【OS】Day12（3）

【Ch7】CPU Scheduling Homework

Question 1

1. Compute the response time and turnaround time when running three jobs of length 200 with the SJF and FIFO schedulers.

For FIFO:

- The response time is $\frac{0+200+400}{3} = 200$
- The turnaround time is $\frac{200+(400-0)+(600-0)}{3} = 400$

```
PS D:\ostep-homework\cpu-sched> python .\scheduler.py -p FIFO -l 200,200,200 -c
ARG policy FIFO
ARG jlist 200,200,200

Here is the job list, with the run time of each job:
  Job 0 ( length = 200.0 )
  Job 1 ( length = 200.0 )
  Job 2 ( length = 200.0 )


** Solutions **

Execution trace:
  [ time   0 ] Run job 0 for 200.00 secs ( DONE at 200.00 )
  [ time 200 ] Run job 1 for 200.00 secs ( DONE at 400.00 )
  [ time 400 ] Run job 2 for 200.00 secs ( DONE at 600.00 )

Final statistics:
  Job   0 -- Response: 0.00  Turnaround 200.00  Wait 0.00
  Job   1 -- Response: 200.00  Turnaround 400.00  Wait 200.00
  Job   2 -- Response: 400.00  Turnaround 600.00  Wait 400.00

  Average -- Response: 200.00  Turnaround 400.00  Wait 200.00
```

For SJF:

- The response time is $\frac{0+200+400}{3} = 200$
- The turnaround time is $\frac{200+(400-0)+(600-0)}{3} = 400$

```
PS D:\ostep-homework\cpu-sched> python .\scheduler.py -p SJF -l 200,200,200 -c
ARG policy SJF
ARG jlist 200,200,200

Here is the job list, with the run time of each job:
  Job 0 ( length = 200.0 )
  Job 1 ( length = 200.0 )
  Job 2 ( length = 200.0 )


** Solutions **

Execution trace:
  [ time   0 ] Run job 0 for 200.00 secs ( DONE at 200.00 )
  [ time 200 ] Run job 1 for 200.00 secs ( DONE at 400.00 )
  [ time 400 ] Run job 2 for 200.00 secs ( DONE at 600.00 )

Final statistics:
  Job   0 -- Response: 0.00  Turnaround 200.00  Wait 0.00
  Job   1 -- Response: 200.00  Turnaround 400.00  Wait 200.00
  Job   2 -- Response: 400.00  Turnaround 600.00  Wait 400.00

  Average -- Response: 200.00  Turnaround 400.00  Wait 200.00
```

Question 2

2. Now do the same but with jobs of different lengths: 100, 200, and 300.

For FIFO:

- The response time is $\frac{0+100+300}{3} = 133.33$
- The turnaround time is $\frac{(100-0)+(300-0)+(600-0)}{3} = 333.33$

```
PS D:\ostep-homework\cpu-sched> python .\scheduler.py -p FIFO -l 100,200,300 -c
ARG policy FIFO
ARG jlist 100,200,300

Here is the job list, with the run time of each job:
  Job 0 ( length = 100.0 )
  Job 1 ( length = 200.0 )
  Job 2 ( length = 300.0 )


** Solutions **

Execution trace:
  [ time   0 ] Run job 0 for 100.00 secs ( DONE at 100.00 )
  [ time 100 ] Run job 1 for 200.00 secs ( DONE at 300.00 )
  [ time 300 ] Run job 2 for 300.00 secs ( DONE at 600.00 )

Final statistics:
  Job   0 -- Response: 0.00  Turnaround 100.00  Wait 0.00
  Job   1 -- Response: 100.00  Turnaround 300.00  Wait 100.00
  Job   2 -- Response: 300.00  Turnaround 600.00  Wait 300.00

  Average -- Response: 133.33  Turnaround 333.33  Wait 133.33
```

For SJF:

- The response time is $\frac{0+100+300}{3} = 133.33$
- The turnaround time is $\frac{(100-0)+(300-0)+(600-0)}{3} = 333.33$

```
PS D:\ostep-homework\cpu-sched> python .\scheduler.py -p SJF -l 100,200,300 -c
ARG policy SJF
ARG jlist 100,200,300

Here is the job list, with the run time of each job:
  Job 0 ( length = 100.0 )
  Job 1 ( length = 200.0 )
  Job 2 ( length = 300.0 )


** Solutions **

Execution trace:
  [ time   0 ] Run job 0 for 100.00 secs ( DONE at 100.00 )
  [ time 100 ] Run job 1 for 200.00 secs ( DONE at 300.00 )
  [ time 300 ] Run job 2 for 300.00 secs ( DONE at 600.00 )

Final statistics:
  Job   0 -- Response: 0.00  Turnaround 100.00  Wait 0.00
  Job   1 -- Response: 100.00  Turnaround 300.00  Wait 100.00
  Job   2 -- Response: 300.00  Turnaround 600.00  Wait 300.00

  Average -- Response: 133.33  Turnaround 333.33  Wait 133.33
```

Question 3

3. Now do the same, but also with the RR scheduler and a time-slice of 1.

We are expecting a response time of $\frac{0+1+2}{3} = 1$. However, the turnaround time can be really large.

```
Final statistics:
  Job   0 — Response: 0.00  Turnaround 298.00  Wait 198.00
  Job   1 — Response: 1.00  Turnaround 499.00  Wait 299.00
  Job   2 — Response: 2.00  Turnaround 600.00  Wait 300.00

  Average — Response: 1.00  Turnaround 465.67  Wait 265.67
```

Question 4

4. For what types of workloads does SJF deliver the same turnaround times as FIFO?

If jobs are scheduled in nondescending order in terms of time, then SJF and FIFo deliver the same turnaround time.(See Q2 for example)

Question 5

5. For what types of workloads and quantum lengths does SJF deliver the same response times as RR?

If the quantum lengths are equal to job lengths, then SJF and RR deliver the same response time.

RR:

```
PS D:\ostep-homework\cpu-sched> python .\scheduler.py -p RR -q 100 -l 100,100,100 -c
ARG policy RR
ARG jlist 100,100,100

Here is the job list, with the run time of each job:
  Job 0 ( length = 100.0 )
  Job 1 ( length = 100.0 )
  Job 2 ( length = 100.0 )


** Solutions **

Execution trace:
  [ time   0 ] Run job   0 for 100.00 secs ( DONE at 100.00 )
  [ time 100 ] Run job   1 for 100.00 secs ( DONE at 200.00 )
  [ time 200 ] Run job   2 for 100.00 secs ( DONE at 300.00 )

Final statistics:
  Job   0 -- Response: 0.00  Turnaround 100.00  Wait 0.00
  Job   1 -- Response: 100.00  Turnaround 200.00  Wait 100.00
  Job   2 -- Response: 200.00  Turnaround 300.00  Wait 200.00

  Average -- Response: 100.00  Turnaround 200.00  Wait 100.00
```

SJF:

```
PS D:\ostep-homework\cpu-sched> python .\scheduler.py -p SJF -l 100,100,100 -c
ARG policy SJF
ARG jlist 100,100,100

Here is the job list, with the run time of each job:
  Job 0 ( length = 100.0 )
  Job 1 ( length = 100.0 )
  Job 2 ( length = 100.0 )


** Solutions **

Execution trace:
  [ time   0 ] Run job 0 for 100.00 secs ( DONE at 100.00 )
  [ time 100 ] Run job 1 for 100.00 secs ( DONE at 200.00 )
  [ time 200 ] Run job 2 for 100.00 secs ( DONE at 300.00 )

Final statistics:
  Job   0 -- Response: 0.00  Turnaround 100.00  Wait 0.00
  Job   1 -- Response: 100.00  Turnaround 200.00  Wait 100.00
  Job   2 -- Response: 200.00  Turnaround 300.00  Wait 200.00

  Average -- Response: 100.00  Turnaround 200.00  Wait 100.00
```

Question 6

6. What happens to response time with SJF as job lengths increase? Can you use the simulator to demonstrate the trend?

If we double the job length, the average response time also gets doubled. In other words, there is a linear relationship between the reaopnse time and job lengths.

Question 7

7. What happens to response time with RR as quantum lengths increase? Can you write an equation that gives the worst-case response time, given N jobs?

The resonse time would increase as the quantum length increase.

Given N jobs and quantum length q, the worst response time is $\frac{(N-1)q}{N}$