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Fuzzy Scheduling of Jobs

Abstract

CPU scheduling is the basis of multi programmed operating system. The idea of multiprogramming is relatively simple, if a process (job) is waiting for an I/O request, then CPU switches from one job to another job so that CPU is always busy and computer becomes more productive.

Scheduling is a fundamental operating system function, almost all computer resources are scheduled before use. The CPU is also one of the primary resources. So, CPU is also scheduled before use. The CPU scheduling algorithm determines how the CPU will be allocated to the process. CPU scheduling algorithm are of two types one is non preemptive and second one is preemptive scheduling algorithm.

In the non preemptive scheduling once the CPU assigned to a process, the processor is not released until completion of that process. The CPU will be assigned to some other job only after the previous job has finished. But in the preemptive scheduling CPU from a lower priority process is taken back and given to higher priority process if it arrives in the middle of execution of the lower priority process.

A fuzzy set is a set containing elements that have varying degrees of membership in the Fuzzy Set. There is fuzziness in all preemptive scheduling algorithms. For example consider a process whose burst time is 4.1 ms and it has already executed to 4ms and a higher priority process arrives, this process will be preempted and put in the Ready Queue. If before preempting it is given 0.1ms, it will complete its execution and so it's waiting time may be reduced and other process may be accommodated in the queue. So, we have explored the possibility of using fuzzy concepts in scheduling to improve the performance of existing CPU scheduling algorithms.

Most of the existing models of scheduling assume the absence of uncertainty within the scheduling environment. In reality this is not true. Consequently the researchers working on scheduling algorithms have been recently trying to solve scheduling problems with uncertainty. Objective of choosing this work is to use fuzzy logic which can deal with imprecise parameters of scheduling.

In this thesis new and improved algorithms have been proposed for fuzzy scheduling of jobs where the scheduling parameters are not always crisp, few parameters may be fuzzy variables.

Job scheduling algorithm decides which of the processes in the ready queue is to be allocated CPU. There are several scheduling algorithm like FCFS, SJF, Priority based Scheduling, RR,

HRRN, priority based scheduling algorithm etc. None of these algorithms has employed fuzziness.
In the entire scheduling algorithm the parameters used are crisp. However, in many circumstances these parameters are vague. To exploit this vagueness we have used fuzzy logic in our proposed scheduling algorithms.
In preemptive priority scheduling algorithm short term scheduler always chooses the process that has the highest priority. When a new process joins the ready queue, the short term scheduler compares the priority of new process and the executing process. If the priority of the new process is higher than executing process, the executing process is preempted and the CPU is allocated to the new process. In this problem if a new higher priority process arrives, then executing lower priority process is always preempted even if the executing process is almost about to finish in fraction of ms. So, executing process very near to completion is put in the ready queue waiting to get turn of CPU. So, this algorithm may be improved by using the concept of fuzzy technique.
In Round Robin scheduling algorithm time quantum or time slice is fixed. Any process cannot get CPU for more than time slice time in one go. If a process can not finish its execution in one time slice, it is preempted and put at the end of the ready queue where it waits for its second turn. It can get the second turn only after all other processes in the ready queue have got their turns. If a process burst time is say 4.1ms and time slice is 4ms,then the process will have to wait in the queue till all processes consumes their time slice even though the process requires just 0.1 ms . So, there is chance of improvement in this algorithm. Improvement may be done by using the concept of fuzzy set theory and fuzzy logic.
Similarly, HRRN and Fair Share Scheduling Algorithms may be improved with the help of Fuzzy Logic concepts.
So, We have proposed Fuzzy Scheduling Algorithms for improving the performance of existing Priority Scheduling Algorithm, Round Robin Scheduling Algorithm, Highest Response Ratio Next (HRRN) Scheduling Algorithm and Fair Share Scheduling Algorithm. A FIS has also been designed for computing Time Quantum and its Dynamic Adjustment. Fuzzy Scheduling has also been proposed for Fault Tolerant and Load Balancing.
The organization of the entire thesis is outlined below.

Organization of the Thesis:

The Thesis contains total eight chapters. Chapter wise description is given below:-
Chapter 1 is introduction of the Thesis.
Chapter 2 briefly describes the preliminaries. This describes, process, process states, schedulers, scheduling criteria, scheduling algorithms and brief introduction of fuzzy techniques.
Chapter 3 describes the proposed General CPU Scheduling Algorithm and Priority Scheduling Algorithm using Fuzzy Logic.
Chapter 4 describes Fuzzy Round Robin Scheduling and Multi Level RR Scheduling.
Chapter 5 describes the proposed algorithm for finding Time Quantum in Time-shared System.
Chapter 6 describes the proposed algorithms using Fuzzy Logic for Improving Fair Share Scheduling and Highest Response Ratio Next Scheduling.
Chapter 7 describes Secure and Fault Tolerant Scheduling using Fuzzy Logic and Load Balancing using Fuzzy Logic.
Chapter 8 describes Conclusion and Future Scope.