CISC 7124 Midterm Exam

Please complete the exam and submit it as a plain text email with the subject "CISC 7124 Midterm Exam" to nzhou@brooklyn.cuny.edu by midnight on Thursday, March 25.

Question 1

Does each of the following programs compile and run? If no, explain the reason; otherwise, give the output.

1. public class P1 {
   public static void main(String[] args) {
     System.out.println(f(4, 2));
     int f(int x, int y) {
       return x > y ? x : y;
     }
   }
}

2. public class P2 {
   public static void main(String[] args) {
     System.out.println(f("567"));
   }
   public static int f(String s) {
     int n = s.length();
     if (n == 0)
       return 0;
     else
       return f(s.substring(0, n-1)) + (s.charAt(n-1) - '0');
   }
}
3. class A {
   A(){
       System.out.println("A");
   }
}
class B extends A {
   B(){
       System.out.println("B");
   }
}

public class P3 {
   public static void main(String[] args){
      A b = new B();
   }
}

4. public class P4 {
   public static void main(String[] args) {
      int n = 2;
      f(n);

      System.out.println("n is " + n);
   }
   static void f(int n) {
      ++n;
   }
}

5. class P5 {
   int x;
   public P5(int x){
      this.x = x;
   }
   public static void m(P5 a){
      a = new P5(2);
   }
   public static void main(String[] args){
      P5 a = new P5(1);
      a.m(a);
      System.out.println("output=\"+a.x);
   }
}
Question 2

Write a class, named `MyString`, that mimics the `String` class in the Java library, and provides the following API:

- `public MyString(char[] chars);`
- `public char charAt(int index);`
- `public int length();`
- `public MyString substring(int begin, int end);`
- `public MyString toLowerCase();`
- `public boolean equals(MyString s);`

No methods of the `String` class can be used.

Question 3

An element in a list of integers is called shaded if there are elements to its left that are greater than or equal to the element. Write a function that takes a list of integers and returns a copy of the list with all the shaded elements removed.

```java
public static ArrayList<Integer> removeShaded(ArrayList<Integer> lst)
```

For example, for `lst = [1,3,3,2,4,3]`, the returned list is `[1,3,4]`.

Question 4

This question continues from Question 3. Suppose a list is represented as a singly linked list of nodes. Write the function of the following specification:

```java
public static ListNode<Integer> removeShaded(ListNode<Integer> head)
```

where `ListNode` is defined as follows:

```java
class ListNode<T> {
    public T data;
    public ListNode<T> next;

    public ListNode(T element){
        data = element;
        next = null;
    }

    public ListNode(T element, ListNode<T> next){
        data = element;
        this.next = next;
    }
}
```
Question 5

The queue data structure contains a collection of elements, in which elements are added and retrieved in a first-in-first-out fashion. Write a class, named Queue, that has the following specification:

```java
public class Queue<T> {
    private ListNode<T> front;
    private ListNode<T> rear;
    private int size;

    public void enqueue(T element){}
    public T dequeue(){}
    public boolean isEmpty(){}
}
```

where ListNode is defined in Question 4. A queue contains three member variables: front references the front node, rear references the last node, and size holds the number of elements in the queue. The method enqueue adds an element into the queue. The method dequeue removes and returns the front element from the queue.