SE375 SYSTEM PROGRAMMING SPRING 2023-2024
Laboratory Assignment 05
March 27-28, 2024

Multi-threaded text manipulation using Locks

Your task is to modify your Java application from last lab's part 3 to make it use Java Locks. Like "synchronized" keyword, Locks also allow threads to enter critical section one at a time thus allowing us to protect, for example, variables or data from being corrupted by simultaneous modifications by different threads. Other than this, your application will do the same as before. You will use Locks in the transformation threads individually.

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)

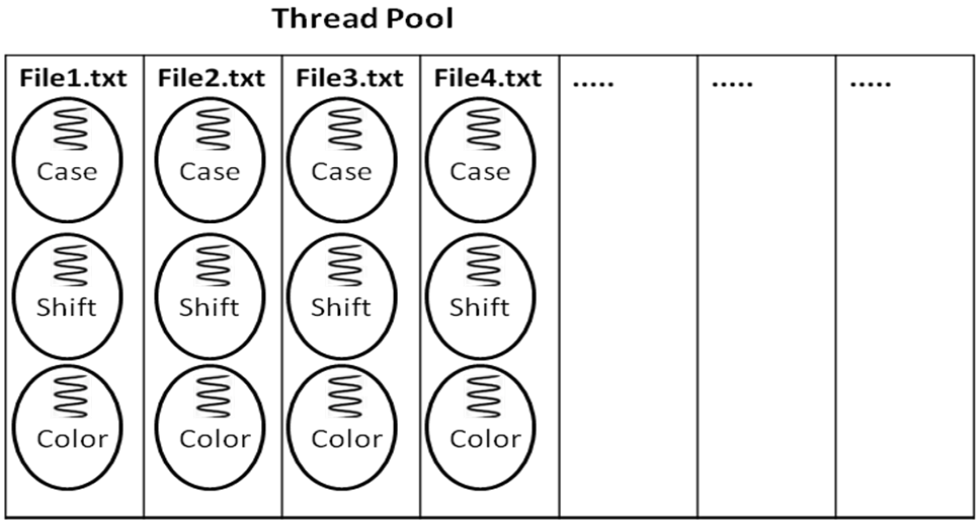
Each thread will also update the total number of transformations applied to that character after completing their task. (Similar to Lab 3)

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.

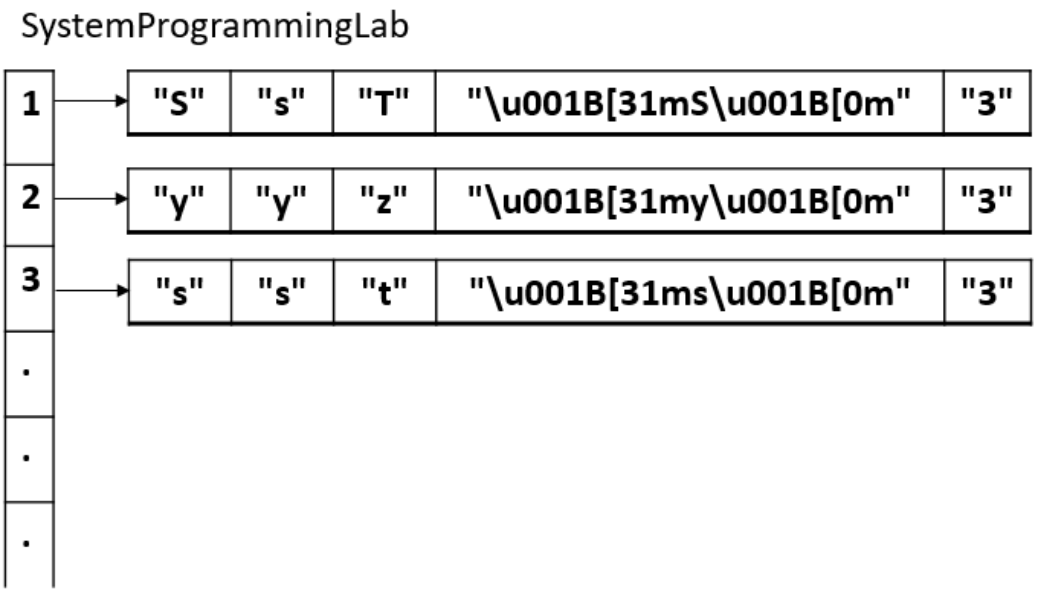
Your program will utilize thread pools to read various number of files. Each thread from the pool will read a file character by character and construct a Hash structure in which the key will be integer index of the character in the file and the value would be an array of five elements, which holds the original value, upper or lower case value, the shifted value, the color code and the number of transformations. These are kept as Strings. Then, transformations are done by individual threads (caseThread, shiftThread and colorThread) created and run by the thread which read the file.

- Whole system should work like this -



Individual threads in the thread pool should work described as below:

If File1.txt contains System Programming Lab the hash structure will look like this for the following user input:
L,1,R



Please read below for the meaning of stings "\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