Montana State University Computer Science Department

Graduating Senior Exam

Spring Semester 2022, 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 ____Faith Nelson_____

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.

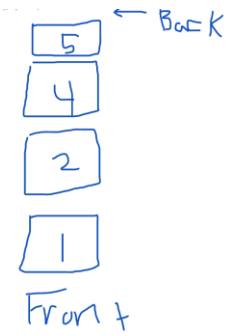
a) What simple data structure would best model this situation? Explain.

a A priority queue would work best in this situation as to the fact that they use priority assignments to choose what should be dealt with first.

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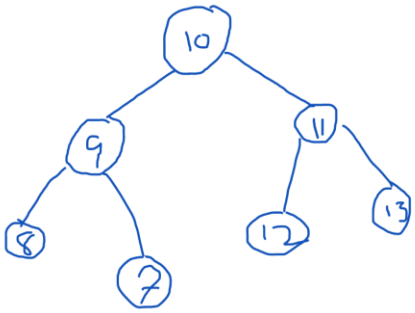
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

a One way would be to have a stack of where they are sorted to have most priority will be at the front, but the least will be at the back. They would be able to pop the object after completing



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

a A second option would be to use nodes and create a binary tree version, where the node will be placed in the tree based on importance.



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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:

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def charCounter(textString, charToCount):
    counter = 0
    for ch in textString.lower():
        if ch == charToCount:
            counter += 1
    return counter
```

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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 perfect world, k will be also in ascending order, causing each k element to be added to the list at the head.

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

Explanation of worst case time complexity:

In the worst case, every k element would the largest in the list, requiring for the list to be gone through to the end for every element.

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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)*
Zoot UX Intern	Creating a blog about 5 areas of ux design, audit accessibility of websites, making changes to client products	600 hours
Zoot Microservices Intern	Complete audit of gateways and various other tasks	300-600 hours
CS Wellness Committee	Create posters, plan and execute events	600-900 hours
Undergraduate Course Assistant CSCI107	Grade programs and help answer questions for students	300-600 hours
Undergraduate Course Assistant CS145	Grade all submissions, attend and run lab bi-weekly labs, and answer any questions.	300 hours

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Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is the false assumptions that an algorithm makes based on data that does not give the full picture of either a group of people, such as race, gender and ability.

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

In a college software, algorithmic bias could show up in school acceptance software, where they will not extend acceptance to based on the college graduation rate of that neighborhood, which lends itself to being possibly bias b based on the income of the neighborhood.

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:

Copyrights and patents will become more enforceable.

Second possible impact:

Code that is useful in multiple areas will then become more likely to be patented in order to gain monetary value from its reuse.

Third possible impact:

Other companies will employee more people in order to recreate the same functionality differently in order to not pay another company for a block 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:

Swerve into other people, objects, or vehicles to avoid hitting something else.

Second type of harm:

Misinterpret the speed on a fast highway causing an accident due to low speed.

Third type of harm:

Mistake a person for stationary object and maintain speed instead of slowing down, risking hitting the person.

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

My current plan is to go into the field of user experience design. I am looking at getting a job at Zoot Enterprises for a Solutions Developer and a User Experience Designer or Playstation as a UX intern in two departments.

Question 9: List any organized social activities 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	*Hours Spent (estimate)*
AWC	125 hours
ACM	50 hours
Country Swing	30 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)*
AWC	125 hours
ACM	50 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:

Ability to merge with GitHub.

Non-trivial feature 2:

Ability to easily resolve merge conflicts.

Non-trivial feature 3:

Documentation and help to find other useful commands and usages.

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)*
Grace Hopper Women in Computing Conference	72 hours
Research into user experience	30-60 hours
Speaking with other industry professionals	10 hours

Best wishes wrapping up the semester and in the future!