**Deadline: 15 May, 2020**

**Q1)**

Write a detail note on mutex. How it works. (explain with the help of example)

**Q2)**

Write a simple program that create two threads sender and receiver. The sender thread send a message string to receiver thread. This program uses semaphore so as to achieve synchronization.

**Q3)**

Write a simple program that create two threads sender and receiver. The sender thread send a message string to receiver thread. This program uses condition variables to achieve synchronization.

**Q4)**

Write a program that contains 3 threads. Each thread increment the global variable and then adds that value to the result which is another global variable. Initialize result and other variable with 0. Output the final value of result and the other global variable. (Synchronize the code so that result does not contains the inconsistent)

**Q5)**

Suppose, you have a bank account with some balance amount Rs. 100. It is not enough to meet one month expenditure, so you asked your dad and brother and cousin to deposit some money in your account. Now, suppose your dad, brother and cousin all tried to deposit money at the same time. To serve their request, server process creates three threads, one for each to let them deposit money. Suppose, to deposit money, thread updates account balance as follows –

1. OldBalance = your\_account.balance

2. NewBalance = OldBalance + depositedAmount

3. your\_account.balance = NewBalance

Now in your dad, brother and cousin’s case they started depositing money at the same time so all threads take OldBalance = 100. All threads do calculation of NewBalance separately as

thread(1) NewBalance = 100 + 10000 ——> dad deposited Rs. 10000.

thread(2) NewBalance = 100 + 5000 ——–> brother deposited Rs. 5000.

thread(3) NewBalance = 100 + 5500 ——–> brother deposited Rs. 5500.

Now suppose thread(2) updates your account balance as Rs. 5100, and just after that thread(1) updates your account balance to Rs. 10100. During updating thread(1) and thread(3), thread three(3) also run on the same time and it will set new balance to Rs. 5600. So, your final account balance is Rs. 5600. So, in effect, the money deposited by your brother and dad hasn’t been credited into your account. Implement the above scenario using mutex(this is why we need synchronization mechanisms).