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 Logan Gilder

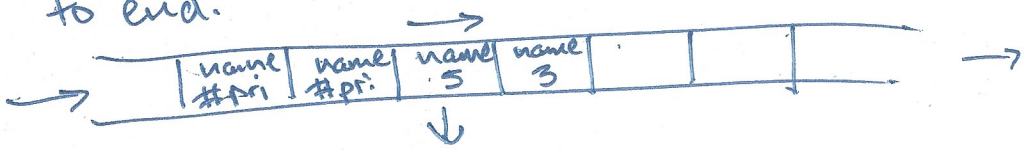
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Priority queue, works like FIFO but each element has a priority value so they go before lower priority elements.

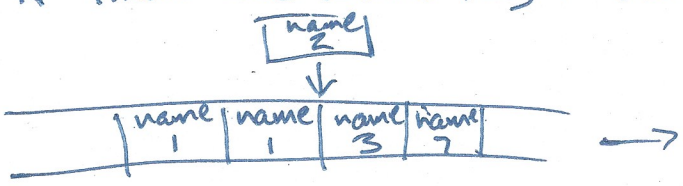
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Use a list where each element is inserted at front and pulled from back unless another element has higher priority. Each list element has a name and priority. When it pulls next it looks for highest priority nearest to end.



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

Similar to above, but, instead of removing highest priority, it will remove from the end. When an element is inserted, the priority is compared to each element until it finds one with higher value



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 foo(text, char):
    count = text.count(char)
    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(k)

Explanation of best case time complexity:

If each number added is lower than every other value in the list, it will only be compared to the first element of the list k times.

Worst case time complexity of algorithm:

O(kn)

Explanation of worst case time complexity:

If each of the k numbers is greater than every other element in the list, for each entry, we will have to iterate through the whole list k 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)*
MSU course assistant	helping students and grading for CS145	50
AYCSS	maintaining and developing web pages	150

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

When a program produces unfair outcomes because of some kind of error

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

A program could be used to determine eligibility for scholarships based on a student's grades and test scores. But if the developer isn't careful, it might not consider scores from a test that isn't used in this region. This would cause an unintentional bias against students from places that aren't local.

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:
More difficult to repurpose code from existing projects

Second possible impact:
Corporations and individuals can claim ownership of certain code

Third possible impact:
Discourage use of others' 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:
Could cause physical harm if the car crashes.

Second type of harm:
Technology could cause harm to some one's livelyhood by making their job obsolete.
Like truckers or cab drivers

Third type of harm:
Potential environmental harm if the cars are not more efficient.

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'm hoping to find a job here in Bozeman but I haven't applied yet.

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)*
Marching/Pep Band	400

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	75

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:

Great for collaboration with built in merging and branching

Non-trivial feature 2:

Keeps history so if something fails, it is easy to go back to last working version

Non-trivial feature 3:

Distributed, so you can have remote repositories and local repositories. Work can be done while off line too.

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)*
Guest lectures on campus	5

Best wishes wrapping up the semester and in the future!