**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 Matt Giotta

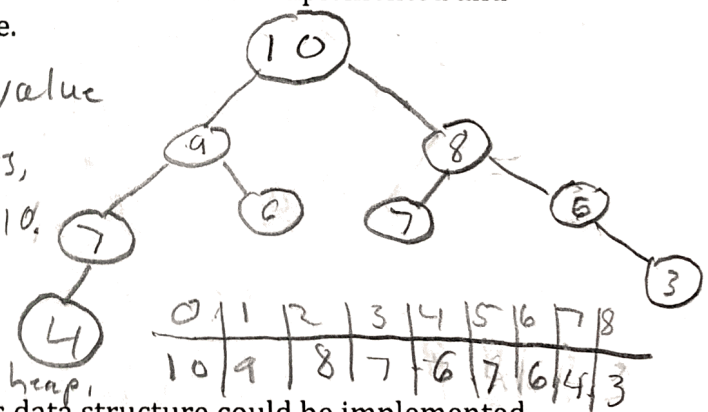
**Question 1:** A company uses a ticket system for customer service. Each ticket is given an urgency score when it is entered into the system. For example, a VIP customer would receive a higher urgency score than a regular customer. Assume that the urgency scores range from 1 to 10,000. The company's 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 think a max heap would be a good way to implement the priority queue system described above. With a heap you can perform necessary operations like add or remove from queue, or change priority in queue.

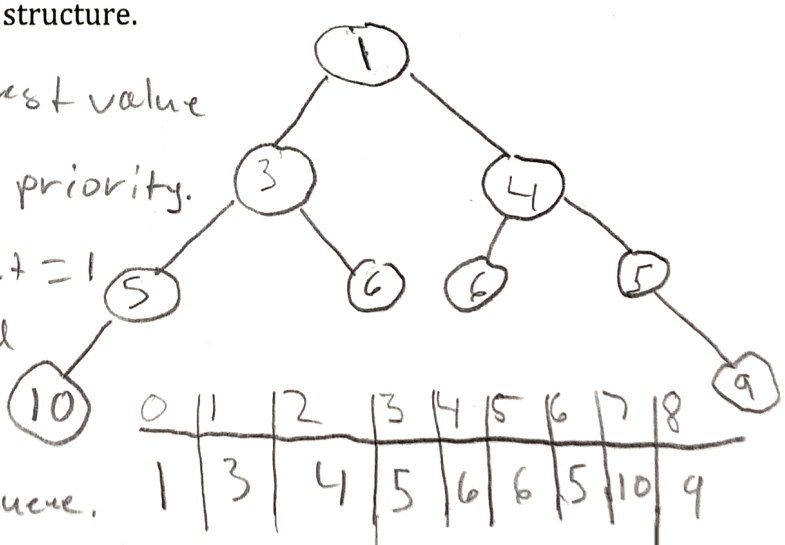
b) Describe one way in which this data structure could be implemented and draw a picture of that data structure.

Root is max, highest value represents highest priority, Example; VIP + Urgent = 10. Highest score is served first out of all elements queued into the heap.




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

Root is min, lowest value represents highest priority. Example; VIP + Urgent = 1 Lowest score is served first out of all elements in priority Queue.



**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):* Java

*Your solution:*

```
package Question2;
public class Search{
    public static void main(String[] args){
        funct fun = new funct();
        String test = "This is a test Please check me";
        System.out.println(fun.retOccurs('e', test));
    }
}
```

```
package Question2;
public class funct{
    public int retOccurs(char x, String y){
        int count=0;
        for(int i=0; i<y.length(); i++){
            if(y.charAt(i)==x){
                count++;
            }
        }
        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:*

Ideally 'k' numbers will be added in constant time to the list. The order of the list has to be maintained, so to achieve best case time complexity 'k' floating point numbers has to be ordered, ascending, to the linked list 'n', without 'n', changing order.

*Worst case time complexity of algorithm:*

O(n)

*Explanation of worst case time complexity:*

If, and this is most likely the case, elements of 'k' can not simply be added in order to the end of 'n', they need to be checked for maintenance of ascending order. This adds one loop through the linked list of size 'n' and 'k' can be added to it in linear time,

**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)* |
|---|---|---|
| none | none | none |
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**Question 5:** IEEE P7003 defines the Algorithmic Bias Standard.

a) Describe briefly what algorithmic bias is.

A process or set of rules that prejudice in favor of or against on thing, person, or group compared with another usually in a way considered to be unfair

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

Someone might complain, hypothetically, and if they complain loudly enough, it is hypothetically considered to be unfair admissions software.

**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:* Gigacorp1

*First possible impact:*

Gigacorp1 makes more money than Gigacorp2.

*Second possible impact:*

Gigacorp2 moves tax money to Panama.

*Third possible impact:*

Gigacorp1 also moves tax money to Panama.

**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:*

Burning. Burning is caused by cars starting on fire and cooking its occupants, Most Painful of the types of harm in my opinion. Listed first.

*Second type of harm:*

Blunt force trauma. Crashing a self driving car will hurt because coming violently to arrest in a metal tub is harmful.

*Third type of harm:*

Owning a self driving car is harmful because the owner is too meek/mild to drive him on herself. Self driving cars perpetuate this weakness and their existence is therefor harmful.

**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 not going to dox myself nice try.

**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)* |
|---|---|
| none | none |
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**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)* |
|---|---|
| none | none |
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**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:* Sharing on Git hub, other people get to view my code.

*Non-trivial feature 2:* Free. Does not require a subscription.

*Non-trivial feature 3:* Backups, If edit undo fails at least there is a previous working version.

**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 | None |
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Best wishes wrapping up the semester and in the future!