CS 431
Programming Languages Lab
Assignment 1

Anubhav Tyagi

170101009

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Q2

a

Concurrency is the ability of different parts or units of a program, algorithm, or problem to be executed out-of-order or in partial order, without affecting the final outcome. This allows for parallel execution of the concurrent units, which can significantly improve overall speed of the execution in multi-processor and multi-core systems. In more technical terms, concurrency refers to the decomposability property of a program, algorithm, or problem into order-independent or partially-ordered components or units.
In the given problem, concurrency is important to allow multiple users to access the data in files simultaneously . that is, multiple users can red the data simultaneously.If concurrency is not guaranteed in this problem, then only single user can access the data at a single time which would decrease the throughput

b

Shared Resources refer to computer data, information, or hardware devices that can be used or accessed by multiple processes over the period of their execution. In the given problem, for example, the shared resources are 3 text files named : Stud_info.txt, Sorted_roll.txt and Sorted_name.txt.

c

If synchronization is not taken care of, then the following cases may arise :

- When one process is reading from a file, another process may write to the same file. For example if TA1 want to decrease the current marks of some student by 3. While TA1 is reading from file to retrieve the current marks of the student, TA2 changes the marks of the same student, thus TA1 will read the changed value and then the updation will result in incorrect marks for that particular student.

- When one process is writing to a file, another process may try to write at the same time, thus producing incorrect values at the same time.Suppose Course Coordinator is writing marks for a student and at the same time TA1 tries to edit the marks

of the same student, then because of race condition, the marks written by TA1 could overwrite that written by Course Coordinator which is something we don't want.

d

In the given problem, concurrency and synchronization were handled with the help of **locks**. There are two types of locks that are used :

- **Shared Lock** : Shared lock is used for reading from file. A shared lock can be held by multiple processes at the same time.Processes holding shared lock for a file can simultaneously read from the file but not write to the file since that may create synchronization issues.Also if another process is writing to the file, then no other process can get the shared lock for the file.
- **Exclusive Lock** : Exclusive lock is used for writing to a file. As the name suggests, exclusive lock is not shared among processes, that is, the process holding the exclusive lock has exclusive access to the resource which in this case is a file.If processes need to write to a file, they need to have an exclusive lock for the file.If any other process is reading from the file, then the process must wait until all reading processes release their shared lock before getting exclusive lock for the file.