

## OS Lab 4

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### BenchMark Used

BenchMark1 : workload\_mix\_5\_0

```
./arithoh.sh & ./arithoh.sh & ./arithoh.sh & ./arithoh.sh & ./arithoh.sh
```

BenchMark2 : workload\_mix\_4\_1

```
./pipe.sh & ./fstime.sh & ./pipe.sh & ./pipe.sh & ./pipe.sh
```

BenchMark3 : workload\_mix\_3\_2

```
./arithoh.sh & ./arithoh.sh & ./fstime.sh & ./fstime.sh & ./arithoh.sh
```

BenchMark4 : workload\_mix\_1\_4

```
./fstime.sh & ./arithoh.sh & ./fstime.sh & ./fstime.sh & ./fstime.sh
```

BenchMark5 : workload\_mix\_0\_5

```
./fstime.sh & ./fstime.sh & ./fstime.sh & ./fstime.sh & ./fstime.sh
```

## Part 1

### Observations and Inferences

#### BenchMark1

It can be observed that the pid swapped statements get printed in a round-robin fashion, with time quanta which is 200 by default is fully used every time the process is scheduled.

Here cpu fairly schedules all the processes. CPU intensive processes do not need to wait for I/O and they execute fully in the Time Quanta they have been allocated.

```

PID 42 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 43 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 41 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 42 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 45 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 43 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 41 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
^[[DPID 45 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 43 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 42 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0

```

```

---
    1:15.70 real        15.38 user        0.01 sys
arithoh completed
---
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 44 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
    1:16.93 real        15.35 user        0.00 sys
arithoh completed
---

```

## BenchMark2

Pipe involves many system calls internally compared to others. All the processes execute in a round-robin fashion and fstime.sh does not use cpu much as it is I/O bound in nature

```

Time Quanta : 200, Time Executed :200, Time Left : 0
PID 254 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 255 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 7 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 9 swapped in
Write done: 1008000 in 4.0667, score 61967
COUNT:61967:0:KBps
TIME:4.1
PID 9 swapped in
PID 255 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 251 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 253 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 7 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Read done: 1000004 in 1.9833, score 126050
COUNT:126050:0:KBps
TIME:2.0
PID 9 swapped in

```

```

PID 255 swapped in
Time Quanta : 200, Time Executed :11, Time Left : 189
    33.11 real      0.81 user      6.21 sys
pipe completed
---
[3]  Done      ./fstime.sh
#    33.41 real      0.81 user      5.71 sys
pipe completed
---
    33.51 real      0.78 user      6.95 sys
pipe completed
---
    33.68 real      0.73 user      6.65 sys
pipe completed
---

```

### BenchMark3

It can be clearly observed that the pid swapped statements get printed again in round robin fashion, with an assigned quantum of 200 which it consumes for the cpu intensive processes but for the I/O intensive process(fstime), the time left can be clearly observed and also that the process was blocked for I/O i.e...cpu bound tasks utilizes all of its quanta whereas I/O bound tasks don't do the same.







```

TIME:4.7
COUNT:54000:0:KBps
COUNT:54000:0:KBps
COUNT:54000:0:KBps
COUNT:54000:0:KBps
TIME:4.7
TIME:4.7
TIME:4.7
TIME:4.7
Read done: 1000004 in 4.4500, score 56179
Read done: 1000004 in 4.4500, score 56179
Read done: 1000004 in 4.4500, score 56179
Read done: 1000004 in 4.4500, score 56179
Read done: 1000004 in 4.4500, score 56179
COUNT:56179:0:KBps
COUNT:56179:0:KBps
COUNT:56179:0:KBps
COUNT:56179:0:KBps
COUNT:56179:0:KBps
COUNT:56179:0:KBps
TIME:4.5
TIME:4.5
TIME:4.5
TIME:4.5
TIME:4.5

```

```

fstime completed
---
Copy done: 1000004 in 8.6667, score 28846
COUNT:28846:0:KBps
TIME:8.7
    28.81 real        0.45 user        3.03 sys
fstime completed
---
Copy done: 1000004 in 8.7333, score 28626
COUNT:28626:0:KBps
TIME:8.7
    28.88 real        0.48 user        3.28 sys
fstime completed
---
Copy done: 1000004 in 9.0000, score 27777
COUNT:27777:0:KBps
TIME:9.0
    29.15 real        0.26 user        3.16 sys
fstime completed
---

```

## Part 2

### Observations and Inferences

#### BenchMark1

Here all the instances of arithoh are executed sequentially as by implemented FIFO policy, with time quanta which is 200 by default is fully used every time the process is scheduled.





```

PID 205 swapped in
PID 205 swapped in
PID 205 swapped in
1:16.91 1:16.91 real real 1:16.91 real 1:16.91 real 1:16.91 real
15.38 15.33 user user 15.40 user 15.45 user 15.35 user
0.00 0.00 sys
sys
0.00 sys
0.00 sys
0.00 sys
arithoh completed
arithoh completed
---
arithoh completed
---
arithoh completed
---
arithoh completed
---

```

## BenchMark2

Pipe involves many system calls internally compared to others. The processes run in nearly the FIFO policy and all the processes execute in a round-robin fashion and fstime.sh does not use cpu much as it is I/O bound in nature

```

Time Quanta : 200, Time Executed :200, Time Left : 0
PID 195 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 196 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 197 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 198 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 199 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 200 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 201 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 202 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 203 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 204 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Write done: 1008000 in 4.9833, score 50568
COUNT:50568:0:KBps
TIME:5.0

```

```

Time Quanta : 200, Time Executed :200, Time Left : 0
PID 204 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Write done: 1008000 in 4.9833, score 50568
COUNT:50568:0:KBps
TIME:5.0
Time Quanta : 200, Time Executed :200, Time Left : 0
      18.00 real      0.76 user      7.03 sys
pipe completed
---
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 9 swapped in
      23.05 real      0.73 user      7.35 sys
pipe completed
---
[1] Done      ./pipe.sh
# Time Quanta : 200, Time Executed :200, Time Left : 0
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
      27.73 real      0.65 user      6.93 sys
pipe completed
---
Time Quanta : 200, Time Executed :200, Time Left : 0

```

```

---
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 9 swapped in
      32.30 real      0.71 user      6.88 sys
pipe completed
---
Read done: 1000004 in 20.0000, score 12500
COUNT:12500:0:KBps
TIME:20.0
PID 9 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 1.9833, score 126050
COUNT:126050:0:KBps
TIME:2.0
      37.96 real      0.48 user      3.41 sys
fstime completed
---
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in

```



```

PID 215 swapped in
PID 215 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in
PID 217 swapped in

```

```

COUNT:145384:0:KBps
COUNT:145384:0:KBps
TIME:1.7
TIME:1.7
Read done: 1000004 in 1.8333, score 136364
Read done: 1000004 in 1.8333, score 136364
COUNT:136364:0:KBps
COUNT:136364:0:KBps
TIME:1.8
TIME:1.8
Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 3.3333, score 75000
COUNT:75000:0:KBps
TIME:3.3
    1:04.06 real        0.43 user        3.30 sys
fstime completed
---
Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 3.8833, score 64377
COUNT:64377:0:KBps
TIME:3.9
    1:04.61 real        0.35 user        3.36 sys
fstime completed
---

```

## BenchMark4

fstime process executes first(due to more priority) but is sent back to the waiting queue as they need to wait for Input/Output. But, it is evident that the policy remained to be FIFO because the reason that the process related to I/O gets blocked(blocked state then to ready state once it gets I/O).

```
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 229 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 230 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 231 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 232 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 233 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 234 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 235 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
```

```
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
PID 232 swapped in
15.40 real 15.38 user 0.00 sys
arithoh completed
```

```
---
Write done: 1008000 in 3.8833, score 64892
Write done: 1008000 in 3.8833, score 64892
Write done: 1008000 in 3.8833, score 64892
Write done: 1008000 in 3.8833, score 64892
COUNT:64892:0:KBps
COUNT:64892:0:KBps
COUNT:64892:0:KBps
COUNT:64892:0:KBps
TIME:3.9
TIME:3.9
TIME:3.9
TIME:3.9
PID 24 swapped in
PID 24 swapped in
```

```

fstime completed
---
[2]   Done                ./arithoh.sh
# Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 7.1000, score 35211
COUNT:35211:0:KBps
TIME:7.1
      41.15 real          0.31 user          2.98 sys
fstime completed
---
Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 7.5167, score 33259
COUNT:33259:0:KBps
TIME:7.5
      41.58 real          0.43 user          3.68 sys
fstime completed
---
Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 7.8500, score 31847
COUNT:31847:0:KBps
TIME:7.8
      41.91 real          0.31 user          3.65 sys
fstime completed
---

```

```

PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in
PID 24 swapped in

```

## BenchMark5

The process can be seen to be executed sequentially, as it is expected due to the implementation of FIFO.

```
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 202 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 203 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 204 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 205 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Write done: 1008000 in 4.6167, score 54584
Write done: 1008000 in 4.6167, score 54584
Write done: 1008000 in 4.6167, score 54584
Write done: 1008000 in 4.6167, score 54584
Write done: 1008000 in 4.6167, score 54584
COUNT:54584:0:KBps
COUNT:54584:0:KBps
COUNT:54584:0:KBps
COUNT:54584:0:KBps
COUNT:54584:0:KBps
TIME:4.6
TIME:4.6
TIME:4.6
TIME:4.6
TIME:4.6
```

```
COUNT:51546:0:KBps
TIME:4.9
TIME:4.9
TIME:4.9
TIME:4.9
TIME:4.9
PID 24 swapped in
PID 24 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
Copy done: 1000004 in 7.2667, score 34403
COUNT:34403:0:KBps
TIME:7.3
    27.75 real        0.33 user        3.38 sys
fstime completed
----
# Time Quanta : 200, Time Executed :200, Time Left : 0
PID 24 swapped in
Copy done: 1000004 in 7.8333, score 31915
COUNT:31915:0:KBps
TIME:7.8
    28.31 real        0.40 user        3.18 sys
fstime completed
----
Time Quanta : 200, Time Executed :200, Time Left : 0
```

```
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
Time Quanta : 200, Time Executed :200, Time Left : 0
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
PID 9 swapped in
```