Data Structures (2028C)

Homework 2 – Elevator Simulation (version 1, 10/26/20)

Topics covered: ***Working with Dynamic Behavior of Classes***

Homework due: ***Nov 20, 2020***

Objective:

The objective of this homework is to create classes for modeling a physical system (elevator in a building) and simulating some events to determine its performance.

Background:

We would like to build a simulator of an elevator system in a building that serves several floors. The goal is to determine if the elevator is meeting the needs of the building tenants. The performance is measured as the average floor wait time and car trip time for a specific time period.

Assuming you are familiar with our buildings on campus, I will use the ERC building, where there is an elevator that serves six floors (Floor 3 to 8). As Floor 3 is connected to the East side entrance of the building and Floor 6 is connected to the walkway to the adjacent Rhodes Hall and exiting the building from the West side, many of the passengers of the elevator are not building occupants but simply people in transit. The goal of the study is to simulate the traffic during the period between class times.

A quick analysis of the problem domain has yielded these essential classes: building, elevator, floor, elevator, door, clock, person, button, and scheduler. An example of an elevator serving two floors, for each trip serving one person is shown in Fig 2.44 [Deitel&Deitel-How to Program C++, 3rd ed.]. The scheduler is a module that randomly creates persons who arrive at each floor at a given arrival time and with an intended destination floor. Persons push buttons at a floor to summon elevator car to go up or down. Once in the car, persons press car panel button for the destination floor. All persons waiting at each floor should be kept in a queue, and once they board the car this list should be rearranged into a priority queue. Car makes a trip up and down on demand. Car moving directions is according to first-come, first-serve mode. Once a direction is initiated, interim calls to the opposite direction will be blocked out, until all the floors on the same direction are served. Elevator can have a home floor, where it parks while there is no call signal. The dynamic behavior of the system is characterized by the various states and the time intervals derived from the events. Assume that the total time of travel includes fixed time for door closing, accelerates, constant travel speed, slowing down, and door open.

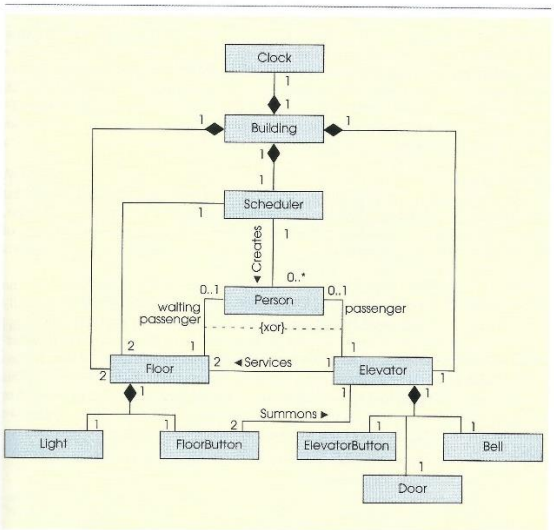

Fig. 2.44 Full class diagram for elevator simulation.

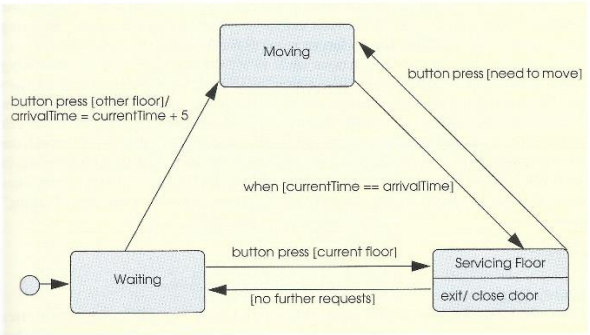

Fig. 3.31 Statechart diagram for class `Elevator`.

Submission:
Submit a report in two parts, Part A and B. Part A includes the OOA and OOD -- the problem statement, the requirements, the assumptions made, and the rationale why and how your classes are derived.
Part B is OOP which should include sample results printout and instructions for compiling and running the programs, the source code files and any required data files.

This homework can be done in group. Make sure to include the name of all group members (up to four members), and what each member contributed.

Grading:

1. 40% - Part A – OOA/D.
2. 40% - Part B – OOP.
3. 20% - Documentation.