Dr. Esteban Parra Rodriguez
Algorithms Assignment
Zain Alsaad
CSC 3130

Link to Github: https://github.com/alsaadza/Algorithms_CSC3130_Homework1

Question 2:

The answer to Question 2 can also be found in my GitHub repo.

```java
// time complexity: (n^2)

public class commonSubstring {
   public static String findCommonString(String text1, String text2) {
       int maxLength = 0;
       int startIndex = 0;


       for (int i = 0; i < text1.length(); i++) { // O(n)
           for (int j = 0; j < text2.length(); j++) { // O(n)
               int length = 0;


               while (i + length < text1.length() && j + length < text2.length() &&
                       text1.charAt(i + length) == text2.charAt(j + length)) {
                   length++;
               }


               if (length > maxLength) {
                   maxLength = length;
                   startIndex = i;
               }


           }
       }

       if (maxLength > 0) {
           return text1.substring(startIndex, startIndex + maxLength);
       } else {
           return "";
       }
   }

   public static void main(String args[]){
       commonSubstring algorithm = new commonSubstring();

       String text1 = "abc";
       String text2 = "abc";
       String result = algorithm.findCommonString(text1, text2);
       System.out.println("Case 1:\ntext1 = " + text1 + " \n text2 = " + text2 + "\n Output: " + result);
       System.out.println("-------------------------------------------------");


       text1 = "almanacs";
       text2 = "albatross";
       result = algorithm.findCommonString(text1, text2);
       System.out.println("Case 2:\ntext1 = " + text1 + " \n text2 = " + text2 + "\n Output: " + result);
       System.out.println("-------------------------------------------------");


       text1 = "gears of war";
       text2 = "History of warriors";
       result = algorithm.findCommonString(text1, text2);
       System.out.println("Case 3:\ntext1 = " + text1 + " \n text2 = " + text2 + "\n Output: " + result);
       System.out.println("-------------------------------------------------");

       text1 = "esteban is a great professor";
       text2 = "zain is a great student";
       result = algorithm.findCommonString(text1, text2);
       System.out.println("Case 4:\ntext1 = " + text1 + " \n text2 = " + text2 + "\n Output: " + result);
       System.out.println("-------------------------------------------------");



   }

}
```

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Question 6:

- *Problem 1:* O(n^2) and Ω(n^2)
    - Explanation: There are two for-loops. Each for-loop is an ‘n’, so to speak. Therefore, we get O(n(n)), because there is a for-loop inside of a for loop. This simplifies to O(n^2).

- *Problem 2:* O(n^3) and Ω(n^2)
    - Explanation: There are two for-loops, and a while loop (which is also an ‘n’). Therefore, we get O(n(n(n))), because there is a while loop, inside a for-loop, inside of a for loop. This simplifies to O(n^3). The best case scenario is Ω(n^2), because if the condition to run the while loop is not met, then the only code being ran from the while-loop is checking the condition, which is O(1).
- *Problem 3:* O(n) and Ω(n)
    - Explanation: There is one for-loop being executed in the ‘generateNotFibonacci()’ method. A for loop is equivalent to an ‘n’ in time complexity. The for-loop will always be executed in the method, therefore the best and worst case scenario is O(n).
- *Problem 4:* O(n^3) and Ω(n^3)
    - Explanation: This problem inherits the time complexity of problem 3. Problem 4 introduced the ‘findPosition()’ method. There are two for-loops inside the ‘findPosition()’ method. Therefore, we get O(n(n) * n) = O(n^3).
- *Problem 5:* O(n) and Ω(1)
    - Explanation: There is one while being executed. A while loop is equivalent to an ‘n’ in time complexity. The best case scenario is Ω(1), because if the condition to run the while loop is not met, then the only code being ran from the while-loop is checking the condition, which is O(1). Therefore the best and worst case scenario is O(n).