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.

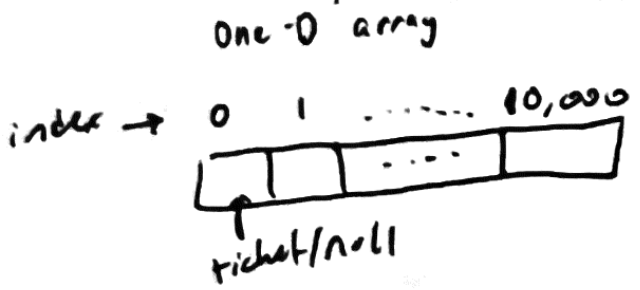
Name Constance Bernard

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.

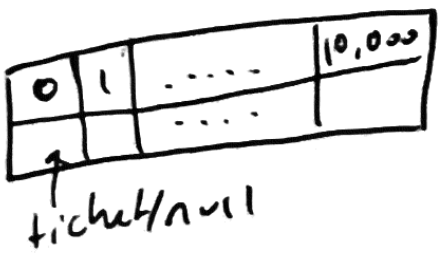
if no urgency score can overlap - ex there can't be two 52's I would use an array. the ticket could be stored at the array index matching its urgency score.

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



tickets are placed in array slots with index corresponding to urgency score. Blank spots are set to null

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



2-D array works the same as 1-d array above.

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 charCount(string, char):
    count = 0
    for x in string:
        if char == x:
            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(k)

Explanation of best case time complexity:

Best case scenario is if all numbers in k are less than all numbers in n. Then the insertions would be at the front of the list every time. Since insertions at the front of a singly linked list take O(1) time the best case would be O(k)

Worst case time complexity of algorithm:

O(k·n)

Explanation of worst case time complexity:

Worst case is if all #s in k are greater than all #s in n. Then each insertion would have to go through the entire list before insertion.

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)*
Workiva intern	coded, worked in teams	800
Undergraduate Course Assistant	led labs	320
Resident Advisor	oversaw 50 residents	540
AWC	member	128
ACM	president, liason	208
Beloved Arise Rebel	volunteer	250
Presbycats	college ministry	310

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Algorithmic bias - when an algorithm is created that has an unjust/ unfounded prefrence towards a group

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

the training data the algorithm was trained on could have consisted of moastly white candidates. these candidates could have had access to resources and activites unavailable to minority students. when implemented this algorithm could show prefrence to admitting white candidates over BIPOC candidates because it sees the white students as "stronger" due to its limited training data.

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:

others are able to use & benefit from Java API

Second possible impact:

Oracle gains more control / Monopoly over API

Third possible impact:

Google needs to rework their mobile platform OS, companies relying on this could struggle.

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 hit a pedestrian

Second type of harm:

Could crash harming those inside the car

Third type of harm:

Could crash into another car, building etc destroying 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 been offered a position as a software engineer at Workiva and plan to accept.

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)*
Bozeman Cold Water Jiujitsu Team (Self organized)	50
Swingdancing	30
Beloved Arise Rebel	250
Presbycats	310

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 as an RA	540
Networks projects	100
Advanced Algorithms Projects	100
Capstone (interdisciplinary)	200

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:

VS Code

Non-trivial feature 1:

F12 - Go to function definition → quickly see where function is defined

Non-trivial feature 2:

Ctr-shift-R - refactor code - quickly rename things across files

Non-trivial feature 3:

Debugger - can use this feature to walk/step through code, see what variables are assigned to etc

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)*
Grace Hopper Conference	60
Richard Tapia Conference	30
ACM	210

Best wishes wrapping up the semester and in the future!

Thank you!