National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Operating Systems**	**Course Code:**	**CS 2006**
Program:	**BS(CS)**	**Semester:**	**Spring 2024**
Section:	**F,G,H**	**Total Marks:**	**75**
Assignment:	**3**	**Pages**	**(4)**
Due Date:	**23 April, 2024**		

Important Instructions:

1. Submit each question file named as your roll number along with the question number., i.e., 22L-1111_Q1.c. DO NOT ZIP YOUR FILES.
2. You are not allowed to copy solutions from other students. We will check your code for plagiarism using plagiarism checkers. If any sort of cheating is found, heavy penalties will be given to all students involved.
3. Late submission of your solution is not allowed.

Question 1: Online Movie Ticketing system[40 marks]

You are to devise an online ticketing system using **shared memory** between server-client programs. The user can see movie names and their show time through client systems and book their ticket. Whenever a client comes, the server will show a welcoming message on client's screen along with available movies in following way

```
----------Welcome to Movie World----------
In theaters:
    [1] Donkey King
    [2] Avengers
    [3] Bohemian Rhapsody
    [4] Halloween
    [5] First Man
```

The client will select a movie by sending the movie number in reply along with the number of tickets in the following format.

2 4 (i.e. book 4 tickets for movie Avengers.)

One user can book many tickets. However, tickets should be available. The server will check the availability of movies and number of seats. If anything is not available print relevant messages. In case of successful reservation, send the total bill (assume ticket price for each show is the same i.e. 500 per ticket) to the user/client. Client will print and display the following message.

“Your Total Bill for the show Avengers is 2000.Rs”

“Press y to proceed or press n to cancel”

If the user presses “y”, the server will decrease the number of tickets from the “movieTicketsInfo.txt” file. If there are no more tickets for a show then remove that show entry from the file. After successfully decreasing the number of tickets from the server side, the server will ask to enter the CNIC (assuming a 4 digit number), movie number along with reserved tickets. The server will save the data in “BookingRecord.txt” then will send a message “Reservation Done” or if any error occur then send message “Reservation cancel”

Note: All clients are handled simultaneously but in Decrease ticket functionality only one client should be allowed at a time. (Assuming only one client can alter ticket number)

movieTicketsInfo.txt BookingRecord.txt

5 1/Donkey King/500 2/Avengers/300 3/Bohemian Rhapsody/300 4/Halloween/400 5/First Man/500	4 1990/2/4 6667/4/4 7865/4/6 5849/2/3

Make use of semaphores for synchronization of client and server.

Please note the file manipulation is to be done through system calls only(open,read,write etc). There will be no credit if any other file manipulation method is used such as ofstream/ ifstream/ fscanf/ fgets/ fprintf/fputs etc.

Question 2: [15 marks]

Consider the following code for a simple Stack:

```
class Stack {
private:
        int* a; // array for stack
        int max; // max size of array
        int top; // stack top
public:

        Stack(int m) {
                a = new int[m]; max = m; top = 0;
        }

        void push(int x) {
                while (top == max)
                        ; // if stack is full then wait
                a[top] = x;
                ++top;
        }

        int pop() {
                while (top == 0)
                        ; // if stack is empty then wait
                int tmp = top;
                --top;
                return a[tmp];
        }
};
```

You can see from the code that a process blocks if it calls push() when the stack is full, or it calls pop() when the stack is empty, the same behavior should be present in the answer. Assuming that the functions push and pop can execute concurrently, synchronize the code using semaphores. Also eliminate the busy waiting.

Question 3: [20 marks]

Picture a theater with separate sections for comedy and drama performances. When someone enters either section, others interested in the same genre may join, but those preferring the other genre must wait. A sign outside each section indicates its current status:

- Empty
- Comedy show in progress
- Drama show in progress

Develop the synchronization procedures for the following scenarios:

1. comedy_fan_wants_to_enter
2. drama_enthusiast_wants_to_enter
3. comedy_fan_leaves
4. drama_enthusiast_leaves

Make use of counters, semaphores, or synchronization techniques.

You can submit a doc file or upload a scanned handwritten solution in pdf format for Q2 and 3.