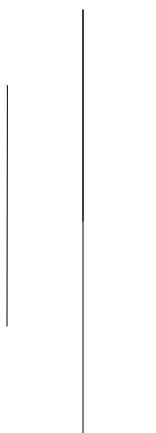# Tribhuvan University

Center Department of Computer Science
&
Information Technology

Programming Lab: 01
CPU Scheduling algorithm implementations

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Introduction: The main objective of the multi programming is to keep on running processes all the time for maximum CPU utilization. As a CPU has multiple numbers of processes. Only one process can use the CPU at a time which process is going to be execute that thing decide a by scheduler and it's whole thing is CPU scheduling.

CPU scheduling decisions may take place when a process:

    i.   Switches from running to waiting state
    ii.   Switches from running to ready state
    iii.   Switches from waiting to ready state
    iv.   Terminates

There are two types of scheduling:

    i. Preemptive
    ii. Non-preemptive

Preemptive:

- In preemptive scheduling, the currently running process may be interrupted and move to the ready state by OS(forcefully).
- It selects a process and lets run for a specific time duration, called time quantum.
- If process is still running at the end of the time interval, it is suspended and the scheduler selects another process to run.

Non Preemptive:

- In non-preemptive scheduling, the running process can only lose the processor voluntarily by terminating or by requesting and I/O. OR, once CPU given to a process it can not be preempted until the process completes its CPU burst.

- It selects a process to run and then just lets it run until it blocks or terminates.

Scheduling Criteria:

- CPU utilization: keep the CPU as busy as possible
- Throughput: No of processes that complete their execution per time unit
- Turnaround time: amount of time to execute a particular process (time from submission to termination)
- Waiting time: amount of time a process has been waiting in the ready queue (sum of time waiting in ready queue)

CPU scheduling algorithms: A Process Scheduler schedules different processes to be assigned to the CPU based on particular scheduling algorithms. There are five popular process scheduling algorithms which we are going to discuss in this chapter-

- First-Come, First-Served (FCFS) Scheduling

- Shortest-Job-First (SJF) Scheduling

- Priority Scheduling

- Shortest Remaining Time

- Round Robin(RR) Scheduling

First-Come First-Serve (FCFS):
In First-Come First-Serve (FCFS) algorithm jobs are executed on first come, first serve basis. It is a non-preemptive, pre-emptive scheduling algorithm. Easy to understand and implement. Easy to understand and implement. Its implementation is based on FIFO queue. Poor in performance as average wait time is high.

Shortest-Job-First (SJF): In Shortest-Job-First (SJF) jobs algorithm Jobs are executed on shortest Job First basis. This is a non-preemptive, pre-emptive scheduling algorithm. It is best approach to minimize waiting time. It is Easy to implement in Batch systems where required CPU time is known in advance. Impossible to implement in interactive systems where required CPU time is not known. The processor should know in advance how much time process will take.

Priority Based: Priority scheduling is a non-preemptive algorithm and one of the most common scheduling algorithms in batch systems. Each process is assigned a priority. Process with highest priority is to be executed first and so on. Processes with same priority are executed on first come first served basis.

Priority can be decided based on memory requirements, time requirements or any other resource requirement.

Shortest Remaining Time: Shortest remaining time (SRT) is the preemptive version of the SJF algorithm. The processor is allocated to the job closest to completion but it can be preempted by a newer ready job with shorter time to completion. It is Impossible to implement in interactive systems where required CPU time is not known. It is often used in batch environments where short jobs need to give preference.

Round Robin Scheduling: Round Robin is the preemptive process scheduling algorithm. Each process is provided a fix time to execute, it is called a quantum. Once a process is executed for a given time period, it is preempted and other process executes for a given time period. Context switching is used to save states of preempted processes.

Results and Analysis:

FCFS Analysis:

Running the given data with First come First Serve algorithm gives the following results. Given data:

Process	Burst Time
P1	24
P2	3
p3	3

Total Waiting Time:51.0

Average Waiting Time:17.0

Average Turnaround Time:10.0

Shortest Job First Analysis:

Running the given data with Shortest Job First algorithm gives the following results. Given data:

Process	Burst Time
P1	7
P2	4
P3	1
P4	4

Total Waiting Time:81.0

Average Waiting Time:20.25

Total Turnaround Time:37

Average Turnaround Time:9.25

Priority Scheduling:

Running the given data with First come First Serve algorithm gives the following results. Given data:

Process	Burst Time	Priority
P1	5	4
P2	4	2
P3	2	6
P4	4	3

Total Waiting Time:25.0

Average Waiting Time:6.25

Total Turnaround Time:17.0

Average Turnaround Time:4.25

Testing With More data:

Let's consider the following data and Let's run the following data into available algorithm and observe the results.
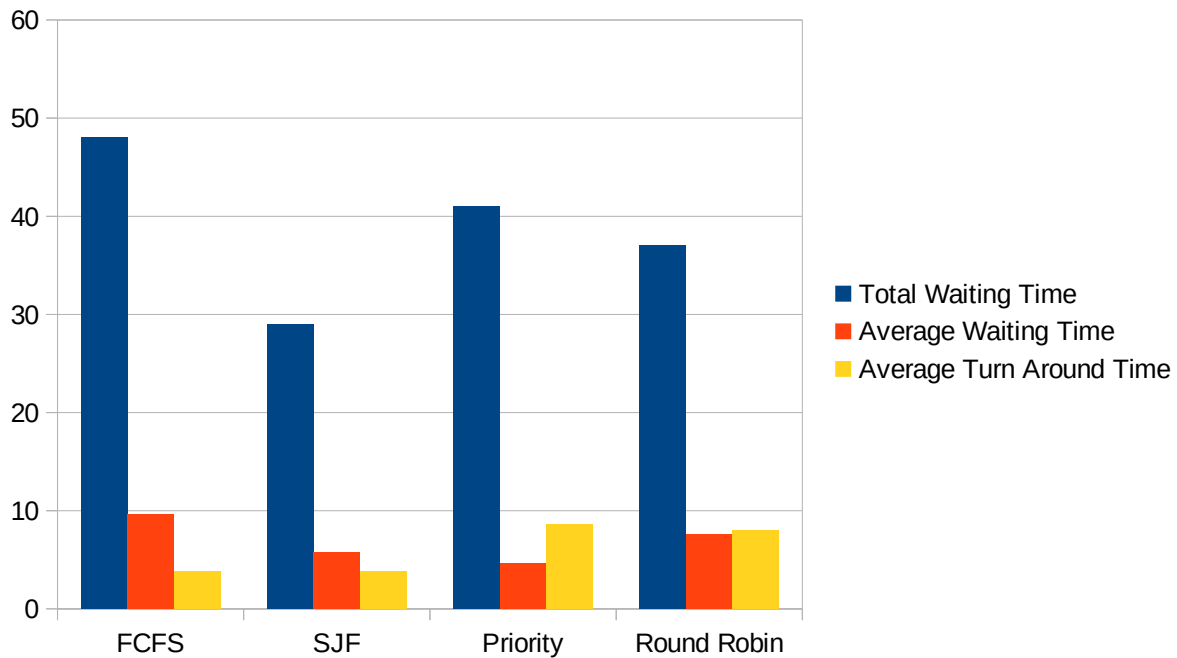
Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

Results for more Data:

	FCFS	Shortest Job First	Priority	Round Robin
Total Waiting Time	48	29	41	37
Average Waiting Time	9.6	5.8	8.2	7.4
Average Turn Around Time	3.8	3.8	4.6	6.0

Total Turn Around Time	19	19	23	30

Bar Graph:

Conclusions and recommendations:

SJF is Optimal algorithm, gives minimum average waiting time for a given set of processes.

In Priority, low priority processes may never execute.

Round Robin has typically, higher average turnaround than SJF, but better response.

References:

- CPU Scheduling Algorithms, Shubhashish Punj, [https://www.slideshare.net/punj25/final-18087303]. Accessed April 24, 2019.

- Scheduling Algorithms, Dhaval Sakhiya, [https://www.slideshare.net/sakhiyadhaval/scheduling-algorithms-55554795]. Accessed April 24, 2019.