Programming Exercise 2 – River Ferry Problem

In this exercise you will write a pthread program that uses pthread mutexes and condition variables to solve another simple synchronization problem.

River Ferry Problem: A river ferry operates a **shuttle** service between the northern and southern banks of a river that flows in an easterly direction. A passenger may board the ferry at either river bank. The ferry has a capacity of one passenger. If there is more than one passenger, other passengers must wait for their turn. The ferry goes back and forth with a constant speed (i.e., it takes a fixed time to go from one bank to the other) starting from northern bank and will not wait if there is no passenger.

Write a program to solve this problem using condition variables and mutexes to provide synchronization between the ferry and the passengers. To assist you get started on this exercise, a program template ferry_template.c has been written for you. You need to fill in the sections marked with dots and write the thread routines *boat_routine()* and *passenger_routine()*. Note that the intended direction of travel for each passenger will be **randomly** determined.

In the *main()* function, the program asks the user to supply the following parameters as inputs:

- *no_of_passengers* – total number of passengers from both directions
- *boat_pace* – the time it takes for the ferry to perform a one-way trip
- *passenger_rate* – the duration between passenger arrivals

Your *boat_routine()* needs to print the following lines where *boat_pace* is a parameter supplied by the user as described above:

- "Boat starts working in pace [*boat_pace*]." – when the thread is started
- "Boat to move n2s." – whenever the ferry begins moving from north to south
- "Boat to move s2n." – whenever the ferry begins moving from south to north
- "Boat has arrived at the northern (or southern) bank. ")

Your *passenger_routine()* needs to print the following lines where *direction* and *id* correspond to the passenger's intended direction of travel and identification number (which is a natural number starting from 0 according to their arrivals at the river bank) respectively:

- "Passenger [*direction*] [*id*] *arrives and waits to cross the river*." – when the thread is started
- "Passenger [*direction*] [*id*] is now on the boat." – when the passenger has boarded the ferry