3. The `StringChecker` interface describes classes that check if strings are valid, according to some criterion.

```
public interface StringChecker
{
    /** Returns true if str is valid. */
    boolean isValid(String str);
}
```

A `CodeWordChecker` is a `StringChecker`. A `CodeWordChecker` object can be constructed with three parameters: two integers and a string. The first two parameters specify the minimum and maximum code word lengths, respectively, and the third parameter specifies a string that must not occur in the code word. A `CodeWordChecker` object can also be constructed with a single parameter that specifies a string that must not occur in the code word; in this case the minimum and maximum lengths will default to 6 and 20, respectively.

The following examples illustrate the behavior of `CodeWordChecker` objects.

Example 1

```
StringChecker sc1 = new CodeWordChecker(5, 8, "$");
```

Valid code words have 5 to 8 characters and must not include the string `"$"`.

Method call	Return value	Explanation
`sc1.isValid("happy")`	`true`	The code word is valid.
`sc1.isValid("happy$")`	`false`	The code word contains `"$"`.
`sc1.isValid("Code")`	`false`	The code word is too short.
`sc1.isValid("happyCode")`	`false`	The code word is too long.

Example 2

```
StringChecker sc2 = new CodeWordChecker("pass");
```

Valid code words must not include the string `"pass"`. Because the bounds are not specified, the length bounds are 6 and 20, inclusive.

Method call	Return value	Explanation
`sc2.isValid("MyPass")`	`true`	The code word is valid.
`sc2.isValid("Mypassport")`	`false`	The code word contains `"pass"`.
`sc2.isValid("happy")`	`false`	The code word is too short.
`sc2.isValid("1,000,000,000,000,000")`	`false`	The code word is too long.

Write the complete `CodeWordChecker` class. Your implementation must meet all specifications and conform to all examples.

4. This question involves reasoning about arrays of integers. You will write two static methods, both of which are in a class named `ArrayTester`.

```
public class ArrayTester
{

    /** Returns an array containing the elements of column c of arr2D in the same order as
     *  they appear in arr2D.
     *  Precondition: c is a valid column index in arr2D.
     *  Postcondition: arr2D is unchanged.
     */
    public static int[] getColumn(int[][] arr2D, int c)
    {  /* to be implemented in part (a) */  }


    /** Returns true if and only if every value in arr1 appears in arr2.
     *  Precondition: arr1 and arr2 have the same length.
     *  Postcondition: arr1 and arr2 are unchanged.
     */
    public static boolean hasAllValues(int[] arr1, int[] arr2)
    {  /* implementation not shown */  }


    /** Returns true if arr contains any duplicate values;
     *          false otherwise.
     */
    public static boolean containsDuplicates(int[] arr)
    {  /* implementation not shown */  }


    /** Returns true if square is a Latin square as described in part (b);
     *          false otherwise.
     *  Precondition: square has an equal number of rows and columns.
     *                square has at least one row.
     */
    public static boolean isLatin(int[][] square)
    {  /* to be implemented in part (b) */  }

}
```

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Question 3: Code Word Checker

Class: `CodeWordChecker`	**9 points**

Intent: *Define implementation of a class to determine if a string meets a set of criteria*

+1 Declares header: `public class CodeWordChecker implements StringChecker`

+1 Declares all appropriate `private` instance variables

+3 Constructors

- **+1** Declares headers: `public CodeWordChecker(int __, int __, String __)` and `public CodeWordChecker(String __)`
- **+1** Uses all parameters to initialize instance variables in 3-parameter constructor
- **+1** Uses parameter and default values to initialize instance variables in 1-parameter constructor

+4 `isValid` method

- **+1** Declares header: `public boolean isValid(String __)`
- **+1** Checks for length between min and max inclusive
- **+1** Checks for unwanted string
- **+1** Returns `true` if length is between min and max and does not contain the unwanted string, `false` otherwise

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Question 3: Scoring Notes

Class `CodeWordChecker`			**9 points**
Points	Rubric Criteria	Responses earn the point if they…	Responses will not earn the point if they…
+1	Declares header: `public class CodeWordChecker implements StringChecker`	• omit keyword `public`	• declare class `private` • declare class `static`
+1	Declares all appropriate `private` instance variables		• declare variables as `static` • omit keyword `private` • declare variables outside the class
+3	Constructors		
+1	Declares headers: `public CodeWordChecker (int __, int __, String __)` and `public CodeWordChecker (String __)`	• omit keyword `public`	• declare method `static` • declare method `private`
+1	Uses all parameters to initialize instance variables in 3-parameter constructor		• fail to declare instance variables • initialize local variables instead of instance variables • assign variables to parameters
+1	Uses parameter and default values to initialize instance variables in 1-parameter constructor	• initialize instance variables to default values when declared	• fail to declare instance variables • initialize local variables instead of instance variables • assign variables to parameters
+4	`isValid` method		
+1	Declares header: `public boolean isValid (String __)`		• fail to declare method `public` • declare method `static`
+1	Checks for length between min and max inclusive		• fail to use instance variables • fail to declare the method header
+1	Checks for unwanted string		• fail to use instance variables • fail to declare the method header
+1	Returns `true` if length is between min and max and does not contain the unwanted string, `false` otherwise	• have incorrect checks for length and/or containment, but return the correct value based on those checks	• fail to declare the method header • fail to return in all cases • only check one substring location for containment

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Question 3: Code Word Checker

```
public class CodeWordChecker implements StringChecker
{
   private int minLength;
   private int maxLength;
   private String notAllowed;

   public CodeWordChecker(int minLen, int maxLen, String symbol)
   {
      minLength = minLen;
      maxLength = maxLen;
      notAllowed = symbol;
   }

   public CodeWordChecker(String symbol)
   {
      minLength = 6;
      maxLength = 20;
      notAllowed = symbol;
   }

   public boolean isValid(String str)
   {
      return str.length() >= minLength && str.length() <= maxLength &&
             str.indexOf(notAllowed) == -1;
   }

}
```

These canonical solutions serve an expository role, depicting general approaches to solution. Each reflects only one instance from the infinite set of valid solutions. The solutions are presented in a coding style chosen to enhance readability and facilitate understanding.