CSC 151 Assignment #4

1. Honor Code

A. For individual assignments: Jane Doe and John Doe will be replaced by your full name(s)

I affirm that I have carried out my academic endeavors with full academic honesty.

[Signed, Manav Bilakhia]

B. Resources/References

Geeks for geeks for syntax

2. Java files and outputs

A. Java files

```
B. package assignment;
   /*
    * I affirm that I have carried out the attached academic endeavors with
   full academic honesty.
    * Manav Bilakhia (MB)
    */
   /**
    * An interface that describes the operations of a bag of objects.
    *
    * @author Frank M. Carrano
    * @author Timothy M. Henry
    * @version 5.0
    */
   public interface BagInterface<T> {
       /**
        * Gets the current number of entries in this bag.
        *
        * @return The integer number of entries currently in the bag.
        */
       public int getCurrentSize();
       /**
        * Sees whether this bag is empty.
        *
        * @return True if the bag is empty, or false if not.
        */
       public boolean isEmpty();
       /**
        * Adds a new entry to this bag.
        *
        * @param newEntry The object to be added as a new entry.
        * @return True if the addition is successful, or false if not.
        */
       public boolean add(T newEntry);
       /**
        * Removes one unspecified entry from this bag, if possible.
        *
        * @return Either the removed entry, if the removal. was successful, or
   null.
        */
       public T remove();
       /**
        * Removes one occurrence of a given entry from this bag, if possible.
        *
        * @param anEntry The entry to be removed.
        * @return True if the removal was successful, or false if not.
        */
       public boolean remove(T anEntry);
       /** Removes all entries from this bag. */
       public void clear();
       /**
        * Counts the number of times a given entry appears in this bag.
        *
        * @param anEntry The entry to be counted.
        * @return The number of times anEntry appears in the bag.
        */
       public int getFrequencyOf(T anEntry);
       /**
        * Tests whether this bag contains a given entry.
        *
        * @param anEntry The entry to find.
        * @return True if the bag contains anEntry, or false if not.
        */
       public boolean contains(T anEntry);
       /**
        * Retrieves all entries that are in this bag.
        *
        * @return A newly allocated array of all the entries in the bag. Note:
   If the
        * bag is empty, the returned array is empty.
        */
       public T[] toArray();
   } // end BagInterface
```

```
/*
 * I affirm that I have carried out the attached academic endeavors with full academic
honesty.
 * Manav Bilakhia (MB)
 */
package assignment;

/**
 * A class of that tests singly linked lists that have String as the data.
 *
 * @author Zeynep Orhan
 */
public class LinkedBagDriver {
    /**
     * palindrome: Tests whether a string is
     *
     * @param w a String
     * @return True if the w is a palindrome, or false otherwise.
     */
    public static boolean palindrome(String w)
    {
        StringBuilder s = new StringBuilder();
        s.append(w);
        s.reverse();

        return w.equals(s.toString());
    }
    /**
     * addAll: adds all the strings in a given String array to this bag.
     *
     * @param w a String array
     * @return a BagInterface<String> which is a LinkedBag by adding all Strings in w
     */
    public static BagInterface<String> addAll(String [] w)
    {
        BagInterface<String> bag = new LinkedBag();
        for (int i = 0; i<w.length; i++)
        {
            bag.add(w[i]);
        }

        return bag;
    }
    /**
     * allPalindrome: adds all the strings in a given String array to a LinkedBag
     * and tests if they are all palindrome
     *
     * @param w a String array
     * @return True if all strings are palindromes, or false otherwise.
     */
    public static boolean allPalindrome(String [] w)
    {
        addAll(w);
        for (int i = 0; i<w.length; i++)
        {
            if(!palindrome(w[i]))
                return false;
        }
        return true;
    }
    /**
     * allPalindromes: adds all the strings in a given String array to a LinkedBag
     * and returns a string of the palindromes
     *
     * @param w a String array
     * @return a string that has all the palindrome strings in the bag separated by
space,
     * most recent one should be at the beginning
     */
    public static String allPalindromes(String [] w)
    {
        BagInterface<String> bag = new LinkedBag();
        for (int i = 0; i<w.length;i++)
        {
            bag.add(w[i]);
        }
        Object[] arr = bag.toArray();
        String s = "";
        for (int i = 0; i<arr.length; i++)
        {
            if(palindrome((String)arr[i]))
                s = s + " " + arr[i];
        }
        return s;

    }
    public static void main(String[] args) {
// TODO Auto-generated method stub
        BagInterface<String> words = new LinkedBag<>();
        String w[] = { "a", "ab", "aba", "abba", "abcba", "abb" };
        for (String word : w)
            words.add(word);
        System.out.println("Add all words");
        System.out.println(words);
        Object wordArray[] = words.toArray();
        for (Object word : wordArray)
            if (palindrome((String) word))
                System.out.println(word + " is a palindrome");
            else
                System.out.println(word + " is not a palindrome");
        System.out.println("Is the list empty? " + words.isEmpty());
```

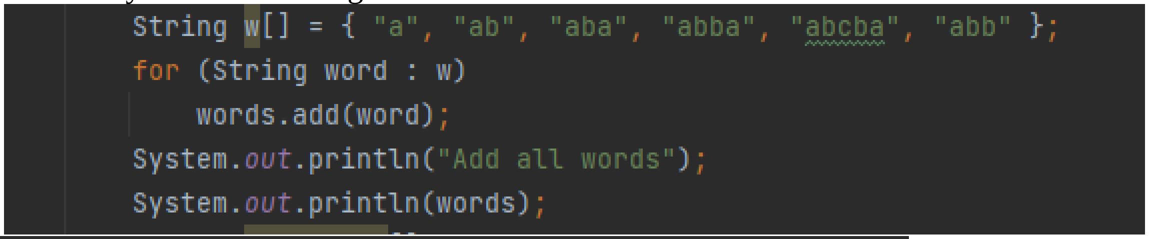
```java
        System.out.println("Number of aa in the list " + words.getFrequencyOf("aa"));
        System.out.println("Number of abb in the list " + words.getFrequencyOf("abb"));
        System.out.println("Add abb " + words.add("abb"));
        System.out.println("Number of abb in the list after adding one more " +
words.getFrequencyOf("abb"));
        System.out.println("Number of words in the list " + words.getCurrentSize());
        words.clear();
        System.out.println("Number of words in the list after clear " +
words.getCurrentSize());
        LinkedBag<String> words2 = (LinkedBag<String>) addAll(w);
        System.out.println("Is the list empty? " + words2.isEmpty());
        System.out.println("Number of aa in the list " + words2.getFrequencyOf("aa"));
        System.out.println("Number of abb in the list " +
words2.getFrequencyOf("abb"));
        System.out.println("Add abb " + words2.add("abb"));
        System.out.println("Number of abb in the list after adding one more " +
words2.getFrequencyOf("abb"));
        System.out.println("Number of words in the list " + words2.getCurrentSize());
        words2.clear();
        System.out.println("Number of words in the list after clear " +
words2.getCurrentSize());
        System.out.println("Are all palindromes? " + allPalindrome(w));
        System.out.println("Show all palindromes " + allPalindromes(w));
    }
}
```

```java
package assignment;
/*
 * I affirm that I have carried out the attached academic endeavors with full academic
honesty.
 * Manav Bilakhia (MB)
 */

import java.util.StringJoiner;

/**
 * A class of bags whose entries are stored in a chain of linked nodes. The bag
 * is never full.
 *
 * @author Frank M. Carrano
 * @author Timothy M. Henry
 * @version 5.0
 */
public final class LinkedBag<T>  implements BagInterface<T> {
    private Node firstNode; // Reference to first node
    private int numberOfEntries;

    /**
     * add: Adds a new entry to this bag.
     *
     * @param newEntry The object to be added as a new entry
     * @return True if the addition is successful, or false if not.
     */
    public boolean add(T newEntry)
    {
        Node newNode = new Node(newEntry);
        newNode.next = firstNode;
        firstNode = newNode;
        numberOfEntries++;
        return true;
    }
    /**
     * toArray: Retrieves all entries that are in this bag.
     *
     * @return A newly allocated array of all the entries in this bag.
     */
    public T[] toArray() {
        T[] result = (T[]) new Object[numberOfEntries];
        int index = 0;
        Node currentNode = firstNode;
        while ((index < numberOfEntries) && (currentNode != null)) {
            result[index] = currentNode.data;
            index++;
            currentNode = currentNode.next;
        }
        return result;
    }

    /**
     * isEmpty: Sees whether this bag is empty.
     *
     * @return True if this bag is empty, or false if not.
     */
    public boolean isEmpty() {
        return numberOfEntries == 0;
    }

    /**
     * getCurrentSize: Gets the number of entries currently in this bag.
     *
     * @return The integer number of entries currently in this bag.
     */
    public int getCurrentSize() {
        return numberOfEntries;
    }

    /**
     * remove: Removes one unspecified entry from this bag, if possible.
     *
     * @return Either the removed entry, if the removal was successful, or null.
     */
    public T remove() {
        T result = null;
        if (firstNode != null) {
            result = firstNode.data;
            firstNode = firstNode.next;
            numberOfEntries--;
        }
        return result;
    }

    /**
     * remove: Removes one occurrence of a given entry from this bag, if possible.
     *
     * @param anEntry The entry to be removed.
     * @return True if the removal was successful, or false otherwise.
     */
    public boolean remove(T anEntry) {
        boolean result = false;
        Node nodeN = getReferenceTo(anEntry);
        if (nodeN != null) {
            nodeN.data = firstNode.data;
            firstNode = firstNode.next;
            numberOfEntries--;
```

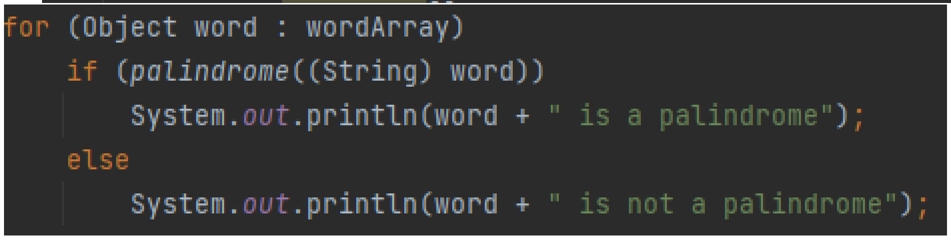
```java
            result = true;
        }
        return result;
    }

    /**
     * clear: Removes all entries from this bag.
     */
    public void clear() {
        while (!isEmpty()) {
            remove();
        }
    }

    /**
     * getFrequencyOf: Counts the number of times a given entry appears in this bag.
     *
     * @param anEntry The entry to be counted.
     * @return The number of times anEntry appears in this bag.
     */
    public int getFrequencyOf(T anEntry) {
        int frequency = 0;
        int counter = 0;
        Node currentNode = firstNode;
        while ((counter < numberOfEntries) && (currentNode != null)) {
            if (anEntry.equals(currentNode.data)) {
                frequency++;
            }
            counter++;
            currentNode = currentNode.next;
        }
        return frequency;
    }

    /**
     * contains: Tests whether this bag contains a given entry.
     *
     * @param anEntry The entry to locate.
     * @return True if the bag contains anEntry, or false otherwise.
     */
    public boolean contains(T anEntry) {
        boolean found = false;
        Node currentNode = firstNode;
        while (!found && (currentNode != null)) {
            if (anEntry.equals(currentNode.data)) {
                found = true;
            } else {
                currentNode = currentNode.next;
            }
        }
        return found;
    }

    /**
     * toString: Convert this bag to a String for displaying.
     * each item will be comma separated and a space after comma enclosed in [ and ]
     * if we have a b c d in the bag a is the most recent one and will be converted as
     * [a, b, c, d]. StringJoiner is a good option to use.
     */
    @Override
    public String toString() {
        StringJoiner joiner = new StringJoiner(", ", "[", "]");
        Node currentNode = firstNode;
        for (int index = 0; index < numberOfEntries; index++)
            joiner.add(currentNode.data.toString());
            currentNode = currentNode.next;
        return joiner.toString();
    }
    // getReferenceTo: Should be private so not written in Javadoc format
    // parameter is an entry of type T
    // Locates a given entry within this bag.
    // Returns a reference to the node containing the entry, if located,
    // or null otherwise.
    private Node getReferenceTo(T anEntry) {
        boolean found = false;
        Node currentNode = firstNode;
        while (!found && (currentNode != null)) {
            if (anEntry.equals(currentNode.data)) {
                found = true;
            } else {
                currentNode = currentNode.next;
            }
        }
        return currentNode;
    }

    // Node class: Should be private so not written in Javadoc format
    // A class that represents a Node with a data of type generic and
    // a Node type next link
    private class Node {
        // Private instance variables
        // Entry in bag
        // Link to next node
        private T data;
        private Node next;
        // Constructors.
        // Constructor with a data of type T
        public Node(T dataPortion) {
            this(dataPortion, null);
        }
        // Constructor with a data of type T and a next of type Node
        public Node(T dataPortion, Node nextNode) {
            data = dataPortion;
            next = nextNode;
        }
        // get/set methods

        public T getData() {
            return data;
        }

        public void setData(T data) {
            this.data = data;
        }

        public Node getNext() {
            return next;
        }

        public void setNext(Node next) {
            this.next = next;
        }
    } // end Node
} // end LinkedBag
```

C. Sample output 1

I. Describe your test 1: testing the add function



```
String w[] = { "a", "ab", "aba", "abba", "abcba", "abb" };
for (String word : w)
    words.add(word);
System.out.println("Add all words");
System.out.println(words);
```

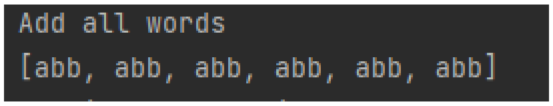


```
for (Object word : wordArray)
    if (palindrome((String) word))
        System.out.println(word + " is a palindrome");
    else
        System.out.println(word + " is not a palindrome");
```

II. Text output 1:

Add all words
[abb, abb, abb, abb, abb, abb]

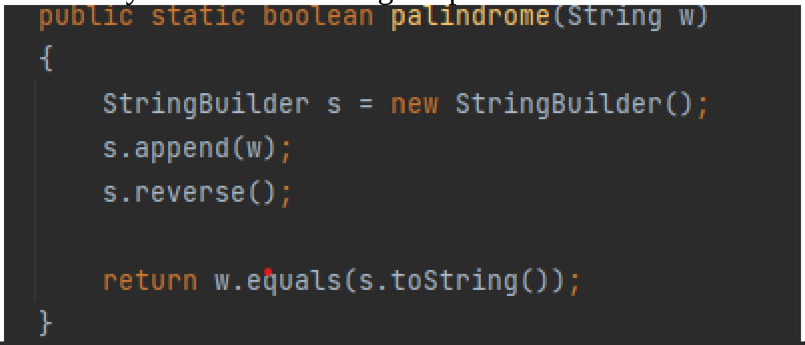
III. Screenshot 1:



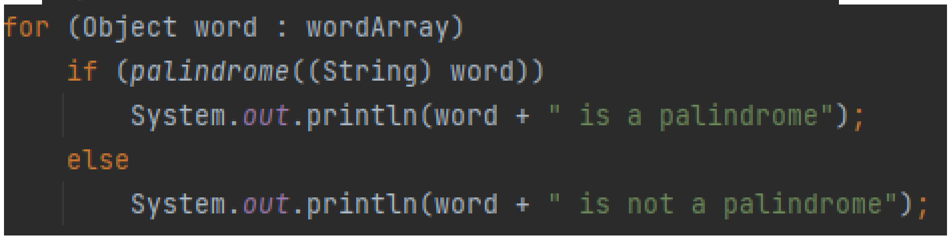
```
Add all words
[abb, abb, abb, abb, abb, abb]
```

D. Sample output 2

I. Describe your test 2: checking the palindrome method



```
public static boolean palindrome(String w)
{
    StringBuilder s = new StringBuilder();
    s.append(w);
    s.reverse();

    return w.equals(s.toString());
}
```



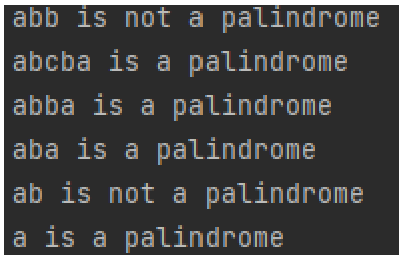
```
for (Object word : wordArray)
    if (palindrome((String) word))
        System.out.println(word + " is a palindrome");
    else
        System.out.println(word + " is not a palindrome");
```

II. Text output 2:

abb is not a palindrome
abcba is a palindrome
abba is a palindrome
aba is a palindrome
ab is not a palindrome

a is a palindrome

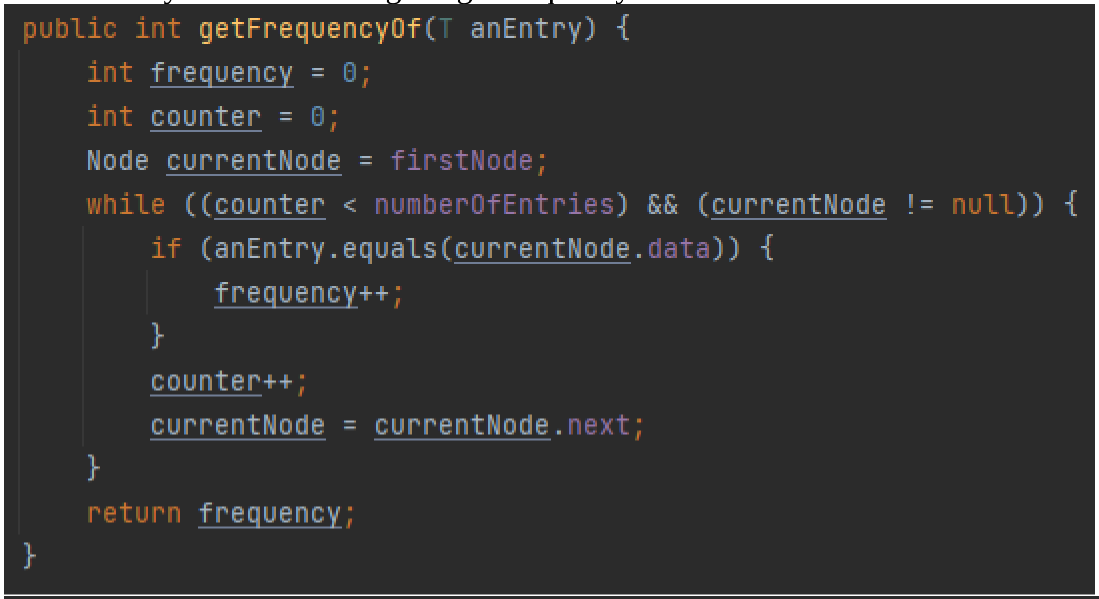
III. Screenshot 2:



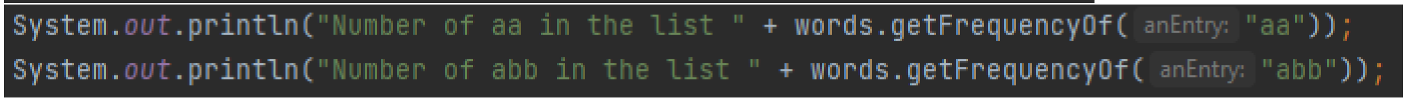
```
abb is not a palindrome
abcba is a palindrome
abba is a palindrome
aba is a palindrome
ab is not a palindrome
a is a palindrome
```

E. Sample output 3

I. Describe your test 3: testing the get frequency method



```java
public int getFrequencyOf(T anEntry) {
    int frequency = 0;
    int counter = 0;
    Node currentNode = firstNode;
    while ((counter < numberOfEntries) && (currentNode != null)) {
        if (anEntry.equals(currentNode.data)) {
            frequency++;
        }
        counter++;
        currentNode = currentNode.next;
    }
    return frequency;
}
```

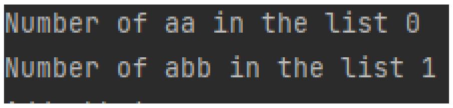


```java
System.out.println("Number of aa in the list " + words.getFrequencyOf( anEntry: "aa"));
System.out.println("Number of abb in the list " + words.getFrequencyOf( anEntry: "abb"));
```

II. Text output 3:

Number of aa in the list 0
Number of abb in the list 1

III. Screenshot 3:



```
Number of aa in the list 0
Number of abb in the list 1
```