Test

Tuesday, April 19, 2022 1:42 PM

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 Sierra Stephens

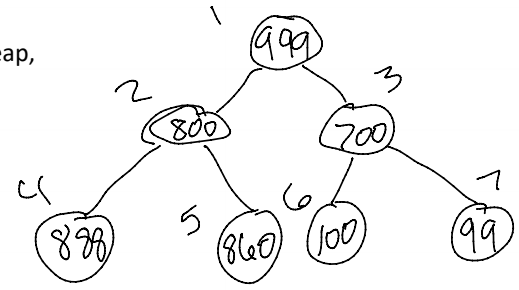
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

Heap, this is commonly used for priority queues, it is easy to find the smallest or largest value in the heap

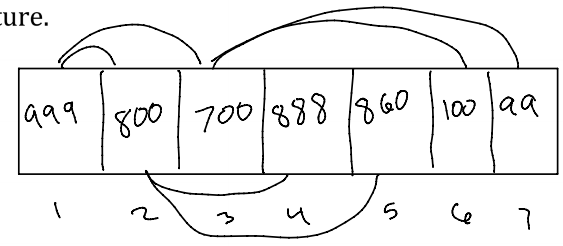
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

The BST could be implemented in a max heap, making the header the highest priority and therefore grabbing and removing the head of the tree would make the list of customers sort itself out to always have the header as the highest priority.



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

The concept of using an array would work as well. The same idea of a tree would apply, where pointers exist in each element in the array to help with sorting



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 char_counter(string, char):
    counter = 0
    for x in string:
        if x == char:
            counter += 1
    return (counter)
```

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:

The algorithm will need to search through the linked list, best case it would look at the head of the list and insert it at the beginning. Meaning it will not have to loop through more than one node and insert k instantly.

Worst case time complexity of algorithm:

O(n)

Explanation of worst case time complexity:

The algorithm searches through the whole linked list and finds that it needs to insert k at the end, meaning it read through the whole length of the linked list to get there.

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)*
AWC	Meetings/Grace Hopper	week
ACM	Meetings	20 hrs
Workiva Intern	Software Engineering Intern	1.5 years
Brightvine Intern	Software Engineering Intern	6 months
TA	Helped in Labs	two semesters

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Diminishing a user or stakeholder's well being in what is considered inappropriate. Including negative bias by using subjective or uninformed data sets, or information known to be inconsistent with legislation concerning protected characteristics.

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

If college applicants were required to have photos sent in with their application, there could be a complication with photos is applicants of color were not easy recognized by the AI as a facial structure due to color differences. Also if there was a check to see if the photo matched their gender listed, applicants could be flagged as fake when the software tagged the photo as a certain gender but the applicant listed themselves as something different.

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:

Google would need to be shut down for a while since their code needs to be adjusted by removing the stolen code.

Second possible impact:

Google would possibly become less efficient if they find a temporary fix. Depending on what the code's function was, Google may never be the same and lose crucial functionality.

Third possible impact:

Other companies may start looking to sue competing companies for stolen code that was not actually stolen since Oracle won this case against Google.

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:

A self-driving car may have to choose whether to save a passenger in a vehicle or to swerve and harm a pedestrian.

Second type of harm:

A self-driving car may malfunction and turn into traffic when the road is not clear.

Third type of harm:

A self-driving car might not calculate the miles it can travel correctly and leave the passenger stranded in the middle of nowhere in unknown weather and environmental conditions, leaving the passenger in harms way for many possible outcomes.

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 applied at every company I fit in descriptions in LinkedIn, I have no received any offers. I plan to move farther away from programming, since it does not produce fulfilling work for myself. I plan to look into forensics and law enforcement. I also plan to look into management.

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)*
Equestrian club	30hrs
Swing dancing	5hrs

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)*
TA	2 semesters

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 / Github

Non-trivial feature 1:

Being able to revert easily

Non-trivial feature 2:

Collaboration and ability for multiple engineers to work on the same PR

Non-trivial feature 3:

Security with keys

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)*
24 hour code	24 hrs

Best wishes wrapping up the semester and in the future!