PUNE INSTITUTE OF COMPUTER TECHNOLOGY

Department of Computer Engineering

SPOSL

K-1 Batch

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**Assignment B5**

**TITLE :** Scheduling algorithms.

**PROBLEM STATEMENT** : Write a Java program (using OOP features) to implement following scheduling algorithms: FCFS , SJF (Preemptive,Non-preemptive), Priority (Non-Preemptive) and Round Robin (Preemptive)

**OBJECTIVE :**

To learn and understand

• Process Scheduling in Multitasking and multiusers OS.

• Implementation of Scheduling Algorithms

**S/W PACKAGES AND HARDWARE APPARATUS USED :**

C/C++ editors and compilers for Linux OS Linux OS/Fedora/Ubuntu PC with the configuration as Pentium IV 2.4 GHz. 4 GB RAM, 500 G.B HDD, 15’’Color Monitor, Keyboard, Mouse.

**THEORY:**

**Process scheduling:** It is an activity process manager that handles the task of scanning process from CPU and running of another process on basis of some strategy.Such OS allows more than one to be loaded in executable memory.

## Scheduler:

They are special system software that handle process scheduling in various ways:

Its main task is to select jobs to be submitted into system and to be divided and decide which process to run.

## Types of Scheduler:

1) Long-term scheduler 2)Short-term scheduler. 3)Medium term scheduler.

**Arrival:** The request arrives in the system hen user submits it to OS. When request arrives, the time is called arrival time.

**Scheduling:** The pending request is scheduled for service when scheduler selects it for servicing. **Preemption:** The process is 39re-empted when CPU switches to another process before completing it and this process is added to pending request.

Non 39re-empted39: The scheduled process is always completed before next scheduling of the process.

**Completion:** The process is completed and next process is selected for processing by CPU.

The CPU scheduling takes the information about arrival time, size of request in CPU seconds, CPU time already consumed by the request, deadline of the process for scheduling policy.

CPU scheduling deals with the problem of deciding which of the processes in the ready queue is to be allowed to utilize the CPU. The criteria for selection of an algorithm are

* The maximum throughput
* Least turnaround time.
* Minimum waiting time.
* Maximum CPU utilization.

Some definitions in scheduling are:

**Arrival time** is when the process arrives in the system.(Ai) **Process time** is the execution time required for the process(Xi) **Completion time** is time at which the process is completed.(Ci) **Deadline** is the time by which the process output is required(Di)

**Turnaround time is** the time to complete the process after arrival.(Ci-Ai)

**Average** or Mean turnaround time is the average of turnaround time of all processes.(1/n



Weighted time around time is the turnaround time of a process to its execution time. (Ci-Ai)/Xi Throughput is the measure of performance and no of processes completed per unit time.(n/(max(Ci)-min(Ai))

# Scheduling Policies:

## FCFS Scheduling:

The process requests are schedules in the order of their arrival time. The pending requests are in a queue. The first request in the queue is scheduled first. The request that comes is ad ded to the end of the queue.

Performance of FCFS scheduling: (Time in sec)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Process  No | Arrival  time | Burst Time | Turnaround time | Waiting time |
| 1 | 0 | 5 | 0 | 0 |
| 2 | 1 | 3 | 5 | 4 |
| 3 | 2 | 8 | 8 | 6 |
| 4 | 3 | 6 | 16 | 13 |

Average waiting time=(0+4+6+13)/4=5.75

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P0 | P1 | P2 | P3 |  |
| 0 | 5 | 8 | 16 | 22 |

**Algorithm:**

1) Input the processes along with burst times. 2)Input arrival time for all processes

3)Sort according to their arrival time along with indices. 4)Perform processes in sorted order

1. Stop.

## Shortest job first (SJF) scheduling:

est approach to minimize waiting time. It is easy to implement in batch systems where required CPU time is known in advance.

* 1. **Non-preemptive**

Performance of SJF scheduling: (Time in sec)

|  |  |  |  |
| --- | --- | --- | --- |
| Proce ss No | Arrival time Ai | Burst time | Waiting time |
| 1 | 0 | 2 | 1 |
| 2 | 0 | 3 | 3 |
| 3 | 1 | 4 | 5 |
| 4 | 0 | 1 | 0 |

Average waiting time=2.25

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P3 | P0 | P1 | P2 |  |
| 0 | 1 | 3 | 6 | 10 |

* 1. **Preemptive:**

|  |  |  |  |
| --- | --- | --- | --- |
| Process | Arrival time | Burst time | Waiting  time |
| P1 | 0 | 300 | 425 |
| P2 | 0 | 125 | 150 |
| P3 | 0 | 400 | 725 |
| P4 | 0 | 150 | 275 |
| P5 | 0 | 100 | 0 |
| P6 | 150 | 50 | 0 |

P5 P2 P6 P2 P4 P1 P3

0 100 150 200 275 425 725 1125

Average waiting time=262.5

**Algorithm**

1. Calculate burst time.
2. Sort all processes in increasing order of burst time. 3)Apply FCFS to sorted list.

4)Perform all processes 5)Stop

**Round Robin scheduling:** Schedules using time slicing. The amount of CPU time a process may use when allocated is limited. The process is 41re-empted if the process requires more time or if process requires I/O operation before the time slice. It makes weighted turnaround time approximately equal all time but throughput may not be well as all processes are treated equally.

Performance of Round Robin scheduling:

|  |  |  |  |
| --- | --- | --- | --- |
| Pro  ces | Arri  val | Burst  time | Waiting  time |
|  |  |  |  |
| s  No | time  Ai |  |  |
| 1 | 1 | 150 | 250 |
| 2 | 2 | 100 | 200 |
| 3 | 3 | 200 | 300 |
| 4 | 4 | 50 | 150 |

Time quantum=50 Average waiting time=225

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P1 | P2 | P3 | P4 | P1 | P2 | P3 | P1 | P3 |  |
| 0 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 550 |

**Algorithm:**

1)Get input for processes with arrival time and burst time. Take quantum. 2)Sort processes according to arrival time.

3)Process till all processes are done: 4)End

**Priority based Scheduling:**

It is non-preemptive algorithm and one of the common scheduling algorithm in batch system. Each process is assigned a priority and process with highest priority is executed first and so on. Processes with same priority are executed on FCFS basis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Process | Arrival time | Burst time | Priority | Waiting time |
| P0 | 0 | 5 | 1 | 9 |
| P1 | 1 | 3 | 2 | 5 |
| P2 | 2 | 8 | 1 | 12 |
| P3 | 3 | 6 | 3 | 0 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P3 | P1 | P0 | P2 |  |
| 0  **Algorithm:** | **6** | **9** | **14** | **22** |

1)Get input for process including arrival time,burst time and priority. 2)Sort process according to arrival time.

1. If process have same arrival time,sort them by priority.

4)Print process according to index. 5)End

**Conclusion:**

We were able to

• Compare the scheduling algorithms

• Implement FCFS, SJF, RR Scheduling Algorithms