

2018

AP[®]

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AP Computer Science A

Free-Response Questions

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2018 AP[®] COMPUTER SCIENCE A FREE-RESPONSE QUESTIONS

COMPUTER SCIENCE A SECTION II

Time—1 hour and 30 minutes

Number of questions—4

Percent of total score—50

Directions: SHOW ALL YOUR WORK. REMEMBER THAT PROGRAM SEGMENTS ARE TO BE WRITTEN IN JAVA.

Notes:

- Assume that the interface and classes listed in the Java Quick Reference have been imported where appropriate.
- Unless otherwise noted in the question, assume that parameters in method calls are not `null` and that methods are called only when their preconditions are satisfied.
- In writing solutions for each question, you may use any of the accessible methods that are listed in classes defined in that question. Writing significant amounts of code that can be replaced by a call to one of these methods will not receive full credit.

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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()
```