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 COMPSCI2024 Networks and Operating Systems Essentials 2 - 2023 - 24

Assessed Exercise

Discussion of Resulting Algorithms

Seed 1

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Processes to be executed:
[#0]: State: ProcessStates.NEW, Arrival: 0.09137963460645723, Service: 4.200037008892023, Remaining: 4.200037008892023
[#1]: State: ProcessStates.NEW, Arrival: 0.12586824629203058, Service: 4.109248457295089, Remaining: 4.109248457295089
[#2]: State: ProcessStates.NEW, Arrival: 0.24523231929554465, Service: 3.426937237241557, Remaining: 3.426937237241557
[#3]: State: ProcessStates.NEW, Arrival: 0.7096617464325311, Service: 5.216388159180393, Remaining: 5.216388159180393
[#4]: State: ProcessStates.NEW, Arrival: 1.6471649987915493, Service: 1.3544813914220648, Remaining: 1.3544813914220648
[#5]: State: ProcessStates.NEW, Arrival: 1.776431150531907, Service: 0.39105208621206977, Remaining: 0.39105208621206977
[#6]: State: ProcessStates.NEW, Arrival: 1.9210333371286286, Service: 4.050347832698991, Remaining: 4.050347832698991
[#7]: State: ProcessStates.NEW, Arrival: 2.1255585575735627, Service: 0.16313747029593131, Remaining: 0.16313747029593131
[#8]: State: ProcessStates.NEW, Arrival: 2.3838029078015284, Service: 0.9887962749698473, Remaining: 0.9887962749698473
[#9]: State: ProcessStates.NEW, Arrival: 2.617937516048193, Service: 0.9575373926013069, Remaining: 0.9575373926013069
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FCFS [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 10.20626019426265
Avg. waiting time: 8.103232992470705
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SJF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 9.054375105202952
Avg. waiting time: 6.951347903411007
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RR [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0, Quantum: 0.5]:
Avg. turnaround time: 7.204485165350515
Avg. waiting time: 5.101457963558569
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SRTF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 4.439666250231411
Avg. waiting time: 2.336639048439465
```

The scheduling algorithms performed as expected for the first seed with Round-Robin being faster than SJF in this iteration. In order of fastest to slowest goes in order of: SRTF, RR, SJF and slowest of all, FCFS.

Seed 2

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Processes to be executed:
[#0]: State: ProcessStates.NEW, Arrival: 0.013132527427572031, Service: 0.5152662672235018, Remaining: 0.5152662672235018
[#1]: State: ProcessStates.NEW, Arrival: 0.5529114890856877, Service: 3.291188069071824, Remaining: 3.291188069071824
[#2]: State: ProcessStates.NEW, Arrival: 0.7644368177975317, Service: 3.5021726288526094, Remaining: 3.5021726288526094
[#3]: State: ProcessStates.NEW, Arrival: 0.8459715994209672, Service: 0.8275264539691745, Remaining: 0.8275264539691745
[#4]: State: ProcessStates.NEW, Arrival: 1.2377452381580236, Service: 0.07331836329579852, Remaining: 0.07331836329579852
[#5]: State: ProcessStates.NEW, Arrival: 1.5175537549633655, Service: 0.8952222890667785, Remaining: 0.8952222890667785
[#6]: State: ProcessStates.NEW, Arrival: 1.8430497521016238, Service: 0.208280007482891, Remaining: 0.208280007482891
[#7]: State: ProcessStates.NEW, Arrival: 2.3983448139855215, Service: 2.907121107077552, Remaining: 2.907121107077552
[#8]: State: ProcessStates.NEW, Arrival: 2.5548433250602107, Service: 0.8405753945921703, Remaining: 0.8405753945921703
[#9]: State: ProcessStates.NEW, Arrival: 3.288604694646798, Service: 0.2822575893474759, Remaining: 0.2822575893474759
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FCFS [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 7.263691855776069
Avg. waiting time: 5.500140766429613
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SJF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 5.590846738146201
Avg. waiting time: 3.827295648799745
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RR [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0, Quantum: 0.5]:
Avg. turnaround time: 9.496777095052447
Avg. waiting time: 7.733226005705991
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SRTF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 5.537420726851737
Avg. waiting time: 3.773869637505282
```

Once again, the fastest of the scheduling algorithms was SRTF. This was expected however it was followed by SJF, FCFS and lastly Round-Robin. This is not expected as FCFS is generally the slowest of all the scheduling algorithms. One possible explanation for the inefficiency of the Round-Robin scheduling algorithm is perhaps the choice of quantum for the list of processes it was given to handle. The list of processes indicates that the workload of the list of processes was lighter therefore not favorable for the Round-Robin scheduling algorithm.

Seed 3

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Processes to be executed:
[#0]: State: ProcessStates.NEW, Arrival: 0.09003807752863792, Service: 1.7380138387191906, Remaining: 1.7380138387191906
[#1]: State: ProcessStates.NEW, Arrival: 0.3099781390327554, Service: 2.832922250753216, Remaining: 2.832922250753216
[#2]: State: ProcessStates.NEW, Arrival: 0.345770483172082, Service: 0.2487471409554467, Remaining: 0.2487471409554467
[#3]: State: ProcessStates.NEW, Arrival: 0.8006709043094271, Service: 0.3698505661047356, Remaining: 0.3698505661047356
[#4]: State: ProcessStates.NEW, Arrival: 1.0122604237270485, Service: 3.3535119849678527, Remaining: 3.3535119849678527
[#5]: State: ProcessStates.NEW, Arrival: 1.2705010150100207, Service: 2.1033635922911853, Remaining: 2.1033635922911853
[#6]: State: ProcessStates.NEW, Arrival: 1.349901047948325, Service: 0.4713528415139992, Remaining: 0.4713528415139992
[#7]: State: ProcessStates.NEW, Arrival: 1.4176896131980878, Service: 0.2733220709823595, Remaining: 0.2733220709823595
[#8]: State: ProcessStates.NEW, Arrival: 2.375775232847038, Service: 3.6589332196992865, Remaining: 3.6589332196992865
[#9]: State: ProcessStates.NEW, Arrival: 2.427845856150098, Service: 0.31969562071565755, Remaining: 0.31969562071565755
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FCFS [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 11.325125212280275
Avg. waiting time: 9.347962673292866
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SJF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 6.958031401876262
Avg. waiting time: 4.980868862888556
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RR [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0, Quantum: 0.5]:
Avg. turnaround time: 7.888769296159832
Avg. waiting time: 5.911606757172425
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SRTF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
Avg. turnaround time: 4.747688087757453
Avg. waiting time: 2.770525548770047
```

SRTF was the most efficient in execution. SJF performs well, but it may have slightly higher waiting times compared to SRTF due to its non-preemptive nature. Round Robin has competitive turnaround and waiting times, but the specific quantum value of 0.5 may contribute to additional context switches and some waiting. FCFS has the highest turnaround and waiting times, typical for non-preemptive algorithms, as it may execute longer processes before shorter ones.

Summary

SRTF and SJF were the two fastest scheduling algorithms in terms of minimal average turnaround and waiting times. Round-Robin was inconsistent in its efficiency, this can be attributed to the chosen quantum as well as the possibility of nonzero context switch time leading to inefficiencies. Finally the slowest of the scheduling algorithms was FCFS as expected.