by misreading a situation causing an accident.

Second type of harm:

It could harm the driver by avoiding a pedestrian and crashing into something.

Third type of harm:

It could harm a pedestrian by avoiding crashing into something.

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

For the time being, I'll remain at my job which is not degree related. I'll continue to apply to jobs in CS, as well as apply to the JET program which involves my minor.

Question 9: List any organized social activities (e.g. SwingCats or some other MSU student club, church, a residence hall volleyball team, etc.) that you were involved with during your 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)*
My job	20-40 hr/week
Lots of group projects	100 hours

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

Name of most sophisticated version control system:

Git

Non-trivial feature 1:

It can run tests

Non-trivial feature 2:

It can roll back to previous versions

Non-trivial feature 3:

It can be forked

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)*
Learn C++	50 hours
Added onto an app for crafting in a game	20 hours
Begin making a game as a hobby	30 hours

Best wishes wrapping up the semester and in the future!