South East Asian J. of Math. & Math. Sci. **ISSN : 0972-7752**
Vol.12, No.1 2016, pp. 95-102

OBSERVING GENERAL SERVICE QUEUES BEFORE JOINING

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Abstract: The present investigation deals with a smart customer S, who uses a strategies of waiting and observing four parallel queues before joining. We analyze the system time of S for three distinct strategies and the best strategy has been indicated.

Keywords: Parallel queue, Strategy, Shift time.

Introduction

The common queue discipline is the FCFS (first come first served) according to which the arrival of customers are processed for servicing in order of their arrival. These disciplines concern the choice of the next customer to be served when the sever terminates a service, for example units may be taken up service at random or the last come first served (LCFS) or on priority basis.

Back Ground-

E.P.C. Kao [1], I.J.B.F. Adan [2], J.F.C. Kingman [3], K.L.Katz [4], M.I. Reiman [5], M.H. Rothkopf [6], M.K. Hui [7], S. Taylor [8], W.K. Gassmann [9], have been studied, with two parallel queues and two possibly heterogeneous servers. The inter arrival times are generally distributed with mean and the service times for the two servers are exponentially distributed with rates μ_1 and μ_2 respectively.

They assume that all customers, with the possible exception of a single smart customer, "join the shortest queue strategy". if the two queues are of equal length, the regular customers (i.e. all but the smart customer) pick either server with probability 0.5 with apologies to Rothkopf and Rech [6], no jockeying is permitted.

The smart customer has the option of waiting as long as it wishes before deciding which queue to join. In our investigation, one strategy has the Smart customer observing in empty system until a service completion occurs. Then the smart customer makes a decision as to which of the two queues to join. During the smart customer's observation time, new customers will join the system and take their place in the queue ahead of the smart customer. This is the cost to the smart customer of delaying its decision.

We present conditions, under which the smart customer can lower the total time in the system by observing the system before joining. We give several strategies and make comparisons under various rates. An analysis of properties of these strategies is presented.

The type of situation analyzed here has considerable potential for application in many areas.

Suppose that we wish to choose a traffic lane, where changing lanes later may be extremely difficult due to heavy traffic. It may be advantageous to observe the rate of movement in the lanes and to make a wise choice while it is still easy to change.

It is common practice IN service systems to have customers who cannot be served immediately upon arrival, wait IN queue until system resources become available to the customer. Traditionally, customers have not been given estimates of their required waiting time, i.e the time until they can begin to receive service. When the waiting times are sufficiently short, there is usually little need for such information, but if waiting times can be long (where what is "long" depends on the context), then prediction can be important.

The present investigation deals with a smart customer S, who uses a strategy of waiting and observing four parallel queues before joining. We analyze the system time of S for three distinct strategies.

Analysis and Conclusion

To justify the claim made in the introduction that the smart customer can lower the expected total time until completion for certain rates consider the following three strategies :

(i) Strategy:- Assume that S behaves like a regular customer i.e. it immediately joins the shortest queue, if there is one. If all the four queues have the same length, S immediately joins either with probability 0.25.

(ii) Strategy:- If either queue is non-empty, then S behaves as in strategy 1. If all the four queues are empty (and no customers are being served), S waits for a customer to queue arrive and complete service. Then S joins the queue of the server who just completed service.

(iii) Strategy:- Shift times of the servers depicted on the nodes (service counters). Before joining either of the four queues smart customer S observes the shift time of the server. If he finds that shift time of server is less than one hour at the time of his arrival and length of queue is so long then he prefers to move to another queued.

```
INTEGER L1, L2, L3,L4, ML, POS, NODE
REAL LEM1, LEM2, LEM3, LEM4, MU1, MU2, MU3, MU4, OT, T1, T2, T3,
T4, MT
ML–100
MT–1000
C    FIRS'T TO OBSERVE TIME LIMIT
WRITE (*,* ) ENTER OBSERVING TIME
READ (*,* ) OT
IF (OT, LT,1) WRITE (*,* ) QUEUE IS NOT BETTER
WRITE (*,* ) ENTER VALUE OF LEMDA & MU FOR 1
READ (*,* ) LEM1, MU1
WRITE (*,* ) ENTER VALUE OF LEMDA & MU FOR 2
READ (*,* ) LEM2, MU2
WRITE (*,* ) ENTER VALUE OF LEMDA & MU FOR 3
READ (*,* ) LEM3, MU3
WRITE (*,* ) ENTER VALUE OF LEMDA & MU FOR 3
READ (*,* ) LEM4, MU4
IF(LEM1.GT. MU1) WRITE (*,* ) QUEUE IS NOT FORMED FOR FIRST
IF(LEM2.GT. MU1) WRITE (*,* ) QUEUE IS NOT FORMED FOR SECOND
IF(LEM3.GT. MU1) WRITE (*,* ) QUEUE IS NOT FORMED FOR THIRD
IF(LEM4.GT. MU1) WRITE (*,* ) QUEUE IS NOT FORMED FOR FORTH
L1- (LEM 1*LEM1 )/(MU1* (MU1-LEM1)
L2- (LEM 2*LEM2 )/(MU2* (MU2-LEM2)
L3- (LEM 3*LEM3 )/(MU3* (MU3-LEM3)
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L4- (LEM 4*LEM4 )/(MU4* (MU4-LEM4)
T1=LEM1 /(MU 1 *(MU1-LEM1))
T2=LEM2 /(MU 2 *(MU2-LEM2))
T3=LEM3 /(MU3 *(MU3-LEM3))
T4=LEM4 /(MU4 *(MU4-LEM4))
C     CALCULATE MINIMUM QUEUE & WAITING TIME
IF (L1, LT, ML)THEN
ML = L1
POS = 1
END IF
IF(L2, LT, ML) THEN
ML= L2
POS=2
END IF
IF (L3, LT, ML) THEN
ML - L3
POS = 3
IF (L4, LT, ML) THEN
ML - L4
POS = 4
END IF
IF (T1, LT, MT) THEN
MT=T1
NODE =1
END IF
IF (T2, LT, MT) THEN
MT=T2
```

```
NODE =2
END IF
IF (T3, LT, MT) THEN
MT=T3
NODE =3
END IF
IF (T4, LT, MT) THEN
MT=T4
NODE =4
END IF
WRITE (*,* ) SHORTEST QUEUE FORMED ON NODE
WRITE(*,* )POS
WRITE (*,* ) SHORTEST WAITING TIME ON NODE
WRITE(*,* )NODE
WRITE (*,* ) CHOOSE YOUR COUNTER NOW?
STOP
END
```

OUTPUT:

```
ENTER VALUE FOR OBSERVING TIME
1
ENTER VALUE OF LEMDA & MU FOR NODE I
1
4
ENTER VALUE OF LEMDA & MU FOR NODE II
2
6
ENTER VALUE OF LEMDA & MU FOR NODE III
3
```

7

ENTER VALUE OF LEMDA & MU FOR NODE IV

4

9

SHORTEST QUEUE FORMED ON NODE

1

SHORTEST WAITING TIME ON NODE

1

NOW CHOOSE YOUR COUNTER?

We now compare strategy 1, 2, and 3 assuming exponential inter-arrival time without loss of generality, we have taken respectively $\lambda_1 = 1,\ \mu_1 = 4,\ \lambda_2 = 2,\ \mu_2 = 6,\ \lambda_3 = 3,\ \mu_3 = 7;\ \&\ \lambda_4 = 4,\ \mu_4 = 9$; for four parallel queues, and then prepared computer program to calculate minimum queue length and waiting time. It is observed that the currently used strategy of immediately joining the shortest queue in not optimal in all circumstances.

In view of assumed values of λ and μ, it is seen that waiting time as well as queue length of the first node (service counter) happen to be less in comparison to other three nodes and thus S should prefer first queue. This means that the smart customer needs to have some information about the system, or else the customers will be penalized for observing.

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