ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 7, pp. 18851-18854, July, 2017

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

COMPARATIVE STUDY OF CPU SCHEDULING ALGORITHMS

Amit Kumar Gupta[1]*., Narendra Singh Yadav[2] and Dinesh Goyal[3]

[1,3]SGVU Jaipur
[2]JECRC University Jaipur

DOI: http://dx.doi.org/10.24327/ijrsr.2017.0807.0580

ARTICLE INFO

Article History:

Received 15th April, 2017
Received in revised form 25th May, 2017
Accepted 28th June, 2017
Published online 28th July, 2017

Key Words:

Operating Systems, Scheduling Algorithm, Time Quantum, Round Robin.

ABSTRACT

The Uniprocessor system can executes only one process at a time. When a process is executing on CPU the other will wait until the CPU is free. The Multiprogrammed operating system executes the process simultaneously to increases the uses of CPU. All the process requires the CPU cycle and I/O cycle to complete its execution. Suppose when a process executed on CPU and finishes its execution on CPU it is waiting for its I/O completion than in simple computer system the CPU will do nothing until the process completed its I/O request. During this the there is no useful working is there the other process which are waiting for CPU may sense the more waiting time. In multiprogramming, the operating system manages the process scheduling in which the processes which are ready to execute will kept in memory at one time. When the process is waiting for its I/O completion the operating system takes the CPU from that process and allocates the CPU to other process. By applying this scheme the utilization of CPU may be increased and the waiting time of the processes may be minimized. In this paper the researcher has presented the comparative analysis of classical CPU scheduling algorithms.

INTRODUCTION

Today operating system are more complex, they are working on multitasking environment in which process are executed concurrently. So CPU scheduling is internal part of operating system design. When more than one process are ready to execute in ready queue then operating system decide using scheduler (which uses scheduling algorithm) which process will be executed. There are several scheduling algorithms available as FCFS (First Come First Serve), SJF (Shortest Job First), Priority Scheduling and RR (Round Robin) scheduling algorithm. These scheduling Algorithms are used to minimize the turnaround time, response time, waiting time and no of context switching. There are some scheduling criteria, on the basis of these criteria we analysis and determine which scheduling algorithm is best.

Scheduling Criteria

There are many CPU scheduling algorithms having different properties, and the selection of a particular algorithm may favour one class of processes over another. The algorithm is selected for a particular state; we must judge properties of a verity of algorithms. The criteria contain the following: [1, 2, 3, 4]

- ***Context Switch****:* A context switch occur when a process interrupt the normal execution sequence of another process. The CPU stores all relevant information of interrupted process in Task Control Box (TCB). The context switch includes wastage of time, memory and scheduling overhead. So scheduling algorithm is designed in such way that it can minimize the number of context switches.
- ***Throughput****:* This term is defined as number of process completed per unit time. So scheduling algorithm is designed in such way that it can maximise the throughput.
- ***CPU Utilization****:* From the performance wise concern the CPU cannot be sit ideal. So scheduling algorithm is designed in such way that it cans maximum use of CPU as possible.
- ***Turnaround Time****:* It is the difference in the time of process when a process is ready to execute and when it complete its execution. So scheduling algorithm is designed in such way that it can minimize the turnaround time.
- ***Waiting Time:*** it is the sum of all waiting done by a process in ready queue for execution. So scheduling algorithm is designed in such way that it can minimize the waiting time.

Corresponding author:* **Amit Kumar Gupta
SGVU Jaipur

- ***Response Time***: Response time is the time it takes to start its execution not the time it takes to output the response.

Scheduling Algorithm

There exist different Scheduling algorithms, each of them has advantages and disadvantages and as follows:

First-Come-First-Served (FCFS) FCFS is simple scheduling algorithm in which process are executed on the basis of their arrival time in ready queue. This scheduling algorithm is non preemptive in nature. The disadvantages of this algorithm is long waiting time, response time for high priority process.

Shortest-Job-First (SJF) In this algorithm the process which have minimum CPU burst time will schedule first. This algorithm can be implemented in two way on is preemptive and another one is non preemptive. This is also known as Shortest Remaining Time first (SRTF). This algorithm may lead a problem that we cannot predict how long a job will executed.

Priority Scheduling In This algorithm the process which has priority among the processes will schedule first. This algorithm may lead a problem of starvation which is defined as if high priority processes are regularly available in ready queue then waiting time for low priority may become infinite.

Round Robin (RR) algorithm which is the main concern of this research is one of the oldest, simplest, and most widely used scheduling algorithms. This algorithm works on time sharing phenomenon. A time slice is given to every process and every process will executed for particular defined time slice. New processes are added to at the last of ready queue. The scheduler pick the process from the starting point of the ready queue and set the timer to a defined time slice and also set an interrupt. If the process still not completed its complete execution within a time slice it will be preempted after a time slice and added at the end of ready queue. The round robin scheduling give the better response time, minimize waiting time and turnaround time, maximize throughput and CPU utilization [1, 2].

Comparative Study of Scheduling Algorithm

Here the researcher is analyzing the various CPU Scheduling algorithms in Uniprocessor system which is popularly used these days. The researcher compares and studies the classical CPU scheduling Techniques name FCFS (First Come First Serve), SJF (Shortest Job First) in preemptive and non preemptive mode, Priority scheduling in preemptive and non preemptive mode and round robin scheduling.

Study to Calculate the Average Waiting Time Using FCFS, SJF, Priority and Round Robin Scheduling Techniques

Consider there are five processes P1, P2, P3, P4 and P5 with their arrival time and execution time as shown in table 1. The Figure 1, 2, 3, 4, 5 and 6 shows Gantt chart for scheduling of process in FCFS, SJF-Non preemptive SJF preemptive, Priority Non preemptive, Priority preemptive and Round Robin with time quantum=5.

Table 1 Process with Burst Time, Arrival Time and Priority

Process	Arrival Time	Burst Time (ms)	Priority
P1	0	10	5
P2	2	4	2
P3	3	2	1
P4	4	6	3
P5	5	8	4

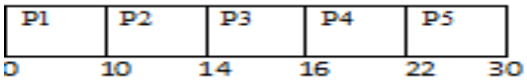

Figure 1 Gantt chart Using FCFS

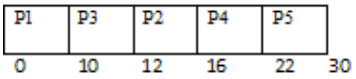

Figure 2 Gantt chart Using SJF (Non Pre-emptive)

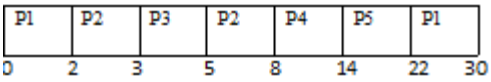

Figure 3 Gantt chart Using SJF (Pre-emptive)

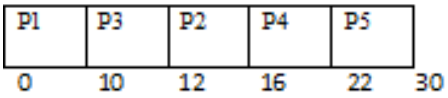

Figure 4 Gantt chart Using Priority Scheduling (Non Pre-emptive)

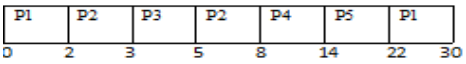

Figure 5 Gantt chart Using Priority Scheduling (Pre-emptive)

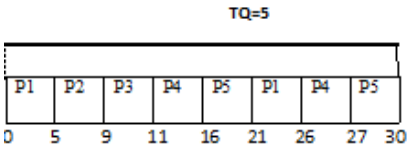

Figure 6 Gantt Chart using Round Robin Scheduling

The average waiting time of above mentioned CPU scheduling algorithm is shown in table 2 and figure 7 comparison graph of average waiting time among FCFS, SJF, Priority and RR CPU scheduling techniques.

Table 2 Average Waiting Time for Classical Cpu Scheduling Algorithm

CPU Scheduling Algorithm	Average Waiting Time (ms)
FCFS	9.6
SJF (Non Pre-emptive)	9.2
SJF (Pre-emptive)	7.4
Priority (Non Pre-emptive)	9.2
Priority (Pre-emptive)	7.4
Round Robin (TQ=5ms)	12

Study to Calculate the Average Turnaround Time Using FCFS, SJF, Priority and Round Robin Scheduling Techniques

Consider there are five processes P1, P2, P3, P4 and P5 with their arrival time and execution time as shown in table 1. The average turnaround time of above mentioned CPU scheduling algorithm is shown in table 3 and figure 8 comparison graph of turnaround time among FCFS, SJF, Priority and RR CPU scheduling techniques.

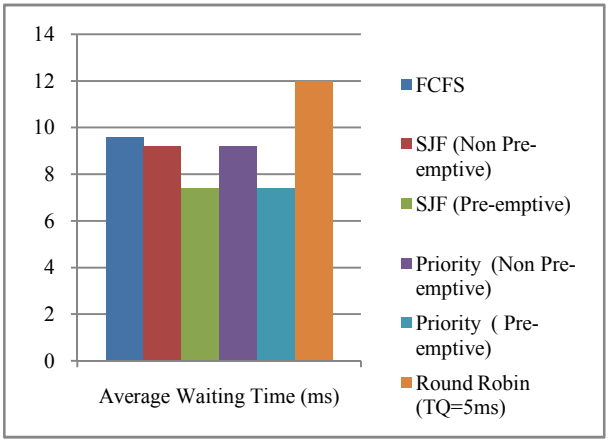

Figure 7 Comparison graph of average waiting time among FCFS, SJF, Priority and RR CPU scheduling techniques

Table 3 Average Turnaround Time for Classical CPU Scheduling Algorithm

CPU Scheduling Algorithm	Average Turnaround Time (ms)
FCFS	15.6
SJF (Non Pre-emptive)	15.2
SJF (Pre-emptive)	13
Priority (Non Pre-emptive)	15.2
Priority (Pre-emptive)	13
Round Robin (TQ=5ms)	17.8

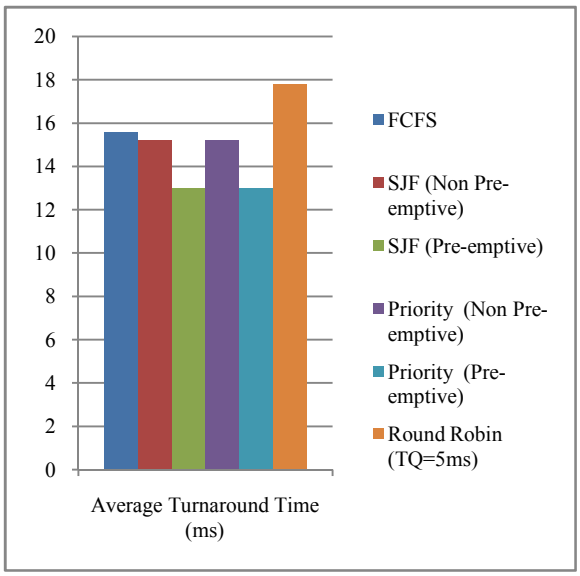

Figure 8 Comparison graph of Average Turnaround time among FCFS, SJF, Priority and RR CPU scheduling techniques

Study to Calculate the Number of Context switches Using FCFS, SJF, Priority and Round Robin Scheduling Techniques

There are five processes P1, P2, P3, P4 and P5 with their arrival time and execution time as shown in table 1. The number of context switches of above mentioned CPU scheduling algorithm is shown in table 4 and figure 9 comparison graph of number of context switches among FCFS, SJF, Priority and RR CPU scheduling techniques.

Table 4 Number of Context Switches for Classical CPU Scheduling Algorithm

CPU Scheduling Algorithm	Number of Context Switches
FCFS	4
SJF (Non Pre-emptive)	4
SJF (Pre-emptive)	6
Priority (Non Pre-emptive)	4
Priority (Non Pre-emptive)	6
Round Robin (TQ=5ms)	7

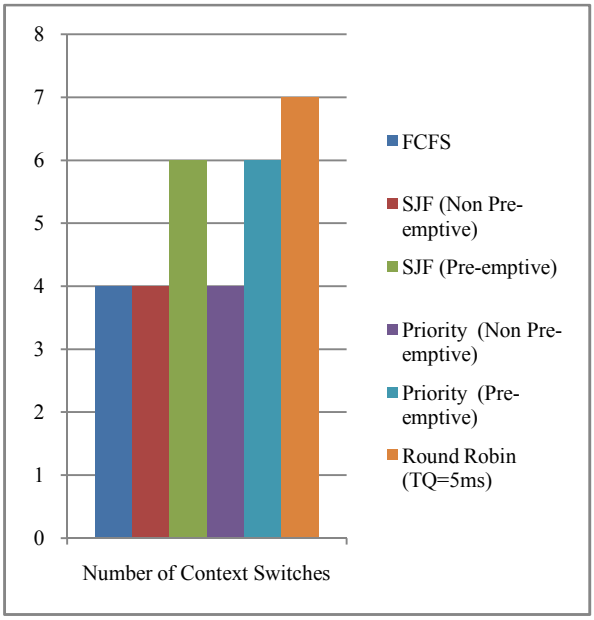

Figure 9 Comparison graph of Number of Context Switches among FCFS, SJF, Priority and RR CPU scheduling techniques

CONCLUSION

From the analysis, it is founded that The FCFS scheduling has long waiting time and response time for high priority process. The SJF scheduling has problem of prediction of execution time of process. The priority scheduling has problem of starvation. The low priority process may be blocked for indefinite time when arrival of high priority process regularly. The Preemptive SJF and Preemptive Priority scheduling included context switch overhead. Simple Round Robin scheduling is not considering the priority of any process. It works on the Preemptive FCFS principle in which the response time of process may be reduced but the average waiting time and turnaround time is increases. The simple RR is also suffering from the selection of Time quantum. If the time quantum is taken high than the system performance may be degraded.

References

1. D.M. Dhamdhere operating Systems A Concept Based Approach, Second edition, Tata McGraw-Hill, 2006.
2. Silberchatz, Galvin and Gagne, 2003. Operating systems concepts
3. Rami J. Matarneh "Self-Adjustment Time Quantum in Round Robin Algorithm Depending on Burst Time of the Now Running Processes" *American Journal of Applied Sciences* 6 (10): 1831-1837, 2009.

4. Ajit Singh, Priyanka Goyal, Sahil Batra "An Optimized Round Robin Scheduling Algorithm for CPU Scheduling" *International Journal on Computer Science and Engineering* Vol. 02, No. 07, 2010, 2383-2385
5. Rakesh Mohanty, Manas Das, M.Lakshmi Prasanna, Sudhashree "Design and performance evaluation of a new proposed fittest job first dynamic round robin (FJFDRR)scheduling algorithm" *International Journal of Computer Information System* Vol. 2 No. 2,2011
6. Abbas Noon, Ali Kalakech, Seifedine Kadry "A New Round Robin Based Scheduling Algorithm for Operating Systems: Dynamic Quantum Using the Mean Average" *IJCSI International Journal of Computer Science* Issues, Vol. 8, Issue 3, No. 1, May 2011
7. Rakesh Mohanty, H. S. Behera, Debashree Nayak, "A New Proposed Dynamic Quantum with Re-Adjusted Round Robin Scheduling Algorithm and Its Performance Analysis", *International Journal of Computer Applications* (0975 - 8887), Volume 5- No.5, August 2010.
8. Debashree Nayak, Sanjeev Kumar malla, Debashree Debadarshini "Improved Round Robin Scheduling using Dynamic Time Quantum" *International Journal of computer Application* (1975-8875) Volume 38-No. 5, January 2012.
9. Rakesh Mohanty, H.S. Behara, Khusbu Tiwari , Manas Das, M.Lakshmi Prasanna "Priority Based dynamic Round Robin(PBDRR) Algorithm with Intelligent Time Slice for Soft Real Time System" *International Journal of Advanced Computer Science and Application* Vol. 2 No. 2, February, 2011.
10. Rakesh Mohanty, H. S. Behera, Khusbu Patwari, Monisha Dash, "Design and Performance Evaluation of a New Proposed Shortest Remaining Burst Round Robin (SRBRR) Scheduling Algorithm", In Proceedings of *International Symposium on Computer Engineering & Technology (ISCET)*, Vol 17, 2010.
11. H. S. Behera and *et. al*. A New Dynamic Round Robin and SRTN Algorithm with Variable Original Time Slice and Intelligent Time Slice for Soft Real Time Systems. *International Journal of Computer Applications* 16(1):54-60, February 2011.

How to cite this article:

Amit Kumar Gupta *et al*.2017, Comparative Study of CPU Scheduling Algorithms. *Int J Recent Sci Res.* 8(7), pp. 18851-18854. DOI: http://dx.doi.org/10.24327/ijrsr.2017.0807.0580

****