

## Writeup For Assignment2

1. **Planning:** How did you plan and organize your program? What does it do? Include user instructions if appropriate.

My program consists of four class: Patient, ExamRoom, EmergencyRoom and ERSimulator.

**Patient** is a simple object which has a patient's information, including patient arrival time, treatment start time, treatment duration(minutes) and urgency level.

**ExamRoom** is a simple object which has property including total busy time, total number of treating patients, current patient departure time and roomNumber.

**EmergencyRoom** is a container with busy examination rooms, empty examination rooms, patients waiting queue, list of all the patients and list of all the examination rooms.

**ERSimulator** simulate the treatment of patients in a hospital emergency room.

2. **Implementation:** How is your program organized? What are the major classes? How do the objects interact? Remember to clarify your design, since we know nothing about your code. Explain this well.

My major classes are EmergencyRoom and ERSimulator. The EmergencyRoom contains different queues and different lists, and it's the main service area. ERSimulator is the class who run the simulation. In ERSimulator, there is a private field of EmergencyRoom, which can control the queue's changes during simulation.

3. **Testing:** How did you test your code? What sort of bugs did you encounter? Are there any unresolved problems in the code? Be sure to list any ways in which the program falls short of the specification.

I use preset generating to test my code. I encounter the problem that the examination room percentage is over 100%. I tried to preset one examination room and print out the result. I find that the simulation running time is less than the duration sum of all the patients. And that is because I didn't count the last patient's treatment time. Program ends when the patients waiting queue is empty. I have solved this problem by adding code in afterGeneration() to calculate the simulation end time according to the departure time of last patient.

4. **Evaluate this project.** What did you learn from it? Was it worth the effort? This could include things you learned about specifications and interfaces, design issues, Java language issues, debugging, etc.

At first, I try to solve this problem using multi-thread functions, like Timer. However, I cannot deal with multi-thread well at this point. So I finally use single thread. In this project, I learn to create the whole project all by myself. I learn to design the structure of the program. And I know interface better than before.

5. Finally, based on the testing you have performed, what do you think is the optimal number of examination rooms? Make sure to back up your recommendation by referring to your results, including average waiting times.

Simulation setting:

interval: 1-20 minutes

urgency: 1-10

treatment duration: 5-35 minutes

<p><b>1.Total examination rooms: 1</b></p> <p>2.Total simulation running time: 16.58 hours</p> <p>3.Total treated patients: 46</p> <p>4.Overall average waiting time: 277.901 minutes</p> <p>    highest priority patients(urgency level 1-4): 22.12 minutes</p> <p>    lowest priority patients(urgency level 9-10): 641.488 minutes</p> <p>5.Average treatment duration: 21.5 minutes</p> <p>6.Amount of patients treated in each examination room:</p> <p>    Room1: 46</p> <p>7.Busy time percentage of each examination room:</p> <p>    Room1: 99.3883945709215%</p>
<p><b>1.Total examination rooms: 2</b></p> <p>2.Total simulation running time: 8.434949999999999 hours</p> <p>3.Total treated patients: 44</p> <p>4.Overall average waiting time: 3.158 minutes</p> <p>    Average waiting time for highest priority patients(urgency level 1-4): 3.822 minutes</p> <p>    Average waiting time for lowest priority patients(urgency level 9-10): 0.57 minutes</p> <p>5.Average treatment duration: 18.0 minutes</p> <p>6.Amount of patients treated in each examination room:</p> <p>    Room1: 20</p> <p>    Room2: 24</p> <p>7.Busy time percentage of each examination room:</p> <p>    Room1: 78.83864160427744%</p> <p>    Room2: 77.65309812150636%</p>
<p><b>1.Total examination rooms: 3</b></p> <p>2.Total simulation running time: 8.4019 hours</p> <p>3.Total treated patients: 44</p> <p>4.Overall average waiting time: 0.976 minutes</p> <p>    Average waiting time for highest priority patients(urgency level 1-4): 0.888 minutes</p> <p>    Average waiting time for lowest priority patients(urgency level 9-10): 1.999 minutes</p> <p>5.Average treatment duration: 20.954545454545453 minutes</p> <p>6.Amount of patients treated in each examination room:</p> <p>    Room1: 13</p> <p>    Room2: 19</p> <p>    Room3: 12</p> <p>7.Busy time percentage of each examination room:</p> <p>    Room1: 60.502187997159375%</p>

Room2: 59.90708450866273% Room3: 62.48586629214821%
<b>1.Total examination rooms: 4</b> 2.Total simulation running time: 8.70195 hours 3.Total treated patients: 45 4.Overall average waiting time: 0.0 minutes Average waiting time for highest priority patients(urgency level 1-4): 0.0 minutes Average waiting time for lowest priority patients(urgency level 9-10): 0.0 minutes 5.Average treatment duration: 19.644444444444446 minutes 6.Amount of patients treated in each examination room: Room1: 11 Room2: 11 Room3: 13 Room4: 10 7.Busy time percentage of each examination room: Room1: 40.795453892518346% Room2: 42.327677512894624% Room3: 41.944621607800556% Room4: 44.24295703836497%
<b>1.Total examination rooms: 5</b> 2.Total simulation running time: 8.435116666666667 hours 3.Total treated patients: 49 4.Overall average waiting time: 0.0 minutes Average waiting time for highest priority patients(urgency level 1-4): 0.0 minutes Average waiting time for lowest priority patients(urgency level 9-10): 0.0 minutes 5.Average treatment duration: 20.285714285714285 minutes 6.Amount of patients treated in each examination room: Room1: 12 Room2: 9 Room3: 8 Room4: 11 Room5: 9 7.Busy time percentage of each examination room: Room1: 37.936641856366336% Room2: 39.71492194338351% Room3: 38.52940188537206% Room4: 41.29561535406544% Room5: 38.92457523804254%

According to the report listed above, I think the best number of examination rooms under this simulation setting is 3. Average waiting time for both all patients and highest priority patients are less than 1 minute. And examination room busy time percentage is around 60%, which is not a waste.