EECS 388 Lab #8

Playing with Linux Scheduler

In this lab, you will learn to interact with Linux's CPU schedulers and monitor their behaviors on Raspberry Pi 4. In the process, you will also learn to use several standard tools and scheduling related system call APIs.

Part 1. Using scheduler related tools

On a terminal, create the following 'cpuhog' program and compile it.

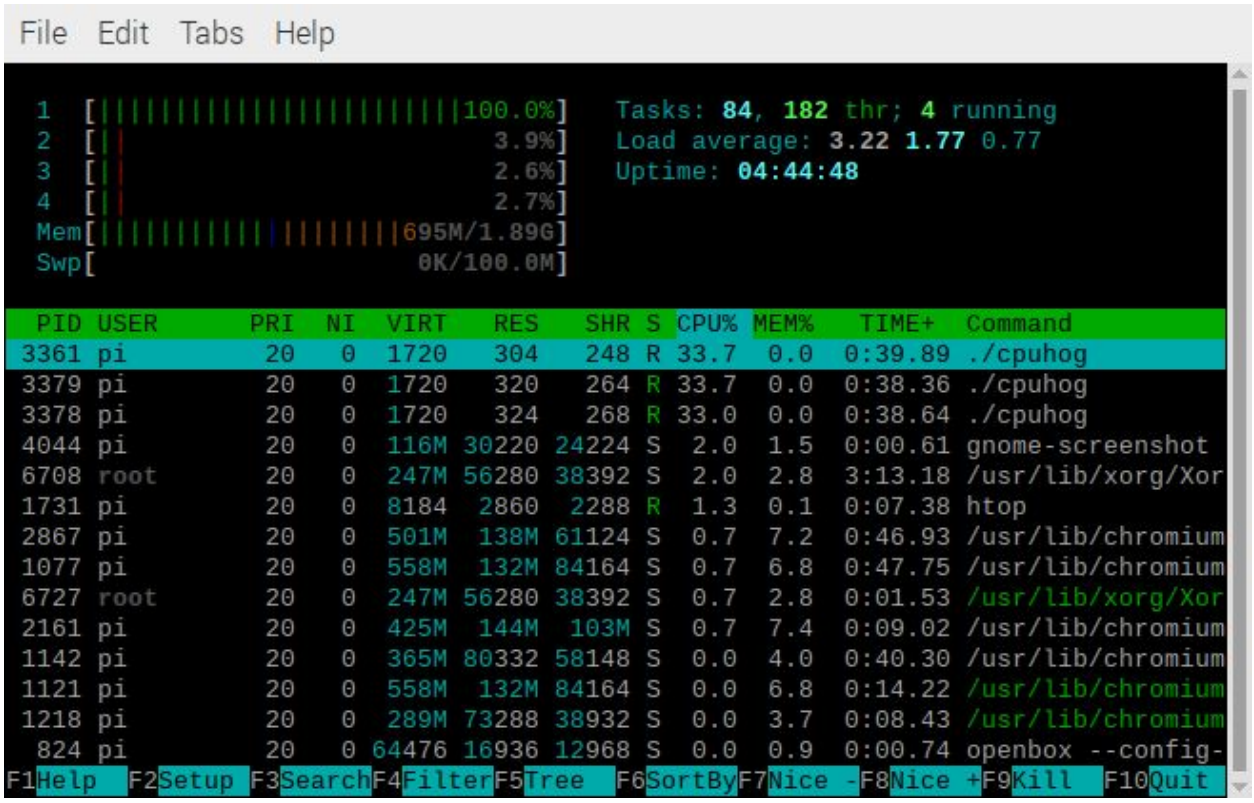
```
$ cat cpuhog.c
int main()
{
        while(1);
}

$ gcc cpuhog.c -o cpuhog
```

Now, you shall use the 'taskset' utility to launch three instances of the 'cpuhog' program as follows.

```
$ taskset -c 0 ./cpuhog &
[1] 3361
$ taskset -c 0 ./cpuhog &
[2] 3378
$ taskset -c 0 ./cpuhog &
[3] 3379
```

The taskset utility controls which CPU core (cores) to execute the given program. In this case, it forces to schedule at core 0 (due to "-c 0").

On the terminal, execute the 'htop' program. You will see something like the following. (Alternatively, you can use 'top' program).



Next, you will change cpuhog instances' nice values (i.e., CFS priority values) using the 'renice' tool. Open up a new terminal so that we can keep monitoring the output of the top.

Check the PID values of the three cpuhog instances shown on the top screen. In the example above, they are 3379, 3378, 3361. Your PID values may be different. You can also check the pid values by using the 'pidof' tool as follows.

```
$ pidof cpuhog
3379 3378 3361
```

Now, let's change the nice value of the first cpuhog instance.

```
$ renice 5 3379
```

On the terminal executing htop, monitor the CPU utilization the cpuhog instances. You should see that the CPU utilization of the reniced cpuhog is dropped to around 14% while each of the other two cpuhog instances utilizes around 43%.

```
  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 3378 pi        20   0    1720    324    268 R  43.0   0.0   1:54.44 cpuhog
 3361 pi        20   0    1720    304    248 R  42.7   0.0   1:55.71 cpuhog
```

```
 3379 pi        25   5    1720    320    264 R  13.9   0.0   1:25.38 cpuhog
```

Next, you again change the second cpuhog instance's nice value as follows.

```
$ renice 5 3378
```

Then, again monitor the 'htop' screen. You should see each of the reniced cpuhog instances (3379 and 3378) consumes around 20% and the remaining 'normal' instance is consuming around 60%.

```
  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 3361 pi        20   0    1720    304    248 R  60.3   0.0   2:20.85 cpuhog
 3379 pi        25   5    1720    320    264 R  19.9   0.0   1:33.62 cpuhog
 3378 pi        25   5    1720    324    268 R  19.5   0.0   2:15.20 cpuhog
```

```
$ renice 5 3361
```

Monitor the 'htop' screen. You should now see all cpuhog instances equally share the CPU---33% each.

```
  PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
 3379 pi        25   5    1720    320    264 R  33.6   0.0   1:45.66 cpuhog
 3361 pi        25   5    1720    304    248 R  33.2   0.0   2:47.86 cpuhog
 3378 pi        25   5    1720    324    268 R  33.2   0.0   2:27.27 cpuhog
```

Part 2. Using scheduler related system calls

So far, you have used 'taskset' and 'renice' tools to control cpu core and nice values of your cpuhog program. Now, instead of using these external tools, you need to modify the cpuhog.c code and directly use system calls.

First, modify cpuhog.c to always be scheduled on core 0. You need to use 'sched_setaffinity' system call. See the manual.

```
$ man sched_setaffinity
```

Then, use the 'setpriority' system call to change the task's nice value to 5. Again, see the manual for usage.

```
$ man setpriority
```

Save the modified code as lab8.c and show it to your TA.