# CS431: Programming Languages Lab Assignment Set I

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## ❖ Sock Matching Robot:

### I. The role of concurrency and synchronization in the above system.

Concurrency:
The given system has multiple robotic arms which are running concurrently, and the other two machines are simultaneously coordinating with them.

Synchronization:
No two robotic arms should pick up the same sock. We also need synchronization when multiple robotic arms want to pass their sock to the Matching machine at the same time. The Matching machine should synchronously take socks from robotics arms, store them and pass to the Shelf Manager.

### II. How did you handle it?

Concurrency:
By using multiple threads, one for each robotic arm, one for matching machine and one for shelf manager to ensure all of them function simultaneously.

Synchronization:
For synchronization, I used the keyword **'synchronized'** from Java libraries which allows only one thread to access that method or block to which it is attached. For the Matching machine and Shelf manager, we need synchronization when updating their member variables. So, I attached the **'synchronized'** keyword in both methods which are run by different threads, of both the classes. So, both methods will lock the same monitor. Therefore, both methods can't simultaneously be executed on the same object from different threads.

## ❖ Data Modification in Distributed System:

### I. Why concurrency is important here?

Since the evaluation system needs to be accessed by multiple users simultaneously, concurrency is quite important in such distributed systems. While one user is accessing, the other cannot be kept waiting for his turn, it will make the system/software quite less scalable.

### II. What are the shared resources?

The shared resources include the file in which data of students is stored. It is common for all the users, so, all the reads and writes should be carefully handled for them. Shared reading should be there.

### III. What may happen if synchronization is not taken care of? Give examples.

If synchronization is not taken care of, it may result in inconsistent data.
Each write to the file should be synchronized as multiple users may try to make changes in the file at the same time.

Ex: When one user tries to add a record in the file and the other just wants to change a field, and they both try to write simultaneously, in the result the changes by user 2 may get lost or even the new record by user 1 may get lost.

### IV. How you handled concurrency and synchronization?

Concurrency:
Different users can access the system by running their own version of the program, making it a distributed system. In the real version, the file should be placed at a server accessed by all users.

Synchronization:
Synchronization is handled by using **FileChannel** and **FileLock** which allows us to lock files in exclusive mode for writes and shared mode for reads. These locks help to synchronize the process of modifying the shared file.