CMPE 160 Project # 3
"Medical Clinic Simulation"

1. Requirements

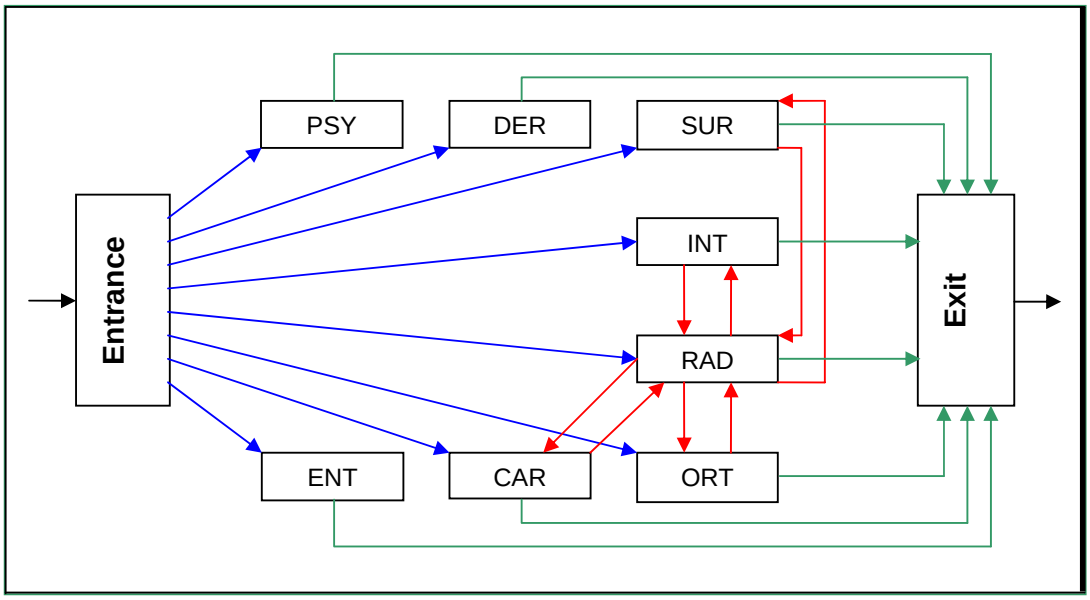
In this project, you are asked to write a program that simulates arrival, examination, and departure processes of patients in a medical clinic. The arrival time and examination duration of each patient will be determined by a random number generator. There are 8 units in the medical clinic which are listed in Table 1. There is a queue in front of each unit.

TABLE 1

UNIT	Number of doctors	Patient arrival ratio (%)	Send to Radiology Unit (%)	Examination duration before radiology (min-max)	Examination duration after radiology (min-max)
INT Internal medicine	1	15	25	5-15 mins	5-10 mins
CAR Cardiology	1	10	25	10-30 mins	5-10 mins
SUR Surgeon	1	10	25	10-30 mins	5-10 mins
PSY Psychiatry	1	15	-	5-20 mins	-
ORT Orthopedics	1	15	50	5-15 mins	5-10 mins
DER Dermatology	1	15	-	5-20 mins	-
ENT Ear, Nose, and Throat	1	15	-	10-20 mins	-
RAD Radiology	1	5	-	10-15 mins	-

As you see from Table 1, there is one doctor in each unit. Patient arrival time will be determined by a random number generator such that, after the arrival of a patient, the next patient will arrive to the clinic in "X seconds" where *X* is a random number between *1* and *A* seconds. (You can assume uniform probability distribution). *A* is an input by the user. *Patient arrival ratio* is the ratio of the number of patients that arrive to the particular unit, to the number of all patients arrived to the clinic. In some units (INT, CAR, SUR, ORT), some of the patients are sent to the Radiology (RAD) unit. The ratio of the number of these patients, to the number of all patients that arrived to those units is specified in "*Send to Radiology Unit (%)*" column of Table 1. Examination duration is also a random variable which varies between min and max values specified in Table 1 (Again you can assume uniform probability distribution). The patients sent to Radiology unit will come back to their initial units and continue to be examined by their doctors. The duration of this examination is also a random variable between 5 and 10 minutes as indicated in the last column of Table 1.

The following chart illustrates the patient flow:



2. Inputs:

The only inputs that will be supplied by the user are the following:

- **A:** Patient arrival parameter. The arrival time of the patients will be determined by this variable as described in the previous section.
- **Simulation time:** The whole simulation duration in terms of days.

3. Outputs:

All simulation outputs should be written in a text file "MedSim.out" which will be printed and turned in for grading. (Specific to this print-out, you can select *A* as 120 secs and Simulation Duration as 4 days)

This file should include the following statistics:

1. Arrival Parameter (A)
2. Simulation Time
3. Total number of patients arrived to the clinic.
4. Total number of patients arrived to each unit.
5. Average time that patients spend in the clinic. (for the whole clinic)
6. Average time that patients spend in the clinic. (for each unit) (You should take care about the initial units of the patients.)
7. Average waiting time in each queue.

8. Average length of each queue.
9. Maximum waiting time of a patient.
10. Average number of patients (per day) that leave the clinic without being examined at the end of the day.

4. Assumptions:

You can assume the following:

1. The medical clinic is open everyday between 8:30 and 18:00. There is no lunch break.
2. The minimum time quantum is “1 second” in this simulation.
3. At the end of the day, all patients that are waiting in the queue exit without being examined. However, the examination of the patients which are started before the end of day should be continued. In the normal working hours, no patient leaves the clinic without examined by his/her doctor.
4. Normally newly arriving patients enter to the end of the queue. However, the patients that come back from the Radiology unit have precedence over the newly arriving patients.
5. The patients that come back from the Radiology unit will not be sent back to the Radiology unit.
6. There is no limit in the queue size.

You should use Queue ADT in this project.

5. Material to Submit:

- **SDD:** You are going to deliver a software design document until April 22, Thursday, 17:00 to Ömer Korçak at ETA 104. The document should follow the guidelines explained in the PS. You are encouraged to use flowcharts, diagrams, and graphical aids to make your document easier to read and understand.
- **CODE:** The complete working code will be delivered on May 3, Monday, until 17:00. Your code should work in Visual C++ 6,0. You are expected to write a clear code, with lots of comments, good variable and class names, and as object-oriented as possible. If you make changes to the SDD please resubmit it.
- **Output file:** “Medsim.out” file that is mentioned in the “Outputs” section.

We are going to check your code for

- -Good programming style
- -Compliance with project specifications
- -Compliance with design document

NOTE:

- Our department has very strict codes for student “collaboration” on projects.
- Remember that the **only** aim of this project is to teach you to have good programming skills that you are going to use for the rest of your lives. There is no way of learning programming other than hands-on experience.
- Both the document and the project will require your full attention for at least a couple of days. If you start them one day before the deadline, it will not possible to complete them in a satisfactory manner.
- Please work on your own, and ask your assistants immediately if there is a problem you cannot handle.