Write the entire `RandomStringChooser` class. Your implementation must include an appropriate constructor and any necessary methods. Any instance variables must be `private`. The code segment in the example above should have the indicated behavior (that is, it must compile and produce a result like the possible output shown). Neither the constructor nor any of the methods should alter the parameter passed to the constructor, but your implementation may copy the contents of the array.

Part (b) begins on page 4.

(b) The following partially completed `RandomLetterChooser` class is a subclass of the `RandomStringChooser` class. You will write the constructor for the `RandomLetterChooser` class.

```
public class RandomLetterChooser extends RandomStringChooser
{
   /** Constructs a random letter chooser using the given string str.
    *  Precondition: str contains only letters.
    */
   public RandomLetterChooser(String str)
   {  /* to be implemented in part (b) */  }

   /** Returns an array of single-letter strings.
    *  Each of these strings consists of a single letter from str. Element k
    *  of the returned array contains the single letter at position k of str.
    *  For example, getSingleLetters("cat") returns the
    *  array { "c", "a", "t" }.
    */
   public static String[] getSingleLetters(String str)
   {  /* implementation not shown */  }
}
```

The following code segment shows an example of using `RandomLetterChooser`.

```
RandomLetterChooser letterChooser = new RandomLetterChooser("cat");
for (int k = 0; k < 4; k++)
{
   System.out.print(letterChooser.getNext());
}
```

The code segment will print the three letters in `"cat"` in one of the possible orders. Because there are only three letters in the original string, the code segment prints `"NONE"` the fourth time through the loop. One possible output is shown below.

```
actNONE
```

Assume that the `RandomStringChooser` class that you wrote in part (a) has been implemented correctly and that `getSingleLetters` works as specified. You must use `getSingleLetters` appropriately to receive full credit.

Complete the `RandomLetterChooser` constructor below.

```
/** Constructs a random letter chooser using the given string str.
 *  Precondition: str contains only letters.
 */
public RandomLetterChooser(String str)
```

2. This question involves two classes that are used to process log messages. A list of sample log messages is given below.

```
CLIENT3:security alert – repeated login failures
Webserver:disk offline
SERVER1:file not found
SERVER2:read error on disk DSK1
SERVER1:write error on disk DSK2
Webserver:error on /dev/disk
```

Log messages have the format *machineId*:*description*, where *machineId* identifies the computer and *description* describes the event being logged. Exactly one colon (":") appears in a log message. There are no blanks either immediately before or immediately after the colon.

The following `LogMessage` class is used to represent a log message.

```
public class LogMessage
{
   private String machineId;
   private String description;

   /** Precondition: message is a valid log message. */
   public LogMessage(String message)
   {  /* to be implemented in part (a) */  }

   /** Returns true if the description in this log message properly contains keyword;
    *          false otherwise.
    */
   public boolean containsWord(String keyword)
   {  /* to be implemented in part (b) */  }

   public String getMachineId()
   {  return machineId;  }

   public String getDescription()
   {  return description;  }

   // There may be instance variables, constructors, and methods that are not shown.
}
```

This question uses two classes, a `Square` class that represents an individual square in the puzzle and a `Crossword` class that represents a crossword puzzle grid. A partial declaration of the `Square` class is shown below.

```
public class Square
{
    /** Constructs one square of a crossword puzzle grid.
     *  Postcondition:
     *    - The square is black if and only if isBlack is true.
     *    - The square has number num.
     */
    public Square(boolean isBlack, int num)
    {  /* implementation not shown */  }

    // There may be instance variables, constructors, and methods that are not shown.
}
```

A partial declaration of the `Crossword` class is shown below. You will implement one method and the constructor in the `Crossword` class.

```
public class Crossword
{
    /** Each element is a Square object with a color (black or white) and a number.
     *  puzzle[r][c] represents the square in row r, column c.
     *  There is at least one row in the puzzle.
     */
    private Square[][] puzzle;

    /** Constructs a crossword puzzle grid.
     *  Precondition: There is at least one row in blackSquares.
     *  Postcondition:
     *    - The crossword puzzle grid has the same dimensions as blackSquares.
     *    - The Square object at row r, column c in the crossword puzzle grid is black
     *      if and only if blackSquares[r][c] is true.
     *    - The squares in the puzzle are labeled according to the crossword labeling rule.
     */
    public Crossword(boolean[][] blackSquares)
    {  /* to be implemented in part (b) */  }

    /** Returns true if the square at row r, column c should be labeled with a positive number;
     *          false otherwise.
     *  The square at row r, column c is black if and only if blackSquares[r][c] is true.
     *  Precondition: r and c are valid indexes in blackSquares.
     */
    private boolean toBeLabeled(int r, int c, boolean[][] blackSquares)
    {  /* to be implemented in part (a) */  }

    // There may be instance variables, constructors, and methods that are not shown.
}
```

Part (a) begins on page 14.

(a) Write the `Crossword` method `toBeLabeled`. The method returns `true` if the square indexed by row `r`, column `c` in a crossword puzzle grid should be labeled with a positive number according to the crossword labeling rule; otherwise it returns `false`. The parameter `blackSquares` indicates which squares in the crossword puzzle grid are black.

Class information for this question

```
public class Square

public Square(boolean isBlack, int num)

public class Crossword

private Square[][] puzzle

public Crossword(boolean[][] blackSquares)
private boolean toBeLabeled(int r, int c, boolean[][] blackSquares)
```

WRITE YOUR SOLUTION ON THE NEXT PAGE.

Complete method `toBeLabeled` below.

```
/** Returns true if the square at row r, column c should be labeled with a positive number;
 *          false otherwise.
 *  The square at row r, column c is black if and only if blackSquares[r][c] is true.
 *  Precondition: r and c are valid indexes in blackSquares.
 */
private boolean toBeLabeled(int r, int c, boolean[][] blackSquares)
```

Part (b) begins on page 16.