SE375 SYSTEM PROGRAMMING SPRING 2023-2024
Laboratory Assignment 03
March 13-14, 2024

Text Manipulation with Threads and Synchronization

Your task is to modify your Java application from last lab to make it use "synchronized" keyword. Its overall purpose is to only allow one thread at a time into a particular section of code thus allowing us to protect, for example, variables or data from being corrupted by simultaneous modifications from different threads. Other than this, your application will do the same as before. Transformations on the content is as follows as a reminder:

1. Make all characters in the file upper case or lower case (caseThread)
2. Encrypt the file by shifting characters by a specified amount(e.g. a→b if the shift amount is 1) (shiftThread)
3. Color the file red or yellow. (colorThread)

Before these transformations, the program will ask the user to enter input values

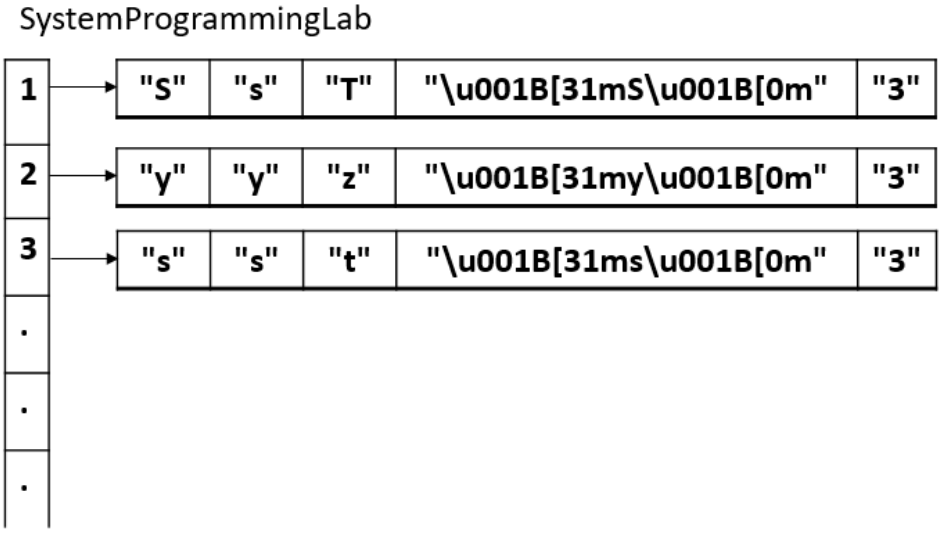
1. U for upper case, L for lower case
2. The shift amount. A value from 1 to 3
3. R for red, Y for yellow.

Your program will read the file character by character and construct a Hash structure in which the key will be integer index of the character in the file and the value would be an array of four elements, which holds the original value, upper or lower case value, the shifted value and the color code. These are kept as Strings.

NEW: The hash structure is now updated as follows: Each array is now going to contain 1 more element. This extra element is going to keep the total number of transformations applied to that character. Each thread, after completing the transformation, is going to update this new element.

Example

If the file contains SystemProgrammingLab the hash structure will look like this for the following user input:
`L,1,R`



Please read below for the meaning of strings "\u001B[31m" and "\u001B[0m". They are used to color a string.

Here's a sample run for a file that contains the text SystemProgrammingLab

```
Please state your choice...
UPPER case or lower case (U or L):
U
Please state your choice...
How many characters to shift (number between 1-3):
1
Please state your choice...
Color of characters (R or Y):
R
Original
SystemProgrammingLab
After Case Change
SYSTEMPROGRAMMINGLAB
After Shift
TztufnQsphsbnnjohMbc
After Color Change
SYSTEMPROGRAMMINGLAB
Number of Transformations
[3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3]
```

You will be evaluated by your usage of data structures and application of algorithms.

How to Color a String

```
public class lab1 {

    public static final String ANSI_RESET = "\u001B[0m";
    public static final String ANSI_RED = "\u001B[31m";
    public static final String ANSI_YELLOW = "\u001B[33m";

    public static void main(String [] args) {
       String x = "SYSTEM";

       System.out.println(x);

       x = new String(ANSI_RED + "SYSTEM" + ANSI_RESET);

       System.out.println(x);


    }
}
```

Output:

SYSTEM
SYSTEM