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COEN 241
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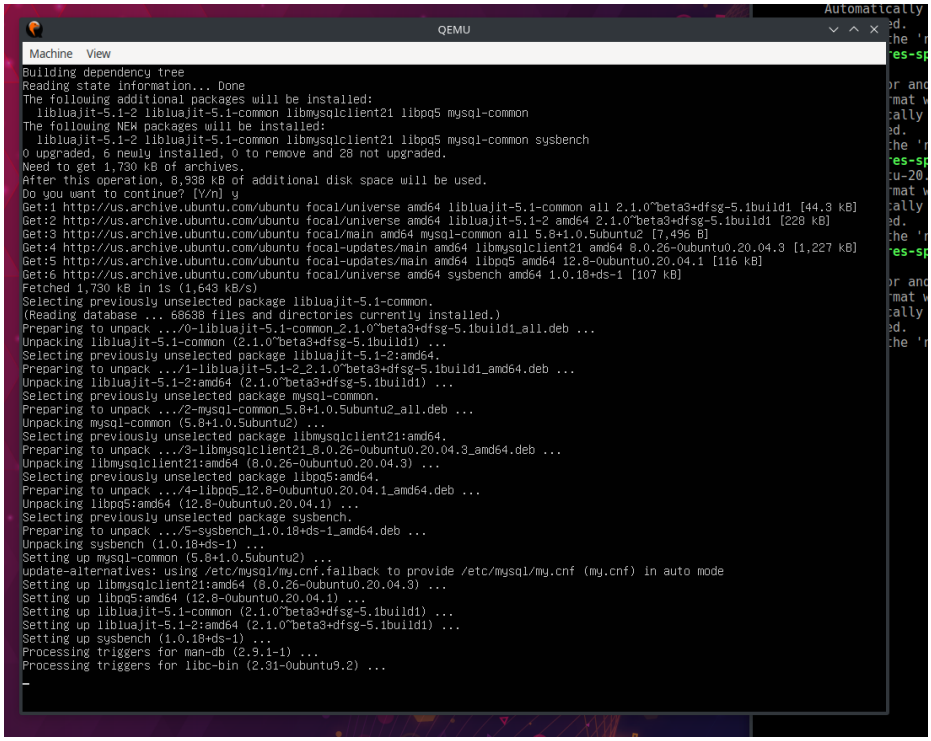
COEN 241 Homework 1

Setup details

Operating System: Kubuntu 20.10
Kernel Version: 5.8.0-63-generic
OS Type: 64-bit
Processors: 8 × Intel® Core™ i7-1065G7 CPU @ 1.30GHz
Memory: 15.3 GiB of RAM
Graphics Processor: Mesa Intel® Iris® Plus Graphics



Sysbench tests

sudo bash cpu.sh # see appendix
sudo bash file.sh

less cpu-test
less file-test

Results

```
sudo qemu-system-x86_64 -hda ubuntu.img -boot d -m 1536
```

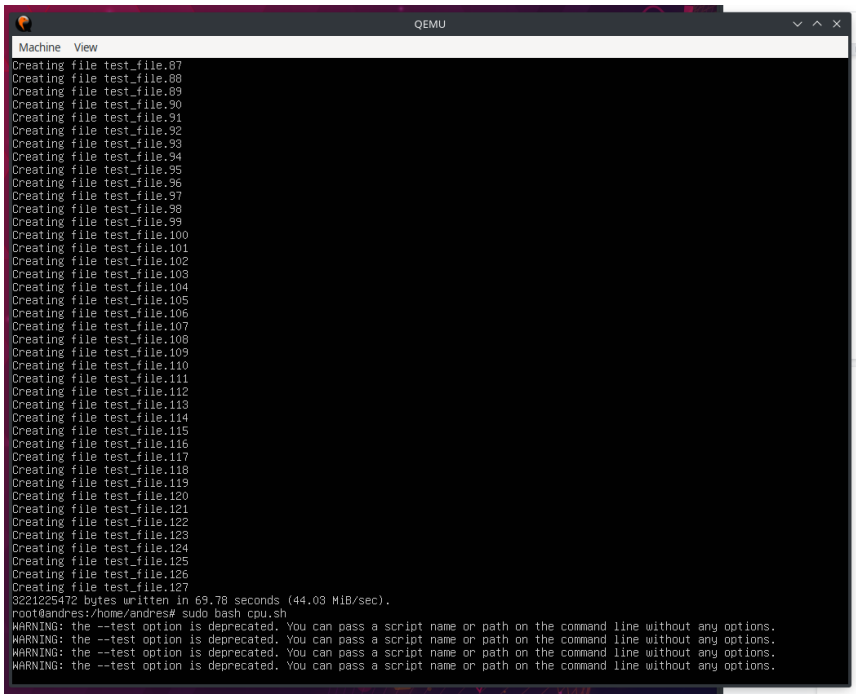
Time results (5 trials): 30.874, 30.5345, 30.3964, 33.7535, 36.9213

- Mean 32.49
- Min 30.3964
- Max 36.9213
- StdDev 2.53

File I/O results (5 trials): 26.53, 27.07, 28.75, 24.03, 25.52

- Mean 26.48
- Min 24.03
- Max 28.75
- StdDev 1.57

`sudo qemu-system-x86_64 -hda ubuntu.img -boot d -smp 255`



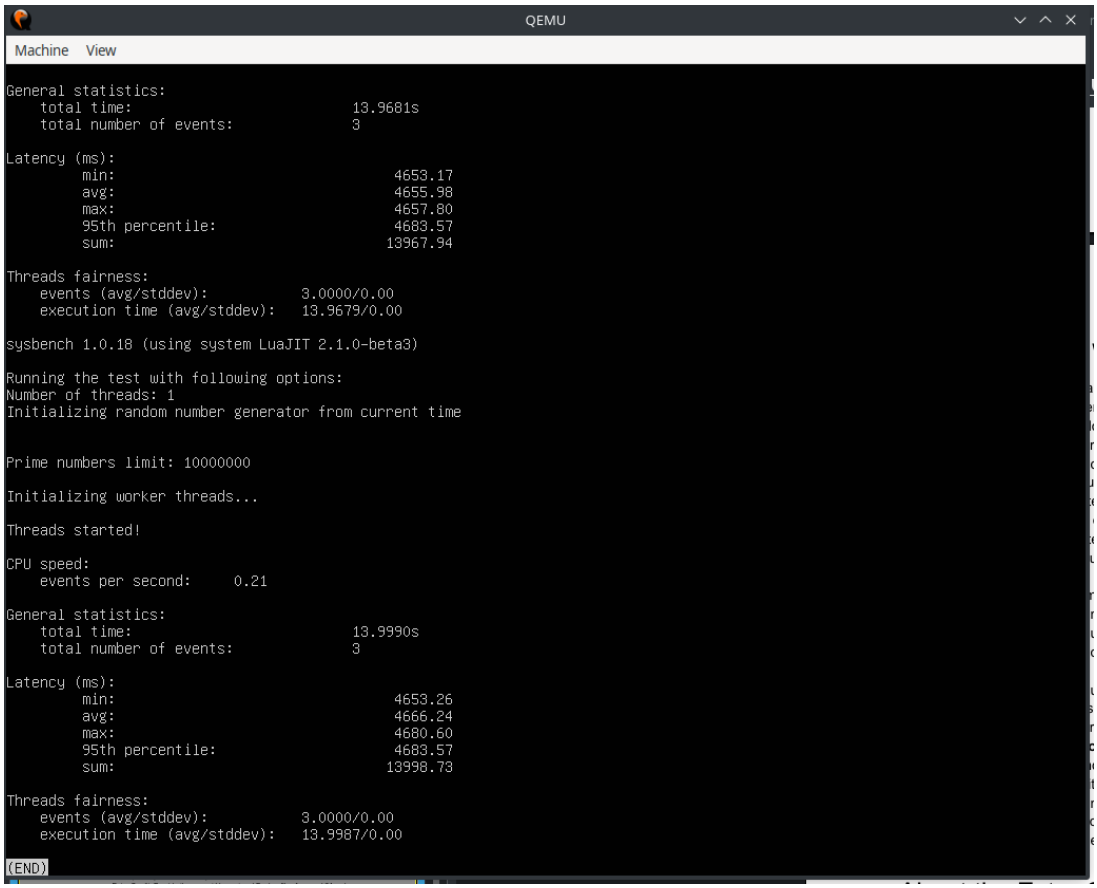
File I/O results (5 trials):

- Time: 56.03, 73.85, 68.65, 66.56, 69.78 s
  - Mean 66.97
  - Min 56.03
  - Max 73.85
  - StdDev 5.96
- Speed: 54.83, 41.6, 44.75, 46.15, 44.03 MiB/sec
- Disk: 3072 Mb

CPU results (5 trials):

- Time: 31.8, 34.3, 34.04, 35.145, 33.98 s
  - Mean 33.85
  - Min 31.8

Max 35.145
StdDev 1.11
Speed: .03, .03, .03, .03, .03 events/s



sudo qemu-system-x86_64 -hda ubuntu.img -boot d -smp 255 -accel kvm

File I/O results (5 trials):
Time: 7.32, 6.14, 11.94, 12.75, 12.16 s
Mean 10.062
Min 6.14
Max 12.75
StdDev 2.75
Speed: 419.45, 500.37, 257.32, 240.97, 252.63 MiB/sec
Disk: 3072 Mb

CPU results (5 trials):
Time: 13.969, 13.992, 13.978, 13.968, 13.999 s
Mean 13.9812
Min 13.968
Max 13.999
StdDev .012
Speed: .21, .21, .21, .21, .21 events/s

Docker

```
(base) andres@andres-spectre-kubuntu:~$ sudo docker images
REPOSITORY               TAG       IMAGE ID       CREATED       SIZE
ubuntu                   latest    ba6acccedd29   6 days ago    72.8MB
hello-world              latest    feb5d9fea6a5   4 weeks ago   13.3kB
csminpp/ubuntu-sysbench  latest    2787c5e16909   5 years ago   336MB
(base) andres@andres-spectre-kubuntu:~$ sudo docker ps
CONTAINER ID   IMAGE          COMMAND       CREATED          STATUS                     PORTS     NAMES
e9035116f747   2787c5e16909   "/bin/bash"   7 minutes ago    Up 7 minutes                         elastic_boyd
7a91187fd6ff   ubuntu         "bash"        20 minutes ago   Up 20 minutes (Paused)               ubuntu_bash
(base) andres@andres-spectre-kubuntu:~$
```

```
sysbench 0.4.12:  multi-threaded system evaluation benchmark

Running the test with following options:
Number of threads: 1

Doing CPU performance benchmark

Threads started!
Done.

Maximum prime number checked in CPU test: 50000


Test execution summary:
    total time:                          29.9554s
    total number of events:              10000
    total time taken by event execution: 29.9535
    per-request statistics:
         min:                                  2.70ms
         avg:                                  3.00ms
         max:                                  6.45ms
         approx.  95 percentile:               3.58ms

Threads fairness:
    events (avg/stddev):           10000.0000/0.00
    execution time (avg/stddev):   29.9535/0.00

sysbench 0.4.12:  multi-threaded system evaluation benchmark

Running the test with following options:
Number of threads: 1

Doing CPU performance benchmark

Threads started!
Done.

Maximum prime number checked in CPU test: 50000


Test execution summary:
    total time:                          30.8763s
    total number of events:              10000
    total time taken by event execution: 30.8736
    per-request statistics:
         min:                                  2.70ms
         avg:                                  3.09ms
         max:                                  9.81ms
         approx.  95 percentile:               3.44ms

Threads fairness:
    events (avg/stddev):           10000.0000/0.00
    execution time (avg/stddev):   30.8736/0.00

root@e9035116f747:/# cat cpu-test
```

sysbench --test=cpu --cpu-max-prime=50000 run >> cpu-test

CPU results (5 trials):

Time: 28.527, 29.094, 30.361, 29.955, 30.876 s

Mean 29.76

Min 28.527

Max 30.876

StdDev .85

Analysis

This homework involved running tests using sysbench in an Ubuntu virtual machine using the QEMU hypervisor as well as a Docker container. For QEMU, I used three different sets of options in the command line: -m 1536, -smp 255, and -accel kvm. I kept the test values the same in order to see the performance differences between these options. -m 1536 was my baseline that I targeted 30 seconds for, and then -smp (symmetric multiprocessing) was slightly slower. The fastest was -accel kvm which uses acceleration using kvm hardware assisted virtualization, which expectedly increased performance.

This homework also involved creating a docker container. I pulled an image from the web which had sysbench pre-installed and ran a similar test for the CPU benchmark, although after some testing, I had to set the max prime to only 50000 for my Docker container.

I ran all of these tests using the Ubuntu operating system with a dual-boot.

Appendix

Docker installation

```
# installing docker
sudo apt update
sudo apt install \
apt-transport-https \
ca-certificates \
curl \
gnupg

curl -fsSL https://download.docker.com6666666/linux/ubuntu/gpg | sudo gpg --dearmor -o
/usr/share/keyrings/docker-archive-keyring.gpg

echo "deb [arch=$(dpkg --print-architecture)
signed-by=/usr/share/keyrings/docker-archive-keyring.gpg]
https://download.docker.com/linux/ubuntu \
  $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null

sudo apt update
sudo apt install docker-ce docker-ce-cli containerd.io
sudo docker run hello-world
sudo docker pull csminpp/ubuntu-sysbench

sudo docker images
sudo docker ps
sudo docker run -it 2787c5e16909
# this is the image id of the pulled image
```

QEMU installation

```
# using ubuntu
sudo apt update
sudo apt install qemu
sudo qemu-system-x86_64 -hda ubuntu.img -boot d -cdrom
./ubuntu-20.04.3-live-server-amd64.iso -m 1536

# run installation setup
sudo qemu-system-x86_64 -hda ubuntu.img -boot d -m 1536

# enter ubuntu server
sudo apt update
sudo apt install sysbench
```

file.sh

```
#!/bin/sh
sysbench --num-threads=16 --test=fileio --file-total-size=3G --file-test-mode=rndrw run > file-test
rm test_file.*
echo 3 > /proc/sys/vm/drop_caches

sysbench --num-threads=16 --test=fileio --file-total-size=3G --file-test-mode=rndrw run >> file-test
echo 3 > /proc/sys/vm/drop_caches

sysbench --num-threads=16 --test=fileio --file-total-size=3G --file-test-mode=rndrw run >> file-test
rm test_file.*
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sysbench --num-threads=16 --test=fileio --file-total-size=3G --file-test-mode=rndrw run >> file-test
rm test_file.*
echo 3 > /proc/sys/vm/drop_caches

sysbench --num-threads=16 --test=fileio --file-total-size=3G --file-test-mode=rndrw run >> file-test
rm test_file.*
echo 3 > /proc/sys/vm/drop_caches
```

cpu.sh

```
#!/bin/sh
sysbench --test=cpu --cpu-max-prime=10000000 run > cpu-test
sysbench --test=cpu --cpu-max-prime=10000000 run >> cpu-test
sysbench --test=cpu --cpu-max-prime=10000000 run >> cpu-test
sysbench --test=cpu --cpu-max-prime=10000000 run >> cpu-test
sysbench --test=cpu --cpu-max-prime=10000000 run >> cpu-test
```