Montana State University Computer Science Department

Graduating Senior Exam

Fall Semester 2021, 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 _____Hung-Kai Sun_____

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

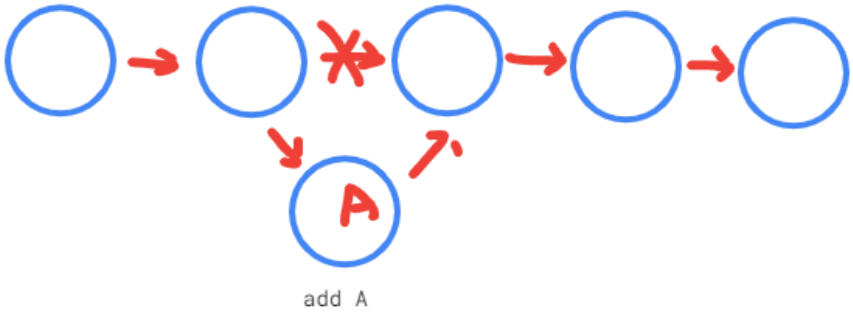
a) What simple data structure would best model this situation? Explain.

Linked list, easy to add number in the list.

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

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Singly linked list



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

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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:

```
def find(input_str, input_char):
    result = 0
    for i in range(len(input_str)):
        if input_str[i] == input_char:
            result += 1
    return result

def main():
    anwswer = find("catcatdog",'a')
    print(anwswer)

main()
```

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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:

Ω (k)

Explanation of best case time complexity:

Assume we have n = [a, b, c], and a < b < c

And we want to put k = [x, y] in it, and x < y

We need to add two rules:

First, the newly added numbers must be sorted from largest to smallest, so it will be k = [y, x]

Second, n0 must lager than k0, which is a > y

Therefore, we can find the best case.

Worst case time complexity of algorithm:

O(kn)

Explanation of worst case time complexity:

:

When the newly added numbers are all larger than n3 which is c

Therefor, we need to run k*n times.

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

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

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias is data that reflects human prejudice, and prejudice is making legal absurdities through AI.

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

Assume there is a threshold for school admissions, and the initial subjects are white people in big cities, and the initial subjects are all white people in big cities. When the software is running, it may eliminate rural students or black and yellow people due to insufficient initial samples.

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:

Safeguard intellectual property rights.

Second possible impact:

Encourage code development by individuals.

Third possible impact:

Promoted laws and policies on the protection of code property rights.

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 accident due to the misjudgment of the software.

Second type of harm:

By considering the ethical issue, it is hard to make decision when there is no solution for an accident, for example, crashed into crowd

Third type of harm:

Autonomous driving cannot guarantee energy saving in all situations.

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.

After graduation from MSU, I have to spend one year in military service in Taiwan. After that, I will work in my friend's educational organization as a python teacher.

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)*

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:

Support non-linear development

Non-trivial feature 2:

Compatible with HTTPS, FTP, SSH and other protocols

Non-trivial feature 3:

Pluggable merge strategies

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

Activity Description	*Hours Spent (estimate)*

Best wishes wrapping up the semester and in the future!