Operating Systems Concepts

**CSci 474**

**Project #2: Threads and semaphores**

**Due Date: 11:55PM, November 26, 2018**

**Submission: Submit your source code and summary to the blackboard. Late submission will NOT be accepted. Email submission will NOT be accepted.**

## I. Project Organization

This project will implement a multi-threaded application using the POSIX threads and semaphores with the programming language of c/c++. Your program will be tested on a machine (lab00.cs.ndsu.nodak.edu -- lab20.cs.ndsu.nodak.edu) in the computer science Linux lab QBB 244.

You should do the following pieces to complete your project. Each piece is explained below:

* Code 30 points
* Output 10 points
* Summary 10 points

# Code

Your code should be nicely formatted with plenty of comments. The code should be easy to read, properly indented, employ good naming standards, good structure, and should correctly implement the design.

# Output

Output will be graded by running your program.

# Summary: The summary includes the following two pieces.

1. Complete the following table in the summary. In the following table, you should list all semaphores used in the program, the function and initial value for each semaphore.

|  |  |  |
| --- | --- | --- |
| Semaphore | Function | Initial Value |
|  |  |  |
|  |  |  |

1. Discuss any difficulties encountered, what was learned, and results. This piece should be at least one page in length (font size - 11 points, single column and single space).

## II. Project Description

### Hotel Simulation

You must use POSIX threads and semaphores to complete this project.

This project creates a system to simulate a hotel. The following rules apply:

Guest:

1. 10 guests visit the hotel (1 thread per guest created in the main thread). Each guest has a unique index ranging from 1 to 10.
2. Check in (hotel only has 5 rooms – room numbers ranging from 1 to 5).
   1. If a room is available, print the activity of entering a hotel (The print must include the guest ID). Otherwise, the guest is blocked until a room is available.
   2. Guests are waiting in a line if the front desk is serving a guest. If the front desk is available, the first guest goes to the front desk for check in (Print the corresponding activity. The print must include the guest ID and the “check in” activity, such as “Guest 1 goes to the front desk for check in”.).
   3. The guest being served by the front desk gets a room number from the front desk (Print the corresponding activity. The print must include the guest ID and room ID.)
3. After check in, a guest does one of the followings:
   1. Print – “Go to hotel swimming pool” (25% chance), randomly sleep for 1-3 seconds.
   2. Print –“Go to hotel restaurant” (25% chance), randomly sleep for 1-3 seconds.
   3. Print –“Go to hotel fitness center” (25% chance), randomly sleep for 1-3 seconds.
   4. Print –“Go to hotel business center” (25% chance), randomly sleep for 1-3 seconds.
4. Check out.
   1. Guests are waiting in a line if the front desk is serving a guest. If the front desk is available, the first guest goes to the front desk and returns the key (Print the corresponding activity and the print must include the guest ID, the “check out” activity, and the room ID.).
   2. The guest gets the total balance (Print the corresponding activity. The print must include the guest ID and total balance. The balance is randomly generated.).
   3. The guest makes a payment. (Print the corresponding activity. The print must include the guest ID).

Front Desk: one thread is created to simulate the front desk in the main thread.

1. Check in:
   1. Greet the guest. (Print the corresponding activity. The print must include the guest ID and the check in activity, e.g., the front desk greets guest 1 for check in).
   2. Assign a room to the guest. (Print the corresponding activity. The print must include the guest ID and the room ID).
2. Check out:
   1. Greet the guest and receive the key. (Print the corresponding activity. The print must include the guest ID, the “check out” activity, and the room ID).
   2. Calculate the balance and give a receipt to the guest. (Print the corresponding activity. The print must include the guest ID and the balance).
   3. Receive the payment and complete the transaction. (Print the corresponding activity. The print must include the guest ID).

At the end of the simulation, give an accounting as follows:

Number of Customers

Total Guests:

Pool:

Restaurant:

Fitness Center:

Business Center:

## III. Project Guidelines

### Submitting

Submit your project on Blackboard. Include in your submission the following files:

1. A Word document for the written pieces of the project
2. Your source files

### Cheating

All work must be your own. If cheating is detected, all parties involved will be given a zero for the project and the penalty will be documented on a form that you must sign. You may be referred to the Dean’s office for further discussion. If you refer to any online resource, you must cite the source in both the comments and the summary document.

### Grading

The written portions will be graded subjectively based on completeness and quality. The code will be graded based on points allocated for each key part of the processing as determined by the instructor. The output will be graded based on expected results for the runs.