ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 3, Issue 7, July 2016

An Analytical Study of CPU Scheduling Algorithms

[1]Manish Chandra Bhatt [2] Nikhil Kumar Singh
[1][2]M. Tech., Babasaheb Bhimrao Ambedkar University, Lucknow
[1] manishraj.bhatt@gmail.com, [2] nikhil199241@gmail.com

***Abstract*— Present paper is the study about most of the CPU scheduling algorithms and its features. In this paper the compression between the algorithms on the same CPU is shown. Using this comparison one can easily understand that what is performing inside the CPU. The aim of this survey is to analyze that CPU scheduler which have maximum efficiency and may also satisfy all the objectives of the scheduling.**

***Keywords:* SJF (Shortest Job First Scheduling), RRS (Round Robin Scheduling), PBS (Priority Based Scheduling), Starvation, Scheduler.**

I. INTRODUCTION

We can say that operating system is the heart of any computer system which manages the resources between the hardware and software. Operating system is a system software which is loaded first in the memory of computer system every time when it starts. Without any operating system we cannot imagine the proper functioning of any computer system. Operating system provides a base or we can say platform where any application system may run. In any computer system there are various applications, processes or tasks which are running or executing simultaneously. Therefore where there are multiple tasks which are running together, there must be a proper and effective manner of using the CPU time. There may also be number of processes which are running on the same instant of time. Therefore there must be a particular fashion for each and every processes which may allow them to share the CPU time among them for their execution [1] [2].

II. CPU SCHEDULING

In multi-programmed operating system CPU scheduling is primary. A computer system may be more productive when the operating system switches the CPU time among various processes. A multi-programming operating system is a system which allows number of processes to execute at the same instant of time by sharing the CPU time among them. Multi- programming is used for sharing of CPU time in a particular fashion between application processes and operating system because the operating system also composed of number of processes [1] [3].
CPU scheduling means for a particular time period a process is assigned to the CPU. In multi-programming the scheme by which processes are assigned to the CPU is also named as scheduling [4]. Scheduling is the way by which processes can access to the system resources. Traffic control such as railways, airways, roadways etc. is the live examples of scheduling [5].

To achieve the goals of an operating system design CPU scheduling is very necessary. The purpose of CPU scheduling is to make the best use of CPU by allowing the number of possible running processes at all the time [6].

III. CPU SCHEDULER

Every time operating system selects one of the process from the ready queue for execution when the CPU is in ideal or in unoccupied condition. A scheduler is something which can conduct the scheduling process. To keep all the resources of the computer system busy and to allow various processes to share the resources among them to achieve the quality of service scheduler is used [7] [8].
Following three types of the schedulers are used by an operating system:-

1) ***Long-term scheduler:* -** Which process will be admitted to the ready queue for the execution is decided by the long term scheduler therefore it can also be named as admission scheduler. Processes are either approved or detained by the dispatcher in this decision. Therefore what

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 3, Issue 7, July 2016

processes are to be run on the system is prescribed by this scheduler [8].

2) ***Mid-term scheduler:*** - In mid-term scheduler some of the processes which are on the main memory are moved temporarily to the secondary memory or vice-versa. The process of moving processes from RAM to secondary memory or vice-versa is named as "Swapping out or swapping in" [8].

3) ***Short-term scheduling:*** - Those processes which are in ready queue or in memory for execution are selected by the short-term scheduler because it is capable of taking frequent decision. Short-term scheduler is preemptive and non-preemptive both [8].

IV. DISPATCHER

The processes selected by the scheduler receive the control of the CPU from a module known as dispatcher. It includes the following functions:-

a) Switching context
b) Switching to user mode
c) Jumping to the proper location in the user program to restart that program

Dispatcher is called on during every time the process switches therefore it should be fast.
Dispatch latency is the time taken in stop one process and starts another one again [7] [9].

V. SCHEDULING CRITERIA

Different Different scheduling algorithms have different criteria following properties of algorithms must be considered:-

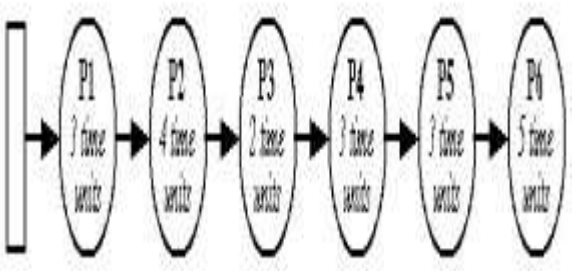
- ***CPU utilization***: - Our aim is to keep the CPU busy as much as possible. It means that we have the maximum CPU utilization without wasting any CPU cycle [7].
- ***Throughput:*** - If processes are executing continuously it means that the CPU is busy and work is being done. Throughput is basically the measure of the processes which have completed their execution in a particular time slice [7].
- ***Turnaround time*****: -** For a particular process the turnaround time is the total time taken by the process to complete its execution which includes the waiting time also it means the time between creation and completion of the process [7].
- ***Waiting time:*** - The time period of the process spent in the ready queue is known as the waiting time. Waiting time must be minimum for the processes [7].
- ***Response time*****: -** The amount of time taken after the submission of any processes till the first response is known as the response time [7].
- ***Context Switch*****: -** It is the process of restoring the CPU state so that the execution of the process may be resumed from the same point [7]

The waiting time, turnaround time and response time must be minimized and the throughput and CPU utilization must be increased.

VI. SCHEDULING ALGORITHMS

Basically the CPU scheduling is the process of taking the decisions that which process have been allotted the CPU time from the ready queue. There are following different scheduling algorithms:-

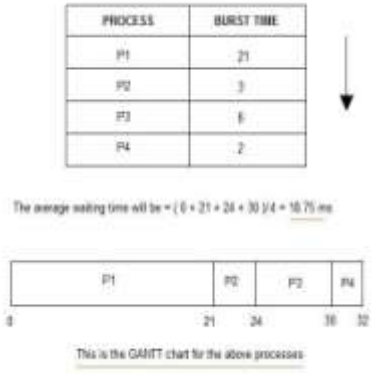
1) ***First-Come, First- Served Scheduling*****: -** The process which request the processor first will be selected first. This is the one of the simplest scheduling algorithm and also termed as FIRST IN FIRST OUT (FIFO) because according to the arrival time of the processes they are moved to the ready queue for execution. This is a non-preemptive algorithm [10].



ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 3, Issue 7, July 2016

Figure 1.1 Diagram representing FCFS scheduling



2) ***Shortest-Job-First Scheduling*: -** The processes are arranged by the scheduler according to their burst time so that the process which have minimum CPU burst can be executed first. It can also be termed as SHORTEST PROCESS NEXT (SPN) and uses the FCFS scheduling when there are two or more processes having same CPU burst[7] [10].

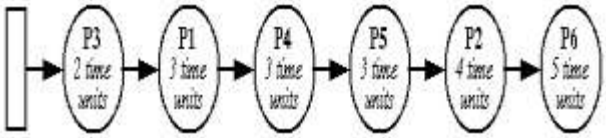
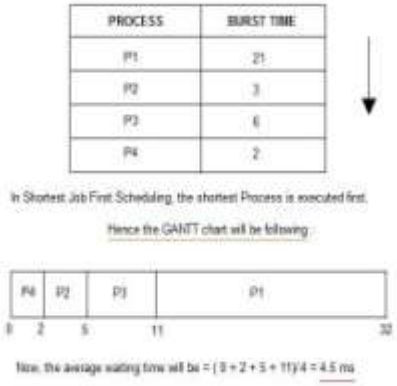
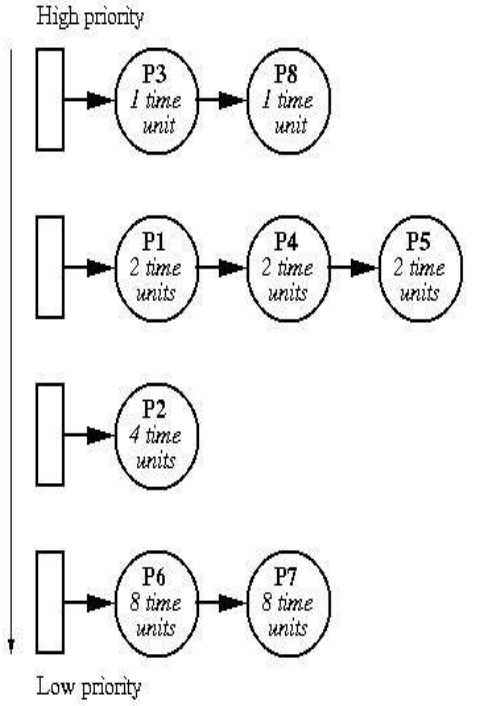


Figure 2.1 Diagram representing SJF scheduling



3) ***Priority Scheduling:* -** Each processes have its priority and the process which is selected from the ready queue for the execution have the highest priority among them. FCFS is used when their is two or more processes having the same priority. The processes having high priority have the lowest waiting time and the processes with lowest priority can suffer from starvation problem. A process can be marked or considered as block which is waiting for the CPU from long time ready to run. Priority scheduling either preemptive or non-preemptive [4] [10].



ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 3, Issue 7, July 2016

Figure 3.1 Diagram representing Priority scheduling

PROCESS	BURST TIME	PRIORITY
P1	21	2
P2	3	1
P3	6	4
P4	2	3

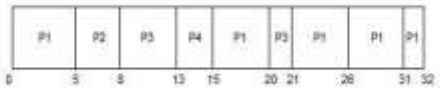
The GANTT chart for following processes based on Priority scheduling will be,

The average waiting time will be, (0 + 3 + 24 + 26)/4 = 13.25 ms

4) *Round-Robin Scheduling*: - Mostly time sharing systems uses the round robin algorithm it is one of the oldest algorithm which assign a fixed time slice for each processes and that fixed time period is known as quantum. In this algorithm each processes have the equal CPU time. Same as the FCFS the processes are moved to the ready queue for the execution but have a fixed time quantum [2] [4].

PROCESS	BURST TIME
P1	21
P2	3
P3	6
P4	2

The GANTT chart for round robin scheduling will be,



The average waiting time will be, 11 ms.

VII. CONCLUSION

Various CPU scheduling algorithms are discussed in this paper according to their CPU overhead, Throughput, Turnaround-time and Response time. The FCFS have the low Throughput, Turnaround-time and Response time. SJF have the high Throughput medium Turnaround-time, CPU overhead and response time. Priority scheduling have the low Throughput medium CPU overhead and high Turnaround-time and response time. Round-Robin have high CPU overhead and response time and have medium Throughput and Turnaround-time.

REFERENCES

[1] Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts”, Sixth Edition.

[2] TarekHelmy, AbdelkaderDekdouk, "Burst Round Robin: As a Proportional-Share Scheduling Algorithm", IEEE Proceedings of the fourth IEEE-GCC Conference on towards Techno Industrial Innovations, pp. 424-428, 11- 14 November, 2007.

[3] A. Noon, A. Kalakech, and S. Kadry, "A new Round Robin Based scheduling algorithm for Operating Systems: Dynamic Quantum time Mean Average", International Journal of Computer Science Issues. 8(3), 224-229, 2011.

[4] RakeshMohanty, H. S. Behera, KhusbuPatwari, 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.

[5] Samih M. Mostafa, S. Z. Rida, Safwat H. Hamad, Finding Time Quantum Of Round Robin Cpu Scheduling Algorithm In General Computing Systems Using Integer Programming, International Journal of Research and Reviews in Applied Sciences IJRRAS), Vol 5, Issue 1, 2010.

[6] Goel, Neetu, and R. B. Garg. "A Comparative Study of CPU Scheduling Algorithms." *arXiv preprint arXiv:1307.4165* (2013).

[7] Saini, Meenakshi, and Navdeep Kumar. "A SURVEY ON CPU SCHEDULING." (2015).

[8] Qureshi, Imran. "CPU Scheduling Algorithms: A Survey." *International Journal of Advanced Networking and Applications* 5.4 (2014): 1968.

[9] M.H. Zahedi, M. Ghazizadeh , and M . Naghibzadeh, "Fuzzy Round Robin CPU Scheduling (FRRCS) Algorithm", Advances in Computer and Information Sciences and Engineering. 348-353, 2008.

[10] SukanyaSuranauwarat, "A CPU Scheduling Algorithm Simulator", 37th ASEE/IEEE Frontiers in Education Conference October 10 – 13, 2007.