KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
Information and Computer Science Department
ICS202: Data Structures
HOMEWORK 2 (Term 061)
Due Date: Saturday, March 24th, 2007

Question # 1: (30 points)

Look at the following code, and then answer the questions afterwards.

```
public static void SSort(int array[]){
   for(int i = 0; i <array.length; i++){
      for(int j = 0; j <array.length; j++){
         if(array[j]>array[i]){
            swap(array,i,j);
         }
       }
   }
}

public static void swap(int arr[],int x, int y){
           int temp = arr[x];
           arr[x]     = arr[y];
           arr[y] = temp;
}
```

a) Find the complexity of the **`SSort`** method in terms of the number of basic operations required to execute the method. Your answer should be a function of **n** i.e., **f(n)**.

b) Find the tight Big-O complexity **g(n)** for the function **f(n)**.

c) Prove that **f(n) = O(g(n))** for the two functions determined above, by finding a pair of suitable values for **c** and $\mathbf{n_0}$,such that for all $\mathbf{n > n_0}$, **f(n) <= c * g(n).**

Question # 2: (30 points)

Consider the code provided for DoublyLinkedList and implement a method called

```
public void SortList()
```

This method should sort the list in increasing order using selection, bubble or insertion sort (Pick any one you prefer). The code for "selection sort" for sorting an array is given below as reference.

public static void SelectionSort(int array[]){

```
    for(int i = 0; i <array.length; i++){
        int min = i;
        for(int j = i; j <array.length; j++){
            if(array[j] < array[min]){
                min = j;
            }
        }
        swap(array,min,i);
    }
}
```

Question # 3: (40 points)

a. Write a class as described below

```
public class Book implements Comparable
{
        private String Title;
        private String Author;
}
```

The ***compareTo*** method with the following header:

```
public int compareTo(Object obj)
```

that does the comparison based on **Title** of the Book

b. Write a program called Library that maintains two lists (Double Linked Lists) of book objects. The first lists holds all the books are present in the library. The second list holds all books that have been borrowed from the library. Your Library program should be menu driven as described below

```
************************************************
*    1. Add new book to Library                *
*    2. Checkout a book from the Library       *
*    3. Return a book                          *
*    4. Find a book                            *
*    5. Sort available books                   *
*    6. Sort borrowed books                    *
*    7. Print all available books              *
*    8. Print all borrowed books               *
*    9. exit                                   *
************************************************
```

1. The first menu item should allow to user to enter a new book. This book object should be inserted in the available books list

2. This option should ask the user for the title of the book. If this book is present in the available books list, it should be removed from the available list and added to the borrowed list otherwise user should be notified that the book is not available.
3. This item should ask the user for the title of the book. If this book is present in the borrowed list, it should be removed from the borrowed list and added back to the available list otherwise user should be notified that the book is not checkedout.
4. This option should ask the user for the title of a book and search for it in both available and borrowed list. If book is found it should be printed otherwise use should be notified that the book does not exist.
5. This option should sort the list containing all the available books
6. This option should sort the list containing all the borrowed books
7. This option should print all the available books.
8. This option should print all the borrowed books.
9. Use your imagination for this option.

Important Notes:

- Your report for this homework must be **word-processed** and must follow the **homework submission template** format, which you can get in the downloadables section of the WebCT.
- All the classes for this homework must be stored in a package **`ics202.hw02.`**
- You must import the necessary packages needed for your program.
- You need to submit two things:
    1. A printed copy of your report at the beginning of your class on the due date.
    2. Submit your entire **`ics202`** package into the webCT under the Assignments option.