Assignment 1
Concurrent Programming

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Sock Matching :

1. The role of concurrency and synchronization in the above system.

Here we have a sock makers which makes socks concurrently and puts in a sock queue(unsorted sock queue) from which multiple robotic arms pick socks and put them in matching queue from which matcher matches the socks and places the matched pairs in sorted sock queue from which shelf manager puts them in shelf.

Role of concurrency:

Concurrency here is required for sock makers to make socks concurrently and dump in unsorted sock queue and multiple robotic arms to pick socks from unsorted sock queue.

Role of synchronization:

Synchronization is required on unsorted sock queue as multiple arms are picking the socks concurrently. If multiple matchers are used then we require synchronization on matching queue as well.

2. How you handle it?

Handling Concurrency:

We created multiple sock maker threads where task of each is make socks and put in unsorted sock queue and also multiple robotic arm threads where task of each thread is to pick up socks from unsorted sock queue.

Handling Synchronization:

Here have used blocking queue to handle synchronization on unsorted sock queue and matching queue if multiple matchers are used.

Data Modification in Distributed Systems :

1. Why concurrency is important here?

We require concurrency for multiple systems to access and edit the shared resources.

2. What are the shared resources?

Resources which are being used by multiple threads simultaneously. Here we can either use record as shared resource or file as shared resource.

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

If synchronization not handled the resource would behaviour may be different for same input. There would be uncertainty in resource.
Example: Let's take a student : XYZ whose marks are 10
If synchronization is not taken care of and if both systems simultaneously increase value by 5. Final marks of XYZ should be 20 but here both accessed initial marks as 10 both of them would compute final value to 15 and save. XYZ marks should have been 20 but it is 15 which isn't correct.

4. How you handled concurrency and synchronization?

Handling Concurrency:

We created thread for each system to access/edit the resource concurrently.

Handling Synchronization:

We used ReentrantLock and synchronized block to handle synchronization. Synchronized block is a piece of code which can be executed only by one of the multiple threads at a particular time. The ReentrantLock class implements the lock interface and provides synchronization methods while accessing shared resources.

Room Delivery Service of Tea and Snacks:

1. What role concurrency plays here?

Multiple clients need to be able to place their order simultaneously. The tea maker and coffee maker concurrently make tea and coffee respectively and also delivery.

2. Do we need to bother about synchronization? Why? Illustrate with example

The operations on items in the inventory are to be synchronized.

Example:

Suppose there 5 chip packets and two clients simultaneously placed order for 5 chips each. If synchronization is not handled each order thread would check availability and it accept order though it actually shouldn't accept both as there are only 5 packets if synchronization is handled only one would be accepted.

3. How you handled both?

Handling Concurrency:

Multithreading in case of orders. Each order runs on a thread. It is same with tea and coffee makers.

Handling Synchronization:

We used synchronized blocks to handle synchronization in this problem. Synchronized block is a piece of code which can be executed only by one of the multiple threads at a particular time.