Trong Le

CS 607

Instructor Nemes

**GPSS PROJECT**

**East Orange VA Hospital Parking Simulations**

*Statement of the problem*

Customers (patients or visitors of patients) arrive at a three-lane parking space. The three-lane parking space is a big parking space with more than 100 parking spots. There is a gate in front of the parking place with 3 lanes which are labeled as lane1, lane2 and lane3. The parking place has an office and a waiting room. There are 5 parking attendants in the office. When a customer arrives, he or she has to park in either lane1, lane2 or lane3. Then a parking attendant will give that customer a ticket which has a ticket number to identify the customer’s car description. The parking attendant then moves that car to a specific parking spot. The customer now can go on with her or his business at the hospital. After being done with his or her business at the VA Hospital, the customer comes back to the parking lot, gives the ticket to a parking attendant, and waits in the waiting room for his or her car to arrive.

Customers arrive at the parking with an average time between arrivals of 3 minutes. The interarrival time actually varies between 2 to 4 minutes, with equal likelihood for each possibility. The 5 parking attendants are uniform in the sense that each requires an average of 8 minutes to take a customer’s car from either lane1, lane2 or lane3 to a specific parking spot inside the parking lot. The actual time from taking a car to park it in a spot ranging from 6 to 10 minutes for each parking attendant. In the same token, getting a car back to a customer takes the same time (average of 8 minutes) as taking a car to a specific parking spot. The actual time from getting a car from a parking spot to a customer in the waiting room also ranging from 6 to 10 minutes. However, some customers have to stay overnight, and the average time of leaving between arrivals of 4 minutes. The actual interarrival time of leaving varies between 1 to 7 minutes. The East Orange VA Hospital emphasizes on being on time for patients’ appointments. Therefore, the VA Hospital divides parking attendants into 2 teams. Team 1 has 3 parking attendants, and they will handle the arrival of customers. Team 2 has 2 parking attendants, and they will handle the departure of customers.

The simulations will determine the percent idle time of the attendants as a group, the average time to handle a customer arrival by the parking attendants, the maximum number of customers (assume one customer per car), the average waiting time of the customers in the waiting line until they talk to parking attendants about getting their cars parked, the average time to handle a customer departure by the parking attendants, and the average waiting time of the customers in the waiting line until they talk to parking attendants about getting their cars back to them. The VA Hospital operate 24 hours a day, seven days a week. It is also good to know how many customers stay overnight at the Hospital.

*Approach taken in building the models*

The simulations will have 2 models. The first model will simulate the arrival of customers to the VA Hospital. The second model will simulate the departure of customers from the VA Hospital.

Model 1: The service capability in team 1 can be represented as a Storage with a capacity of 3 units. Even though there are 3 parking attendants operating in parallel, the model can be built with a single sequence of blocks. No differentiation is made among the parking attendants because they provide service at a uniform rate.

Model 2: The service capability in team 2 can be represented as a Storage with a capacity of 2 units. Even though there are 2 parking attendants operating in parallel, the model can be built with a single sequence of blocks. No differentiation is made among the parking attendants because they provide service at a uniform rate.

*Table of Definitions*

Time Unit: 1 minute

GPSS Entity Interpretation

Transaction A customer

Queue LINE The waiting line

Storage S(ATTD),3 The 3 attendants (model 1)

Storage S(ATTD),2 The 2 attendants (Model2)

*Discussion of Output*

The output statistics for Model 1:

* The number of customers during the course of the day was 239 customers (That was also 239 cars in total).
* The attendants were busy 87.7% of the time.
* The average time to handle a customer arrival (a car) was 7.93 minutes.

From Queue LINE statistics:

* There were never more than 3 customers in the waiting line (“Maximum Contents 3”).
* A total of 239 customers entered the waiting line (“Total Entries 239”) but of these, 154 were “Zero Entries”, that is, entered and then immediately left the Queue (waiting line) without having to wait at all. In total, 64.4% of the Queue entries were of the Zero Entry type (“Percent Zeros 64.4).
* Customers who joined the waiting line had to spend on average of 1.09 minutes (“$Average Time/Unit 1.091”) in the waiting until they talk to parking attendants about getting their cars parked.
* On the average, there were 0.129 customers in the waiting line (“Average Contents 0.129”)

The output statistics for Model 2:

* The number of leaving customers during the course of the day was 180 customers (59 customers had to stay overnight at the VA Hospital).
* The attendants were busy 96.3% of the time.
* The average time to handle a customer departure (a car) was 7.973 minutes.

From Queue LINE statistics:

* There were never more than 7 customers in the waiting line (“Maximum Contents 7”).
* A total of 180 customers entered the waiting line (“Total Entries 180”) but of these, 20 were “Zero Entries”, that is, entered and then immediately left the Queue (waiting line) without having to wait at all. In total, 11.1% of the Queue entries were of the Zero Entry type (“Percent Zeros 11.1).
* Customers who joined the waiting line had to spend on average of 7.647 minutes (“$Average Time/Unit 7.647”) in the waiting line until they talk to parking attendants about getting their cars back.
* On the average, there were 0.1699 customers in the waiting line (“Average Contents 0.1699”)