21720 – Concurrent Programming

2021-22 Academic Year

10th January 2023

Part Two. Time: 1 hr and 30 min.

Question 4 (4 marks).

Simulation: There is a bridge with capacity for a single vehicle and two accesses: NORTH and SOUTH. If there are two cars trying to access the bridge from both sides, the car which is at the end where there are more cars waiting must go first (if the number of cars waiting at both sides is the same, no particular order is required). An ambulance will have priority over other vehicles. Vehicles are expected to cross the bridge and end the simulation.

The simulation must be done by programming a BridgeMonitor that manages access to the bridge. The monitor must have **implicit condition variables**, and it must comprise five car processes and one ambulance process. The cars will go NORTH or SOUTH randomly; the direction for the ambulance is irrelevant. The arrival time for each vehicle, as well as the time it will take each of them to cross the bridge, must be simulated with random values.

The simulation should generate an output similar to the following:

```
run:
     Ambulance 1010 is en route
Car 1 is heading SOUTH
Car 0 is heading SOUTH
Car 3 is heading SOUTH
Car 2 is heading NORTH
Car 4 is heading SOUTH
     Car 1 is waiting at SOUTH access, they are waiting at SOUTH 1
     Car 1 is on the bridge, they are waiting at SOUTH 0
     Car 0 is waiting at SOUTH access, they are waiting at SOUTH 1
Car 2 is waiting at NORTH access, they are waiting at NORTH 1
     Car 3 is waiting at SOUTH access, they are waiting at SOUTH 2
     Car 4 is waiting at SOUTH access, they are waiting at SOUTH 3
+++++Ambulance 1010 is waiting to enter the bridge
---->Vehicle 1 leaves the bridge
+++++Ambulance 1010 is on the bridge
---->Vehicle 1010 leaves the bridge
     Car 0 is on the bridge, they are waiting at SOUTH 2
---->Vehicle 0 leaves the bridge
     Car 4 is on the bridge, they are waiting at SOUTH 1
---->Vehicle 4 leaves the bridge
Car 2 is on the bridge, they are waiting at NORTH 0
---->Vehicle 2 leaves the bridge
     Car 3 is on the bridge, they are waiting at SOUTH 0
---->Vehicle 3 leaves the bridge
```