

Name _____

CS 102 – Midterm

This is a timed exam. There are 13 questions and you have 90 minutes to complete the exam. Submit your answers on blackboard as one document (pdf or word). (80 points)

Honor Code Statement for Exam: I, _____, agree to neither give nor receive any help on this exam from other students. I understand that providing answers to questions on this exam to other students is an academic misconduct violation as is taking or receiving answers to questions on this exam from other students. It is important to me to be a person of integrity and that means that ALL ANSWERS on this exam are my answers. Signed _____

- 1) (2 points) What is the meaning of the declaration: `String [][] a = new String [60][80];` ?
 - a) Create an array of 60 strings, each of size 80 characters.
 - b) Create an array of 80 strings, each of size 60 characters.
 - c) Create a two-dimensional array of strings with 60 columns and 80 rows.
 - d) Create a two-dimensional array of strings with 60 rows and 80 columns.

- 2) (2 points) In a recursive method that writes a string of characters in reverse order, the base case is _____.
 - a) a string with a length of 0
 - b) a string whose length is a negative number
 - c) a string with a length of 3
 - d) a string that is a palindrome

- 3) (2 points) A recursive solution that finds the factorial of n generates _____ recursive calls.
 - a) n-1
 - b) n
 - c) n+1
 - d) n*2

- 4) (2 points) In the ADT list, when an item is inserted into position i of the list, _____.
 a) the position of all items is increased by 1
 b) the position of each item that was at a position smaller than i is increased by 1
 c) the position of each item that was at a position greater than i is increased by 1
 d) the position of each item that was at a position smaller than i is decreased by 1 while the position of each item that was at a position greater than i is increased by 1
- 5) (2 points) The ADT sorted list inserts and deletes items by their _____.
 a) name
 b) value
 c) position name
 d) position number
- 6) (2 points) Which of the following is *true* about a *circular doubly-linked list* (i.e. *reference-based*)?
 a) Inserting into the first position of the list is a special case.
 b) Deleting from the last position of the list is not a special case.
 c) The **prev** reference of the last node has the value **null**.
 d) The next reference of the last node has the value null.
- 7) (2 points) an array-based implements of the ADT list:
 a) Requires less memory to store an item than a reference-based implementation.
 b) Is not a good choice for a small list.
 c) Has a variable size.
 d) Has items which explicitly reference the next items.
- 8) (2 points) which of the following will be true when the reference variable **curr** reference the last node in a linear linked list (i.e reference-based)
 a) That `curr == null`.
 b) That `head == null`.
 c) That `curr.next == null`.
 d) That `head.next == null`.

- 9) (15 points) Write a method in java with the following header:

```
Public static int maxNumber (int [] arr, int first, int last)
```

Please provide a recursive implementation that takes 3 parameters: an integer array *arr*, and two integers *first* and *last*. The method will find the largest value in a between indices first and last, inclusive. That is, it will return the largest value in the part of the array *arr[first..last]* . You may assume that $first \leq last$.

- 10) (6 points) Short answer

Write the code segment that is used to insert a new node, referenced by the reference variable **newNode**, at the beginning of a linear linked list (i.e. a simple *reference-based list*)

Note: use **.next** to reference the next node of a node (you cannot use **.prev** in this question).

- 11) (10 points) Describe the differences between a *stack* and a *queue*, specifying: the strategy (1), the main operations (2), and example of usage (3)
- 12) (3 points) Suppose we begin with an empty stack, and perform the following operations: push 7, push 2, push 9, push 6, pop, pop, peek, push 1, push 3, peek, push 8, pop, peek, pop, pop, push 5, push 4, pop, pop, pop, push 8. What is contained on the stack when we are done? Write out the contents from top to bottom.
- 13) Consider the following definitions for a reference-based linked list, similar to those given in class:

```
public class ListNode {
    private Object item;
    private ListNode next;

    public ListNode() { item = null; next = null; }
    public ListNode( Object val ) { item = val; next = null; }

    public Object getItem() { return item; }
    public ListNode getNext() { return next; }

    public void setItem( Object val ) { item = val; }
    public void setNext ( ListNode val ) { next = val; }
}

public class LinkedList {
    private ListNode head;
    ...
}
```

Consider the following Java methods belonging to the **LinkedList** class. All of the methods compile correctly; however, they do not function as described in their relative header. What is wrong? How would you fix them?

The following methods recursively print the entire list:

```
public void printList() { printListRec( head); }

private void printListRec ( ListNode node ){
    System.out.println ( node.getItem() );
    printListRec( node.getNext() );
}
```

- What is wrong? How would you fix these methods? (15 points)
- Provide an iterative implementation for the method **printList**. (15 points)