COMP3511 Operating Systems (Fall 2016) – Supplementary Note

Topic 5: CPU Scheduling

- **Preemptive and Non-Preemptive Scheduling**

  - Preemptive scheduling: Currently running process may be interrupted and moved to the ready state by the OS.
  - Non-preemptive scheduling: If a process enters into the running state, it continues to execute until it terminates or blocks itself to wait for I/O or by requesting some operating system service.

Examples

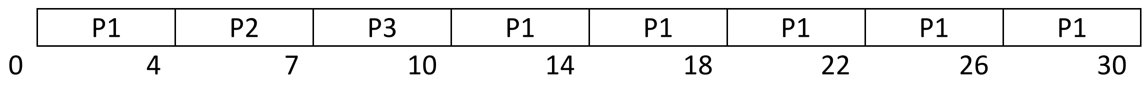
Preemptive	Non-preemptive
Shortest-Remaining-Time First (SRTF)	First-Come, First-Served (FCFS)
Priority	Shortest-Job First (SJF)
	Priority

- **Computation of Turnaround Time for RR**

Process	Burst Time
P1	24
P2	3
P3	3

Assume time quantum = 4

The Gantt chart is



Turnaround time of P1 = 30
Turnaround time of P2 = 7
Turnaround time of P3 = 10
Therefore, the average turnaround time = (30 + 7 + 10) / 3 = 15.67

- **Multilevel feedback Queue**

The scheduler of multilevel feedback queue always starts picking up processes from the head of the highest level queue. If the highest level queue has become empty, then the scheduler takes up a process from the next lower level queue. The same policy is implemented for picking up in the subsequent lower level queues.

More details about the operations of multilevel feedback queue are given below:

1. A new process in inserted at the end of the top-level queue.
2. At some stage, the process reaches the head of the queue and is assigned the CPU.
3. If the process is completed within the time quantum of the given queue, it leaves the system.
4. If the process voluntarily relinquishes control of the CPU, it leaves the queuing network, and when the process becomes ready again it is inserted at the end of the same queue which it relinquished earlier.
5. If the process uses all the quantum time, it is preempted and inserted at the end of the next lower level queue. This next lower level queue will have a time quantum which is more than that of the previous higher level queue.
6. This scheme will continue until the process completes or it reaches the base level queue.
    a. At the base level queue, the processes circulate in round robin fashion until they complete and leave the system. Processes in the base level queue can also be scheduled on a FCFS basis.
    b. Optionally, if a process blocks for I/O, it is "promoted" one level, and placed at the end of the next higher queue. This allows I/O bound processes to be favored by the scheduler and allows processes to "escape" the base level queue.

- **Advantages and disadvantages of each scheduling algorithm**

Algorithm	Advantages	Disadvantages
First-Come First-Served (FCFS)	• Simple method (minimum overhead on processor) • No starvation	• Small process should wait for its turn to come to utilize the CPU. Short process behind long process results in lower CPU utilization • Throughput is not emphasized
Shortest-Job First (SJF)	• It gives superior turnaround time performance to shortest process • Throughput is high	• Starvation may be possible for the longer processes
Non-Preemptive Priority	• Good response for the highest priority processes	• Starvation may be possible for the lowest priority processes
Preemptive Priority	• Very good response for the highest priority process over non-preemptive version of it	• Starvation may be possible for the lowest priority processes
Round-Robin	• Effective in general-purpose, time-sharing system or transaction-processing system • Fair treatment for all the processes • Overhead on processor is low • Good response time for short processes	• Care must be taken in choosing quantum value • Processing overhead is there in handling clock interrupt (context switching) • Throughput is low if time quantum is too small