CO327 LAB 01 : MULTIPROCESSING

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E/13/058

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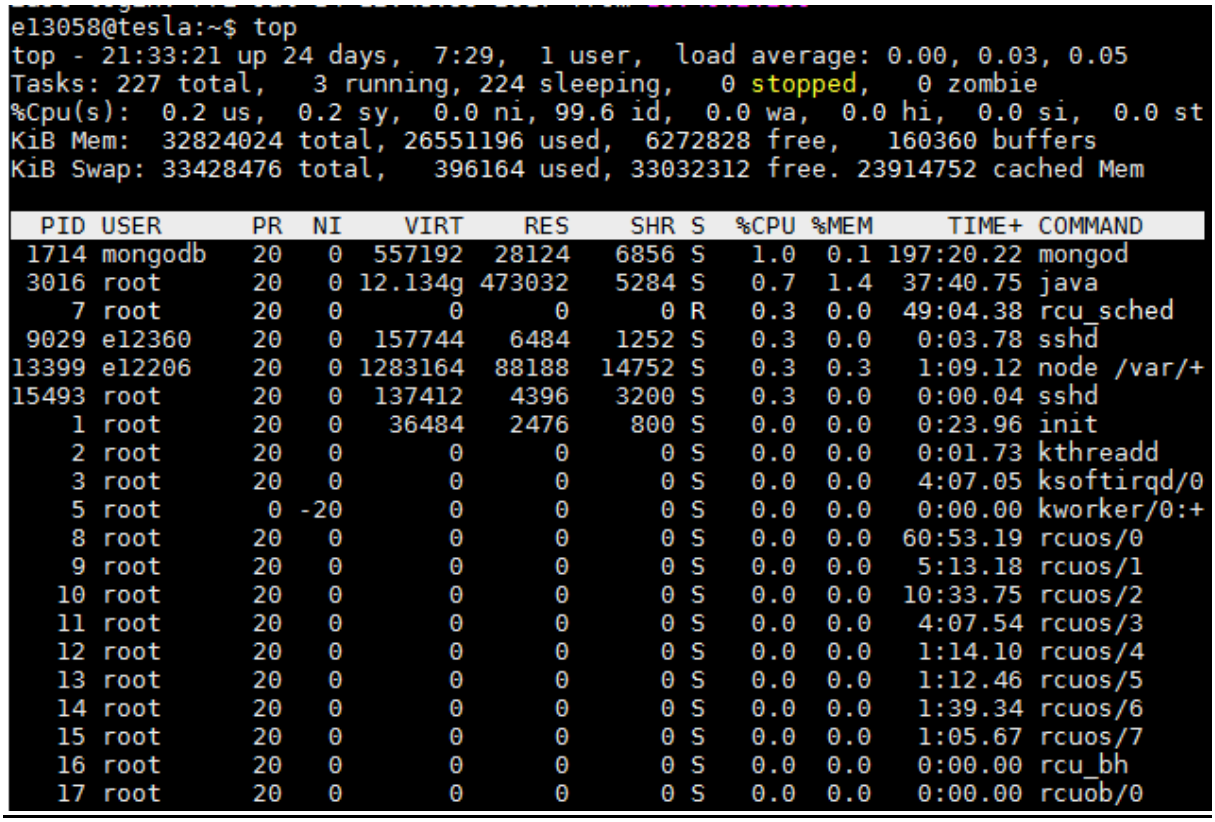
Exercise 01

i. Top commands give details of active processes and they are sorted by CPU usage by default.



```
e13058@tesla:~$ top
top - 21:33:21 up 24 days,  7:29,  1 user,  load average: 0.00, 0.03, 0.05
Tasks: 227 total,   3 running, 224 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.2 us,  0.2 sy,  0.0 ni, 99.6 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem:  32824024 total, 26551196 used,  6272828 free,   160360 buffers
KiB Swap: 33428476 total,   396164 used, 33032312 free. 23914752 cached Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 1714 mongodb   20   0  557192  28124   6856 S   1.0  0.1 197:20.22 mongod
 3016 root      20   0 12.134g 473032   5284 S   0.7  1.4  37:40.75 java
    7 root      20   0       0      0      0 R   0.3  0.0  49:04.38 rcu_sched
 9029 e12360    20   0  157744   6484   1252 S   0.3  0.0   0:03.78 sshd
13399 e12206    20   0 1283164  88188  14752 S   0.3  0.3   1:09.12 node /var/+
15493 root      20   0  137412   4396   3200 S   0.3  0.0   0:00.04 sshd
    1 root      20   0   36484   2476    800 S   0.0  0.0   0:23.96 init
    2 root      20   0       0      0      0 S   0.0  0.0   0:01.73 kthreadd
    3 root      20   0       0      0      0 S   0.0  0.0   4:07.05 ksoftirqd/0
    5 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 kworker/0:+
    8 root      20   0       0      0      0 S   0.0  0.0  60:53.19 rcuos/0
    9 root      20   0       0      0      0 S   0.0  0.0   5:13.18 rcuos/1
   10 root      20   0       0      0      0 S   0.0  0.0  10:33.75 rcuos/2
   11 root      20   0       0      0      0 S   0.0  0.0   4:07.54 rcuos/3
   12 root      20   0       0      0      0 S   0.0  0.0   1:14.10 rcuos/4
   13 root      20   0       0      0      0 S   0.0  0.0   1:12.46 rcuos/5
   14 root      20   0       0      0      0 S   0.0  0.0   1:39.34 rcuos/6
   15 root      20   0       0      0      0 S   0.0  0.0   1:05.67 rcuos/7
   16 root      20   0       0      0      0 S   0.0  0.0   0:00.00 rcu_bh
   17 root      20   0       0      0      0 S   0.0  0.0   0:00.00 rcuob/0
```

- Sort by memory usage :top –o %MEM

```
top - 21:36:32 up 24 days,  7:32,  1 user,  load average: 0.03, 0.04, 0.05
Tasks: 226 total,   2 running, 224 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.1 us,  0.2 sy,  0.0 ni, 99.6 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem:  32824024 total, 26550240 used,  6273784 free,   160380 buffers
KiB Swap: 33428476 total,   396164 used, 33032312 free. 23914800 cached Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 3016 root      20   0 12.134g 473032   5284 S   0.0  1.4  37:41.00 java
13399 e12206    20   0 1283164  88736  14752 S   0.0  0.3   1:09.23 node /var/+
 1894 root      20   0  269352  63488    680 S   0.0  0.2   0:04.79 lightdm
29444 www-data  20   0  526428  48412  31740 S   0.0  0.1   0:00.64 apache2
 1812 mysql     20   0  880860  40668   2260 S   0.0  0.1  25:08.10 mysqld
 2092 www-data  20   0  527840  31884  15620 S   0.0  0.1   0:01.21 apache2
 2320 www-data  20   0  530284  31028  14584 S   0.0  0.1   0:00.87 apache2
29475 www-data  20   0  526164  30920  14568 S   0.0  0.1   0:00.63 apache2
  866 syslog    20   0  258320  30108    464 S   0.0  0.1   2:34.60 rsyslogd
 9783 www-data  20   0  527236  29740  14360 S   0.0  0.1   0:00.89 apache2
 2410 e12206    20   0  934168  28724   5152 S   0.0  0.1  27:19.31 PM2 v2.5.0+
29473 www-data  20   0  528096  28204  11972 S   0.0  0.1   0:00.43 apache2
 1714 mongodb   20   0  557192  28124   6856 S   1.0  0.1 197:21.66 mongod
29880 www-data  20   0  527668  27168  11308 S   0.0  0.1   0:00.17 apache2
14237 root      20   0  502852  25440  15672 S   0.0  0.1   0:54.06 apache2
29661 www-data  20   0  524304  25348  10892 S   0.0  0.1   0:00.19 apache2
  524 www-data  20   0  524164  24296  10100 S   0.0  0.1   0:00.20 apache2
11824 www-data  20   0  524148  23912   9876 S   0.0  0.1   0:00.05 apache2
 2062 lightdm   20   0  597836  13376   6868 S   0.0  0.0   9:17.20 lightdm-gt+
 9029 e12360    20   0  157744   6748   1252 S   0.0  0.0   0:03.95 sshd
 5114 root      20   0  441852   5552   2536 S   0.0  0.0   2:55.94 sssd_be
14523 e13058    20   0   42316   5228   1852 S   0.0  0.0   0:00.03 bash
14325 root      20   0  152416   4940   3688 S   0.0  0.0   0:00.02 sshd
```

ii. Run ps with options –a,-x,-u,-w

```
e13058@tesla:~$ ps -a
  PID TTY          TIME CMD
16594 pts/2    00:00:00 ps
27104 pts/6    00:00:00 ssh
e13058@tesla:~$ ps -x
  PID TTY      STAT   TIME COMMAND
14465 ?        S      0:00 sshd: e13058@pts/2
14521 ?        S      0:00 sshd: e13058@notty
14522 ?        Ss     0:00 /usr/lib/openssh/sftp-server
14523 pts/2    Ss     0:00 -bash
16735 pts/2    R+     0:00 ps -x
e13058@tesla:~$ ps -u
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
e13058   14523  0.0  0.0  42316  5228 pts/2    Ss   21:28   0:00 -bash
e13058   16738  0.0  0.0  36804  1476 pts/2    R+   21:39   0:00 ps -u
e13058@tesla:~$ ps -w
  PID TTY          TIME CMD
14523 pts/2    00:00:00 bash
16755 pts/2    00:00:00 ps
```

What is the name of the process with PID 1? init

```
e13058@tesla:~$ ps 1
  PID TTY      STAT   TIME COMMAND
    1 ?        Ss     0:23 /sbin/init
```

Exercise 2:

1. In what order are the messages from parent and child printed? Is the order always the same?
   Parent process was shown first and the order of messages didn't change when executed again and again.

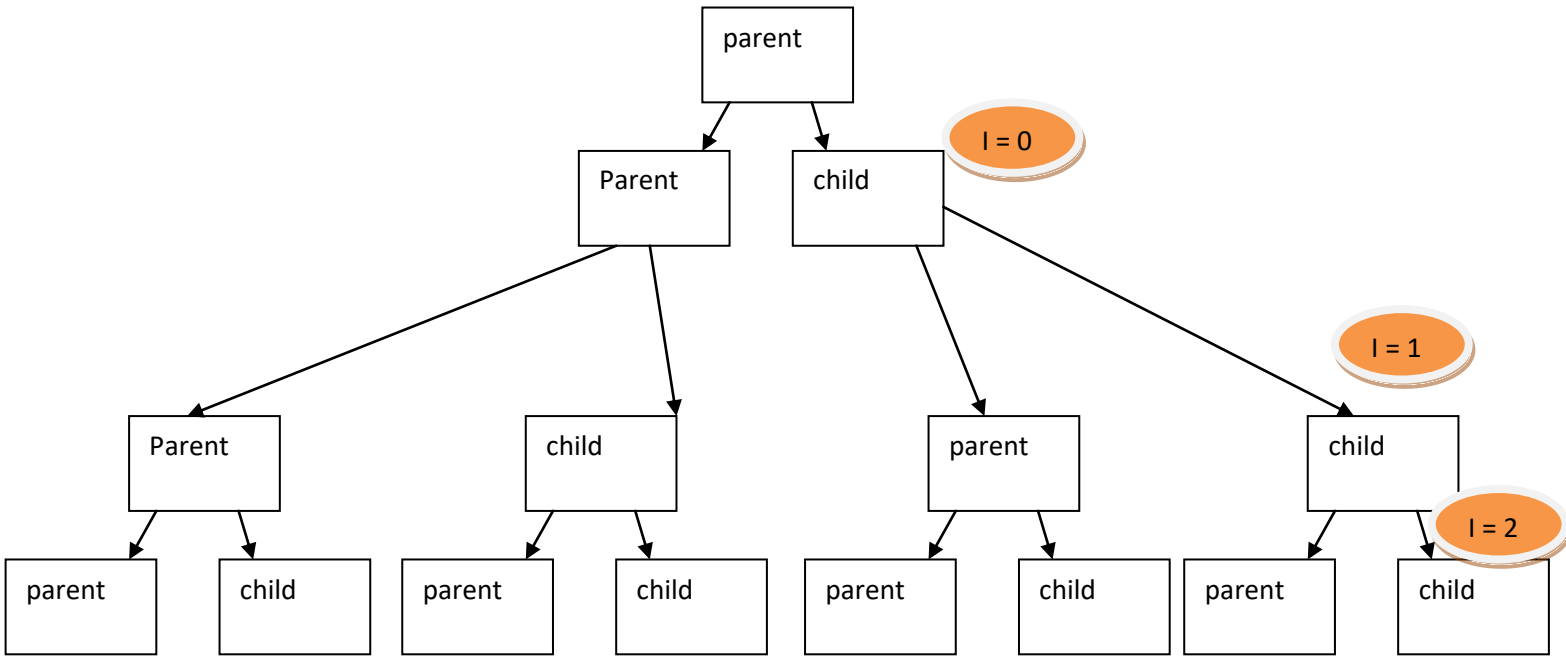
```
e13058@tesla:~$ gcc -Wall -o exercise02 exe2.c
e13058@tesla:~$ ./exercise02
This is the parent process       pid = 25524     ppid = 14523
This is the child process        pid = 25525     ppid = 25524
e13058@tesla:~$ ./exercise02
This is the parent process       pid = 25527     ppid = 14523
This is the child process        pid = 25528     ppid = 25527
e13058@tesla:~$ ./exercise02
This is the parent process       pid = 25529     ppid = 14523
This is the child process        pid = 25530     ppid = 25529
e13058@tesla:~$ ./exercise02
This is the parent process       pid = 25531     ppid = 14523
This is the child process        pid = 25532     ppid = 25531
e13058@tesla:~$ ./exercise02
This is the parent process       pid = 25533     ppid = 14523
This is the child process        pid = 25534     ppid = 25533
e13058@tesla:~$ ./exercise02
This is the parent process       pid = 25535     ppid = 14523
This is the child process        pid = 25536     ppid = 25535
```

2. How many children will the following program spawn? Draw a diagram illustrating the parent – child relationships between processes.

```
int main(void)
{
   for (int i=0; i<3; i++)
      fork();
}
```

```
e13058@tesla:~$ gcc -Wall -o exercise2.2 exe2.2.c
e13058@tesla:~$ ./exercise2.2
This is the parent process        pid = 30048     ppid = 14523
This is the parent process        pid = 30049     ppid = 30048
This is the parent process        pid = 30052     ppid = 30049
This is the child process         pid = 30054     ppid = 30052
e13058@tesla:~$ This is the parent process        pid = 30050     ppid = 1
This is the child process         pid = 30053     ppid = 1
This is the child process         pid = 30051     ppid = 1
This is the child process         pid = 30055     ppid = 1
```

As you can see 7 child processes will spawn by the above program.



Exercise 03:

Modify the program in section 1.1 so that the parent always prints its

Message after the child. Refer to man2 wait for details.

```
int main(void)
        {
                int pid,i;

                for(i=0;i<3;i++) {
                        pid = fork();
                        printf("fork - %d\n",pid);
                }

                if (pid < 0){
                        perror("fork");
                        exit(1);
                }

                if (pid == 0)
                        printf("This is the child process \t pid = %d \t ppid = %d\n",getpid
(),getppid());

                else{

                        wait(NULL);
                        printf("This is the parent process \t pid = %d \t ppid = %d\n",getpi
d(),getppid());

                }
                return 0;

        }
```

```
e13058@tesla:~$ gcc -Wall -o exercise3 exe3.c
e13058@tesla:~$ ./exercise3
fork - 1943
fork - 1944
fork - 0
fork - 1945
fork - 0
fork - 1946
fork - 1947
fork - 1948
fork - 0
fork - 0
This is the child process        pid = 1947      ppid = 1944
This is the child process        pid = 1945      ppid = 1942
fork - 0
This is the parent process       pid = 1942      ppid = 14523
This is the parent process       pid = 1944      ppid = 1942
This is the child process        pid = 1948      ppid = 1943
This is the parent process       pid = 1943      ppid = 1
fork - 0
fork - 1949
fork - 0
This is the child process        pid = 1949      ppid = 1946
e13058@tesla:~$ This is the parent process       pid = 1946      ppid = 1
```

Exercise 04:

1. The message “program ls has terminated” was not printed.
2.