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 Malcolm Cusack

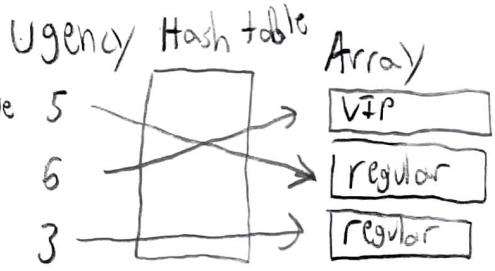
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Hash table, they have very fast searching capabilities by using each value's index (hash code) to look up a specific value.

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

1) Convert element to be stored into an Int
2) Store int element as a index that provides the value
3) The value can be looked up by using the index (hash key)



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

1) Create hash table class
2) Set each key/value when a ticket is created ('VIP', 6)
3) Remove from hash table using string remove('VIP')

key, value
↓
hash function()
↓
11



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 charOccurence(string, char):
    caunt = 0
    for i in string:
        if(i == char):
            caunt = caunt + 1
    return caunt

charOccurence("test", "t")
```

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, we know where k needs to be added. If the addition is in the front or end of the list, it's just a matter of adding the new element

Worst case time complexity of algorithm: O(N)

Explanation of worst case time complexity:

Worst case, the new k element is added somewhere in the middle of the list, meaning all the elements have to be shifted after the addition of k.

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)*
Hacker cats	club member	8
RMDS	club member	8
CCC	activist	16
Raytheon MD	System Engineer Intern	528
Lawnbot	ReactJS Dev	600
Brightvine	Full stack intern	300

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

When an algorithm has errors in it that can create privileged or unprivileged outcomes from the input

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

This bias could come in the form of ranking applications from the state Michigan above all other states with no good reason.

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: All java code used before the infringement can be sold/used without penalty

Second possible impact: Java becomes open source.

Third possible impact: Oracle looses billions of dollars that they can have profited from by buying Java.

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: Self driving cars may choose to run over a cyclist instead of hurting it's passenger causing harm to the cyclist.

Second type of harm: Self driving cars can breach it's passenger's right to privacy. Causing harm.

Third type of harm: The car can not sense a cat in the road and run it over. Causing harm to the cat and someone's 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 have job offers from Raythean Technologies as a system engineer, Full stack associate at Brightvine and currently interving for Software engineer position at Hubspot. I plan on working full time for Brightvine.

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)*
CCC	16
Skiing Beacon Boys	300
Parting	a lot

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 310 R	64
Web Dev	64
Capstone	100
Internships	1000 +
Room mates	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 Hub

Non-trivial feature 1: Store code by commiting and pushing it

Non-trivial feature 2: revert to old commits if current code is broken.

Non-trivial feature 3: Branch off to make improvement on code to then merge that branch in with original code when done.

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)*
Flappy Bird -AI project	24
Amazon Web clone	20
Tinder Web clone	12
Swift course	8
ReactJS course	9
NodeJS	8
AWS	18

Best wishes wrapping up the semester and in the future!

THX!