

Assignment 2

5DV171

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Code exist at:
<https://github.com/jimnor/5dv171a2>

Introduction

The purpose of this program is to allow a comparison between different scheduling policies when using threads. The program focus on the overall performance during a fixed time while running simulations with other threads. Meaning the throughput but also on the spread as some threads will run more times than others. Two different “tasks” has been made to help create some disturbance as one is a lot less requiring then the other.

The scheduling policies picked for the test are FIFO, ROUND ROBIN and the default setting (which should be CFS, “Completely Fair Scheduler” according to <http://man7.org/linux/man-pages/man7/sched.7.html>).

The code for the program exist at <https://github.com/jimnor/5dv171a2>

Design

There are a few interesting design choices made for the program. First off to achieve a more balanced run, so all threads runs about the same time and not with threads that runs alone. A simple mutex lock has been used. This one prevents the threads from running until they main thread has created enough threads. Which allows for a more even run.

The other design choices is the two tasks, since as seen in the “test runs” the lighter task is a lot faster then the heavy task. This is simply because the heavy task is made out of I/O operations, which takes quite some time to perform. The simply open a file, write to it, read from it and then closes it.

The second task is much lighter, it is simple math operations (not math.h just * and / and such). However to not make the thread complete the task to fast they need to run the operation 10000 times before they get a lap (this is to remove a little bit of “noise factor”).

Though due to the design of the program it is very sensitive to noise factors which will be seen in the test runs. As they are not consistent even after running for 30 sec. However after a couple of runs they do yield some valid data

Conclusion

So the conclusion of this test. Well for first it requires several runs before it yields proper data. Especially if run on a fairly noisy computer like "itchy.cs.umu.se". However the data does show a little bit of things. As seen in the tables below

Default light	Default heavy	FIFO light	FIFO heavy	RR light	RR heavy
631194	31574	634341	32044	636403	31519
634576	31000	635570	31555	636780	30722
633545	30928	633545	30928	635738	31470

Table 1 shows data from when running with 10 threads for 30 seconds

As observed in table 1 it shows little different in the average completed task runs. The differences can be simply be contributed to the "noise factor".

Default light	Default heavy	FIFO light	FIFO heavy	RR light	RR heavy
19325	83	9926	68	536	109
10472	45	5004	121	954	55
9141	76	2267	62	701	121

Table 2 shows data from when running with 10 threads for 30 seconds

Table 2 however shows a lot more interesting data. It shows that RR (round robin) clearly has a better spread on the light tasks while it have a worse spread on the heavy ones. So even if the average completed task runs are the same, this is probably cause RR has a max run time for each process before switching, causing RR to have a higher wait time.

We can also see that FIFO has the biggest differences in the spreads. Though on average the spread is less than the default setting. But the default setting seem to have lowest spread on average with the heavy tasks. Though it is clearly not in favor of the light ones.

This concludes that if you run a program on several processors maybe an more evenly spread RR can be preferable, given that you are not running heavy tasks as if you are running heavy tasks you should use the default. Which puts FIFO in the middle.

Test runs

Test will run with 10 threads during 1 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 42358
Lowest amount of completed laps for light task: 33028
Highest amount of completed laps for light task: 54194
Gap between highest and lowest completions for light task: 21166

Average task laps completion for heavy task is: 476
Lowest amount of completed laps for heavy task: 470
Highest amount of completed laps for heavy task: 494
Gap between highest and lowest completions for heavy task: 24

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 42425
Lowest amount of completed laps for light task: 30975
Highest amount of completed laps for light task: 50795
Gap between highest and lowest completions for light task: 19820

Average task laps completion for heavy task is: 445
Lowest amount of completed laps for heavy task: 437
Highest amount of completed laps for heavy task: 448
Gap between highest and lowest completions for heavy task: 11

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 42593
Lowest amount of completed laps for light task: 37387
Highest amount of completed laps for light task: 47324
Gap between highest and lowest completions for light task: 9937

Average task laps completion for heavy task is: 419
Lowest amount of completed laps for heavy task: 413
Highest amount of completed laps for heavy task: 427
Gap between highest and lowest completions for heavy task: 14

Test will run with 10 threads during 1 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 42359
Lowest amount of completed laps for light task: 33861
Highest amount of completed laps for light task: 51275
Gap between highest and lowest completions for light task: 17414

Average task laps completion for heavy task is: 527
Lowest amount of completed laps for heavy task: 522
Highest amount of completed laps for heavy task: 530
Gap between highest and lowest completions for heavy task: 8

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 42063
Lowest amount of completed laps for light task: 33110
Highest amount of completed laps for light task: 46198
Gap between highest and lowest completions for light task: 13088

Average task laps completion for heavy task is: 518
Lowest amount of completed laps for heavy task: 513
Highest amount of completed laps for heavy task: 525
Gap between highest and lowest completions for heavy task: 12

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 42294
Lowest amount of completed laps for light task: 36161
Highest amount of completed laps for light task: 48737
Gap between highest and lowest completions for light task: 12576

Average task laps completion for heavy task is: 473
Lowest amount of completed laps for heavy task: 471
Highest amount of completed laps for heavy task: 481
Gap between highest and lowest completions for heavy task: 10

Test will run with 10 threads during 10 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 404912
Lowest amount of completed laps for light task: 371638
Highest amount of completed laps for light task: 454922
Gap between highest and lowest completions for light task: 83284

Average task laps completion for heavy task is: 5019
Lowest amount of completed laps for heavy task: 4987
Highest amount of completed laps for heavy task: 5036
Gap between highest and lowest completions for heavy task: 49

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 389686
Lowest amount of completed laps for light task: 369531
Highest amount of completed laps for light task: 408564
Gap between highest and lowest completions for light task: 39033

Average task laps completion for heavy task is: 5087
Lowest amount of completed laps for heavy task: 5056
Highest amount of completed laps for heavy task: 5130
Gap between highest and lowest completions for heavy task: 74

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 421067
Lowest amount of completed laps for light task: 404653
Highest amount of completed laps for light task: 440153
Gap between highest and lowest completions for light task: 35500

Average task laps completion for heavy task is: 4343
Lowest amount of completed laps for heavy task: 4321
Highest amount of completed laps for heavy task: 4358
Gap between highest and lowest completions for heavy task: 37

Test will run with 10 threads during 10 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 421365
Lowest amount of completed laps for light task: 391470
Highest amount of completed laps for light task: 438253
Gap between highest and lowest completions for light task: 46783

Average task laps completion for heavy task is: 4284
Lowest amount of completed laps for heavy task: 4203
Highest amount of completed laps for heavy task: 4317
Gap between highest and lowest completions for heavy task: 114

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 420350
Lowest amount of completed laps for light task: 404925
Highest amount of completed laps for light task: 438265
Gap between highest and lowest completions for light task: 33340

Average task laps completion for heavy task is: 4727
Lowest amount of completed laps for heavy task: 4705
Highest amount of completed laps for heavy task: 4739
Gap between highest and lowest completions for heavy task: 34

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 422506
Lowest amount of completed laps for light task: 387734
Highest amount of completed laps for light task: 433463
Gap between highest and lowest completions for light task: 45729

Average task laps completion for heavy task is: 3653
Lowest amount of completed laps for heavy task: 3649
Highest amount of completed laps for heavy task: 3659
Gap between highest and lowest completions for heavy task: 10

Test will run with 10 threads during 10 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 419508
Lowest amount of completed laps for light task: 402997
Highest amount of completed laps for light task: 436598
Gap between highest and lowest completions for light task: 33601

Average task laps completion for heavy task is: 4724
Lowest amount of completed laps for heavy task: 4702
Highest amount of completed laps for heavy task: 4743
Gap between highest and lowest completions for heavy task: 41

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 419230
Lowest amount of completed laps for light task: 383411
Highest amount of completed laps for light task: 465417
Gap between highest and lowest completions for light task: 82006

Average task laps completion for heavy task is: 4288
Lowest amount of completed laps for heavy task: 4273
Highest amount of completed laps for heavy task: 4318
Gap between highest and lowest completions for heavy task: 45

Running on ROUND ROBIN scheduler

Making threads

running test...

Test complete, displaying result

Average task laps completion for light task is: 420376

Lowest amount of completed laps for light task: 409707

Highest amount of completed laps for light task: 430905

Gap between highest and lowest completions for light task: 21198

Average task laps completion for heavy task is: 4425

Lowest amount of completed laps for heavy task: 4406

Highest amount of completed laps for heavy task: 4443

Gap between highest and lowest completions for heavy task: 37

Test will run with 10 threads during 30 seconds

Initiating test... wait a bit

Running on Standard scheduler (should be CFS)

Making threads

running test...

Test complete, displaying result

Average task laps completion for light task is: 631194

Lowest amount of completed laps for light task: 617271

Highest amount of completed laps for light task: 636596

Gap between highest and lowest completions for light task: 19325

Average task laps completion for heavy task is: 31574

Lowest amount of completed laps for heavy task: 31522

Highest amount of completed laps for heavy task: 31605

Gap between highest and lowest completions for heavy task: 83

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 634341
Lowest amount of completed laps for light task: 626691
Highest amount of completed laps for light task: 636617
Gap between highest and lowest completions for light task: 9926

Average task laps completion for heavy task is: 32044
Lowest amount of completed laps for heavy task: 32007
Highest amount of completed laps for heavy task: 32075
Gap between highest and lowest completions for heavy task: 68

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 636403
Lowest amount of completed laps for light task: 636157
Highest amount of completed laps for light task: 636693
Gap between highest and lowest completions for light task: 536

Average task laps completion for heavy task is: 31519
Lowest amount of completed laps for heavy task: 31474
Highest amount of completed laps for heavy task: 31583
Gap between highest and lowest completions for heavy task: 109

Test will run with 10 threads during 30 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 634576
Lowest amount of completed laps for light task: 626414
Highest amount of completed laps for light task: 636886
Gap between highest and lowest completions for light task: 10472

Average task laps completion for heavy task is: 31000
Lowest amount of completed laps for heavy task: 30974
Highest amount of completed laps for heavy task: 31019
Gap between highest and lowest completions for heavy task: 45

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 635570
Lowest amount of completed laps for light task: 631688
Highest amount of completed laps for light task: 636692
Gap between highest and lowest completions for light task: 5004

Average task laps completion for heavy task is: 31555
Lowest amount of completed laps for heavy task: 31510
Highest amount of completed laps for heavy task: 31631
Gap between highest and lowest completions for heavy task: 121

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 636780
Lowest amount of completed laps for light task: 636286
Highest amount of completed laps for light task: 637240
Gap between highest and lowest completions for light task: 954

Average task laps completion for heavy task is: 30722
Lowest amount of completed laps for heavy task: 30699
Highest amount of completed laps for heavy task: 30754
Gap between highest and lowest completions for heavy task: 55

Test will run with 10 threads during 30 seconds
Initiating test... wait a bit
Running on Standard scheduler (should be CFS)
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 633545
Lowest amount of completed laps for light task: 627708
Highest amount of completed laps for light task: 636849
Gap between highest and lowest completions for light task: 9141

Average task laps completion for heavy task is: 30928
Lowest amount of completed laps for heavy task: 30880
Highest amount of completed laps for heavy task: 30956
Gap between highest and lowest completions for heavy task: 76

Running on FIFO scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 635738
Lowest amount of completed laps for light task: 634445
Highest amount of completed laps for light task: 636712
Gap between highest and lowest completions for light task: 2267

Average task laps completion for heavy task is: 31470
Lowest amount of completed laps for heavy task: 31424
Highest amount of completed laps for heavy task: 31486
Gap between highest and lowest completions for heavy task: 62

Running on ROUND ROBIN scheduler
Making threads
running test...
Test complete, displaying result

Average task laps completion for light task is: 636468
Lowest amount of completed laps for light task: 636013
Highest amount of completed laps for light task: 636714
Gap between highest and lowest completions for light task: 701

Average task laps completion for heavy task is: 32092
Lowest amount of completed laps for heavy task: 32045
Highest amount of completed laps for heavy task: 32166
Gap between highest and lowest completions for heavy task: 121