OPERATING SYSTEMS
SYNCHRONIZATION TOOLS

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Contents

1 Goal :

- The goal is to implement TAS, CAS and Bounded Waiting with CAS mutual exclusion (ME) algorithms and comparing the average time required by a thread to enter critical section and comparing the maximum time required by a thread to enter critical section by varying the number of threads.

2 Input :

- The inputs are given by text file **inp-params.txt** and are:
  - Number of threads used in the program (N)
  - Number of times each each thread enters CS (K)
  - λ_1 is the mean of exponential distributes delay values for t_1 in milliseconds.
  - λ_2 is the mean of exponential distributes delay values for t_2 in milliseconds.

3 Output :

- We have three output files for each ME :
  1. TAS ME output ($tas\_output.txt$)
  2. CAS ME output ($cas\_output.txt$)
  3. Bounded CAS ME output ($cas\_bounded\_output.txt$)

4 Analyzing Program Output Files:

1) TAS ME Output :

- We can observe that there isn't any significant change between the times of Entered, Exited and Exited to entering of a new process to CS as the sleep time beign in milli seconds.
- As the value of number of threads reaches the max value of 50 we get an atmost time difference of 2 min, for smalll values of number threads there isn't any significant change in time between first and last write to the file.
- The output demonstrates the mutual exclusion of TAS, as when we see Requested, Entered, Exited these all occur for a write in sequential order which means that the property of mutual exclusion is followed, as there isn't any other process interupting our executing process.
- The printing was done not in order to demonstrate the validity of mutual exclusion.

2) CAS ME Output :

- The time difference between times of Entered, Exited and Exited to entering of a new process to CS arey very much near because of sleep time beign in milli seconds.
- Mutual exclusion can be understood by seeing the pattern of output, which are in regular pattern of Requested, Entered, Exited for a single thread.
- The printing was done not in order to demonstrate the validity of mutual exclusion.

3) Bounded waiting CAS ME Output :

- The time difference between times of Entered, Exited and Exited to entering of a new process to CS arey very much near because of sleep time beign in milli seconds.
- Mutual exclusion can be understood by seeing the pattern of output, which are in regular pattern of Requested, Entered, Exited for a single thread.
- The printing was done not in order to demonstrate the validity of mutual exclusion.

5 Analyzing Graphs :

- We analyze the program in two modes:
  1. Average time taken to enter the CS by each thread with varying the number of threads.
  2. The worst case time taken by a process to enter the CS with varying the number of threads.

5.1 Graph 1 :

- The value of K used by the program is fixed and is equal to 10.
- Now we see the variation of average time of entering into CS (T) by varying the number of threads (N).

5.1.1 Graph :

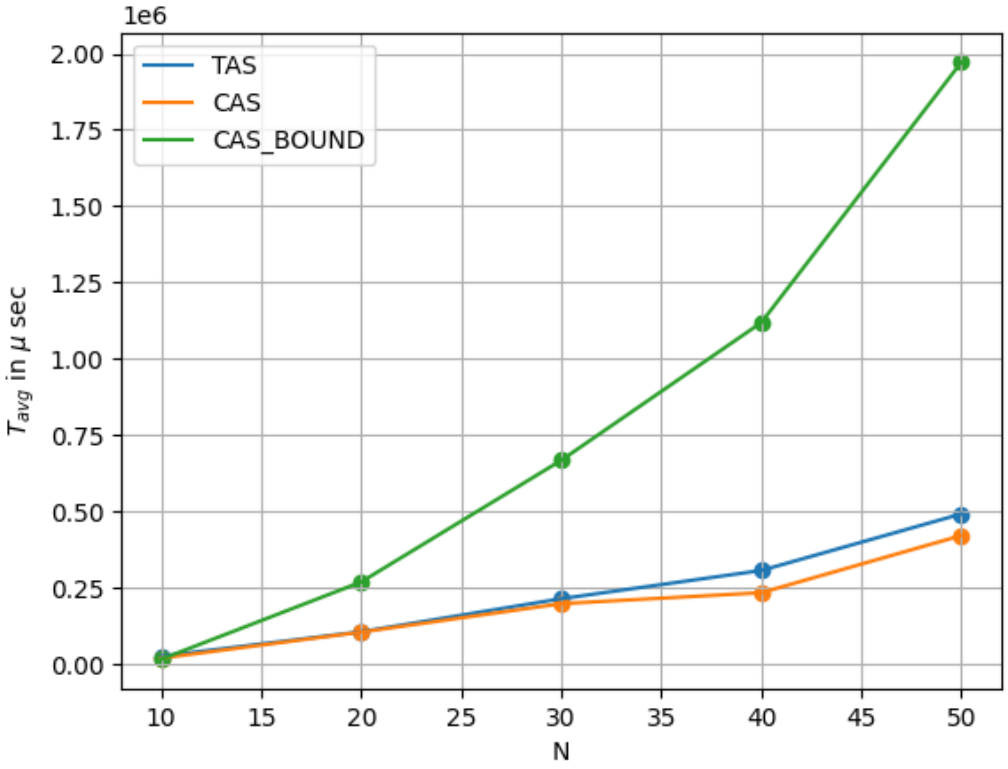

Figure 1: T_{avg} vs N

5.1.2 Observations :

- From the graph we can observe that using TAS or CAS we get nearly the same entering average time into CS.
- Average entering time is highest in case of $Bounded - CAS$.

5.2 Graph 2 :

- The value of K used by the program is fixed and is equal to 10.
- Now we see the variation of max time of entering into CS (T) by varying the number of threads (N).

5.2.1 Graph :

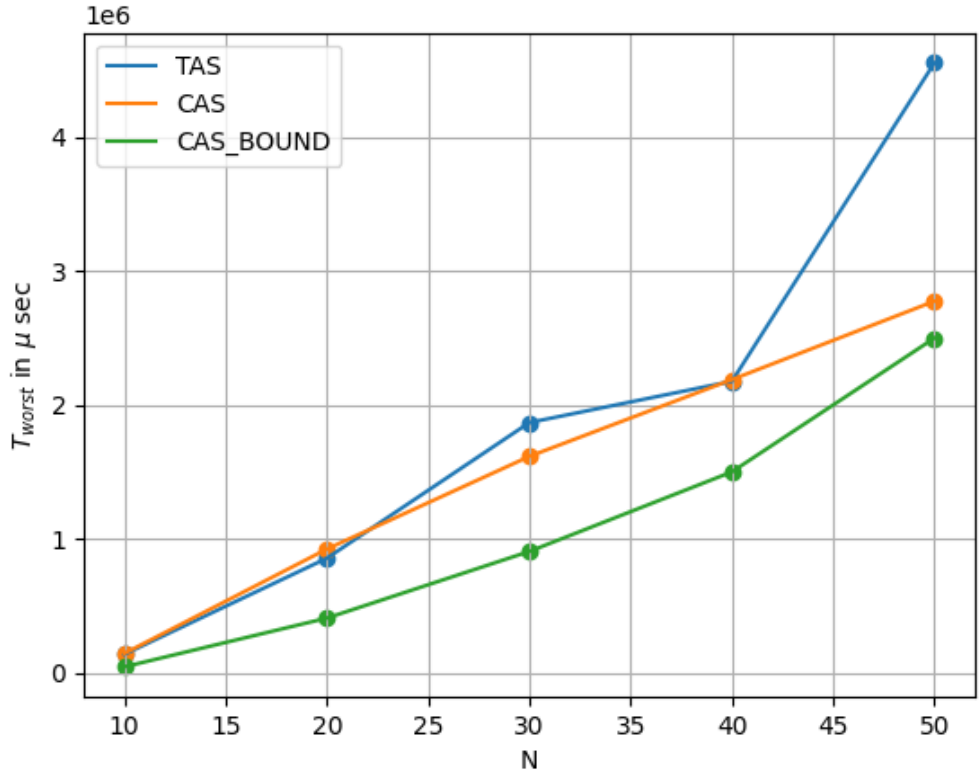

Figure 2: T_{max} vs N

5.2.2 Observations :

- From the graph we can observe that using TAS or CAS we get nearly the same maximum entering time into CS for small values of N, but as value of N increases for TAS maximum entering time increases rapidly.
- Maximum entering time is lowest in case of $Bounded - CAS$.

6 Final Conclusion:

- Maximum entering time is lowest in case of $Bounded - CAS$, and Average entering time is highest in case of $Bounded - CAS$.