Multiprocessing - LAB 01

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E/14/049

EXERCISE 01 :

i). top command: list all the processes. which is sorted by cpu usage by default.

```
5. aiken.ce.pdn.ac.lk (e14049)
top - 16:21:25 up 14 days,  4:45,  2 users,  load average: 0.00, 0.01, 0.05
Tasks: 465 total,   1 running, 464 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni,100.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem:  26411862+total, 14641564 used, 24947707+free,   672900 buffers
KiB Swap: 25009766+total,        0 used, 25009766+free.  6454088 cached Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 5545 sgeadmin  20   0   58856   3672   1352 S   0.7  0.0  92:09.66 sge_execd
    6 root      20   0       0      0      0 S   0.3  0.0   1:00.79 kworker/u128:0
  396 root      20   0       0      0      0 S   0.3  0.0   4:40.60 kworker/17:1
    1 root      20   0   36760   4092   1508 S   0.0  0.0   0:29.44 init
    2 root      20   0       0      0      0 S   0.0  0.0   0:00.05 kthreadd
    3 root      20   0       0      0      0 S   0.0  0.0   1:01.07 ksoftirqd/0
    5 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 kworker/0:0H
    8 root      20   0       0      0      0 S   0.0  0.0  10:09.13 rcu_sched
    9 root      20   0       0      0      0 S   0.0  0.0   0:34.65 rcuos/0
   10 root      20   0       0      0      0 S   0.0  0.0   0:30.29 rcuos/1
   11 root      20   0       0      0      0 S   0.0  0.0   0:31.48 rcuos/2
   12 root      20   0       0      0      0 S   0.0  0.0   0:39.73 rcuos/3
   13 root      20   0       0      0      0 S   0.0  0.0   0:29.58 rcuos/4
   14 root      20   0       0      0      0 S   0.0  0.0   0:26.95 rcuos/5
   15 root      20   0       0      0      0 S   0.0  0.0   0:31.11 rcuos/6
   16 root      20   0       0      0      0 S   0.0  0.0   0:57.06 rcuos/7
   17 root      20   0       0      0      0 S   0.0  0.0   0:28.37 rcuos/8
   18 root      20   0       0      0      0 S   0.0  0.0   0:28.67 rcuos/9
   19 root      20   0       0      0      0 S   0.0  0.0   0:30.89 rcuos/10
   20 root      20   0       0      0      0 S   0.0  0.0   0:29.46 rcuos/11
   21 root      20   0       0      0      0 S   0.0  0.0   0:28.01 rcuos/12
   22 root      20   0       0      0      0 S   0.0  0.0   0:28.00 rcuos/13
   23 root      20   0       0      0      0 S   0.0  0.0   0:30.02 rcuos/14
   24 root      20   0       0      0      0 S   0.0  0.0   0:26.52 rcuos/15
   25 root      20   0       0      0      0 S   0.0  0.0   0:02.40 rcuos/16
   26 root      20   0       0      0      0 S   0.0  0.0   0:24.59 rcuos/17
   27 root      20   0       0      0      0 S   0.0  0.0   1:01.50 rcuos/18
   28 root      20   0       0      0      0 S   0.0  0.0   0:03.67 rcuos/19
   29 root      20   0       0      0      0 S   0.0  0.0   0:03.27 rcuos/20
   30 root      20   0       0      0      0 S   0.0  0.0   0:03.21 rcuos/21
   31 root      20   0       0      0      0 S   0.0  0.0   0:03.36 rcuos/22
```

In order to sort them by memory usage **top -o %MEM**

```
5. aiken.ce.pdn.ac.lk (e14049)
top - 16:24:08 up 14 days,  4:48,  2 users,  load average: 0.00, 0.01, 0.05
Tasks: 465 total,   1 running, 464 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.0 us,  0.0 sy,  0.0 ni,100.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem:  26411862+total, 14630520 used, 24948811+free,   672900 buffers
KiB Swap: 25009766+total,        0 used, 25009766+free.  6454132 cached Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
34617 kibana    20   0 1352664 187584  13688 S   0.0  0.1   0:42.66 node
 1855 root      20   0 3036868  51288  14880 S   0.0  0.0  30:25.89 dockerd
50199 mysql     20   0  552144  51204   7056 S   0.0  0.0   3:45.60 mysqld
 4759 lightdm   20   0  543792  37896  17540 S   0.0  0.0   2:54.70 lightdm-gtk-gre
 2152 root      20   0 2822096  29924   4612 S   0.0  0.0  14:45.95 docker-containe
 4541 root      20   0  352800  25160  15168 S   0.0  0.0   0:11.47 Xorg
 2386 root      20   0  407652  21932  18596 S   0.0  0.0   0:58.91 sssd_nss
 2137 root      20   0  439296  13320   8540 S   0.0  0.0   0:58.83 sssd_be
 4742 root      20   0  201256   9404   3296 S   0.0  0.0   0:00.31 lightdm
 1711 root      20   0  325496   9256   6984 S   0.0  0.0   0:01.59 smbd
 2387 root      20   0  393648   9004   5804 S   0.0  0.0   0:33.69 sssd_pam
 1922 root      20   0  413124   8668   5996 S   0.0  0.0   0:43.74 sssd
 5445 redis     20   0   37396   7408   1068 S   0.3  0.0  77:53.57 redis-server
 4793 lightdm   20   0  555880   7200   3980 S   0.0  0.0   0:00.01 indicator-sound
 4570 root      20   0  282776   6552   3036 S   0.0  0.0   0:00.30 polkitd
40924 e14049    20   0   45308   6228   1824 S   0.0  0.0   0:00.04 bash
40592 e14049    20   0   45276   6196   1824 S   0.0  0.0   0:00.04 bash
 5366 root      20   0   17104   5624      0 S   0.0  0.0   0:00.09 vmnet-dhcpd
 4792 lightdm   20   0  283540   5340   2668 S   0.0  0.0   0:00.00 indicator-power
 4762 lightdm   20   0  337404   5212   2608 S   0.0  0.0   0:00.00 at-spi-bus-laun
 4777 lightdm   20   0  280140   5184   2540 S   0.0  0.0   0:00.00 gvfsd-fuse
40808 root      20   0  147784   4932   3696 S   0.0  0.0   0:00.01 sshd
 4795 lightdm   20   0  286804   4860   3812 S   0.0  0.0   0:00.00 indicator-appli
 4544 root      20   0  301672   4844   3424 S   0.0  0.0   1:06.58 accounts-daemon
40534 root      20   0  147784   4792   3548 S   0.0  0.0   0:00.01 sshd
40866 root      20   0  147784   4768   3536 S   0.0  0.0   0:00.00 sshd
 2031 root      20   0  334456   4484   3308 S   0.0  0.0   0:00.02 ModemManager
 4803 root      20   0  239356   4432   3476 S   0.0  0.0   0:00.22 upowerd
17608 root      20   0 4263112   4192   2920 S   0.0  0.0   0:01.06 console-kit-dae
    1 root      20   0   36760   4092   1508 S   0.0  0.0   0:29.44 init
 4494 root      20   0  278008   3904   2968 S   0.0  0.0   0:01.93 lightdm
```

ii). ps-a: select all processors except session leaders/get it in man

ps-x : process own by you

ps-u: Select by effective user ID (EUID) or name. This selects the processes who's effective User list.

ps-w: window size will be adjust.

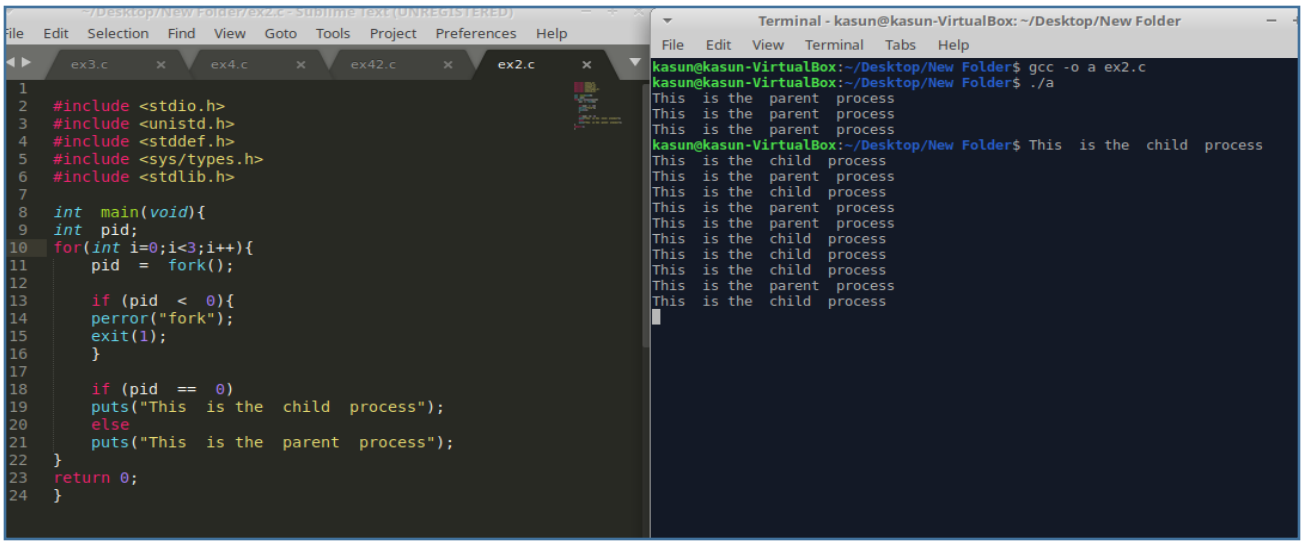
```
e14049@aiken:~$ ps -a
  PID TTY          TIME CMD
40961 pts/1    00:00:00 ps
e14049@aiken:~$ ps -x
  PID TTY      STAT   TIME COMMAND
40591 ?        S      0:00 sshd: e14049@pts/3
40592 pts/3    Ss+    0:00 -bash
40611 ?        Ss     0:00 /usr/lib/openssh/sftp-server
40864 ?        S      0:00 sshd: e14049@pts/1
40922 ?        S      0:00 sshd: e14049@notty
40923 ?        Ss     0:00 /usr/lib/openssh/sftp-server
40924 pts/1    Ss     0:00 -bash
40962 pts/1    R+     0:00 ps -x
e14049@aiken:~$ ps -u
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
e14049   40592  0.0  0.0  45276  6196 pts/3    Ss+  16:01   0:00 -bash
e14049   40924  0.0  0.0  45308  6228 pts/1    Ss   16:21   0:00 -bash
e14049   40963  0.0  0.0  38796  1420 pts/1    R+   16:34   0:00 ps -u
e14049@aiken:~$ ps -w
  PID TTY          TIME CMD
40924 pts/1    00:00:00 bash
40967 pts/1    00:00:00 ps
e14049@aiken:~$
```

To find the PID =1 process " **ps -p 1 -o comm= " or "ps -eaf"** commands.

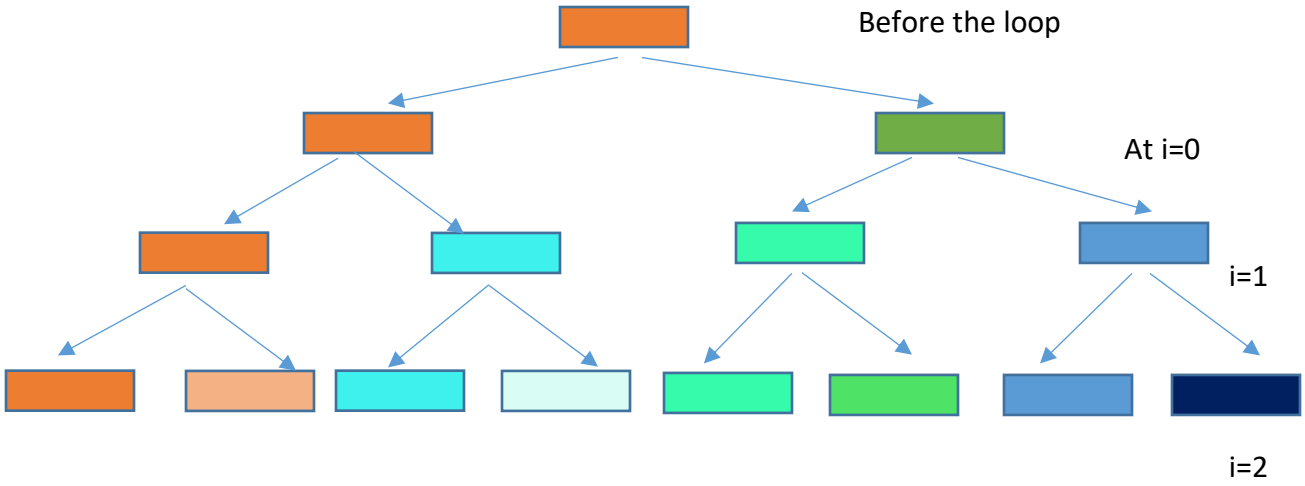
```
e14049@aiken:~$ ps -p 1 -o comm=
init
e14049@aiken:~$ clear
e14049@aiken:~$ ps -eaf
UID        PID  PPID  C STIME TTY          TIME CMD
root         1     0  0 Oct22 ?        00:00:29 /sbin/init
root         2     0  0 Oct22 ?        00:00:00 [kthreadd]
root         3     2  0 Oct22 ?        00:01:01 [ksoftirqd/0]
root         5     2  0 Oct22 ?        00:00:00 [kworker/0:0H]
root         6     2  0 Oct22 ?        00:01:00 [kworker/u128:0]
root         8     2  0 Oct22 ?        00:10:09 [rcu_sched]
root         9     2  0 Oct22 ?        00:00:34 [rcuos/0]
root        10     2  0 Oct22 ?        00:00:30 [rcuos/1]
root        11     2  0 Oct22 ?        00:00:31 [rcuos/2]
root        12     2  0 Oct22 ?        00:00:39 [rcuos/3]
root        13     2  0 Oct22 ?        00:00:29 [rcuos/4]
root        14     2  0 Oct22 ?        00:00:26 [rcuos/5]
root        15     2  0 Oct22 ?        00:00:31 [rcuos/6]
root        16     2  0 Oct22 ?        00:00:57 [rcuos/7]
root        17     2  0 Oct22 ?        00:00:28 [rcuos/8]
root        18     2  0 Oct22 ?        00:00:28 [rcuos/9]
root        19     2  0 Oct22 ?        00:00:30 [rcuos/10]
root        20     2  0 Oct22 ?        00:00:29 [rcuos/11]
root        21     2  0 Oct22 ?        00:00:28 [rcuos/12]
root        22     2  0 Oct22 ?        00:00:28 [rcuos/13]
root        23     2  0 Oct22 ?        00:00:30 [rcuos/14]
root        24     2  0 Oct22 ?        00:00:26 [rcuos/15]
root        25     2  0 Oct22 ?        00:00:02 [rcuos/16]
root        26     2  0 Oct22 ?        00:00:24 [rcuos/17]
root        27     2  0 Oct22 ?        00:01:01 [rcuos/18]
root        28     2  0 Oct22 ?        00:00:03 [rcuos/19]
root        29     2  0 Oct22 ?        00:00:03 [rcuos/20]
root        30     2  0 Oct22 ?        00:00:03 [rcuos/21]
root        31     2  0 Oct22 ?        00:00:03 [rcuos/22]
```

EXERCISE 02 :

1).parent process is the one who creating the child processes. Printed order may be different with the CPU scheduling criteria. But most of the time parents will print before their respective Childs.



2).when you have multiple fork(); in a loops there will be 7 children's finally with the parent. All together there will be 8 processes.



As you can see in the figure there will be 8 process will be create in the loop. One parent with 7 children's. Using "getppid();" we can get the parent pid but "getcpid()' in not available. Because when fork(); execute it return the pid of the child to the parent. Therefore no need to have a function called "getcpid()".

EXERCISE 03 :

wait() and waitpid()

The wait() system call suspends execution of the calling process until one of its children terminates. The call wait(&wstatus) is equivalent to waitpid(-1, &wstatus, 0);

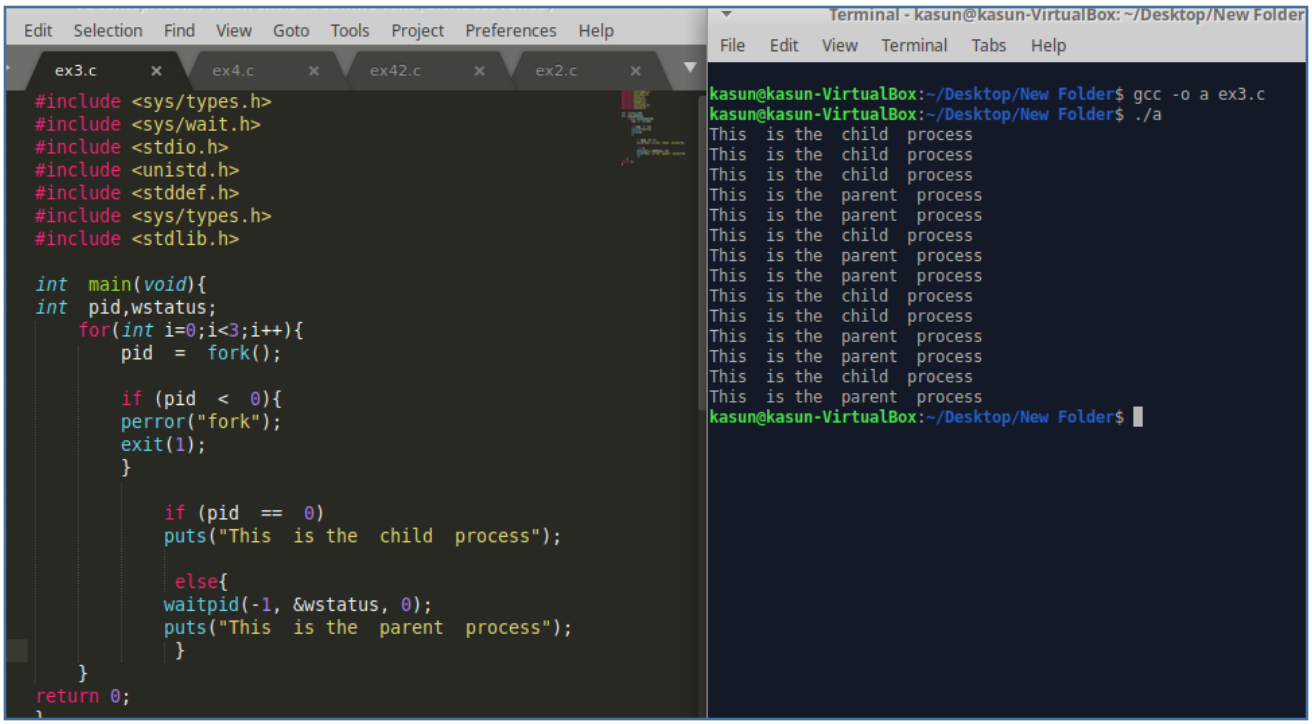
The value of pid can be:

< -1 meaning wait for a child process whose process group ID is equal to the absolute value of pid.

-1 meaning wait for any child process.

0 meaning wait for any child process whose process group ID is equal to that of the calling recess.

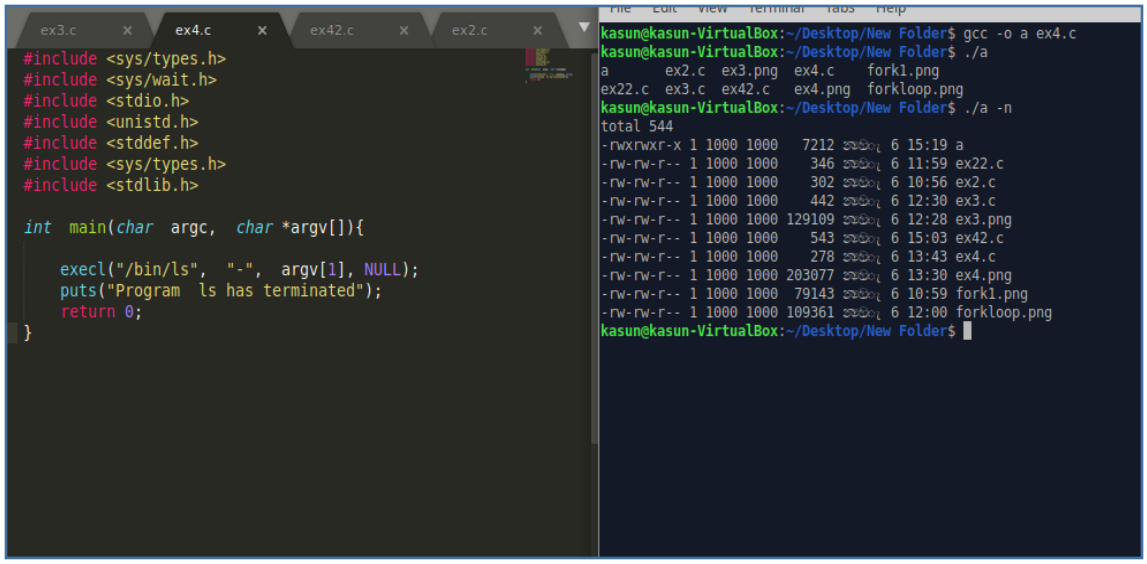
> 0 meaning wait for the child whose process ID is equal to the value of pid.



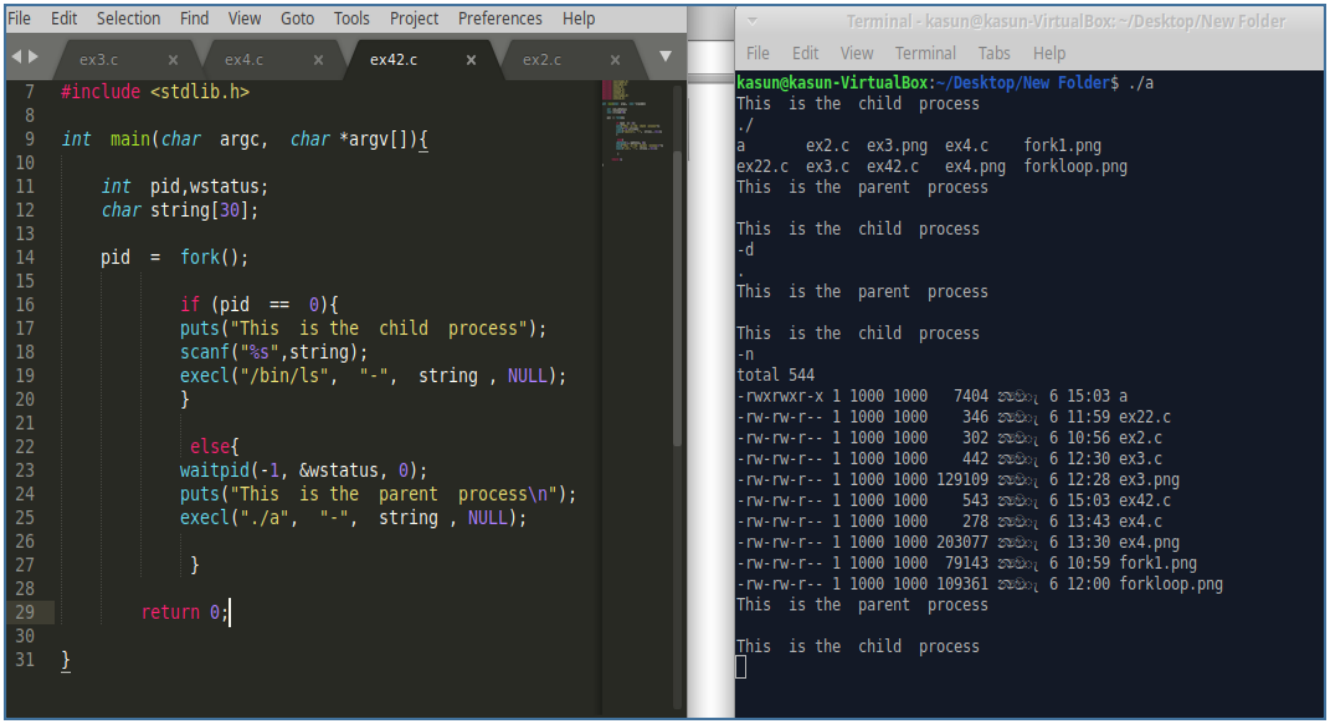
As you can see in the output when we use the " waitpid(-1, &wstatus, 0);" it wait for child process. After that the parent process will execute.

EXERCISE 04 :

i). The exec() family of functions replaces the current process image with a new process image. It loads the program into the current process space and runs it from the entry point. Therefore nothing will be printed after executing the execl().



ii).



EXERCISE 05 :

i).

```
File  Edit  View  Terminal  Tabs  Help
kasun@kasun-VirtualBox:~/Desktop/New Folder$ gcc -o a ex5server.c
kasun@kasun-VirtualBox:~/Desktop/New Folder$ ./a
[+]Server Socket is created.
[+]Bind to port 12345
[+]Listening....
PID: 3223, Connection accepted from 184.204.214.183:0
PID: 3226, Client: hi i am client 1

PID: 3223, Connection accepted from 127.0.0.1:60952
PID: 3228, Client: hi i am client 2

PID: 3226, Client: i am going to disconnect

PID: 3226, Disconnected from 184.204.214.183:0
PID: 3228, Client: exit

PID: 3228, Client:

PID: 3228, Disconnected from 127.0.0.1:60952
```

```
File  Edit  View  Terminal  Tabs  Help
kasun@kasun-VirtualBox:~/Desktop/New Folder$ nc 127.0.0.1 12345
hi i am client 1
i am going to disconnect
:exit

kasun@kasun-VirtualBox:~/Desktop/New Folder$
```

```
Terminal - kasun@kasun-VirtualBox: ~/Desktop/New Folder
File  Edit  View  Terminal  Tabs  Help
kasun@kasun-VirtualBox:~/Desktop/New Folder$ nc 127.0.0.1 12345
hi i am client 2
exit

:exit
```

ii).Since the parent process wait until the child process finished then the server only able to handle one client at a time. Other clients has to wait until the serving client finishes.

```
File  Edit  View  Terminal  Tabs  Help
kasun@kasun-VirtualBox:~/Desktop/New Folder$ gcc -o a ex5server.c
kasun@kasun-VirtualBox:~/Desktop/New Folder$ ./a
[+]Server Socket is created.
[+]Bind to port 12345
[+]Listening....
PID: 3274, Connection accepted from 184.108.220.183:0
PID: 3276, Client: hi
PID: 3276, Client: i am client 1

PID: 3276, Disconnected from 184.108.220.183:0
PID: 3274, Connection accepted from 127.0.0.1:60966
PID: 3278, Client: i am client 2

PID: 3278, Client: i have waited until client 2

PID: 3278, Disconnected from 127.0.0.1:60966
```

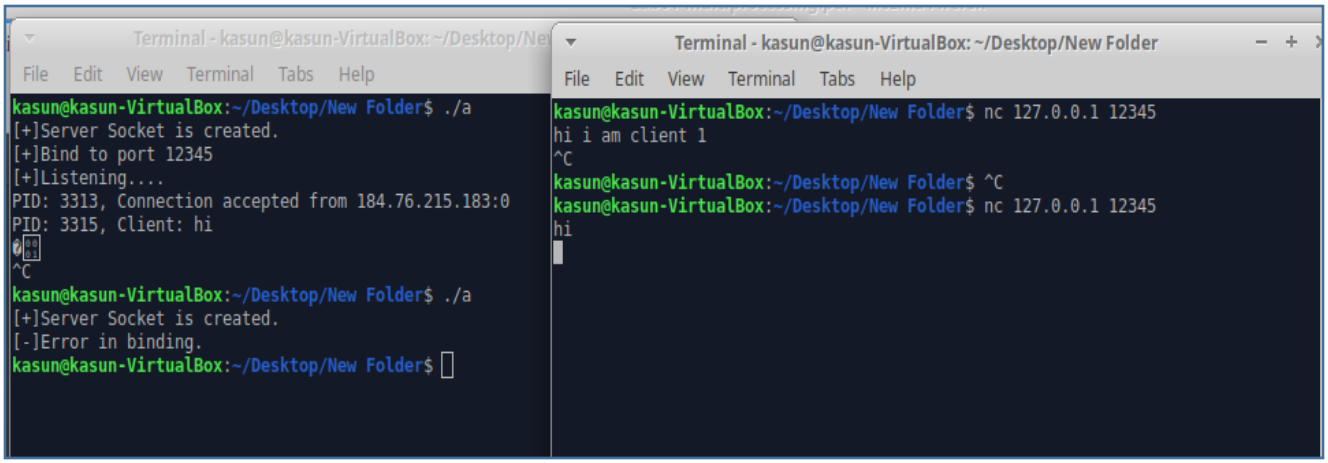
```
Terminal - kasun@kasun-VirtualBox: ~/Desktop/New Folder
File  Edit  View  Terminal  Tabs  Help
kasun@kasun-VirtualBox:~/Desktop/New Folder$ nc 127.0.0.1 12345
hi
i am client 1
:exit

kasun@kasun-VirtualBox:~/Desktop/New Folder$
```

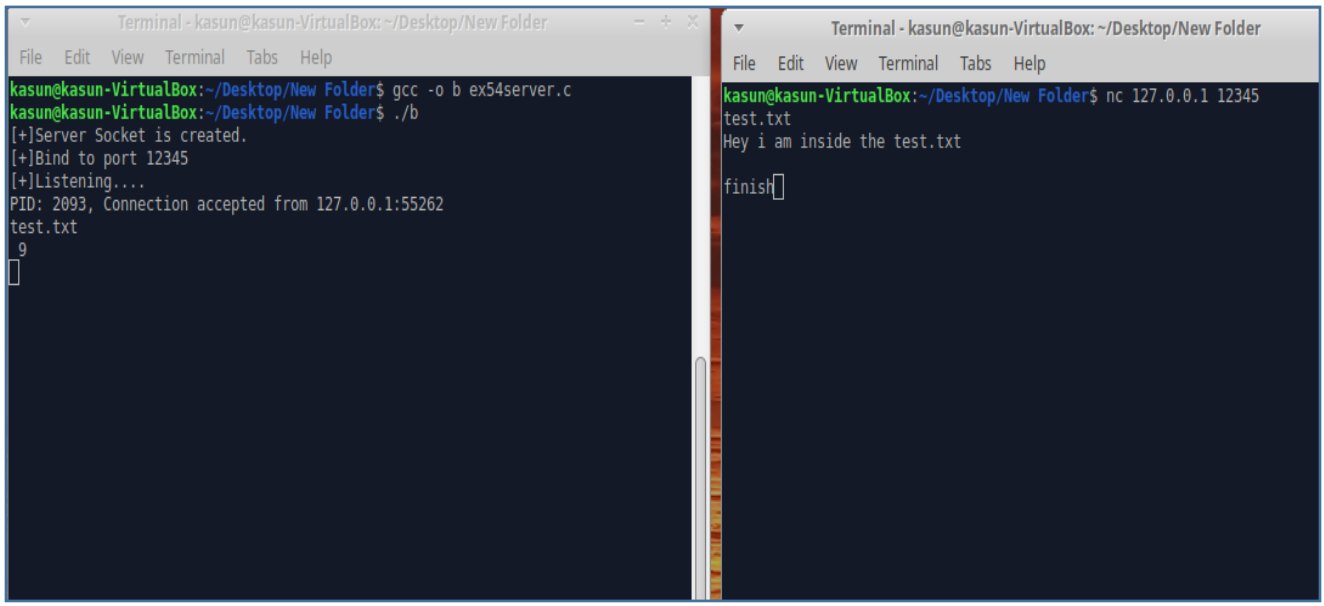
```
Terminal - kasun@kasun-VirtualBox: ~/Desktop/New Folder
File  Edit  View  Terminal  Tabs  Help
kasun@kasun-VirtualBox:~/Desktop/New Folder$ nc 127.0.0.1 12345
i am client 2
i have waited until client 2
:exit

kasun@kasun-VirtualBox:~/Desktop/New Folder$
```

iii). When you terminate the server while a client is connected, and then try to restart it the port will be busy. Because the client is using that port.



iv).



It is possible to two client to access the same file concurrently.