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EECS 338
HW1
Due: Jan 23 2019

1) From the textbook, a process is defined as a program that is loaded into memory **and** executing. Thus, the difference between a program in memory and a process is that a process is actively executing. A program loaded into memory is a passive entity; that is, no CPU cycles are devoted to its execution. In contrast, a process is an active entity that is supplying the CPU with instructions.

2) I used this command to pipe top to a .txt: $top -b -u bp0017 > topped.txt
This is the output, the relevant entries are bolded.

```
top - 14:38:33 up 32 min,  2 users,  load average: 0.23, 0.42, 0.27
Tasks: 232 total,   3 running, 164 sleeping,   0 stopped,   0 zombie
%Cpu(s):  2.9 us,  0.3 sy,  0.1 ni, 96.7 id,  0.1 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  7985248 total,  4880668 free,  1349764 used,  1754816 buff/cache
KiB Swap:     1020 total,     1020 free,        0 used.  6265484 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
10459 bp0017    20   0    4508    708    644 R 100.0  0.0   0:00.16 for
 8846 bp0017    20   0  596000  56116  29312 R  62.5  0.7   0:17.72 xfce4-term+
10460 bp0017    20   0    4508    744    680 S   6.2  0.0   0:00.01 while
 1134 bp0017    20   0   76992   8060   6664 S   0.0  0.1   0:00.03 systemd
 1135 bp0017    20   0  112052   2712     44 S   0.0  0.0   0:00.00 (sd-pam)
 1151 bp0017    20   0  281252   7720   6760 S   0.0  0.1   0:00.03 gnome-keyr+
 1154 bp0017    20   0    4628   1628   1536 S   0.0  0.0   0:00.03 sh
 1169 bp0017    20   0   50596   5064   3828 S   0.0  0.1   0:00.23 dbus-daemon
 1255 bp0017    20   0   11304    320      0 S   0.0  0.0   0:00.00 ssh-agent
 1273 bp0017    20   0  334096  14480  12660 S   0.0  0.2   0:00.06 xfce4-sess+
 1277 bp0017    20   0   59376   5192   4528 S   0.0  0.1   0:00.02 xfconfd
 1284 bp0017    20   0  191772  26100  18872 S   0.0  0.3   0:03.59 xfwm4
 1288 bp0017    20   0  406300  28940  22516 S   0.0  0.4   0:00.57 xfce4-panel
 1290 bp0017    20   0  557644  35272  27360 S   0.0  0.4   0:01.18 Thunar
 1292 bp0017    20   0  579004  53312  33760 S   0.0  0.7   0:00.84 xfdesktop
 1293 bp0017    20   0  647864  37360  27996 S   0.0  0.5   0:02.65 plank
 1294 bp0017    20   0    4628    872    808 S   0.0  0.0   0:00.00 ruby.sh
 1296 bp0017    20   0  645316  54652  31776 S   0.0  0.7   0:00.49 guake
 1301 bp0017    20   0  381928  17120  14288 S   0.0  0.2   0:00.20 xfsettingsd
 1305 bp0017    20   0   56016  10984   5160 S   0.0  0.1   0:00.07 ruby
 1318 bp0017    20   0  591584  13120  11208 S   0.0  0.2   0:00.00 xfce4-volu+
 1320 bp0017    20   0  398492  20904  15812 S   0.0  0.3   0:00.12 light-lock+
 1322 bp0017    20   0  322532  19876  14848 S   0.0  0.2   0:00.12 polkit-gno+
 1323 bp0017    20   0  349220   6412   5724 S   0.0  0.1   0:00.00 at-spi-bus+
 1332 bp0017    20   0   49924   4176   3708 S   0.0  0.1   0:00.08 dbus-daemon
 1338 bp0017    20   0  188032   5304   4544 S   0.0  0.1   0:00.11 dconf-serv+
 1342 bp0017    20   0  254236  32892  15900 S   0.0  0.4   0:00.35 applet.py
 1343 bp0017    20   0  649472  37996  30112 S   0.0  0.5   0:00.71 nm-applet
 1346 bp0017    20   0  672876  56372  35284 S   0.0  0.7   0:00.43 blueman-ap+
 1348 bp0017    20   0  350188  21136  15540 S   0.0  0.3   0:00.15 xfce4-powe+
 1351 bp0017     9 -11  900996  11752   8536 S   0.0  0.1   0:00.06 pulseaudio
 1353 bp0017    20   0  220772   6900   6188 S   0.0  0.1   0:00.29 at-spi2-re+
 1356 bp0017    20   0  284856   7072   6168 S   0.0  0.1   0:00.01 gvfsd
 1364 bp0017    20   0  416112   5396   4864 S   0.0  0.1   0:00.00 gvfsd-fuse
 1391 bp0017    20   0  415188  25276  19804 S   0.0  0.3   0:00.13 xfce4-noti+
 1392 bp0017    20   0  367432  31756  24564 S   0.0  0.4   0:00.22 panel-1-wh+
 1404 bp0017    20   0    4628    832    764 S   0.0  0.0   0:00.00 ruby.sh
 1419 bp0017    20   0 4269656  25792   7844 S   0.0  0.3   0:05.85 ruby
 1423 bp0017    20   0  416480  25972  18900 S   0.0  0.3   0:00.69 bamfdaemon
 1424 bp0017    20   0  173852  14428  12552 S   0.0  0.2   0:00.03 panel-4-sy+
 1427 bp0017    20   0  396852  31780  25952 S   0.0  0.4   0:00.41 panel-5-po+
 1462 bp0017    20   0  299200   8452   7184 S   0.0  0.1   0:00.01 gvfs-udisk+
 1466 bp0017    20   0  371704   7576   6684 S   0.0  0.1   0:00.00 gvfs-afc-v+
 1473 bp0017    20   0  268760   4816   4352 S   0.0  0.1   0:00.00 gvfs-mtp-v+
 1477 bp0017    20   0  266948   5880   5300 S   0.0  0.1   0:00.00 gvfs-goa-v+
 1481 bp0017    20   0  281548   5628   5032 S   0.0  0.1   0:00.00 gvfs-gphot+
 1487 bp0017    20   0   22708   4664   3128 S   0.0  0.1   0:00.01 bash
 1503 bp0017    20   0   82728   6756   6096 S   0.0  0.1   0:00.00 obexd
 1513 bp0017    20   0  361120   7604   6440 S   0.0  0.1   0:00.03 gvfsd-trash
 1544 bp0017    20   0  197376   5840   5244 S   0.0  0.1   0:00.00 gvfsd-meta+
 2294 bp0017    20   0    4628    800    732 S   0.0  0.0   0:00.00 sh
 2298 bp0017    20   0 3121572 131972  98124 S   0.0  1.7   0:04.34 pia_nw
 2404 bp0017    20   0  372708  43320  35524 S   0.0  0.5   0:00.02 pia_nw
 2441 bp0017    20   0 2463540 161668  97324 S   0.0  2.0   0:03.68 exe
 2443 bp0017    20   0  812640  50948  39548 S   0.0  0.6   0:00.04 exe
 2530 bp0017    20   0 2116884 366476 161616 S   0.0  4.6   0:28.11 firefox
 2621 bp0017    20   0 1708788 222056 138936 S   0.0  2.8   0:09.53 Web Content
 2695 bp0017    20   0 1614260 154768  84720 S   0.0  1.9   0:06.32 WebExtensi+
 4459 bp0017    20   0 98.237g 103480  56492 S   0.0  1.3   0:01.79 atril
 4467 bp0017    20   0  187764   4240   3856 S   0.0  0.1   0:00.00 atrild
 4478 bp0017    20   0 97.920g  32960  27680 S   0.0  0.4   0:00.03 WebKitNetw+
 4584 bp0017    20   0  145440   6292   5168 S   0.0  0.1   0:00.01 oosplash
 4602 bp0017    20   0 1394072 185032 118728 S   0.0  2.3   0:13.99 soffice.bin
 8852 bp0017    20   0   23224   5768   3516 S   0.0  0.1   0:00.06 bash
 9019 bp0017    20   0   22708   5060   3332 S   0.0  0.1   0:00.07 bash
 9195 bp0017    20   0   23224   5544   3288 S   0.0  0.1   0:00.09 bash
 9592 bp0017    20   0    4508    768    704 S   0.0  0.0   0:00.00 input
10077 bp0017    20   0 1470632  77424  61464 S   0.0  1.0   0:00.12 Web Content
10461 bp0017    20   0    4508    788    724 S   0.0  0.0   0:00.00 sleep
10462 bp0017    20   0   41776   3804   3224 R   0.0  0.0   0:00.00 top
```

For and while both take the most CPU cycles, whereas input and sleep take very few. For takes that most resources, comparatively This makes sense, as the for program is doing the most “work,” as it prints almost nothing and loops for a long period of time. The while program, while also looping, prints things out, which returns control to the system. The sleep program does nothing but wait, and the input program does the same after requesting input, resulting in an ‘S’ in the status column.

3) Using a similar command: $./for & ./for & ./for & ./for & ./for & ./for & ./for & ./for & ./for & ./for & ./for & top -b -u bp0017 > topped.txt

We run many instances of for due to having an 8 core system.

```
top - 14:50:16 up 43 min,  2 users,  load average: 0.41, 0.74, 0.50
Tasks: 241 total,  11 running, 163 sleeping,   0 stopped,   0 zombie
%Cpu(s):  3.7 us,  0.3 sy,  0.1 ni, 95.8 id,  0.1 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  7985248 total,  4809960 free,  1381596 used,  1793692 buff/cache
KiB Swap:     1020 total,     1020 free,        0 used.  6204868 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
13315 bp0017    20   0    4508    796    732 R 100.0  0.0   0:00.19 for
13318 bp0017    20   0    4508    796    732 R 100.0  0.0   0:00.19 for
13321 bp0017    20   0    4508    796    732 R 100.0  0.0   0:00.19 for
13319 bp0017    20   0    4508    796    732 R  93.8  0.0   0:00.17 for
13316 bp0017    20   0    4508    748    684 R  81.2  0.0   0:00.15 for
13324 bp0017    20   0    4508    712    652 R  75.0  0.0   0:00.12 for
13320 bp0017    20   0    4508    736    672 R  68.8  0.0   0:00.13 for
13317 bp0017    20   0    4508    748    684 R  62.5  0.0   0:00.13 for
13322 bp0017    20   0    4508    752    692 R  62.5  0.0   0:00.12 for
13323 bp0017    20   0    4508    768    704 R  56.2  0.0   0:00.10 for
 1134 bp0017    20   0   76992   8060   6664 S   0.0  0.1   0:00.03 systemd
 1135 bp0017    20   0  112052   2712     44 S   0.0  0.0   0:00.00 (sd-pam)
 1151 bp0017    20   0  281252   7720   6760 S   0.0  0.1   0:00.03 gnome-keyr+
 1154 bp0017    20   0    4628   1628   1536 S   0.0  0.0   0:00.03 sh
 1169 bp0017    20   0   50596   5064   3828 S   0.0  0.1   0:00.31 dbus-daemon
…
…
```

Interestingly, the processes have less then 100 %CPU. This makes sense, as the number of processes exceeds the number of cores, the operating system halts execution on one process to execute another. The OS shares CPU power between the 11 running processes, and as a result, most of the processes are not executed 100% of the time, as there is a finite amount of cores.

4)
After executing the previous command with 11 for’s, the window is immediately closed.

```
top - 15:01:40 up 55 min,  2 users,  load average: 0.63, 0.53, 0.56
Tasks: 228 total,   1 running, 162 sleeping,   0 stopped,   0 zombie
%Cpu(s):  4.4 us,  0.4 sy,  0.0 ni, 95.1 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  7985248 total,  4802952 free,  1376488 used,  1805808 buff/cache
KiB Swap:     1020 total,     1020 free,        0 used.  6208704 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 2695 bp0017    20   0 1617332 169852  85324 S   6.2  2.1   0:10.28 WebExtensi+
15566 bp0017    20   0   41776   3632   3052 R   6.2  0.0   0:00.02 top
 1134 bp0017    20   0   76992   8060   6664 S   0.0  0.1   0:00.03 systemd
 1135 bp0017    20   0  112052   2712     44 S   0.0  0.0   0:00.00 (sd-pam)
 1151 bp0017    20   0  281252   7720   6760 S   0.0  0.1   0:00.04 gnome-keyr+
 1154 bp0017    20   0    4628   1628   1536 S   0.0  0.0   0:00.03 sh
 1169 bp0017    20   0   50596   5064   3828 S   0.0  0.1   0:00.43 dbus-daemon
 1255 bp0017    20   0   11304    320      0 S   0.0  0.0   0:00.00 ssh-agent
 1273 bp0017    20   0  334096  14480  12660 S   0.0  0.2   0:00.06 xfce4-sess+
 1277 bp0017    20   0   59376   5192   4528 S   0.0  0.1   0:00.02 xfconfd
 1284 bp0017    20   0  191772  26100  18872 S   0.0  0.3   0:08.87 xfwm4
 1288 bp0017    20   0  406464  29228  22424 S   0.0  0.4   0:01.98 xfce4-panel
 1290 bp0017    20   0  558160  35528  27092 S   0.0  0.4   0:03.63 Thunar
 1292 bp0017    20   0  579004  51488  31936 S   0.0  0.6   0:01.17 xfdesktop
 1293 bp0017    20   0  647864  37376  28012 S   0.0  0.5   0:04.77 plank
 1294 bp0017    20   0    4628    872    808 S   0.0  0.0   0:00.00 ruby.sh
 1296 bp0017    20   0  646332  55532  31840 S   0.0  0.7   0:00.83 guake
 1301 bp0017    20   0  381928  17120  14288 S   0.0  0.2   0:00.61 xfsettingsd
…
…
```

The system appears to automatically kill processes when the terminal window is closed. This is on Ubuntu 18.04 using bash 4.4.19. However, we can use the disown command to cause processes to “detach” from a terminal window.

```
$./for & ./for & ./for & ./for & ./for & ./for &  ./for & ./for & ./for & ./for & ./for &
$disown  -h  %1
```

Then, upon closing the terminal window:

```
top - 15:06:40 up  1:00,  2 users,  load average: 1.88, 0.84, 0.65
Tasks: 242 total,  12 running, 165 sleeping,   0 stopped,   0 zombie
%Cpu(s):  4.5 us,  0.4 sy,  0.0 ni, 95.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  7985248 total,  4612736 free,  1556096 used,  1816416 buff/cache
KiB Swap:     1020 total,     1020 free,        0 used.  6036748 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
17401 bp0017    20   0    4508    720    656 R 100.0  0.0   0:05.66 for
17409 bp0017    20   0    4508    756    692 R 100.0  0.0   0:05.06 for
17403 bp0017    20   0    4508    736    672 R  93.3  0.0   0:05.42 for
17407 bp0017    20   0    4508    768    704 R  93.3  0.0   0:05.51 for
17404 bp0017    20   0    4508    768    704 R  80.0  0.0   0:04.78 for
17408 bp0017    20   0    4508    748    684 R  80.0  0.0   0:04.95 for
17400 bp0017    20   0    4508    812    748 R  66.7  0.0   0:05.19 for
17410 bp0017    20   0    4508    856    792 R  66.7  0.0   0:04.96 for
17402 bp0017    20   0    4508    712    648 R  53.3  0.0   0:05.08 for
17405 bp0017    20   0    4508    740    680 R  53.3  0.0   0:05.65 for
17406 bp0017    20   0    4508    716    652 R  53.3  0.0   0:06.66 for
 8846 bp0017    20   0  600388  56864  29504 S   6.7  0.7   0:27.22 xfce4-term+
 1134 bp0017    20   0   76992   8060   6664 S   0.0  0.1   0:00.03 systemd
 …
…
```

Now the processes remain. Anecdotally, on different platforms (such as Windows) this behavior may not be the same.