CS370

FCFS, Priority Scheduling and Round Robin
Fall 2021

Homework-4 Review

Write a C program to demonstrate the following scheduling algorithms

- First Come First Serve
- Priority Based Scheduling without preemption
- Round Robin with time quantum

Evaluation:

- Sequence of execution in (Gantt chart)
- Individual turnaround time and Average turnaround time.
- Individual waiting time and Average waiting time.
- Throughput.

Homework-4 Review

A CSV file is provided which contains all the processes.

processes.csv

Header

Process 1

Process 2

ProcessID	Arrival Time	Burst Time
2	0	5
3	0	3
1	9	8
4	10	6

- **You can expect a maximum of 9 processes existing in the processes.csv file**

First Come First Serve

- Non preemptive.
- Schedules with respect to arrival time.
- Process that arrived first will get the CPU burst until it completes.
- If multiple processes arrive at the same time, execute lower PID first

Let's work on an example.

First Come First Serve

Proc ID	Arrival Time	Burst Time
2	0	5
1	0	3
4	3	2
3	12	6

Sort by Arrival time

Process ID	Arrival Time	Burst Time
1	0	3
2	0	5
4	3	2
3	12	6

First Come First Serve

Process ID	Arrival Time	Burst Time
1	0	3
2	0	5
4	3	2
3	12	6

Gantt Chart

Pseudo Code to proceed with the Algorithm

```
Sort by PID
Sort by ArrivalTime

#No process to run --> IDLE
                if(cur_time < arr) :
                        gantt<----------((cur_time, arr, 'IDLE'))
                        --------------------------------
#Process arrived and has waited
                if(cur_time > arr) :
                        gantt<----------------------((cur_time, cur_time+burst, pid))
                        #Get total wait time (no preemption)
                        ------------------------------------------
                        #Advance to end of burst
                        ------------------------------------------
#Process arrived and has not waited
                else :
                        gantt<-------------------------(arr, arr+burst, pid))
                        #Advance to end of burst
                        ---------------------------------
```

Priority Scheduling without Preemption

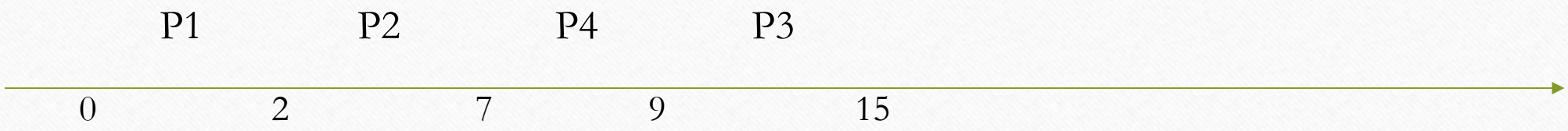
- The process with the higher priority (lower value) will execute first
  - i.e. priority 1 executes before priority 5
- Preemption - if a job comes in with a higher priority, it gets to execute right away

Again, let's work with an example.

Priority Scheduling without Preemption

Process ID	Arrival Time	Burst Time	Priority
1	0	2	4
2	1	5	5
4	5	2	1
3	3	6	3

Gantt Chart



Round Robin

- Round robin – Everyone gets a chance.
- The quantum (integer) is used to determine the time quantum for round robin. (Command line argument)
- Ready Queue is First come First served.
- For this assignment, if a new process arrives the same instant when a process is switched out, the new process gets in the ready queue first.

Round Robin (quantum 2) – (1)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	3
2	1	5	5
4	3	2	2
3	12	6	6

Time elapsed = 0

Ready Queue

P1									

Round Robin (quantum 2) – (2)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	1
2	1	5	5
4	3	2	2
3	12	6	6

Time elapsed = 2

Ready Queue

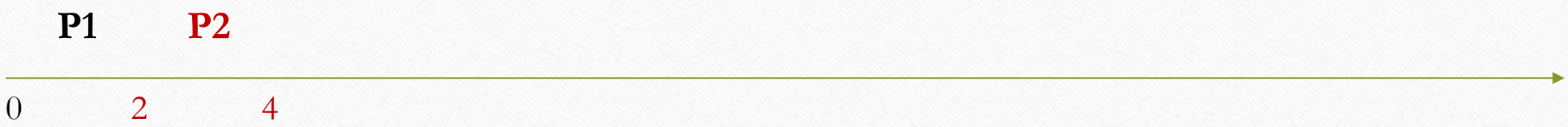
P2	P1								

P1

0 2

Round Robin (quantum 2) – (3)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	1
2	1	5	3
4	3	2	2
3	12	6	6



Time elapsed = 4

Ready Queue

P1	P4	P2							

Round Robin (quantum 2) – (4)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	**0**
2	1	5	**3**
4	3	2	**2**
3	12	6	**6**

Time elapsed = 5

Ready Queue

P4	P2								

P1 **P2** **P1**

0 2 4 5

Round Robin (quantum 2) – (5)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	**0**
2	1	5	**3**
4	3	2	**0**
3	12	6	**6**

Time elapsed = 7

Ready Queue

P2									

P1 **P2** **P1** **P4**

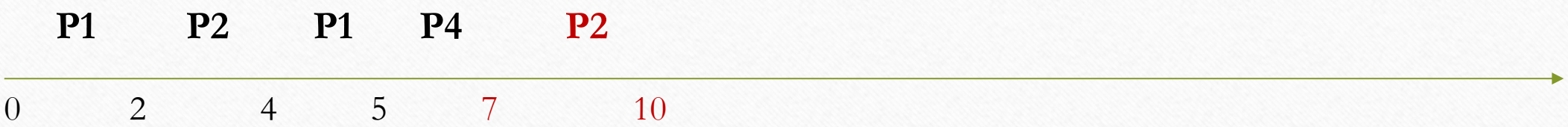
0 2 4 5 7

Round Robin (quantum 2) – (6)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	**0**
2	1	5	**0**
4	3	2	**0**
3	12	6	**6**

Time elapsed = 10

Ready Queue



Round Robin (quantum 2) – (7)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	**0**
2	1	5	**0**
4	3	2	**0**
3	12	6	**6**

Time elapsed = 12

Ready Queue

P1 **P2** **P1** **P4** **P2** **IDLE**

Round Robin (quantum 2) – (8)

Process ID	Arrival Time	Burst Time	Remaining Burst time
1	0	3	0
2	1	5	0
4	3	2	0
3	12	6	0

Time elapsed = 18

Ready Queue

Method accepts (data, Time Quantum)

---

create Ready Queue
Sort by pid
Sort by arrival time

Add all processes arriving at time 0 to ready queue
Remove them from unarrived queue

Hold objects once finished in finished_queue

while **ready_queue is! empty** or **not all process arrived** or **prev_run_process** is not None :

Now in this while Loop implement the following

Check if every process has arrived to prevent early termination upon IDLE.
Add new arrivals to ready queue and remove from unarrived queue
Add most recently run process to ready queue after new arrivals
Checks if IDLE and sets process to correct time while updating Gantt Chart
Get next process in ready queue
Add waiting time

If process has more than time quantum remaining. Burst and store to put back on ready queue.
Else burst remaining amount and set to finished. Do not add back on queue

Notes:

- The maximum length of the Gantt chart will not exceed 100 intervals.
- Processes may not appear in the file in order
- The processID is not related to arrival time, priority, or anything else
- The processID's may not always be consecutive numbers e.x. {1,3,6}
- There may be multiple processes with the same arrival time.
  - Break ties by processID
  - processID's are always unique

Other Requirements

- Language: C or Python.
- Must run on department machines.
- Use Canvas to submit a single .tar file named HW4.tar that contains:
  - All files related to the assignment. (Please document your code)
  - A README.txt file containing a description of each file and any information you feel the grader may need.
  - If your code exists in multiple files then there must exist one driver program which runs all the three scheduling algorithms. We execute only one file.

Thank you - Questions?

Acknowledgements

- These slides are based on contributions of current and past CS370 instructors and TAs, including Phil.Sharp ,J. Applin, S. R. Chowdhury, K. Bruhwiler, Y. K. Malaiya, S. Pallickara, K. Drago