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 Kenneth A Taylor

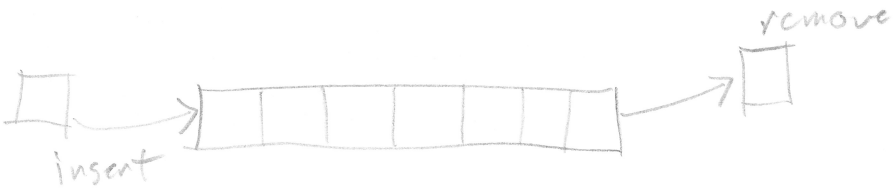
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

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

Could be implemented as an array



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

As a linked list



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

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

Your solution:

```
int count(strong s, char c)
{
    int res = 0;
    for (int i; i < s.length; i++)
    {
        if (s[i] = c)
        {
            res++;
        }
    }
    return res;
}
```

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:

cut each half in half to find where to insert new number

Worst case time complexity of algorithm:

$O(n)$

Explanation of worst case time complexity:

start at the beginning and work through one by one.

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

Organization	*Main Activities*	*Hours Spent (estimate)*
TechLink	Acceptance Testing	5 yrs

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Systematic and repeatable errors in a computer system that create unfair outcomes.

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

If most students come from the same ethnic background, then opportunities for students from diverse backgrounds could be reduced

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. only the lawers win

Side you choose to win: Google

First possible impact: Google make millions on their operating system

Second possible impact: sets a precident to using others code

Third possible impact: Companies get better at securing their 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: property damage

Second type of harm: harm to occupants

Third type of harm: harm to other persons

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 a permanent job already and will be taking on more responsibility with the project and training the new interns.

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. N/A

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)*
Teaching	14yrs
internship	5yrs

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:

Gitlab

Non-trivial feature 1: branch protection - certain branches cannot be deleted by just anyone

Non-trivial feature 2: squashing - keeps development branch from tracking all history from all branches ever created

Non-trivial feature 3: Allows teammates to checkout each others branches and test changes locally

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)*
Creating a web site	40

Best wishes wrapping up the semester and in the future!