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Laboratory task 3

Operating Systems – 2020/2021 Summer Semester

I declare that this piece of work is which is the basis for recognition of achieving learning outcomes in the Operating Systems course was completed on my own.

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Introduction

In this lab we are to get familiar with CPU scheduling of processes. A non-preemptive First Come First Serve (FCFS) algorithm will be used to run different numbers of processes, each of which is to run for 2000ms total and every 500ms it will be blocked for input or output. The simulation will run for 10000ms each time.

CPU Scheduling

CPU Scheduling is a process by which we determine which of many processes will use the CPU for execution while another processes are on hold, typically by means of a process queue. We use process scheduling to utilize the CPU as much as possible and complete as many processes in the shortest amount of time (while potentially taking note of their priority).

Preemptive scheduling

In preemptive scheduling the processes are executed according to priority and the execution of one process may be halted once a process of a higher priority becomes available for execution. An example of a preemptive algorithm is the…

Round-robin scheduling

In this scheduling algorithm processes are given a time slot, during which they can run. After that time the running process is interrupted and moved to the back of the queue, and the proces that has been thusly moved to the front is executed. If a proces finishes or is interrupted before the full time allocated, another process starts and the timer for the time slot is reset.

Non-preemptive scheduling

In non-preemptive scheduling a process holds the CPU until it gets terminated or reaches a waiting state (being blocked for input or output in our case). If it didn't it would run until completion before the CPU could be allocated to another process. This scheduling method is not very flexible and may be less efficient as high priority processes may have to wait for longer.

First-Come First-Served scheduling

The FCFS algorithm queues and executes processes in order of arrival. If a process is not interrupted it will finish and only then the next process will be executed.

2 Processes

Summary-Processes file output

Process: 0 registered... (2000 500 0 0)
Process: 0 I/O blocked... (2000 500 500 500)
Process: 1 registered... (2000 500 0 0)
Process: 1 I/O blocked... (2000 500 500 500)
Process: 0 registered... (2000 500 500 500)
Process: 0 I/O blocked... (2000 500 1000 1000)
Process: 1 registered... (2000 500 500 500)
Process: 1 I/O blocked... (2000 500 1000 1000)
Process: 0 registered... (2000 500 1000 1000)
Process: 0 I/O blocked... (2000 500 1500 1500)
Process: 1 registered... (2000 500 1000 1000)
Process: 1 I/O blocked... (2000 500 1500 1500)
Process: 0 registered... (2000 500 1500 1500)
Process: 0 completed... (2000 500 2000 2000)
Process: 1 registered... (2000 500 1500 1500)
Process: 1 completed... (2000 500 2000 2000)

Summary-Results file output

Scheduling Type: Batch (Nonpreemptive)
Scheduling Name: First-Come First-Served
Simulation Run Time: 4000
Mean: 2000
Standard Deviation: 0

Process #	CPU Time	IO Blocking	CPU Completed	CPU Blocked
0	2000 (ms)	500 (ms)	2000 (ms)	3 times
1	2000 (ms)	500 (ms)	2000 (ms)	3 times

Comments

The simulation run for 4000ms in total in a way we might expect with process 0 running for 500ms, being blocked and process 1 taking its place. Then as process 1 is being blocked process 0 starts being executed again. This oscillating pattern repeats until both processes have finished.

5 Processes

Summary-Processes file output

Process: 0 registered... (2000 500 0 0)
Process: 0 I/O blocked... (2000 500 500 500)
Process: 1 registered... (2000 500 0 0)
Process: 1 I/O blocked... (2000 500 500 500)
Process: 0 registered... (2000 500 500 500)
Process: 0 I/O blocked... (2000 500 1000 1000)
Process: 1 registered... (2000 500 500 500)
Process: 1 I/O blocked... (2000 500 1000 1000)
Process: 0 registered... (2000 500 1000 1000)
Process: 0 I/O blocked... (2000 500 1500 1500)
Process: 1 registered... (2000 500 1000 1000)
Process: 1 I/O blocked... (2000 500 1500 1500)
Process: 0 registered... (2000 500 1500 1500)
Process: 0 completed... (2000 500 2000 2000)
Process: 1 registered... (2000 500 1500 1500)
Process: 1 completed... (2000 500 2000 2000)
Process: 2 registered... (2000 500 0 0)
Process: 2 I/O blocked... (2000 500 500 500)
Process: 3 registered... (2000 500 0 0)
Process: 3 I/O blocked... (2000 500 500 500)
Process: 2 registered... (2000 500 500 500)
Process: 2 I/O blocked... (2000 500 1000 1000)
Process: 3 registered... (2000 500 500 500)
Process: 3 I/O blocked... (2000 500 1000 1000)
Process: 2 registered... (2000 500 1000 1000)
Process: 2 I/O blocked... (2000 500 1500 1500)
Process: 3 registered... (2000 500 1000 1000)
Process: 3 I/O blocked... (2000 500 1500 1500)
Process: 2 registered... (2000 500 1500 1500)
Process: 2 completed... (2000 500 2000 2000)
Process: 3 registered... (2000 500 1500 1500)
Process: 3 completed... (2000 500 2000 2000)
Process: 4 registered... (2000 500 0 0)
Process: 4 I/O blocked... (2000 500 500 500)
Process: 4 registered... (2000 500 500 500)
Process: 4 I/O blocked... (2000 500 1000 1000)
Process: 4 registered... (2000 500 1000 1000)
Process: 4 I/O blocked... (2000 500 1500 1500)

Process: 4 registered... (2000 500 1500 1500)

Summary-Results file output

Scheduling Type: Batch (Nonpreemptive)
Scheduling Name: First-Come First-Served
Simulation Run Time: 10000
Mean: 2000
Standard Deviation: 0

Process #	CPU Time	IO Blocking	CPU Completed	CPU Blocked
0	2000 (ms)	500 (ms)	2000 (ms)	3 times
1	2000 (ms)	500 (ms)	2000 (ms)	3 times
2	2000 (ms)	500 (ms)	2000 (ms)	3 times
3	2000 (ms)	500 (ms)	2000 (ms)	3 times
4	2000 (ms)	500 (ms)	2000 (ms)	3 times

Comments

For this batch of processes the initial two executions are as expected, but after process 1 is blocked one might think that process 2 should start execution. This is not the case because of the FTFS algorithm that is in use. It makes is to that after becoming available process 0 will start execution immediately as it was the first process to arrive. Processes are therefore executed in pairs, with a new pair starting only after both of the previous processes have completed their execution. Here it's not the case for the last process as it doesn't have a pair so it just executes all at once. The "Process: 4 completed..." message is not present as the simulation didn't have enough time to display it as process 4 completed right at the end of it. If the simulation time is extended by even a millisecond the message shows.

10 Processes

Summary-Processes file output

Process: 0 registered... (2000 500 0 0)
Process: 0 I/O blocked... (2000 500 500 500)
Process: 1 registered... (2000 500 0 0)
Process: 1 I/O blocked... (2000 500 500 500)
Process: 0 registered... (2000 500 500 500)
Process: 0 I/O blocked... (2000 500 1000 1000)
Process: 1 registered... (2000 500 500 500)
Process: 1 I/O blocked... (2000 500 1000 1000)
Process: 0 registered... (2000 500 1000 1000)
Process: 0 I/O blocked... (2000 500 1500 1500)
Process: 1 registered... (2000 500 1000 1000)
Process: 1 I/O blocked... (2000 500 1500 1500)
Process: 0 registered... (2000 500 1500 1500)
Process: 0 completed... (2000 500 2000 2000)
Process: 1 registered... (2000 500 1500 1500)
Process: 1 completed... (2000 500 2000 2000)
Process: 2 registered... (2000 500 0 0)
Process: 2 I/O blocked... (2000 500 500 500)
Process: 3 registered... (2000 500 0 0)
Process: 3 I/O blocked... (2000 500 500 500)
Process: 2 registered... (2000 500 500 500)
Process: 2 I/O blocked... (2000 500 1000 1000)
Process: 3 registered... (2000 500 500 500)
Process: 3 I/O blocked... (2000 500 1000 1000)
Process: 2 registered... (2000 500 1000 1000)
Process: 2 I/O blocked... (2000 500 1500 1500)
Process: 3 registered... (2000 500 1000 1000)
Process: 3 I/O blocked... (2000 500 1500 1500)
Process: 2 registered... (2000 500 1500 1500)
Process: 2 completed... (2000 500 2000 2000)
Process: 3 registered... (2000 500 1500 1500)
Process: 3 completed... (2000 500 2000 2000)
Process: 4 registered... (2000 500 0 0)
Process: 4 I/O blocked... (2000 500 500 500)
Process: 5 registered... (2000 500 0 0)
Process: 5 I/O blocked... (2000 500 500 500)
Process: 4 registered... (2000 500 500 500)
Process: 4 I/O blocked... (2000 500 1000 1000)

Process: 5 registered... (2000 500 500 500)

Summary-Results file output

Scheduling Type: Batch (Nonpreemptive)
Scheduling Name: First-Come First-Served
Simulation Run Time: 10000
Mean: 2000
Standard Deviation: 0

Process #	CPU Time	IO Blocking	CPU Completed	CPU Blocked
0	2000 (ms)	500 (ms)	2000 (ms)	3 times
1	2000 (ms)	500 (ms)	2000 (ms)	3 times
2	2000 (ms)	500 (ms)	2000 (ms)	3 times
3	2000 (ms)	500 (ms)	2000 (ms)	3 times
4	2000 (ms)	500 (ms)	1000 (ms)	2 times
5	2000 (ms)	500 (ms)	1000 (ms)	1 times
6	2000 (ms)	500 (ms)	0 (ms)	0 times
7	2000 (ms)	500 (ms)	0 (ms)	0 times
8	2000 (ms)	500 (ms)	0 (ms)	0 times
9	2000 (ms)	500 (ms)	0 (ms)	0 times

Comments

Here the situation for the first 4 processes is the same as before. What is different is that the next two processes come in a pair. This means that while left with 2000ms of simulation time the two processes 4 and 5 are trying to share execution time evenly and therefore none of them is completed as it would require at least 1500ms more simulation time for one to finish, and 2000ms more for both to do so.