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Project3

* Executable
  + Project3
* Compiling on Linux

1. Copy project files with make file over to a Linux system like empress.
2. Needs C++11 support, empress has g++, osc virtual machine needs apt-get install g++
3. Run command make
4. Run command ./project3
5. Select options for process count and FCFS or SJF scheduler, watch simulated CPU run.

The two scheduling algorithms tested are First Come First Served (FCFS) and Shortest Job First (SJF). After a few tests, it seems SJF is the better scheduling algorithm with all the I/O interrupts. The downside of SJF is none of the longer running jobs where able to finish in the simulated 5 minutes while only a few of the first processes where able to finish with FCFS.

Here’s the full printout for the 2 schedulers with 20 processes.

|  |  |  |
| --- | --- | --- |
| 20 Processes | First Come First Served:  Process 1:  arrival time: 20.052 s  finish time: 32.012 s  service time: 5.304 s  I/O time: 5.269 s  turnaround time: 11.96 s  waiting time: 1.387 s  Process 2:  arrival time: 27.589 s  finish time: 169.558 s  service time: 49.253 s  I/O time: 49.167 s  turnaround time: 141.969 s  waiting time: 43.549 s  Process 3:  arrival time: 71.332 s  finish time: 210.948 s  service time: 28.047 s  I/O time: 27.979 s  turnaround time: 139.616 s  waiting time: 83.59 s  CPU Utilization is 85%  Throughput is 0.00996565 jobs / s  Average turnaround time: 97.848 s  Average wait time: 42.842 s | Shortest Job First:  Process 1:  arrival time: 20.052 s  finish time: 32.012 s  service time: 5.304 s  I/O time: 5.269 s  turnaround time: 11.96 s  waiting time: 1.387 s  Process 3:  arrival time: 71.332 s  finish time: 147.132 s  service time: 28.022 s  I/O time: 27.966 s  turnaround time: 75.8 s  waiting time: 19.812 s  Process 8:  arrival time: 155.824 s  finish time: 176.67 s  service time: 6.043 s  I/O time: 6.019 s  turnaround time: 20.846 s  waiting time: 8.784 s  Process 6:  arrival time: 115.05 s  finish time: 194.101 s  service time: 21.2 s  I/O time: 21.169 s  turnaround time: 79.051 s  waiting time: 36.682 s  Process 10:  arrival time: 189.49 s  finish time: 195.869 s  service time: 2.594 s  I/O time: 2.515 s  turnaround time: 6.379 s  waiting time: 1.27 s  Process 5:  arrival time: 115.024 s  finish time: 212.289 s  service time: 35.35 s  I/O time: 35.272 s  turnaround time: 97.265 s  waiting time: 26.643 s  Process 12:  arrival time: 196.175 s  finish time: 222.768 s  service time: 10.979 s  I/O time: 10.874 s  turnaround time: 26.593 s  waiting time: 4.74 s  Process 7:  arrival time: 124.799 s  finish time: 288.302 s  service time: 37.633 s  I/O time: 37.562 s  turnaround time: 163.503 s  waiting time: 88.308 s  Process 11:  arrival time: 195.455 s  finish time: 295.921 s  service time: 35.727 s  I/O time: 35.647 s  turnaround time: 100.466 s  waiting time: 29.092 s  CPU Utilization is 85%  Throughput is 0.0299458 jobs / s  Average turnaround time: 64.651 s  Average wait time: 24.079 s |

As you can see, the average wait time for SJF is much lower and more processes finished within our observed time. For FCFS only the first 3 processes where able to finish but with SJF the first 3 never completed in our simulated 5 minutes.

Here’s some more runs with different processes counts.

|  |  |  |
| --- | --- | --- |
| 10 Processes | First Come First Served:  …  CPU Utilization is 69%  Throughput is 0.0266653 jobs / s  Average turnaround time: 55.561 s  Average wait time: 13.181 s | Shortest Job First:  …  CPU Utilization is 67%  Throughput is 0.0266631 jobs / s  Average turnaround time: 46.609 s  Average wait time: 5.676 s |
| 100 Processes | First Come First Served:  …  CPU Utilization is 99%  Throughput is 0.0163851 jobs / s  Average turnaround time: 114.715 s  Average wait time: 106.982 s | Shortest Job First:  …  CPU Utilization is 99%  Throughput is 0.0822929 jobs / s  Average turnaround time: 38.438 s  Average wait time: 19.651 s |

With 10 processes, there is enough space where the CPU idles more. With FCFS, we see slightly higher utilization but still turnaround time and wait time are still higher. Again with 100 processes, the average wait time for FCFS is 5 times higher than SJF. SJF has the issue with starvation though is it does have some downsides.

The throughput and number of tasks completed look low and I’m not sure if it’s because of some scheduling issues or because there are so many I/O events. Each task has nearly the same amount of I/O time to service time since the CPU bursts and I/O times where scheduled nearly the same way.