

COP 4610 - Programming Assignment

CPU Scheduler

Project objective: To learn more about OS scheduling through a hands-on simulation programming experience

Implement the following 3 CPU scheduling algorithms

- Simulate and evaluate each with the set of eight processes below.
- Use any programming language. The program listing should be submitted with the report.

- **FCFS non-preemptive (partial results provided)**
- **SJF non-preemptive**
- **MLFQ**

Multilevel Feedback Queue (absolute priority in higher queues)

Queue 1 uses RR scheduling with $T_q = 5$

Queue 2 uses RR scheduling with $T_q = 10$

Queue 3 uses FCFS

All processes enter first queue 1. If time quantum (T_q) expires before CPU burst is complete, the process is downgraded to next lower priority queue. Processes are not downgraded when preempted by a higher queue level process. Once a process has been downgraded, it will not be upgraded.

Assumptions:

- All processes are activated at time 0
- Assume that no process waits on I/O devices.
- After completing an I/O event, a process is transferred to the ready queue.
- Waiting time is accumulated while a process waits in the ready queue.
- Turnaround time is a total of (Waiting time) + (CPU burst time) + (I/O time)
- Response time is the first measure of waiting time from arrival at time 0 until the first time on the CPU.

Process Data:

process goes {CPU burst, I/O time, CPU burst, I/O time, CPU burst, I/O time,....., last CPU burst}

P1 {5, 27, 3, 31, 5, 43, 4, 18, 6, 22, 4, 26, 3, 24, 4}

P2 {4, 48, 5, 44, 7, 42, 12, 37, 9, 76, 4, 41, 9, 31, 7, 43, 8}

P3 {8, 33, 12, 41, 18, 65, 14, 21, 4, 61, 15, 18, 14, 26, 5, 31, 6}

P4 {3, 35, 4, 41, 5, 45, 3, 51, 4, 61, 5, 54, 6, 82, 5, 77, 3}

P5 {16, 24, 17, 21, 5, 36, 16, 26, 7, 31, 13, 28, 11, 21, 6, 13, 3, 11, 4}

P6 {11, 22, 4, 8, 5, 10, 6, 12, 7, 14, 9, 18, 12, 24, 15, 30, 8}

P7 {14, 46, 17, 41, 11, 42, 15, 21, 4, 32, 7, 19, 16, 33, 10}

P8 {4, 14, 5, 33, 6, 51, 14, 73, 16, 87, 6}

Simulation completed for FCFS (see results in table below).

Presentation of results:

Write the simulation program in a programming language (such as C, C++, C#, Java, or any other language).

Submit REPORT: Write a well-organized report, which will include:

- Table of Content
- Introduction
- General flow chart (logic) of the simulation program **and/or** GANTT Charts
- Well-presented final results including tables and discussion
- Discussion and Tables (see below) for
 - U (CPU utilization),
 - Tw (waiting times)
 - Ttr (turnaround times),
 - Rt(response times)
- for all processes and averages for each algorithm(see FCFS below)
 - **Compare results SJF, FCFS, MLFQ**
 - Sample of dynamic execution (program output)
---This information should be displayed for each context switch
 - Current Execution time
 - Running process
 - The Ready queue, with the CPU burst time for each process
 - The Processes in I/O with the remaining time for every process for its I/O burst completion
 - Indicate when a process has completed its total execution.
 - Results printed at the end of each simulation
This information should be displayed at the end of each simulation
- Total time needed to complete all 8 processes.
- CPU utilization - [%] (U).
- Waiting times for each process and the average waiting time for all processes (Tw)
- Turnaround time for each process and the average turnaround time.(Ttr)
- Response time for each process and the average response time (Tr).
- Well commented source code

The grading will be based on the following

- (1) Program structure and organization
- (2) Overall report
- (3) Final results and discussion

Table of results comparison (SJF, FCFS, MLFQ)

	SJF	FCFS	MLFQ
CPU utilization		85.34%	
Avg Waiting time (Tw)		185.25	

Avg Turnaround time (Ttr)		521.37	
Avg Response time (Tr)		24.37	

				SJF CPU utilization:			FCFS CPU utilization: 85.34%			MLFQ CPU utilization:		
	<i>Tw</i>	<i>Ttr</i>	<i>Tr</i>		<i>Tw</i>	<i>Ttr</i>	<i>Tr</i>		<i>Tw</i>	<i>Ttr</i>	<i>Tr</i>	
P1					170	395	0					
P2					164	591	5					
P3					165	557	9					
P4					164	648	17					
P5					221	530	20					
P6					230	445	36					
P7					184	512	47					
P8					184	493	61					
Avg					<i>185.25</i>	<i>521.37</i>	<i>24.37</i>					