

## 2018 AP<sup>®</sup> COMPUTER SCIENCE A FREE-RESPONSE QUESTIONS

2. This question involves reasoning about pairs of words that are represented by the following `WordPair` class.

```
public class WordPair
{
    /** Constructs a WordPair object. */
    public WordPair(String first, String second)
    { /* implementation not shown */ }

    /** Returns the first string of this WordPair object. */
    public String getFirst()
    { /* implementation not shown */ }

    /** Returns the second string of this WordPair object. */
    public String getSecond()
    { /* implementation not shown */ }
}
```

You will implement the constructor and another method for the following `WordPairList` class.

```
public class WordPairList
{
    /** The list of word pairs, initialized by the constructor. */
    private ArrayList<WordPair> allPairs;

    /** Constructs a WordPairList object as described in part (a).
     *   Precondition: words.length >= 2
     */
    public WordPairList(String[] words)
    { /* to be implemented in part (a) */ }

    /** Returns the number of matches as described in part (b).
     */
    public int numMatches()
    { /* to be implemented in part (b) */ }
}
```

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- (a) Write the constructor for the `WordPairList` class. The constructor takes an array of strings `words` as a parameter and initializes the instance variable `allPairs` to an `ArrayList` of `WordPair` objects.

A `WordPair` object consists of a word from the array paired with a word that appears later in the array. The `allPairs` list contains `WordPair` objects (`words[i]`, `words[j]`) for every `i` and `j`, where  $0 \leq i < j < \text{words.length}$ . Each `WordPair` object is added exactly once to the list.

The following examples illustrate two different `WordPairList` objects.

### Example 1

```
String[] wordNums = {"one", "two", "three"};
WordPairList exampleOne = new WordPairList(wordNums);
```

After the code segment has executed, the `allPairs` instance variable of `exampleOne` will contain the following `WordPair` objects in some order.

```
("one", "two"), ("one", "three"), ("two", "three")
```

### Example 2

```
String[] phrase = {"the", "more", "the", "merrier"};
WordPairList exampleTwo = new WordPairList(phrase);
```

After the code segment has executed, the `allPairs` instance variable of `exampleTwo` will contain the following `WordPair` objects in some order.

```
("the", "more"), ("the", "the"), ("the", "merrier"),
("more", "the"), ("more", "merrier"), ("the", "merrier")
```

Class information for this question

```
public class WordPair

public WordPair(String first, String second)
public String getFirst()
public String getSecond()

public class WordPairList

private ArrayList<WordPair> allPairs

public WordPairList(String[] words)
public int numMatches()
```

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Complete the `WordPairList` constructor below.

```
/** Constructs a WordPairList object as described in part (a).
 *   Precondition: words.length >= 2
 */
public WordPairList(String[] words)
```

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- (b) Write the `WordPairList` method `numMatches`. This method returns the number of `WordPair` objects in `allPairs` for which the two strings match.

For example, the following code segment creates a `WordPairList` object.

```
String[] moreWords = {"the", "red", "fox", "the", "red"};
WordPairList exampleThree = new WordPairList(moreWords);
```

After the code segment has executed, the `allPairs` instance variable of `exampleThree` will contain the following `WordPair` objects in some order. The pairs in which the first string matches the second string are shaded for illustration.

```
("the", "red"), ("the", "fox"), ("the", "the"),
("the", "red"), ("red", "fox"), ("red", "the"),
("red", "red"), ("fox", "the"), ("fox", "red"),
("the", "red")
```

The call `exampleThree.numMatches()` should return 2.

Class information for this question

```
public class WordPair

public WordPair(String first, String second)
public String getFirst()
public String getSecond()

public class WordPairList

private ArrayList<WordPair> allPairs

public WordPairList(String[] words)
public int numMatches()
```

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Complete method `numMatches` below.

```
/** Returns the number of matches as described in part (b).  
 */  
public int numMatches()
```