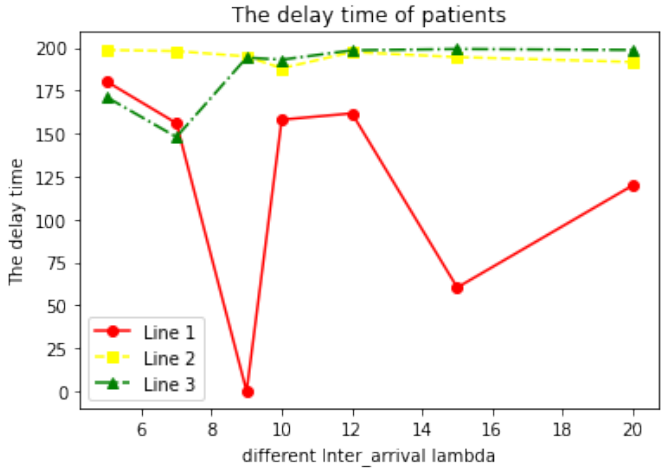
Lab L2. Hospital Emergency Room

Shaoyong Guo
Politecnico di Torino
s296966
s296966@studenti.polito.it

I. Lab Requirements

In the lab, it is necessary to simulate how hospitals deal with different emergency patients. It uses three colors to tag different patients, red for the most urgent patient with a probability of 1/6, yellow for the second most urgent patient with a probability of 1/3, and green for a normal patient with a probability of 1/2. Before simulation, some parameters need to be set. First, K is the number of servers in the system, which is set to 1. The patient's Inter arrival time is also set to a series of exponentially distributed numbers with lambda 5, 7, 9, 10, 12, 15 . After that, the service time of each patient is also set as a series of exponentially distributed numbers with lambda 1. Meanwhile, the maximum simulation time is 2000 ms.



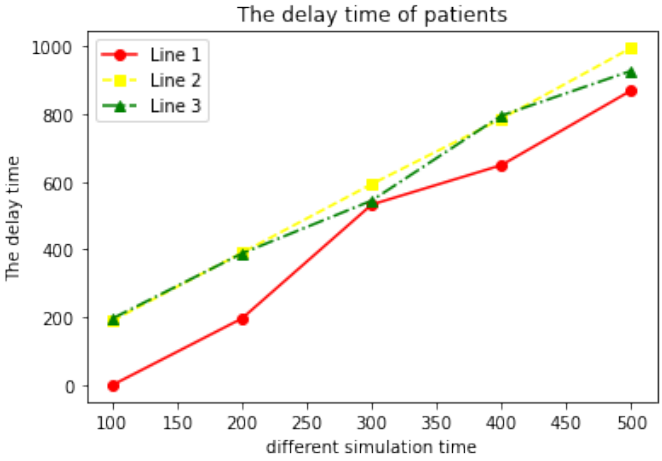
Gambar 1. The delay time with different inter-arrival time

II. Approach

In the simulation we will focus on different patients (red, yellow and green). It is also important to use other entity classes and functions to measure all the information we want to obtain, which will be clearly defined. This includes client and server classes, arrival and departure functions.

A. Event Entities

The customer class has three different attributes: type, color, and arrival time, which record the status, color, and arrival and departure time of each customer, respectively. The colors represent different levels of urgency of the patient. In the simulation process, a random uniform function with different weights is used to simulate the occurrence of different colors representing emergencies. The server class also has three different properties: the end time, the service time, and the time of the last event. After the server executes once, it records the service information for each client and then updates each record.



Gambar 2. The delay time with different simulation time

B. Arrival and Departure Event

In addition, we need to define two functions: arrival and departure, which will demonstrate the whole process of the simulation. In the arrival section, each client is masked with a random color upon arrival at the hospital. If the client's arrival time is less than the server's end time, indicating that other patients are being served, then he will be placed in the red waiting queue, yellow waiting queue or green waiting queue, depending on his color. Red events enjoy the highest priority and will interrupt other services once they occur. In the simulation, it is necessary to determine who enjoys priority service. It uses the Strict Priority Service function, which gets the arrival time and expected departure time of the current customer and determines whether the red patient will be inserted into the queue. In the departure section, the main job is to compute the delay time for every client. when the system simulate once, the arrival section will output a record of departure record, which include the departure time, the color, the status, the arrival time and service time. The delay time

TABEL I
THE RESULTS OF SIMULATION WITH DIFFERENT INTER-ARRIVAL TIME

number of arrival per second	*Number of arrivals*	*Number of departures*	*average delay*	*delay rate*
5	384.0	215.0	2.093387	67.90
7	218.0	168.0	2.557679	72.55
9	197.0	147.0	2.746509	70.44
10	414.0	162.0	3.437561	77.58
12	236.0	170.0	2.838647	72.67
15	150.0	136.0	3.172760	77.64
20	186.0	144.0	3.363432	76.82

TABEL II
THE RESULTS OF SIMULATION WITH DIFFERENT SIMULATION TIME

Simulation Time	*Number of arrivals*	*Number of departures*	*average delay*	*delay rate*
100	127.0	144.0	2.683026	76.67
200	454.0	306.0	3.189737	78.32
300	1124.0	525.0	3.181933	73.75
400	466.0 1	530.0	4.20885	79.58
500	1980.0	950.0	2.939057	69.15

could be obtained by departure time - arrival time - service time.

III. CONCLUSIONS

Table 1 shows the simulation results for different arrival interval times. In this process, the system uses an exponential random time with lambda of 5, 7, 9, 10, 12, 20 as the customer's arrival interval time. As the interval increases, the number of arriving clients decreases, but the number of departing clients remains stable. The reason for this is that when we use fixed service times(the service is exponential random time with lambda = 1), the working hours of a server always remain the same. Figure 1 shows that yellow and green patients will maintain stable delay times at different intervals, but red patients will have large fluctuations in delay times. Table 2 clearly shows that simulation time affects the number of arriving and departing clients. This is also demonstrated in Figure 2, where the delay time for patients of different colors increases as the simulation time increases. However, the system will maintain the same average delay for different arrival intervals or different simulation times.