PROCESSES VS THREADS TESTING

COMP 8005

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Contents

Testing

#	DESCRIPTION	STEPS	EXPECTED RESULT	ACTUAL RESULT	RESULT
1	Correctly implemented Taylor Series to approximate Pi	1. Run the program with 1 iteration 2. Run the program with 10000 iterations	accuracy of pi increases as number of iterations increases	accuracy of pi increases as number of iterations increases	PASS
2	Time measurement is correct	1. Run the program with 10000 iterations 2. Take note of elapsed time via system clock	Printed elapsed time matches actual elapsed time	Printed elapsed time matches actual elapsed time	PASS
3	Time of computation decreases as number of workers increases	1. Run the program with 10000000 iterations with 1 worker 2. Run the program with 10000000 iterations with 4 workers	Elapsed time is reduced with more workers	Elapsed time is reduced with more workers	PASS
4	Pi approximation is the same regardless of process workers and thread workes	1. Run the program with 10000000 iterations and 4 processes 2. Run the program with 10000000 iterations and 1 process with 4 threads	Approximated value of Pi is the same in both scenarios	Approximated value of Pi is the same in both scenarios	PASS
5	Work is spread evenly amongst workers	1. Run the program with 1000000 iterations with 8 workers 2. Monitor top or htop to see CPU core distribution	All cores are utilized	All cores are utilized	PASS
6	Fully uses compute cores	1. Run the program with 1000000 iterations with 8 workers 2. Monitor top or htop to see CPU core distribution	All cores are utilized	All cores are utilized	PASS
7	Correctly spawns number of threads per process	1. Run the program with 1000000 iterations with 2 processes with 4 threads per process 2. Monitor htop to see number of processes and threads	See 2 processes and 8 threads in htop	See 2 processes and 8 threads in htop	PASS
8	Help message displays correctly	1. Run the program with the –help arg	See help message	See help message	PASS

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Terminal 1:

```
spenser@spenser-desktop: ~/Documents/git/comp8005-processes-vs-threads
File  Edit  View  Search  Terminal  Help
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 1 1
Total Iterations          = 1
Total Workers             = 1
Iterations Per Worker     = 1
Process Workers           = 1
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 2.66666666666666666652
actual  pi = 3.14159265358979323846

elapsed time: 0 milliseconds
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 10000 1
Total Iterations          = 10000
Total Workers             = 1
Iterations Per Worker     = 10000
Process Workers           = 1
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 3.14169264359054321292
actual  pi = 3.14159265358979323846

elapsed time: 12 milliseconds
```

Terminal 2:

```
spenser@spenser-desktop: ~/Documents/git/comp8005-processes-vs-threads
File  Edit  View  Search  Terminal  Help
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 1 1
Total Iterations          = 1
Total Workers             = 1
Iterations Per Worker     = 1
Process Workers           = 1
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 2.66666666666666666652
actual  pi = 3.14159265358979323846

elapsed time: 0 milliseconds
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 10000 1
Total Iterations          = 10000
Total Workers             = 1
Iterations Per Worker     = 10000
Process Workers           = 1
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 3.14169264359054321292
actual  pi = 3.14159265358979323846

elapsed time: 12 milliseconds
```

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Terminal 3:

```
spenser@spenser-desktop: ~/Documents/git/comp8005-processes-vs-threads
File  Edit  View  Search  Terminal  Help
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 10000000 1
Total Iterations          = 10000000
Total Workers             = 1
Iterations Per Worker     = 1e+07
Process Workers           = 1
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 3.14159275358978327952
actual  pi = 3.14159265358979323846

elapsed time: 3881 milliseconds
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 10000000 4
Total Iterations          = 10000000
Total Workers             = 4
Iterations Per Worker     = 2.5e+06
Process Workers           = 4
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 3.14159275358978325393
actual  pi = 3.14159265358979323846

elapsed time: 1267 milliseconds
```

Terminal 4:

```
spenser@spenser-desktop: ~/Documents/git/comp8005-processes-vs-threads
File  Edit  View  Search  Terminal  Help
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 10000000 4
Total Iterations          = 10000000
Total Workers             = 4
Iterations Per Worker     = 2.5e+06
Process Workers           = 4
Thread Workers Per Process = 0
File Output               = 1

approx. pi = 3.14159275358978325393
actual  pi = 3.14159265358979323846

elapsed time: 1277 milliseconds
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi 10000000 1 -t 4
Total Iterations          = 10000000
Total Workers             = 4
Iterations Per Worker     = 2.5e+06
Process Workers           = 1
Thread Workers Per Process = 4
File Output               = 1

approx. pi = 3.14159275358978325393
actual  pi = 3.14159265358979323846

elapsed time: 1158 milliseconds
```

Panel 5:

```
spenser@spenser-desktop: ~

File  Edit  View  Search  Terminal  Help

  1 [||||||||||||||||||||||||||||||||||100.0%]    5 [||||||||||||||||||||||||||||||||||100.0%]
  2 [||||||||||||||||||||||||||||||||||100.0%]    6 [||||||||||||||||||||||||||||||||||100.0%]
  3 [||||||||||||||||||||||||||||||||||100.0%]    7 [||||||||||||||||||||||||||||||||||100.0%]
  4 [||||||||||||||||||||||||||||||||||100.0%]    8 [||||||||||||||||||||||||||||||||||100.0%]
  Mem[||||||||||||||||||||        3.88G/15.6G]    Tasks: 169, 590 thr; 11 running
  Swp[                                0K/9.54G]    Load average: 1.00 0.27 0.38
                                                  Uptime: 07:10:00

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
18118 spenser    20   0 15484   200     0 R 99.7  0.0  0:04.40 ./approx-pi 100000000 8
18114 spenser    20   0 15484  3396  3196 R 98.3  0.0  0:04.39 ./approx-pi 100000000 8
18117 spenser    20   0 15484   200     0 R 98.3  0.0  0:04.38 ./approx-pi 100000000 8
18121 spenser    20   0 15484   200     0 R 97.7  0.0  0:04.50 ./approx-pi 100000000 8
18122 spenser    20   0 15484   200     0 R 92.4  0.0  0:04.32 ./approx-pi 100000000 8
18120 spenser    20   0 15484   200     0 R 89.8  0.0  0:03.97 ./approx-pi 100000000 8
18123 spenser    20   0 15484   200     0 R 83.8  0.0  0:03.76 ./approx-pi 100000000 8
18119 spenser    20   0 15484   200     0 R 72.6  0.0  0:03.77 ./approx-pi 100000000 8
 2722 spenser    20   0 1179M  338M 51432 R 44.2  2.1  6:29.84 /opt/sublime_text/sublime_text
```

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Panel 6:

```
spenser@spenser-desktop: ~

File  Edit  View  Search  Terminal  Help

  1 [||||||||||||||||||||||||||||||||||100.0%]    5 [||||||||||||||||||||||||||||||||||100.0%]
  2 [||||||||||||||||||||||||||||||||||100.0%]    6 [||||||||||||||||||||||||||||||||||100.0%]
  3 [||||||||||||||||||||||||||||||||||100.0%]    7 [||||||||||||||||||||||||||||||||||100.0%]
  4 [||||||||||||||||||||||||||||||||||100.0%]    8 [||||||||||||||||||||||||||||||||||100.0%]
  Mem[||||||||||||||||||||        3.88G/15.6G]    Tasks: 169, 590 thr; 11 running
  Swp[                                0K/9.54G]    Load average: 1.00 0.27 0.38
                                                  Uptime: 07:10:00

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
18118 spenser    20   0 15484   200     0 R 99.7  0.0  0:04.40 ./approx-pi 100000000 8
18114 spenser    20   0 15484  3396  3196 R 98.3  0.0  0:04.39 ./approx-pi 100000000 8
18117 spenser    20   0 15484   200     0 R 98.3  0.0  0:04.38 ./approx-pi 100000000 8
18121 spenser    20   0 15484   200     0 R 97.7  0.0  0:04.50 ./approx-pi 100000000 8
18122 spenser    20   0 15484   200     0 R 92.4  0.0  0:04.32 ./approx-pi 100000000 8
18120 spenser    20   0 15484   200     0 R 89.8  0.0  0:03.97 ./approx-pi 100000000 8
18123 spenser    20   0 15484   200     0 R 83.8  0.0  0:03.76 ./approx-pi 100000000 8
18119 spenser    20   0 15484   200     0 R 72.6  0.0  0:03.77 ./approx-pi 100000000 8
 2722 spenser    20   0 1179M  338M 51432 R 44.2  2.1  6:29.84 /opt/sublime_text/sublime_text
```

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Panel 7:

```
spenser@spenser-desktop: ~

File  Edit  View  Search  Terminal  Help

  1 [||||||||||||||||||||||||||||||||||100.0%]    5 [||||||||||||||||||||||||||||||||||100.0%]
  2 [|||||||||||||||||||||||||||||||||| 98.0%]    6 [||||||||||||||||||||||||||||||||||100.0%]
  3 [|||||||||||||||||||||||||||||||||| 97.3%]    7 [||||||||||||||||||||||||||||||||||100.0%]
  4 [|||||||||||||||||||||||||||||||||| 97.4%]    8 [||||||||||||||||||||||||||||||||||100.0%]
  Mem[||||||||||||||||||||        3.86G/15.6G]    Tasks: 162, 583 thr; 9 running
  Swp[                                0K/9.54G]    Load average: 3.50 1.17 0.69
                                                  Uptime: 07:11:02

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
18165 spenser    20   0  303M   200     0 S 382.  0.0  0:18.10 ./approx-pi 100000000 2 -t 4
18162 spenser    20   0  303M  3388  3184 S 351.  0.0  0:17.51 ./approx-pi 100000000 2 -t 4
18172 spenser    20   0  303M   200     0 R 100.  0.0  0:04.70 ./approx-pi 100000000 2 -t 4
18171 spenser    20   0  303M   200     0 R 99.4  0.0  0:04.65 ./approx-pi 100000000 2 -t 4
18173 spenser    20   0  303M   200     0 R 98.8  0.0  0:04.73 ./approx-pi 100000000 2 -t 4
18167 spenser    20   0  303M  3388  3184 R 92.1  0.0  0:04.53 ./approx-pi 100000000 2 -t 4
18168 spenser    20   0  303M  3388  3184 R 88.2  0.0  0:04.52 ./approx-pi 100000000 2 -t 4
18166 spenser    20   0  303M  3388  3184 D 86.2  0.0  0:04.47 ./approx-pi 100000000 2 -t 4
18169 spenser    20   0  303M  3388  3184 R 86.2  0.0  0:03.97 ./approx-pi 100000000 2 -t 4
18170 spenser    20   0  303M   200     0 R 84.8  0.0  0:03.99 ./approx-pi 100000000 2 -t 4
 2722 spenser    20   0 1179M  338M 51432 R 44.4  2.1  6:35.41 /opt/sublime_text/sublime_text
```

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Panel 8:

```
spenser@spenser-desktop:~/Documents/git/comp8005-processes-vs-threads$ ./approx-pi --help
Usage: approx-pi [OPTION...] NUM_ITERATIONS NUM_PROCESSES
approx-pi -- a program to compare the performance between
processes and threads, where the busy-work task is to
approximate pi using the Taylor series.

  -o, --output              disable worker I/O operations
  -t, --threads=AMOUNT      number of worker threads PER process
  -?, --help                Give this help list
      --usage               Give a short usage message
  -V, --version             Print program version

Mandatory or optional arguments to long options are also mandatory or optional
for any corresponding short options.
```

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