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 Philip Gehde

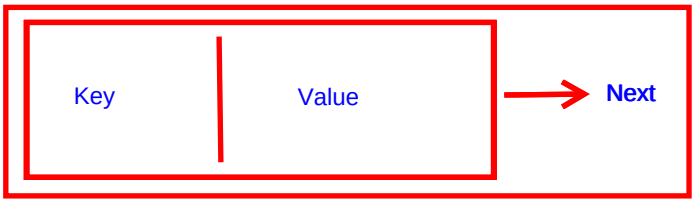
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Python Dictionary - We could simply store the user and associated urgency score as a key-value pair. Python implements dictionaries using hash tables, which is why they are fast to work with.

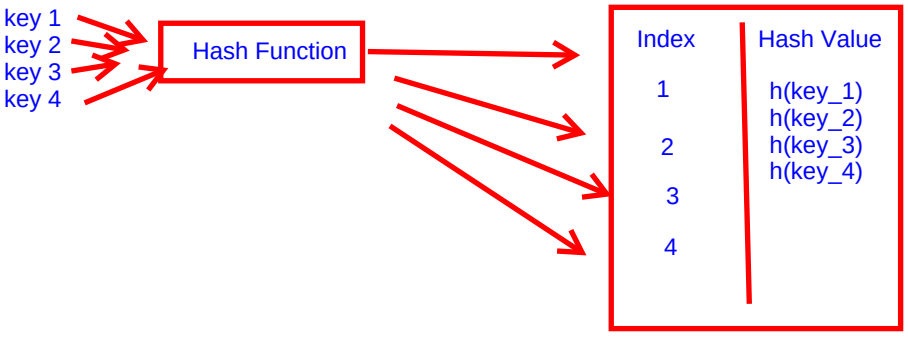
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

We simply store urgency score with a related key.



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

To overcome problems involving direct addressing we using a suitable hash function.



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:

```
somefunction(string,character):
    count = 0

    for i in string:
        if i == character:
            count = count + 1

    return count
```

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:

Linear Operation First Item in list.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

Last item in 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)*
AEI Env Consultants	VBA Macros and Python	20h/w

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Describes systematic and repeatable errors in a algorithm or computer system which may result in unfavorable outcome due to an inherent bias. For example the system may favor a particular user group, thereby creating an unfair outcome that is not necessarily in the best interest of the user base as a whole.

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

For example, it is likely that admission software might judge an applicant solely on metrics like extracurricular involvement, GPA, High school grades, etc. It may be the case that students from lower income backgrounds were not privy to the same support systems during their early stages of development that may have helped strengthen these metrics. As a result, it is possible that students from higher income backgrounds generally score higher in some of these metrics creating an unfair advantage. The metrics don't reflect a students ability to do well, and may simply represent a product of circumstance. If the University only selects according to these metrics it would perhaps result in a less diverse student body.

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. Supreme Court decided for Google.

First possible impact: Existing Software may be scrutinized more carefully in the future, to see if copyright cases do exist, seeing how this may be lucrative. Even if any copywritten code used was minimal (Google only used about 0.4% of Java's source code), this would still entitle the creator to restitution.

Second possible impact: Companies should be very careful when depending on third party API's, and be aware of the associated copyright, as a potential lawsuit may threaten their very existence.

Third possible impact: Declarative Code cannot simply be copied, if the source of the code is evident. This may be considered a copyright infringement.

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: Autonomous driving poses a threat to truckers, who are likely to be displaced in the job market.

Second type of harm: Autonomous driving may result in accidents that could have been avoided by a human driver.

Third type of harm: Autonomous driving software may be the subject of malicious attacks, creating a potential threat.

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 will continue to work for my company remotely, and engage in freelance development on Upwork, as well as doing more project management type work for a friends software development company.

I have not received any official acceptances besides the work I am already doing.

Frankly, I do not feel comfortable disclosing this information as it nobody's business but my own.

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)*
Intramurals Soccer	10
Bozeman Outdoor Soccer	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)*
Working On Branching Strategies in Github	10
Soccer, Team sports is always a great exercise.	30
Work	

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:

Branches: Developing new features in seperate branches, while maintaining a seperate development branch was vital.

Non-trivial feature 2:

Issues: working in collaborative manner by creating issues and bug reports using this feature.

Non-trivial feature 3:

Actions: Creating tests of our software to ensure that new code does not break our application.

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)*
Udemy	60
Programming Activities	100
Coursera	60
Youtube Tutorials	100

Best wishes wrapping up the semester and in the future!