CS: 431 Programming Language Lab

Assignemnt 1

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a) **The role of concurrency and synchronization in the above system**:
Concurrency: There are multiple robotic arms are working Simultaneously which can take sock concurrently from the heap and pass it for further processing. Similarly sock matcher and shelf manager are also working with the robot arms.
Synchronization: There are multiple arms working together so they can execute at the same time or can access same sock. 2 Arms can take 1 sock which will not be synchronized so we have to make some mechanism by which only 1 robot arm picks up a given sock. So, picking of the sock should be synchronized. Also, at the shelf manager and Matching Machine multiple robots should also be synchronous. Arrangement of socks into pair at shelf should be synchronous with robotic arms.

b) **How did you handle it?**
Concurrency: This can be handled by multithreading. A specific thread is working for each robotic arm.
Synchronization: Synchronization is achieved by using block Synchronization. Only one thread has access to the heap, it chooses the sock and free the heap. Since I have to make changes to the heap when I am taking a sock so that it is unavailable for further access for this I have to make sure that the heap is accessible to only 1 thread for some time, after given changes thread release the heap.

2.

a) Why concurrency is important here:
Concurrency: Since CC, TA1, TA2 are updating marks simultaneously, so it is important to make system concurrent so that if 1 of the teacher is updating marks then, other do not have to wait for him to finish. Concurrency is required for them to work independently and simultaneously.

b) **What are shared resources?-** Here the files containing the marks of students are shared resources. These are to be handled carefully.

c) **What may happen if synchronization is not taken care of? Give examples.:** There will be some problem in concurrency there might be some error in updation of marks. Since threads for each teacher is working independently so there might be some problem in updation.
Example: Student1's initial marks = 20
      update-1: TA1 increasing Student1's marks by 20
      update-2: TA2 increasing Student1's marks by 20

Now if they both update this respectively, Since no teacher has written back yet, So TA2 will see students marks as 20 initially(Since both the teachers have open session and none of them has saved the file) So when he write back, student marks will be 40 , but marks should be 60 since both teachers have added 20 marks. So here the update 1 will not have any effect.

d) How you handled concurrency and synchronization?
Concurrency: Concurrency is handled by multithreading. A specific thread is created for each teacher (CC, TA1, TA2), which are to be executed concurrently.
Synchronization: I used Semaphores for each record so that record will be accessible for only 1 teacher at a time.

3. I have done all the working that was asked in the Assignment. I have made necessary changes in the GUI such that no function key will be highlighted until atleast 1 number key is present. Do not Process divide by 0. And other necessary changes. I have handled Concurrency by creating another thread which will sleep and awake at different intervals.