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 _____Dawson Kanehl_____

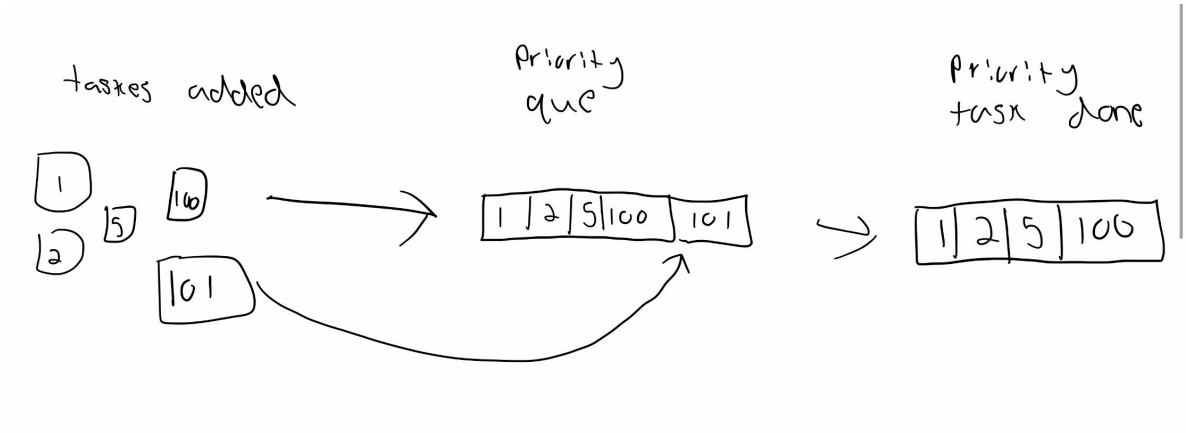
Question 1: A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's customer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

I would implement a priority queue, this is like a regular queue where its first in first out expert each node or ticket in this case has an associated priority score. They are inserted into the priority queue based on this score number where the higher the number the higher in the value of priority are the the top and will be served first. If two VIPs have the same priority score of urgency then they are served based on who put in the ticket first.

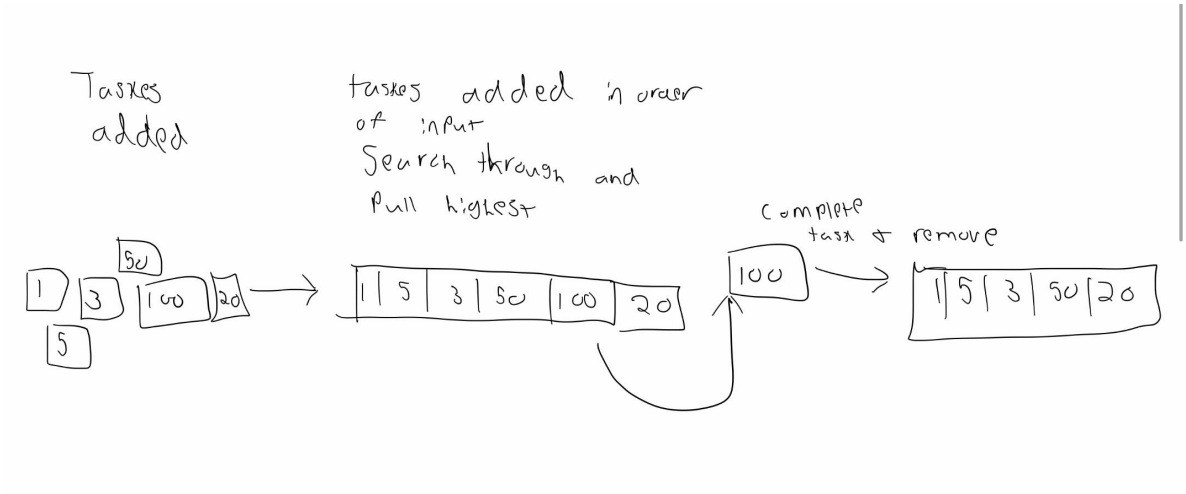
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Same as above to where when we assign a number of urgency to each user and vip, when they put in a ticket for service it will be pushed into the queue based on that priority number making this list ordered. From there the customer service team could pull priority to get the highest urgency number and serve them first. Once served they are removed and the next number down is now the top.



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

A second way that a priority queue could be implemented is to leave the queue unsorted but when the customer service team pulls highest priority it will scan the entire queue and once it's completed the entire scan it will then pull down the highest urgency score. This could take more time to execute.



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 getCount(w, c) :
   num = 0
   for i in range(len(w)) :
      if (w[i] == c):
         num = num + 1
   return num

word= "computerscienceiscool"
char = 'c'
print(getCount(word, char))
```

In this case it returns and prints 4

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(n)

Explanation of best case time complexity:
*Assuming that this is a simple sorting alg used on the linked list and we also know that only one is being inserted at a time that makes the time being k*n to sort through the list, best case is that it's the first one making it o(n).*

Worst case time complexity of algorithm: O(n)

Explanation of worst case time complexity:
*The same as above, assuming its a simple sorting alg and k being inserted one at a time, the time is then k*n and worst case would be to look through the entire list, even in that case the time complexity is still O(n).*

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)*
ACE cyber security boot camp	*An internship focused on cyber security and leadership in a military environment. Weekly papers and topics finished with a 48hr marathon capstone*	*800*
CySER	*A cyber security capstone, bi weekly book meetings and guest speakers, a 2 week summer workshop, followed by a 8 week internship*	*176*

Question 5: IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

Is the idea that an algorithm can make unfair decisions based on how its written as well based on the input data. This can be due to how the data was collected in a

biased way. Additionally, if the programmers all have the same background or knowledge they could be leaving out key information that they didn't think of but is crucial to make the most accurate representation of the data.

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

An example of this would be to take a look at all the percentages of grades of all students in the cs department. The algorithm could rack and stack students based on how smart they are from what grades they currently have. This would have bias because it does not incorporate the difficulty of class, how many classes, as well as the weight of the class and the curves associated with them. This could lead to false data that misrepresents seniors compared to freshmen.

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: less shared code practice/fair use law being questioned more and more. Computer science community generally is accepted to share code in, we would see a vast decline in this and that would take up more time in the development process if everyone has to do everything from scratch.

Second possible impact: open source code will be used more often, we will see a shift to more open sourced projects instead of using the paid/licensed code out of fear of being hit with copyright.

Third possible impact: less variety in open source, afraid to use the code that is already out there, there are only so many ways to reinvent the wheel. Coders would not want any code to look remotely like anything else, leading to unneeded code bloat.

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: Physical harm, the car may be forced to make a decision that can put either others or the passengers in danger.

Second type of harm: Electronic harm, there is the possibility of the car being manipulated by an outside hacker to cause damages either to the passenger or to others around the car

Third type of harm: Psychological damages, with the coming of driverless cars there is a false sense of safety, we may become too reliant or oblivious to the dangers around us if we are in the car or a pedestrian.

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 am going into the Air Force as an Officer after I graduate. I have been selected as a nuclear and missile operator. I will complete training for the military but then I plan on getting my master's degree. I am looking at the University of Wyoming and something along the lines of public administration. I have not applied to anywhere yet, I am going to take about a year off before I go back to school.

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)*
Air Force ROTC	*1000*

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)*
Air Force ROTC	*1000*

Question 11: Name the most sophisticated version control system that you use and describe three non trivial features it has**.**

Name of most sophisticated version control system: Github

Non-trivial feature 1: Collaboration on projects, it allows you to invite anyone to download the code, edit and then with permissions edit the code to make it better.

Non-trivial feature 2: branches to work on different parts of the same code without worry of overriding. A sort of version control that allows for users to fork and test and do their own thing without worrying about screwing up the main line of code.

Non-trivial feature 3:version control to revert back when things go bad, additionally you can see what changes were made and the differences between versions.

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)*
None	

Best wishes wrapping up the semester and in the future!