Assignment Set 1 (Concurrent programming)

- **Assignments will be evaluated by the TAs.**
- **You should submit report (for answering non-code related questions), complete source codes and executable files.**
- **All codes must be properly documented and good code writing practice should be followed (carry marks).**
- **Copying is strictly prohibited. Any case of copying will automatically result in F for the whole course, irrespective of your performance in the other parts of the lab.**

- **Submission deadline: 16th September, 2018**

- **Total weight = 20%**

- **Marks distribution: 20, 30, 50**

Problem 1 – Sock Matching

There is a heap of new labelled socks. Each sock is having one of four colours: white, black, blue and grey. There are several robotic arms which can pick up a single sock at a time and pass it to a *matching machine*. The matching machine is able to find two socks of the same colour and pass the pair of socks to a *shelf manager* robot. The shelf manager robot then puts the pair of socks to the appropriate shelf.

Write a java program to simulate the sock sorting system. Write a brief report highlighting the following.

1. The role of concurrency and synchronization in the above system.
2. How you handled it?

Problem 2 – Data Modification in Distributed System

The evaluation process of the B.Tech final year students is going to be conducted for the Programming Lab. The evaluation will be done by the course coordinator (CC) and two teaching assistants (TA1, TA2) of the department. A file (named Stud_Info.txt) is used to record the students' data with the following fields (shown along with some sample data).

Roll No	Name	Mail_id	Marks	Teacher
174101055	Amit Kumar Sharma	amit55@iitg.ac.in	75	TA1
174101012	Abdul Najim	abdul12@iitg.ac.in	29	TA2
174101058	Kunal Kishore	Kunal58@iitg.ac.in	67	TA2
174101033	Subhra Shivani	subhra33@iitg.ac.in	53	CC
174101035	Savnam Khatam	savanam35@iig.ac.in	88	TA1

File entries are made based on the following assumptions.

Assumptions:

1. The file can be updated by TA1, TA2 or CC.
2. CC is having higher priority than TA1 and TA2.
3. TA1 and TA2 is having equal priorities, i.e. If TA1 is modifying a field of a record, it can be modified by TA2 later and vice versa.
4. If CC is modifying any data, that can only be modified by CC later and not by any TAs.
5. The file can be assessed by TA1, TA2 or CC simultaneously.
6. There can be negative marks for students.

You are asked to write a Java program for the evaluation system. The system should be able to perform the following.

a) Allow the CC, TA1 and TA2 to update the Stud_Info.txt.
b) Should be able to generate a file containing all the students data in sorted order based on the **Roll No**. Call this file Sorted_Roll.txt.
c) Should be able to generate a file containing all the students data in sorted order based on the **Name**. Call this file Sorted_Name.txt.

Your program should allow the updating of Stud_Infor.txt at two levels: *record level* and *file level*.

a) **Record level modification example**: If the mark of Amit Kumar Sharma is modified from 75 to 80 by TA2 and TA1 want to decrease the mark by 3, the sorted files should contain the 77 mark for Amit.
b) **File level modification example**: If the mark of Kunal Kishore is modified from 67 to 70 by TA1 and TA2 want to decrease the value by 5 mark for Savnam (88 to 83), both should be reflected in the sorted files.

Along with the Java program, submit a report answering the following.

1. Why concurrency is important here?
2. What are the shared resources?
3. What may happen if synchronization is not taken care of? Give examples.
4. How you handled concurrency and synchronization? (**you must use a different synchronization technique than you used in Q1)?**

Problem 3 – Room Delivery Service of Tea/Snacks.

Suppose the tea stall of IITG Core-II is planning for "room delivery" service for the CSE, EEE, and DD faculty members and students. Write a program in java to build the system keeping in mind the following things:

a. A person can order tea, coffee, cookies, snacks etc., from a list of items online mentioning her/his lab/room.
b. Availability and expected time for delivery will be shown instantly after the order is placed.

c. Assume that
    i. Tea/coffee should never be unavailable.
    ii. Time required to prepare a cup of tea/coffee is 1 minute.
    iii. Time required to deliver the order is 2 minutes.
    iv. Stock of cookies, snacks, packaged food etc. is limited (e.g., 100 packets). When stock reaches its minimum threshold value (e.g., 10), that item should be enlisted to the purchase list to maintain the stock.
    v. Multiple customers can place order at the same time.
    vi. All the items for a particular order should be delivered together.
    vii. Order should be delivered in FCFS manner.
d. An invoice should be generated mentioning the order details with price.
e. A sales list should be prepared with date, name of the customer, item, rate, quantity, and price. The total amount of sales (daily, monthly and for a particular period) should also be prepared.

Note that the program requires you to have idea on the following Java packages, in addition to the package required for concurrency.

1. The Swing package to make the interface for placing orders online.
2. The Java networking package to implement the online system (with clients and server).

Learn about the packages. Also submit a report on the following.

a) What role concurrency plays here?
b) Do we need to bother about synchronization? Why? Illustrate with example.
c) How you handled both ((**you must use a different synchronization technique than you used in Q1 and Q2)?**