Operating System 111 Fall

Homework 3

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Process Scheduling

1. Shortest Remaining Time First Scheduling (SRTF, Preemptive SJF)

2. Round-Robin(RR)

3. Multilevel Feedback Queue
   1st Level : Round-Robin
   2nd Level : First Come First Serve(FCFS)

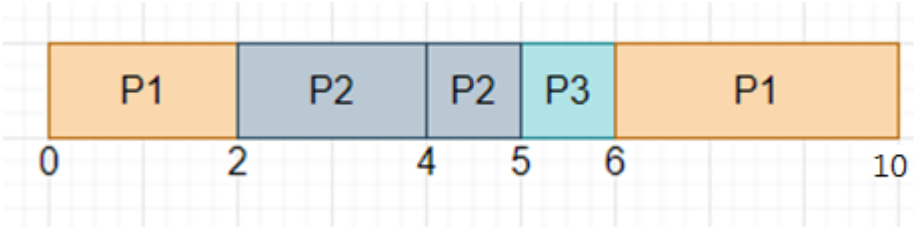
Scheduling Criteria

Throughput	**Number of completed processes per time unit.**
Turnaround Time	**The amount of time taken to complete a process.**
Waiting Time	**Total time spent by the process in the ready queue.**
Response Time	**The time spent when the process is being submission and gets the CPU for the first time.**

Shortest Remaining Time First Scheduling (SRTF)

Example

Process	Arrival	CPU burst
1	0	6
2	2	3
3	4	1



Waiting Time **P1 = 4, P2 = 0, P3 = 1**

Total Waiting Time **[4 + 0 + 1] = 5**

Turnaround Time **P1 = 10, P2 = 3, P3 = 2**

Total Turnaround time **[10 + 3 + 2] = 15**

The Format of Input & Output

Input

3	# Total Number of Processes
0 2 4	# Arrival Time of Each Process
6 3 1	# Burst Time of Each Process

Output

You should output **four things** :

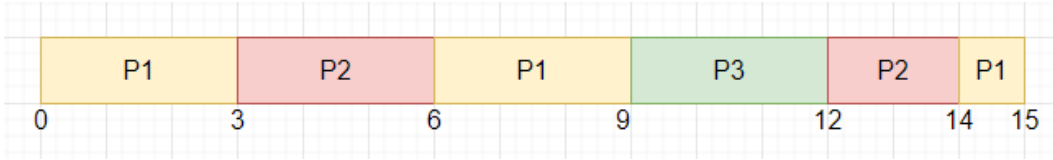
1. Waiting time of each process
2. Turnaround time of each process
3. Total waiting time
4. Total turnaround time

Click here to see the output format

Round-Robin

Example with Time Quantum = 3

Process	Arrival	CPU burst
1	0	7
2	2	5
3	4	3



Waiting Time **P1 = 8, P2 = 7, P3 = 5**

Total Waiting Time **[8 + 7 + 5] = 20**

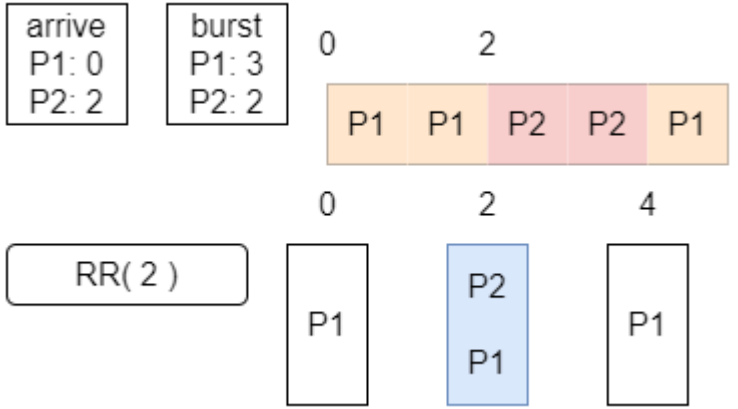
Turnaround Time **P1 = 15, P2 = 12, P3 = 8**

Total Turnaround time **[15 + 12 + 8] = 35**

Round-Robin (RR)

Pay attention to this case:

A new process comes while old process just leave CPU because of time quantum.
In this case, CPU will select new process.



The Format of Input & Output

Input

3	# Total Number of Processes
0 2 4	# Arrival Time of Each Process
7 5 3	# Burst Time of Each Process
3	# Time Quantum

Output

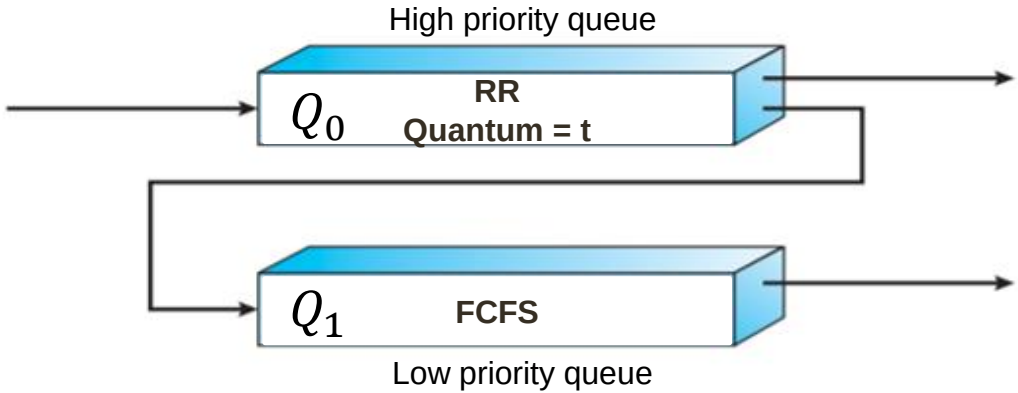
You should output **four things** :

1. Waiting time for each process
2. Turnaround time for each process
3. Total waiting time
4. Total turnaround time

Click here to see the output format

Multilevel Feedback Queue (RR+FCFS)

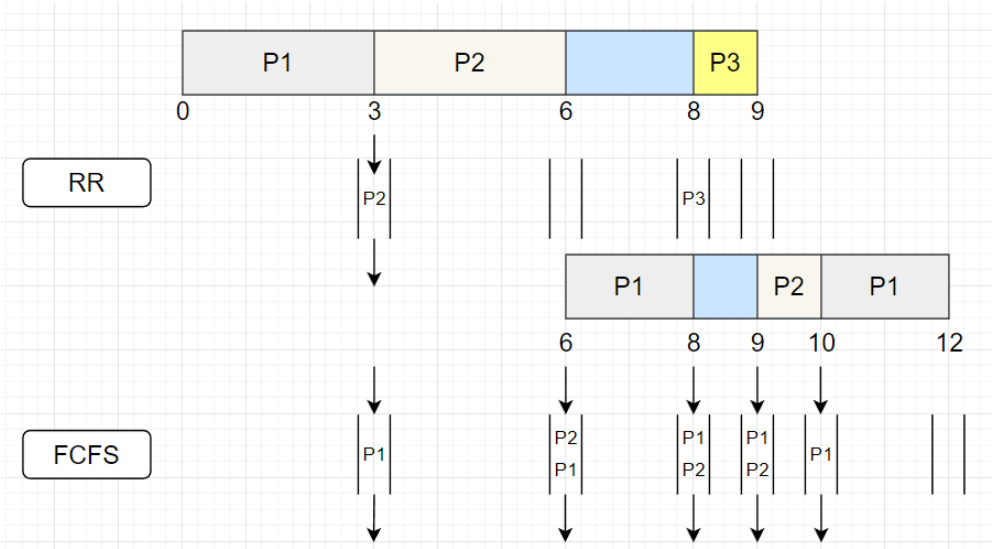
1. Processes in lower priority queue is selected if the higher queues are empty.
2. If a new process comes to higher priority queue, currently executing process in lower priority queue will be preempted by it.
3. When a new job comes, it first enters queue $Q0$ which is served as RR. As it gains CPU, job receives “t” time unit.
4. If it doesn’t finish in “t” time unit, job is moved to the next queue $Q1$ which is served as FCFS.
5. The preempted process will be re-inserted to the end of Q1.



Multilevel Feedback Queue

Example with Time Quantum = 3

Process	Arrival	CPU burst
1	0	7
2	2	4
3	8	1



Waiting Time **P1 = 5, P2 = 4, P3 = 0**

Total Waiting Time **[5 + 4 + 0] = 9**

Turnaround Time **P1 = 12, P2 = 8, P3 = 1**

Total Turnaround time **[12 + 8 + 1] = 21**

The format of input file & output

Input

3	# Total Number of Processes
0 2 8	# Arrival Time of Each Process
7 4 1	# Burst Time of Each Process
3	# Time Quantum for RR

Output

You should output **four things** :

1. Waiting time for each process
2. Turnaround time for each process
3. Total waiting time
4. Total turnaround time

Click here to see the output format

The Format of Output (Take SRTF for Example)

```
4 10
0 3
1 2
5
15
```

time.txt

```
Process         Waiting Time            Turnaround Time
P[1]            4                       10
P[2]            0                       3
P[3]            1                       2
Total Waiting Time: 5
Total Turnaround Time: 15
```

Detail Explain

You just need to print the format as time.txt

number space number\n
number space number\n
…
number\n number

Notes

TAs will use “g++ hw3_1.cpp -o hw3_1 ” to compile.

In Linux, after saving the test case in testcase.txt, we can use “./hw3_1 < testcase.txt > student_ans.txt” to test, and compare it to answer.txt.

So, please use **std::cin** to get user input in your homework!

Grade

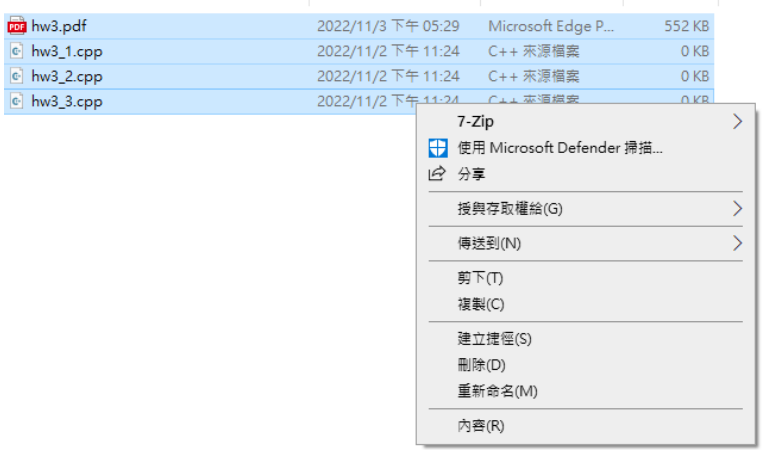
Total score : 100pts. Copy will get 0 point!

1. hw3-1, hw3-2, hw3-3 : 30 pts for each question.
2. There will be three test cases for each scheduling algorithm, one is visible, and the others are hidden. You will get 10 pts, if you pass one case.
3. Report : 10 pts
4. The format of Report is in hw3_report.docx. Please export it to PDF (hw3_report.pdf) before submitting.
5. If you just use { printf ("0 7\n5 9\n7 8\n12\n24“) ; }, you will get 0 pts.
6. Deadline : 2022/11/30 (Wes) 23:59. Late submission will get a -20% point per day.

Requirements

1. You should write codes in c/c++.
2. The name of .cpp file must in the form of “hw3_1.cpp” & “hw3_2.cpp” & “hw3_3.cpp”.

3. Put all *.cpp source files and report(*.pdf) into same compressed file. The type of compressed file must be “zip”.



Requirements

The name of your compressed file must have the form of “studentID_hw3.zip” and without any folder.

Incorrect file form : -20 pts
(Including the names of ***compressed file***, ***.cpp files***, ***report file***)

```
studentID_hw3.zip
                ├──hw3_1.cpp
                ├──hw3_2.cpp
                ├──hw3_3.cpp
                └──hw3_report.pdf
```