CSCE 146 – Midterm Exam 1
17 February 2009

You have 75 minutes. Look over the test first. Divide points into time to estimate how much time you ought to spend on any given question.

Justify any answer you give.

You may wish to make simplifying assumptions. STATE THOSE ASSUMPTIONS CLEARLY. If the assumptions are entirely reasonable (that is, they turn an otherwise very difficult problem into a problem that is reasonable for an exam) then this is perfectly acceptable. If your assumptions turn an otherwise reasonable problem into a relatively trivial problem, then I will not grant full marks for the answer.

NAME:

1. (8)	**6. (6)**	**11. (10)**
2. (10)	**7. (10)**	
3. (9)	**8. (9)**	
4. (10)	**9. (10)**	
5. (8)	**10. (10)**	**Total**

1. (8 points total) For an empty stack `s`, we execute the following code sequentially:

```
s.push("a");
s.push("b");
s.push("c");
s.pop();
s.pop();
```

What will be returned by the execution of the last two lines of code? You may assume that this code will execute correct and that you will **not** get errors from this.

2. (10 points) Assume you are writing a class for a doubly linked list.

   (a) (4 points) What are the instance variables that are required?

   (b) (6 points) What are the basic methods that are required?

3. (9 points) Explain three differences between an array and a linked list.

4. (10 points) Write a `contains` method to iterate over a linked list of `String` data looking for a particular `String` and returning a `boolean` value of `true` or `false` depending on whether the sought-for `String` was found.

5. (8 points) Explain the primary difference (logical or operational, not syntactical) between an array and a linked list in terms of accessing data. What is the worst-case complexity of accessing an element in a linked list of n nodes?

6. (6 points) What is an `interface` in Java, and what is its purpose? Be clear and precise.

7. (10 points total) You have the following code that includes two classes. What is the output from executing the method whatIf()

```
public class ClassOne
{
  public void whatIf()
  {
    String a = "kartoffeln", b = "gemuese", c = "";
    c = zokni(6, a, b);
    System.out.println("zokni is " + c);
    c = zokni(16, a, b);
    System.out.println("zokni is " + c);
  }
}
public class ClassTwo<T>
{
  public T zokni(int i, T one, T two)
  {
    if(i > 10)
      return one;
    else
      return two;
  }
}
```

8. (9 points) The following is a template for a class for a singly linked list. Write the code for the method to link a node in after a given node as in the following code segment.

```
public class SLL
{
  private int size;
  private SLLNode head, tail;
  public SLL()
  {
    this.head = null;
    this.tail = null;
    this.setSize(0);
  }
  public int getSize() { return this.size; }
  public void setSize(int value) { this.size = value; }
// MORE METHODS
/**********************************************************************
 * Method to unlink a node.
 * @param node the 'SLLNode' to unlink.
**/
  public void unlink (SLLNode node)
  {
// YOUR CODE FOR THIS EXAM QUESTION WOULD GO HERE
  } // public void unlink(SLLNode node)
} // public class SLL
```

9. (10 points) Suppose you have the declaration

```
int[] data = new int[100];
int i;
```

Write a small segment of Java code that will shift `data[51] ... data[99]` down one spot each to the locations `data[50] ... data[98]`, leaving `data[99]` in its original location. Use a `for` loop for this purpose.

10. (10 points) Write a class definition that could be used to define a node in a doubly linked list. Include only the instance variables, not the methods.

11. (10 points) What does this code do? That is, what is the data structure implemented by this code? Specifically, what is the function performed for this data structure by method `xxx`? What is the function performed by method `yyy`?

```
public class X
{
  int a,b;
  String[] z;
  public X(int n)
  {
    z = new String[n];
    a = 0;
    b = -1;
  }
  public int getA()
  {
    return a;
  }
  public int getB()
  {
    return b;
  }
  public String yyy()
  {
    String s = z[b];
    --b;
    --a;
    return s;
  }
  public void xxx(String www)
  {
    ++b;
    ++a;
    z[b] = www;
  }
}
```