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Networks and Operating Systems: Exericse 2 – Scheduling Algorithms

Test results

First seed

```
NOSE2 :: AE2 :: Scheduler Discrete Event Simulation
---------------------------------------------------
Using seed: 1797410758
Processes to be executed:
   [#0]: State: ProcessStates.NEW, Arrival: 0.01874985913506718, Service: 0.024082859896149694,
Remaining: 0.024082859896149694
   [#1]: State: ProcessStates.NEW, Arrival: 0.34659969422148434, Service: 0.04939805767338781,
Remaining: 0.04939805767338781
   [#2]: State: ProcessStates.NEW, Arrival: 1.0702461107834187, Service: 8.589090636275131,
Remaining: 8.589090636275131
   [#3]: State: ProcessStates.NEW, Arrival: 1.082379556436702, Service: 2.893534830133524,
Remaining: 2.893534830133524
   [#4]: State: ProcessStates.NEW, Arrival: 1.1636907225178434, Service: 0.20712579697293265,
Remaining: 0.20712579697293265
   [#5]: State: ProcessStates.NEW, Arrival: 1.1763155340637397, Service: 0.12798104125124352,
Remaining: 0.12798104125124352
   [#6]: State: ProcessStates.NEW, Arrival: 1.372802000843104, Service: 0.2428342995239517,
Remaining: 0.2428342995239517
   [#7]: State: ProcessStates.NEW, Arrival: 1.9233807328523982, Service: 2.7156449945284207,
Remaining: 2.7156449945284207
   [#8]: State: ProcessStates.NEW, Arrival: 2.7497838693531627, Service: 1.225013439022086,
Remaining: 1.225013439022086
   [#9]: State: ProcessStates.NEW, Arrival: 3.408243345957417, Service: 4.955566062642633,
Remaining: 4.955566062642633
-----
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
-----
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
-----
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
-----
SRTF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
   Avg. turnaround time: 4.612115039551169
   Avg. waiting time: 2.5090878377592247
```

Second seed

```
NOSE2 :: AE2 :: Scheduler Discrete Event Simulation
---------------------------------------------------
Using seed: 2688744162
Processes to be executed:
   [#0]: State: ProcessStates.NEW, Arrival: 0.16327294289381494, Service:
1.2126630374852756, Remaining: 1.2126630374852756
   [#1]: State: ProcessStates.NEW, Arrival: 0.24085628657883698, Service:
1.0030664748411222, Remaining: 1.0030664748411222
   [#2]: State: ProcessStates.NEW, Arrival: 1.4583361638682946, Service:
0.5979376023015062, Remaining: 0.5979376023015062
   [#3]: State: ProcessStates.NEW, Arrival: 1.5627054374610734, Service:
0.8411480864168259, Remaining: 0.8411480864168259
   [#4]: State: ProcessStates.NEW, Arrival: 1.8117295076376054, Service:
4.345316795486844, Remaining: 4.345316795486844
   [#5]: State: ProcessStates.NEW, Arrival: 2.0503379721504627, Service:
1.864959607151706, Remaining: 1.864959607151706
   [#6]: State: ProcessStates.NEW, Arrival: 2.0866714480550264, Service:
2.1117670771129284, Remaining: 2.1117670771129284
   [#7]: State: ProcessStates.NEW, Arrival: 2.1262568525419177, Service:
2.0524635080504736, Remaining: 2.0524635080504736
   [#8]: State: ProcessStates.NEW, Arrival: 2.3874624828863755, Service:
2.5947014305782727, Remaining: 2.5947014305782727
   [#9]: State: ProcessStates.NEW, Arrival: 3.1359956253356143, Service:
1.0114872740395993, Remaining: 1.0114872740395993
-----
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
-----
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
-----
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
-----
SRTF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context
switch time: 0.0]:
   Avg. turnaround time: 5.583667184225575
   Avg. waiting time: 3.8201160948791184
```

Third seed

```
NOSE2 :: AE2 :: Scheduler Discrete Event Simulation
---------------------------------------------------
Using seed: 3399474557
Processes to be executed:
   [#0]: State: ProcessStates.NEW, Arrival: 0.005930213541710191, Service: 4.4839386129296,
Remaining: 4.4839386129296
   [#1]: State: ProcessStates.NEW, Arrival: 0.44239268344700244, Service: 1.1663691985419704,
Remaining: 1.1663691985419704
   [#2]: State: ProcessStates.NEW, Arrival: 0.6221361157180596, Service: 0.32972498456122207,
Remaining: 0.32972498456122207
   [#3]: State: ProcessStates.NEW, Arrival: 1.017754714690284, Service: 0.873947322870889,
Remaining: 0.873947322870889
   [#4]: State: ProcessStates.NEW, Arrival: 1.064892422603134, Service: 7.667055271847057,
Remaining: 7.667055271847057
   [#5]: State: ProcessStates.NEW, Arrival: 1.3794685179090076, Service: 0.24261641981985113,
Remaining: 0.24261641981985113
   [#6]: State: ProcessStates.NEW, Arrival: 1.633799580749315, Service: 0.9993152350772446,
Remaining: 0.9993152350772446
   [#7]: State: ProcessStates.NEW, Arrival: 1.6398513280293314, Service: 2.7320994317866765,
Remaining: 2.7320994317866765
   [#8]: State: ProcessStates.NEW, Arrival: 1.871912791379139, Service: 0.030334733541581848,
Remaining: 0.030334733541581848
   [#9]: State: ProcessStates.NEW, Arrival: 1.93791830913886, Service: 1.2462241788979702,
Remaining: 1.2462241788979702
-----
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
-----
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: 4.9808688628888556
-----
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
-----
SRTF [#Processes: 10, Avg arrivals per time unit: 3.0, Avg CPU burst time: 2, Context switch time: 0.0]:
   Avg. turnaround time: 4.905435962826498
   Avg. waiting time: 2.9282734238390917

Process finished with exit code 0
```

The performance of a scheduling algorithm is mainly determined by the amount of time it takes to complete all the processes. As such, the main variable of concern is the average waiting time.

Seeds used in the simulations are:

First Come First Serve

This algorithm has the highest average turnaround time if all seeds are considered. This is mainly because of the waiting time for subsequent processes. However, it would be expected that through all the seeds, this algorithm performs the worst. However, in the second seed, it beats round robin algorithm in terms of performance because round robin has higher turnaround and waiting times. The second seed highlights the strength of FCFS algorithm over the round robin algorithm.

Shortest Job First

From the result, SJF algorithm is fairly average in terms of performance. It is better than FCFS and worse than Shortest Remaining Time First algorithm through all the seeds. However, compared to the Round Robin algorithm, it is better only through the second seed. This is interesting because the second seed basically doesn't do justice to the strengths of the round robin algorithm.

Round Robin

This scheduler adds processes to the queue and they are ordered in terms of when they arrived and then they get executed up to a certain amount of time (time quantum/time slice). This algorithm can be said to be fairly average too. Apart from the second seed, it displays average turnaround and waiting times for the processes. It performs worst through the second seed. This must be due to the amount of time it takes to context switch rather than process the processes. This seed exposes its disability to smoothly enable processing.

Shortest Remaining Time First

Clearly the best performance algorithm of the four. Throughout the simulations, it displays the shortest turnaround and waiting times. Of all the seeds, the first seed makes this algorithm perform best. It performs worst through the second seed, and even at that, it is still the best performer.

Each seed produced a different outcome for every one of the algorithms. As well as this, the average waiting time and the average turnaround time were giving different values for each of the seeds. This is mainly because the seeds contain different timings. On average, the second seed enables the algorithms to perform best, even if it undermines the strengths of the round robin algorithm. It is also the second seed that makes the algorithms behave almost similar. There is lesser range in the performance parameters when compared to the other seeds. As a matter of fact, through the second seed, SJF and SRTF have almost the same time values: the second seed makes them behave the same.