Description:

In this homework, you are asked to implement a multithreaded program that will allow us to measure the performance (i.e., CPU utilization, Throughput, Turnaround time, Waiting time, and Response time) of the four basic CPU scheduling algorithms (namely, FIFO, SJF, PR, and RR) by simulating the processes whose priority, sequence of CPU burst time(ms) and I/O burst time(ms) will be given in an input file.

Assume that all scheduling algorithms except RR will be non-preemptive, and all scheduling algorithms except PR will ignore process priorities (i.e., all processes have the same priority in FIFO, SJF and RR). Also assume that there is only one IO device and all IO requests will be served using that device in a FIFO manner.

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Your program will take the name of the scheduling algorithm, related parameters (if any), and an input file name from command line. Here how your program should be executed:

prog -alg [FIFO|SJF|PR|RR] [-quantum [integer(ms)]] -input [file name]

The output of your program will be as follows:

Input File Name : file name

CPU Scheduling Alg : FIFO|SJF|PR|RR (quantum)

CPU utilization : ....

Throughput : ....

Turnaround time : ....

Waiting time : ....

Response time : ....

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The input file is formatted such that each line starts with proc, sleep, stop key words. Following proc, there will be a sequence of integer numbers: the first one represents the priority (1: lowest, ..., 5: normal, ..., 10: highest), while the remaining ones represent CPU burst and I/O burst times (ms) in an alternating manner. Following sleep, there will be an integer number representing the time (ms) after which there will be another process. So one of the threads in your program would be responsible for processing this file as follows. As long as it reads proc, it will create a new process and put it in a ready queue (clearly this process is not an actual one, it will be just a simple data structure (similar to PCB) that contains the given priority and the sequence of CPU burst and I/O burst times, and other fields). When this thread reads sleep x, it will sleep x ms and then try to read new processes from the file. Upon reading stop, this thread will quit.

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Here is a sample input file:

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proc 1 10 20 10 50 20 40 10

proc 1 50 10 30 20 40

sleep 50

proc 2 20 50 20

stop

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You need at least two other threads to simulate the behaviors of CPU scheduler and I/O system.

 CPU scheduler thread will check ready queue; if there is a process, it will pick one according to the scheduling algorithm from ready queue and hold CPU resource for the given CPU burst time (or for quantum time if the scheduling algorithm is RR). Then it will release CPU resource and put this process into IO queue (or ready queue if RR is used) or just terminate if there is no more CPU or IO burst. Then CPU scheduler thread will check ready queue again and repeat the same...

 I/O system thread will check IO queue; if there is a process, it will hold IO device for the given IO burst time and then put this process back into ready queue. Then it will check IO queue and repeat the same ....

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