SYSC 4001

Assignment 2
Process Scheduling, Memory Management
Report

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Github Repo Part 1:
https://github.com/SabariMathiyalagan/Assignment_3_P1

Introduction

In this assignment, I implement a simulator for a single-CPU system for 3 different scheduling algorithms (External Priorities (EP), Round Robin (RR), and combined External Priorities Round Robin (EP_RR). These 3 scheduling algorithms were tested with a variety of different input traces that contained information for different processes in order to analyze how these different algorithms would handle such processes.

Simulators and Testcases

Each simulation result was based on a specific trace input and the chosen scheduler algorithm. The trace input represented processes with the following information: Pid, memory size, arrival time, total CPU time, I/O frequency, and I/O duration as shown below in Figure 1.

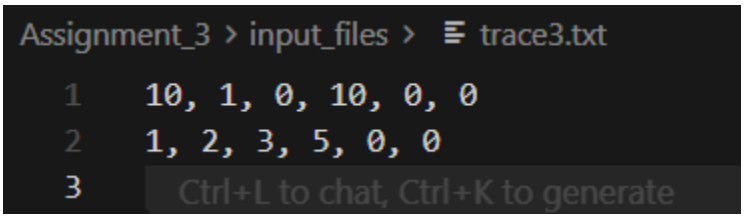

Figure 1: trace3.txt

Based on these inputs and the scheduling algorithm, the simulator would simulate these processes running and move them through the usual states (NEW, READY, RUNNING, WAITING, TERMINATED), and each change in state was recorded to the output execution file with the: Time of transition, pid, old state, and new state as shown in Figure 2.

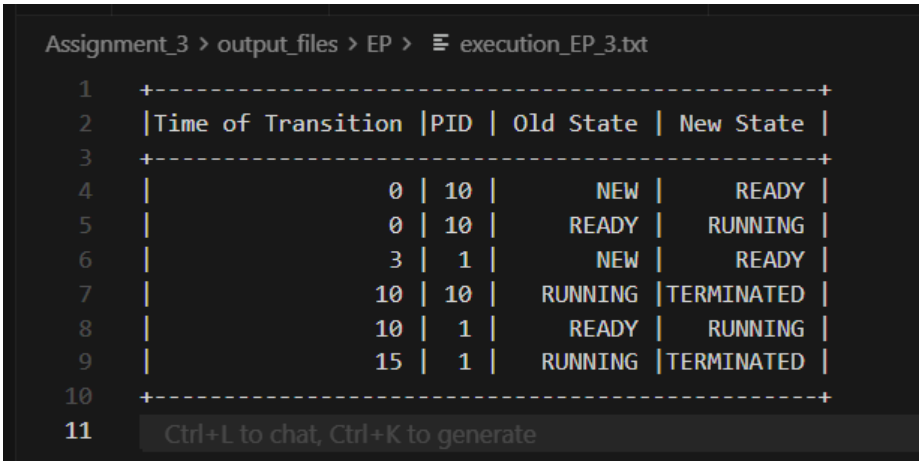

Figure 2: execution_EP_3.txt

A total of 24 input traces were run for each scheduler, each with varying characteristics. For example: CPU-bound traces, I/O bound traces, and balanced traces which will be discussed in the next section.

Metrics and Comparison

Below you will find 4 different tables regarding the important metrics for these scheduling algorithms under different trace conditions.

Overall Metrics

	Throughput	Average wait time	Average turnaround time	Average response time
External Priority	0.0270	141.20	290.84	68.38
Round Robin	0.0270	135.4	274.00	55.72
External Priority + Round Robin	0.0270	130.58	248.12	40.46

CPU-Bound Traces Metrics

	Throughput	Average wait time	Average turnaround time	Average response time
External Priority	0.0319	139.83	255.26	74.25
Round Robin	0.0319	156.74	272.17	78.00
External Priority + Round Robin	0.0319	122.57	237.52	42.50

I/O Bound Traces Metrics

	Throughput	Average wait time	Average turnaround time	Average response time
External Priority	0.0201	143.12	340.65	64.18
Round Robin	0.0201	125.78	283.32	43.45
External Priority + Round Robin	0.0201	117.78	255.98	39.00

Discussion

Overall, looking at the metrics above, the External Priority + Round Robin scheduling algorithm seemed to perform the best in all cases. This is due to the fact that this system benefits from the priority-driven selections, which would benefit if the priorities were set on meaningful process

attributes, such as burst time, for example, while still enforcing the time slice to prevent any monopolization of the CPU, regarding the other 2 scheduling methods individually. EP seems to perform better in CPU-bound traces while RR performs better in I/O-bound traces. This is because for CPU-bound tasks, the traces benefit from longer uninterrupted bursts of CPU without context switches, while in I/O bound tasks, the frequent blocking due to I/O means processes are regularly waiting to re-enter the ready queue, and RR ensures they are quickly rotated back in once I/O completes, reducing response time