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**Call Center**

Problem formulation and objective:

A queuing system is described as calling population, waiting line and server. The calling population represented in customers and the number of customers is infinite because any number of customers can join the system at any time to get his service. We have the server that is multi-channel queue it has two technical support the able and baker. Able is more experience and can provide service faster than baker. We also have two waiting line so if infinite people came to the system can be wait until they served. Arrivals of customer for service occur one at a time in random way. If there is still one customer served the arrived one wait in the queue until they served. We can get the arrivals and service time from the distribution table of the time between arrivals and the distribution table of service time. The waiting line has no capacity, so any number of customers can wait in line. Customers are served in the order of their arrival (first come first serve). In both single and multi-channel, we need to get some information and statistics in case the able is serving customer alone and if the able and baker together. In case of able only:

We need to know the average service time.

* The average time that the customer will waiting in the queue.
* The maximum queue length between the customer who served and the arrived customers.
* The probability that a customer waits in the queue.
* The proportion of idle time of the server.

In case of able and baker:

* We need to know the efficiency of able and baker.
* We also need the average of the delay of the call.
* We want to know if we need extra server with the same capabilities as Baker and one not has experience as the able? Why?
* If the assignment of calls to either Able or Baker when both are idle is done randomly, would it be better or not?

Model Conceptualization:

System: call center.

Entity: customers.

Activities: get service from the technical support.

Attributes: service begin, service ends.

Events: arrival, departure

State variable: number of customers, the status of the system either busy nor idle.

The system consists of one server with two technical support able and baker. Customers arrive or join the system at random time from 1 to 4. Each value of inter-arrival time has the same probability in table 1. Service time for able varies from 2 to 5 with probabilities shown in table 2. Service time for baker varies from 3 to 6 with probabilities shown in table 3. The problem is to simulate the arrival and service of n number of customers. We generate random numbers to get the arrival and assign service time for each customer in the system.

Experimental design:

In case of able only: I run the system 15 trial with 100 customers then I starting to increase the number of customer the average service time and the probability that the customer must wait is fixed at some value, but the average waiting time is grow without bound.

In case of able and baker: I run 20 trials with 100 customer the average caller delay varies about specific ratio. On the other hand, when I tried with the same trials but increasing the customers number to 500 the average caller delay decreased. while the number of customer is increasing the average caller, delay is decreasing.

Do we need extra server with the same capabilities as Baker? Why?

We do not need extra server because the caller delay did not increase when the customer number is increased.

What is the effect of the seniority rule between Able and Baker when getting calls and both are idle? Would it be better if the assignment of calls to either Able or Baker when both are idle is done randomly?

When both are idle the able will take the call because he is more experienced and faster than baker, so he will serve the customer quickly and the call delay will not be long. If we assign the call randomly the caller delay will increase will the customer is increasing because the baker is not efficient as much as the able.

**Car dealer**

Problem formulation and objective:

The inventory is described as we have a maximum unit that the inventory cannot exceed it. The time of days to review the inventory after it. This is a car inventory with 11 maximum unit. The cycle is consisting of five days and after each cycle we review to know the number of cars that we need to make order with it. If there are shortage we add this shortage on the order quantity. The inventory is started with 3 cars and there are 3 cars will be arrived after 2 days. we need to get some information and statistics about the inventory:

* The average ending unit of inventory after the cycles is finished.
* The number of days when there is shortage.
* If there are a better value for the review period to minimize the shortage.

Model Conceptualization:

System: car dealer.

Entity: days.

Activities: buying cars.

Attributes: starting inventory, ending inventory.

Events: demand.

State variable: shortage quantity.

We have the demand from 0 to 4 with probabilities shown in table1. And we have the lead time varies from 1 to 3 with probabilities shown in table 2. Each value of the demand gives us the order of the day by the customers. And the lead time give us information about the number of days until the order is arrives. We generate random numbers to get the demand and lead time for each day in the system.

Experimental Design:

I run the system 10 trial and with 10 cycles. The review is 10 days