# Question no 1 : Professor-Student Problem

Synchronization Using PThreads

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Brief problem statement : There is a professor and a set of students. Every student wants to ask a set of questions to the professor. Professor can answer only one student at a time. Implement the mechanism without conflicts and print appropriate messages tracing order of execution.

Solution :
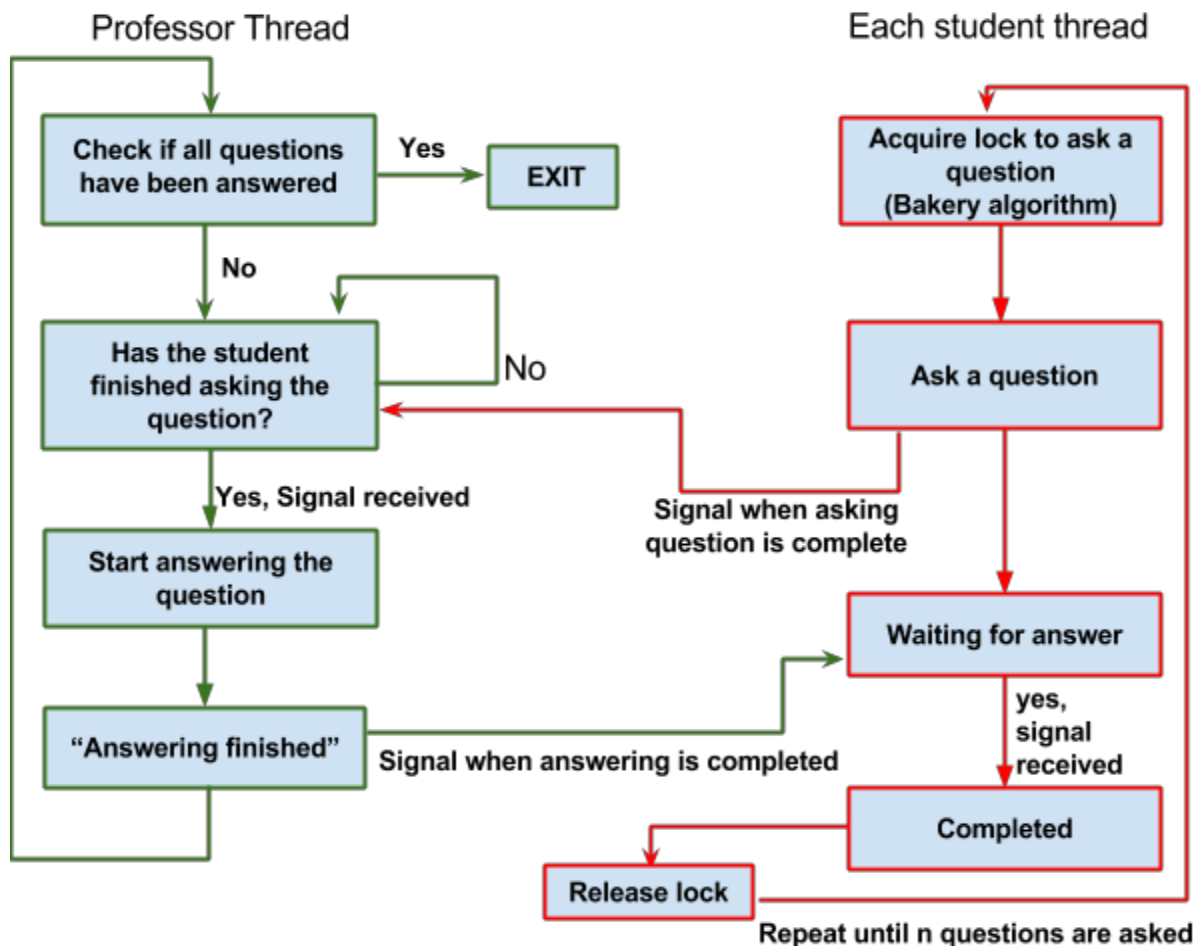
Solution Description : To resolve the contention between student threads, bakery algorithm has been implemented. The student thread with the least token will get the chance to ask the question first, others will wait for their turn. When there are no other threads with lesser token numbers in the system, a thread gets its turn to ask a question. Rest of the execution is as per the flow chart shown above. After getting the answer for a question, the student releases the lock. For each question a student wants to ask, separate locks has to be acquired, thereby avoiding race conditions and bringing fairness into the system as whole. Mutexes have been used to safeguard shared variables. Conditional variables have been used to implement the *wait-signal* mechanism, as required.

Parallelism : The professor thread and student threads are spawned in parallel. Professor can answer only one question at a time, so effectively, one thread asks one question at a time, everyone else waits in queue with their questions.

Assumption Made : It is said in problem statement that every questions take 1 unit time to ask and professor takes anywhere between 2 to 15 time units to answer a question. We have assumed one unit of time as 10ms in the implementation.

Sample Output :

> Creating Professor thread
>
> Professor is ready to answer
>
> Student 4 is ready to ask a question
>
> Student 4 is asking question no 1
>
> Professor is answering Question no 1 from Student 4
>
> Professor finished answering Question no 1 from Student 4
>
> Student 4 finished with question no 1
>
> Professor is ready to answer
>
> All threads created. 1 - Prof & 25 - Students

Student 6 is ready to ask a question

Student 6 is asking question no 1

Professor is answering Question no 1 from Student 6

Professor finished answering Question no 1 from Student 6

Student 6 finished with question no 1

Professor is ready to answer

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Professor is ready to answer

Student 9 is ready to ask a question

Student 9 is asking question no 10

Professor is answering Question no 10 from Student 9

Professor finished answering Question no 10 from Student 9

Student 9 finished with question no 10

All questions answered.

STATS : 250 questions from 25 students answered.

Professor is calling it a day...