ON PREEMPTIVE RESUME VERSUS NON-PREEMTIVE DISCIPLINES RELEVANT TO MONOPOLY SERVICE FACILITY

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Abstract

In the present study the expected sojourn times of the n-th customer in the preemptive-resume discipline and non-preemptive discipline have been compared with the help of computer program and graphs and interesting conclusion have been drawn.

Keywords- *Preemptive, non- Preemptive, monopoly service*

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1. INTRODUCTION

1.1 Priority Queue services

The common queue discipline is the FCFS (first come first served) according to which the arrivals 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.

1.2 Preemptive Priority

In this case customer with the highest priority is allowed to enter service immediately after entering into the system even if a customer with lower priority is already in service. That is, lower priority customer's service is interrupted (preempted) to start service for a special customer. This interrupted service is resumed again alter the higher priority customer is served or according to the preemptive rules.

1.3 Non Preemptive Priority

Where a customer, once in service, will leave the facility only after the service is completed and regardless of the priority of newly arriving customers.

The FCFS service discipline is not always applicable in many service systems and customers are classified according to different priorities.

1.4 Back Ground

A, Cobham[(1)], Hawkes [(2)], Gaver[(3)], Keilson[(5)],Kleinrock[(6)], Takacs[(7)], Jaiswal[(8)], Nelson[(9)] have been studied.

In the present study the expected sojourn times of the n-th customer S(n) in the preemptive resume discipline and non-preemptive discipline have been compared with the help of computer programs and interesting conclusions have been drawn.'"Let S(n) denote the expected sojourn time of the n-th (the last) customer in the low priority class. Adliri and Yechiali[(4)] presented this representation in a recursive form.

$$S(1) = \frac{1}{\mu} + \frac{\rho}{\mu(1-\rho)}$$

$$S(2) = \frac{2}{\mu} + \frac{\rho}{\mu(1-\rho)}$$

$$S(n) = \frac{n}{\mu} + \frac{\rho}{\mu(1-\rho)}\left[1 + \sum_{q=0}^{n-2} \frac{\rho^q}{(1+\rho)^{2q}} \sum_{m=1}^{n-q-1} \frac{m\rho^m}{(m+q)(1+\rho)^m} \begin{bmatrix} m+2q-1 \\ q \end{bmatrix}\right]$$

$n \geq 2$

My proposed methodology is to studied the preemptive & non- preemptive cases of service facility is

For the non-preemptive resume case

$$S(1) = \frac{1}{\mu}$$

$$S(2) = \frac{2}{\mu} + \frac{\rho}{\mu(1-\rho)}$$

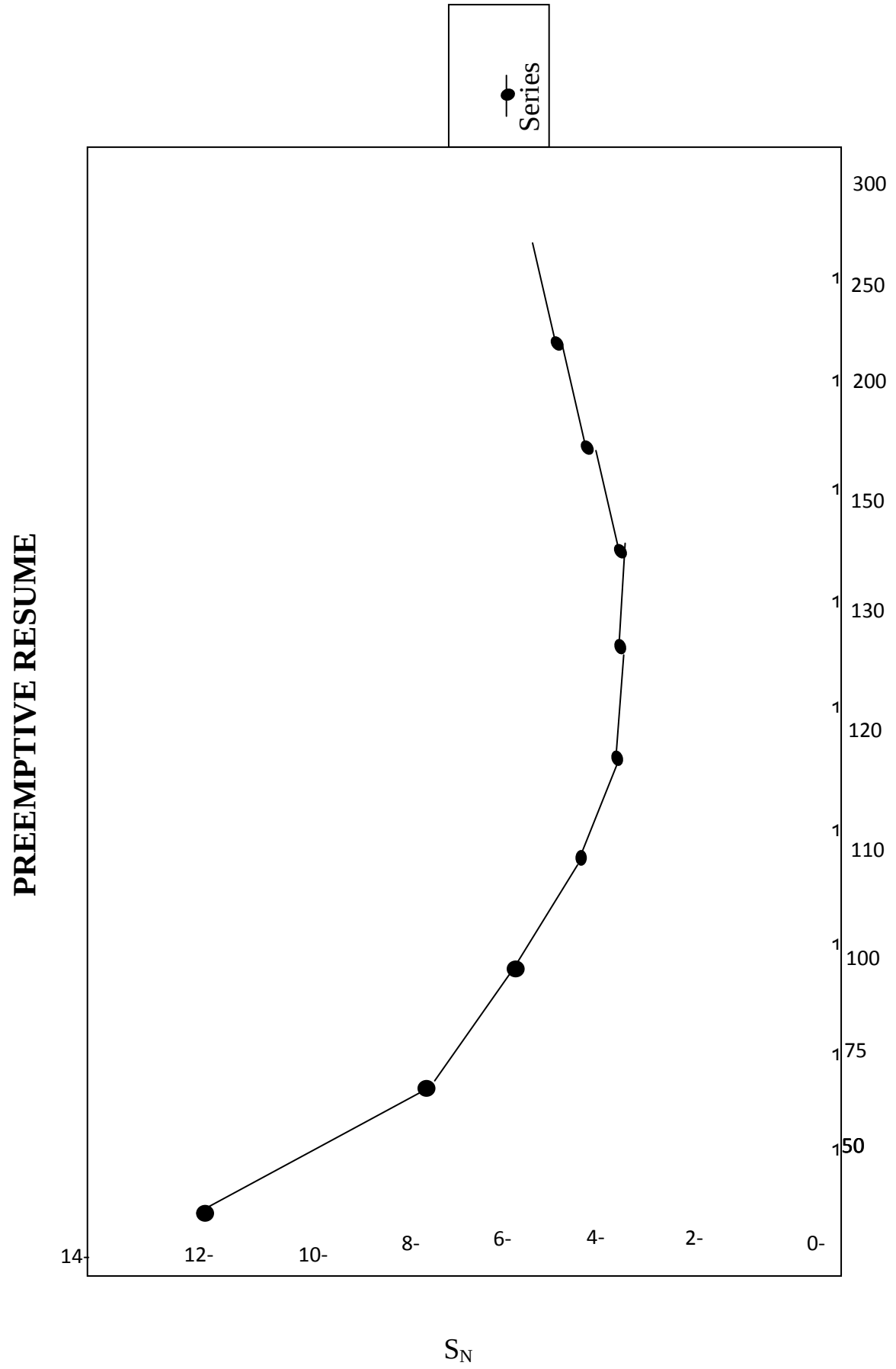
$$S(n) = \frac{n}{\mu} + \frac{\rho}{\mu(1-\rho)}\left[1 + \sum_{q=0}^{n-3} \frac{\rho^q}{(1+\rho)^{2q}} \sum_{m=1}^{n-q-1} \frac{m\rho^m}{(m+q)(1+\rho)^m} \begin{bmatrix} m+2q-1 \\ q \end{bmatrix}\right]$$

$n \geq 3$

Preemptive

λ	μ	N	S_n	S_1	S_2
1	5	50	12.0634110046	.25000	.45000
1	10	75	7.72741529	.111111	.211111
1	15	100	6.7326101956	.07142857	.1380952
1	20	110	5.52786027	.05263157	.102631
1	25	120	4.814413465	.0416666	.0816666
1	30	130	4.341796100	.034482758	.06781609
1	35	150	4.29113429	.0294117647	.0579831932
1	40	200	5.0036992577	.0256410256	.05064102564
1	45	250	5.558203172	.02272727	.0449494949
1	50	300	6.001967032	.0204081632	.0404081632

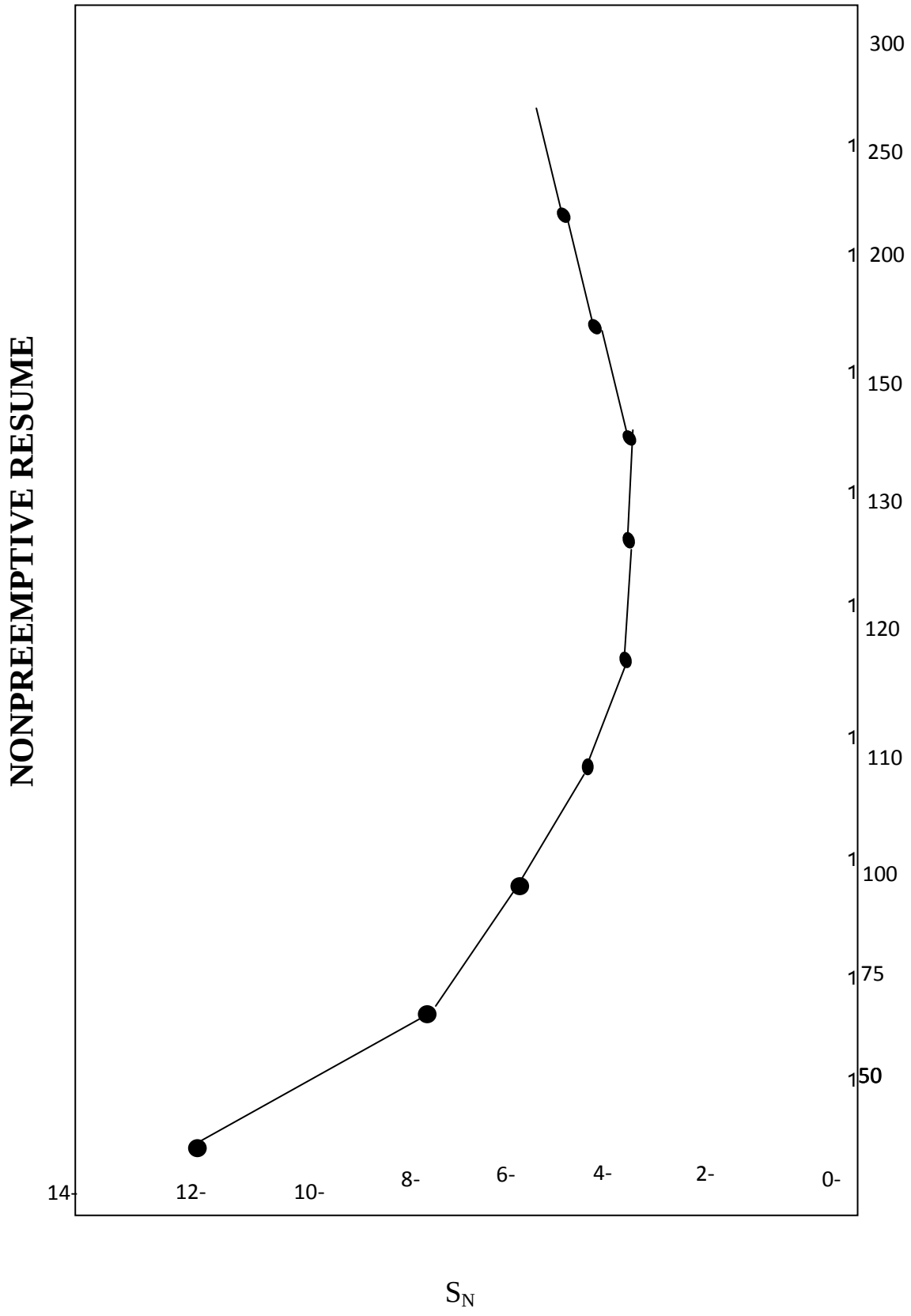
```
C       PROGRAM TO CALCULATE THE VALUE FOR S_N IN PREEMPTIVE CASE:
        SUBROUTINE FACT (N, IFN)
        J = 1
        DO 101 = 1,N
         J = J * I
10      CONTINUE
         IFN = J
         RETURN
END
        INTEGER Q, K, N, FR, FN, FNR
        DOUBLE PRECISION LEM, MU,NCR, MQ, SI, S2, SQ, SN, SM,
        R, RO
        READ (*, *) LEM, MU
        RO - LEM / MU
        S1 = (1.0 / MU ) + ( RO / ( MU * ( 1.0 - RO ))) S2= (2.0 / MU ) + ( RO / ( MU * ( 1.0 - RO )))
        READ (*, *) N
        MQ = M + (2*Q)-1
        SQ-0
        SM = 0
        DO 1 Q = 0, N - 2
        SQ-SQ 1 (( RO **Q )/(( 1 I RO ) ** ( 2 * Q )))
        DO 2 M = 1, N - Q - 1
        CALL FACT ( M + (2 * Q ) 1,FN)
        CALL FACT ( Q, FR )
        CALL F A C T  ( M i ( 2 * Q ) - l - Q ,  FNR )
        NCR = FN / ( FR * FNR )
        SM - SM + ( M * RO ** M ) / (( M Q ) * ( 1 + RO ) M ) • NCR
2       CONTTNTTE
1       CONTINLIE
        SN - ( N / MU) + (( RO / ( MU * ( 1 - RO ))) * ( 1 + SQ * SM ))
        WRITE (*,*) SN
        WRITE (*,*) SI, S2
        STOP
        END
```


Series
PREEMPTIVE RESUME
300
250
200
150
130
120
110
100
75
50
14-
12-
10-
8-
6-
4-
2-
0-
S_N

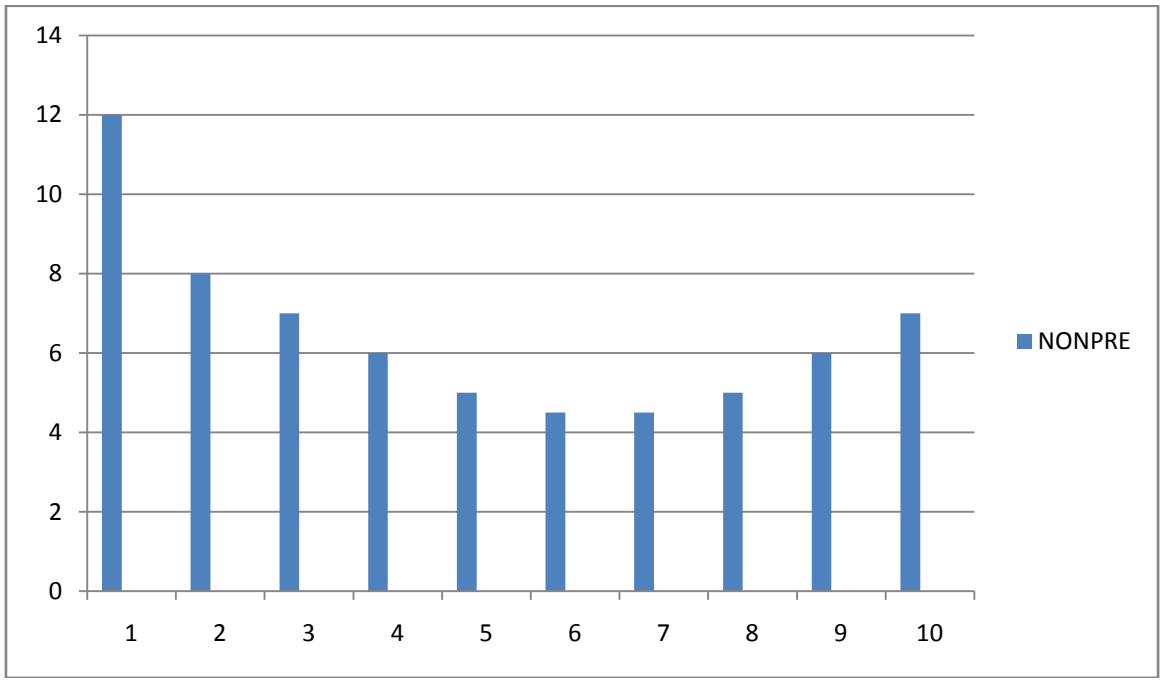
Non- Preemptive

λ	μ	n	S_n	S_1	S_2
1	5	50	12.06312660	.20000	.450000
1	10	75	7.72739728	.10000	.211111
1	15	100	6.73260656	.066666	.1380952
1	20	110	5.527858943	.050000	.10263157
1	25	120	4.8144128607	.040000	.0816666
1	30	130	4.341795784125	.03333	.06781609
1	35	150	4.2911341202	.02857142	.0579831
1	40	200	5.0036991731	.0250000	.0506410256
1	45	250	5.5582031258	.02222	.04494949
1	50	300	6.001967004	.020000	.0404081632

```
C       PROGRAM TO CALCULATE THE VALUE FOR S_N IN NON- PREEMPTIVE CASE:
        SUBROUTINE FACT (N, IFN)
        J = 1
        DO 101 = 1,N
         J = J * I
10      CONTINUE
         IFN = J
         RETURN
 END
        INTEGER Q, K, N, FR, FN, FNR
        DOUBLE PRECISION LEM, MU,NCR, MQ, SI, S2, SQ, SN, SM,
        R, RO
        READ (*, *) LEM, MU
        RO - LEM / MU
        S1 = (1.0 / MU )
        S2= (2.0 / MU ) + ( RO / ( MU * ( 1.0 - RO )))
        READ (*, *) N
        MQ = M + (2*Q)-1
        SQ-0
        SM = 0
        DO 1 Q = 0, N - 3
        SQ-SQ 1 (( RO **Q )/(( 1 I RO ) ** ( 2 * Q )))
        DO 2 M = 1, N - Q - 1
        CALL FACT ( M + (2 * Q ) 1,FN)
        CALL FACT ( Q, FR )
        CALL FACT  (Mi(2*Q)-l-Q,  FNR )
        NCR = FN / ( FR * FNR )
        SM - SM + ( M * RO ** M ) / (( M Q ) * ( 1 + RO ) M ) • NCR
2       CONTTNTTE
1       CONTINLIE
        SN - ( N / MU) + (( RO / ( MU * ( 1 - RO ))) * ( 1 + SQ * SM ))
        WRITE (*,*) SN
        WRITE (*,*) SI, S2
        STOP
        END
```


NONPREEMPTIVE RESUME
300
250
200
150
130
120
110
100
75
50
14-
12-
10-
8-
6-
4-
2-
0-
S_N

2. COMPARISION BETWEEN PREEMPTIVE & NON PREEMPTIVE RESUME



3. DISCUSSION AND CONCLUSIONS

Assigning various values to n, λ and μ the recursive representations (the expected sojourn times of the n^{th} customer denoted by S(n) in the low priority class) for the preemptive resume discipline and non- preemptive resume case have been computed.

Figure-1 illustrates the possible shapes of the prevalence of sojourn times in preemptive resume while Figure-2 depicts the possible shapes of the prevalence of sojourn times in non-Preemptive resume. With the increase in the number of customers, sojourn times in both disciplines decrease. A comparison of two disciplines (Figure-3) shows that sojourn times in non-preemptive discipline are less than sojourn times in preemptive discipline. In case of fewer customers main characteristics of graphs rapidly change and sojourn times in both disciplines be almost but not exactly the same.

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