EOPSY Lab 3 Report

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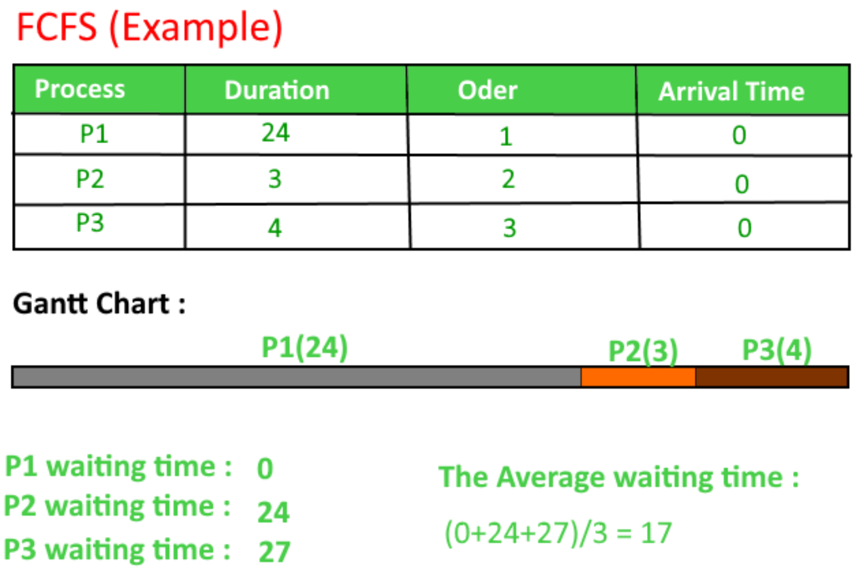
April 30, 2022

1 Introduction

The goal of the laboratory was to create three scenarios using config file and then investigate how those scenarios played out.
Scenario 1: 2 Processes
Scenario 2: 5 Processes
Scenario 3: 10 Processes
We had to get to know how the schedulers work, how they switch. [1]

First come first serve We used First come first serve algorithm → This algorithm simply executes the process which arrived first. The process that requests CPU as a first process gets the CPU first. It is easy to implement and understand. We just use Queue data structure and we pick processes from the head of the queue and new procesess are added at the tail of the queue. [2]

Figure 1: First come first serve example graphic from Geeks for Geeks



FCFS (Example)

Process	Duration	Oder	Arrival Time
P1	24	1	0
P2	3	2	0
P3	4	3	0

Gantt Chart :

P1 waiting time : 0
P2 waiting time : 24
P3 waiting time : 27

The Average waiting time :

(0+24+27)/3 = 17

Other algorithms [3]

1. Shortest-Job-Next - Executes first processes that will take least time to finish
2. Priority Scheduling - Each process gets assigned a prority and we execute them from the process with highest priority to the process with lowest prority
3. Round Robin Scheduling - We give each process a constant time to execute, after this time expires regardless whether process finished or not we go to another process untill all of them are finished

2 Explanation of types of values in summary results and summary process

2.1 Summary Results

- Scheduling Type - Type of scheduling algorithm used
- Scheduling Name - Name of the scheduling algorithm
- Simulation Run Time - How long simulation run
- Mean - Average runtime for the processes

- Standard Deviation - Deviation from mean
- Process # - Process number
- CPU Time - Total runtime for the process
- IO Blocking - How long process runs before it is blocked for input or output
- CPU Completed - How long runtime completed for the process
- CPU Blocked - How often the process was blocked

[1]

2.2 Summary Processes

- process-number - Process number assigned by simulator
- process-status - Registered - process can be used by scheduling algorithm, I/O blocked - process blocked for input or output, Completed - process met or exceeded execution time
- cpu-time - Total amount of runtime allowed for this process
- block-time - amount of time before blocking process
- accumulated-time - how long the process has already executed (appears twice)

[1]

3 Scheduling conf settings

```
// # of Process
numprocess 2 or 5 or 10

// mean deivation
meandev 2000

// standard deviation
standdev 0

// process    # I/O blocking
process 500
process 500
(more if we set numprocess to 5 or 10)

// duration of the simulation in milliseconds
runtime 10000
```

4 Two processes

4.1 Summary Results file

```
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

4.2 Summary Processes file

```
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)
```

4.3 Comments

Scheduling type was Batch since I did not change it in SchedulingAlgorithm.java file
Scheduling Name was First-Come First-Served since this is what what we use as described in README for this laboratory
Simulation Run time is 4000 ms and NOT 10000 ms since the simulation finished before it exceeded this max time
Mean is 2000 since this is a value I set in conf value according to laboratory task description, same with standard deviation equal to 0 and CPU Time equal to 2000 ms
IO Blocking is equal to 500 ms, this is a value which we specified in configuration file and since we did not exceeded the runtime parameter it stayed equal to 500 ms

CPU completed is equal to 2000 since this is deviation we set in configuration settings and the runtime was not exceeded
All processes blocked 3 times, analysing summary processes we can see that they blocked at 500 ms, 1000 ms and 1500 ms and at 2000 seconds they completed

5 Five processes

5.1 Summary Results file

```
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

5.2 Summary Processes file

```
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)
```

5.3 Comments

Scheduling type was Batch since I did not change it in SchedulingAlgorithm.java file
Scheduling Name was First-Come First-Served since this is what what we use as described in README for this laboratory
Simulation run time is 10000 ms since it run untill the limit I set in conf file according to task description
CPU blocking is set everywhere to 500 ms as in conf file
Mean is 2000 since this is a value I set in conf value according to laboratory task description, same with standard deviation equal to 0 and CPU Time equal to 2000 ms
CPU completed is equal to expected 2000 ms, this makes sense since we had run time equal to 10000 ms and 5 procesess so each of them could take exactly the amonunt of time we set them to take.

6 Ten processes

6.1 Summary Results file

```
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

6.2 Summary Processes file

```
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)
```

6.3 Comments

Scheduling type was Batch since I did not change it in SchedulingAlgorithm.java file
Scheduling Name was First-Come First-Served since this is what what we use as described in README for this laboratory
Simulation run time is 10000 ms since it run untill the limit I set in conf file according to task description
IO Blocking set to 500 ms as in config file
Mean is 2000 since this is a value I set in conf value according to laboratory task description, same with standard deviation equal to 0 and CPU Time equal to 2000 ms
CPU completed this time is equal to 2000 up to 4th process and then is equal to 1000 ms for 5th and 6th and then it is equal to 0 ms, this means that the simulation exceeded the runtime before it had a chance to run all processes

7 Getting process to be blocked 4 times

Up untill now process got blocked for maximum of 3 times. This makes sense since since they get blocked every 500 ms and the runtime for single process is 2000 ms, so they get blocked first time at 500 ms, second time at 1000 ms and third time at 1500 ms, at 2000 ms they finish execution so they do not get blocked.
If we change runtime of process to 2001 ms we should get as the result them getting blocked 4 times!
I changed meandev in scheduling.conf to 2001 and observed results:

7.1 Summary Results file

```
Scheduling Type: Batch (Nonpreemptive)
Scheduling Name: First-Come First-Served
Simulation Run Time: 6003
Mean: 2001
Standard Deviation: 0
```

Process #	CPU Time	IO Blocking	CPU Completed	CPU Blocked
0	2001 (ms)	500 (ms)	2001 (ms)	4 times
1	2001 (ms)	500 (ms)	2001 (ms)	4 times
2	2001 (ms)	500 (ms)	2001 (ms)	4 times

Sure enough we got all of the processes blocked 4 times!

8 Finishing comments

We runned all the processes, get to know scheduling, get to know first come first served algorithm.
There are upsides and downsides of first come first served algorithm:
Upsides:

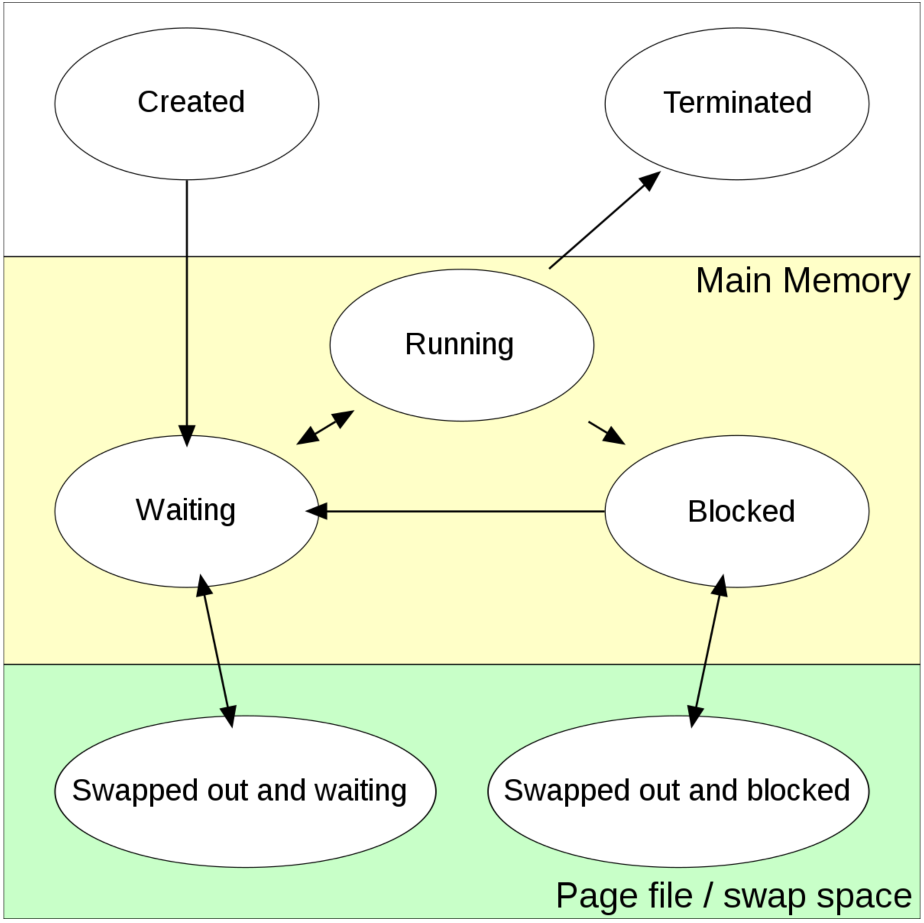
- It is easy to implement
- It is easy to understand

Downsides:

- It is very inefficient (Last experiment with 10 processes barely acknowledged existence of the 5th one)
- High average wait time (Imagine 1000 processes and how long we would have to wait)

Using pretty much any other algorithm we could get better results [2]

Figure 2: Process states and how they switch from wikimedia



References

[1] Manual in the laboratory 3 files.

[2] https://www.studytonight.com/operating-system/first-come-first-serve

[3] Tutorials point process scheduling algorithms