Exercise 1

Ex: 1. (i)

Sorted by CPU usage

```
top - 17:59:54 up 21:47,  4 users,  load average: 0.38, 0.61, 0.59
Tasks: 221 total,   1 running, 219 sleeping,   0 stopped,   1 zombie
%Cpu(s):  2.0 us,  0.6 sy,  0.0 ni, 97.0 id,  0.4 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  8076828 total,  1909456 free,  3309612 used,  2857760 buff/cache
KiB Swap:  9763836 total,  9763836 free,        0 used.  4064240 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 4353 gihanch+  20   0 2807124 790076 186796 S   4.7  9.8 102:12.65 firefox
30784 gihanch+  20   0 2508732 654352 153140 S   2.3  8.1  18:56.27 Web Content
 4512 gihanch+  20   0 1929848 275984  96276 S   2.0  3.4  24:43.62 WebExtensions
 1585 gihanch+   9 -11  587244  13864  10352 S   1.0  0.2  16:20.56 pulseaudio
    7 root      20   0       0      0      0 S   0.3  0.0   0:48.90 rcu_sched
 2212 root      20   0  386464  96720  81712 S   0.3  1.2  17:23.09 Xorg
 2399 gihanch+  20   0   22676   2732   1620 S   0.3  0.0   0:04.68 dbus-daemon
 2530 gihanch+  20   0  390748  25856  19388 S   0.3  0.3   0:02.29 xfce4-terminal
 2592 gihanch+  20   0  527756  31072  24724 S   0.3  0.4   0:09.93 panel-6-indicat
 2998 gihanch+  20   0   41804   3636   3060 R   0.3  0.0   0:00.08 top
 4702 gihanch+  20   0 2135080 377148 133884 S   0.3  4.7  23:38.63 Web Content
14629 gihanch+  20   0 1159840 296400 157420 S   0.3  3.7  11:25.55 chrome
14695 gihanch+  20   0 2046268 367352  83040 S   0.3  4.5   8:17.49 chrome
25695 gihanch+  20   0 1109104  87560  62932 S   0.3  1.1   0:07.22 chrome
28248 gihanch+  20   0 1360980 247628  77604 S   0.3  3.1   3:32.01 chrome
    1 root      20   0  185456   6020   3948 S   0.0  0.1   0:02.09 systemd
    2 root      20   0       0      0      0 S   0.0  0.0   0:00.03 kthreadd
    3 root      20   0       0      0      0 S   0.0  0.0   0:00.20 ksoftirqd/0
```

Sorted by memory usage

```
top - 18:00:19 up 21:47,  4 users,  load average: 0.25, 0.56, 0.58
Tasks: 220 total,   1 running, 218 sleeping,   0 stopped,   1 zombie
%Cpu(s):  1.9 us,  0.8 sy,  0.0 ni, 97.4 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
KiB Mem :  8076828 total,  1928660 free,  3283324 used,  2864844 buff/cache
KiB Swap:  9763836 total,  9763836 free,        0 used.  4083616 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
 4353 gihanch+  20   0 2807124 792016 186796 S   6.3  9.8 102:13.97 firefox
30784 gihanch+  20   0 2505660 628936 153140 S   1.0  7.8  18:57.39 Web Content
 4702 gihanch+  20   0 2135080 377288 133884 S   0.3  4.7  23:38.65 Web Content
14695 gihanch+  20   0 2046268 367456  83040 S   0.3  4.5   8:17.53 chrome
 2735 gihanch+  20   0 3542264 298416 102004 S   0.0  3.7   1:00.56 skypeforlinux
14629 gihanch+  20   0 1159840 296692 157484 S   0.3  3.7  11:25.62 chrome
 4512 gihanch+  20   0 1929848 278888  96276 S   2.6  3.5  24:44.09 WebExtensions
28248 gihanch+  20   0 1360980 247920  77604 S   0.3  3.1   3:32.05 chrome
  971 tomcat    20   0 4567424 227320  17260 S   0.0  2.8   1:43.99 java
14667 gihanch+  20   0  627672 164104 126980 S   0.0  2.0   3:57.78 chrome
 2566 gihanch+  20   0 3464216 139976  80584 S   0.0  1.7   1:11.05 skypeforlinux
26089 gihanch+  20   0 1152096 131936  86884 S   0.3  1.6   0:44.18 chrome
25683 gihanch+  20   0 1174948 126924  73640 S   0.0  1.6   0:37.58 chrome
14763 gihanch+  20   0 1178280 125712  61976 S   0.0  1.6   0:40.47 chrome
32244 gihanch+  20   0 1553384 122352  93092 S   0.0  1.5   0:04.90 Web Content
 2212 root      20   0  391720  99084  83908 S   3.0  1.2  17:23.89 Xorg
28386 gihanch+  20   0 1111344  92164  64380 S   0.0  1.1   0:37.62 chrome
```

Ex: 1. (ii)
ps command with flags.

```
gihanchanaka@gihanchanaka-Inspiron-3542:~$ ps
  PID TTY          TIME CMD
 3060 pts/0    00:00:00 ps
26729 pts/0    00:00:00 bash
gihanchanaka@gihanchanaka-Inspiron-3542:~$ ps -a
  PID TTY          TIME CMD
 3062 pts/0    00:00:00 ps
gihanchanaka@gihanchanaka-Inspiron-3542:~$ ps -u
USER       PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
gihanch+  2609  0.0  0.0  22884  5472 pts/2    Ss+  ∞∞∞05   0:00 bash
gihanch+  2618  0.0  0.0  22888  5488 pts/5    Ss+  ∞∞∞05   0:00 bash
gihanch+  3063  0.0  0.0  37368  3320 pts/0    R+   18:00   0:00 ps -u
gihanch+ 26729  0.0  0.0  22864  5328 pts/0    Ss   12:24   0:00 bash
gihanchanaka@gihanchanaka-Inspiron-3542:~$ ps -w
  PID TTY          TIME CMD
 3065 pts/0    00:00:00 ps
26729 pts/0    00:00:00 bash
gihanchanaka@gihanchanaka-Inspiron-3542:~$ ps -x
  PID TTY      STAT   TIME COMMAND
 1190 ?        Ss     0:00 /lib/systemd/systemd --user
 1191 ?        S      0:00 (sd-pam)
 1585 ?        S<l   16:21 /usr/bin/pulseaudio --start --log-target=syslog
 1618 ?        S      0:00 upstart --user --startup-event indicator-services-start
 2113 ?        Sl     0:11 ristretto /home/gihanchanaka/tesla/Desktop/Memes/45467537_1417790988352216_1
 2318 ?        SLl    0:12 /usr/bin/gnome-keyring-daemon --daemonize --login
 2321 ?        Ss     0:00 /sbin/upstart --user
 2391 ?        S      0:00 upstart-udev-bridge --daemon --user
 2399 ?        Ss     0:04 dbus-daemon --fork --session --address=unix:abstract=/tmp/dbus-KNRvjhiX4X
 2447 ?        S      0:00 upstart-dbus-bridge --daemon --session --user --bus-name session
 2449 ?        S      0:00 upstart-file-bridge --daemon --user
 2454 ?        S      0:02 upstart-dbus-bridge --daemon --system --user --bus-name system
```

PID 1 is given to the process **systemd**. This is a software bundle around **init demon.**

```
gihanchanaka@gihanchanaka-Inspiron-3542:~$
gihanchanaka@gihanchanaka-Inspiron-3542:~$ ps --pid 1
  PID TTY          TIME CMD
    1 ?        00:00:02 systemd
gihanchanaka@gihanchanaka-Inspiron-3542:~$
```
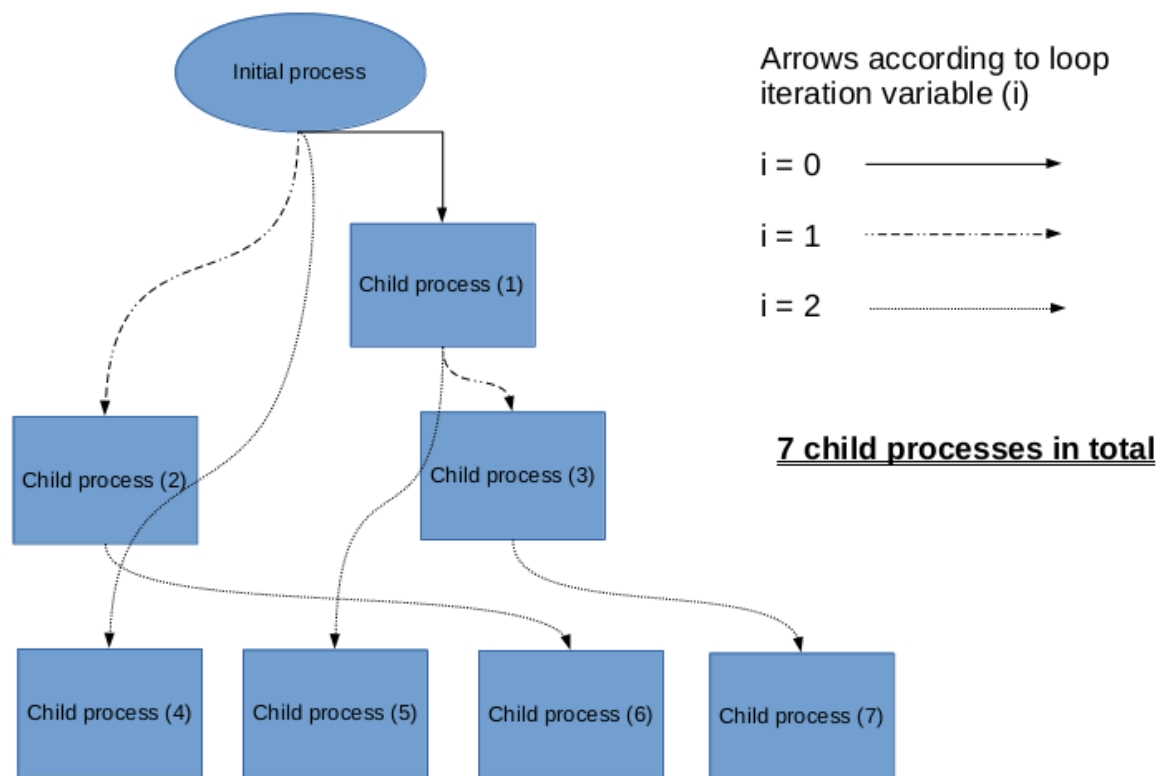
Exercise 2

Ex: 2. (i) Fork.c

```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01/ex02$ ./a.out
This is the parent process
This is the child process
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01/ex02$ ./a.out
This is the parent process
This is the child process
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01/ex02$ ./a.out
This is the parent process
This is the child process
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01/ex02$ ./a.out
This is the parent process
This is the child process
```

The order is always the same

Ex: 2. (ii) Fork2.c

Exercise 3

WaitForChild.c

Exercise 4

Ex: 4.(i) Exec.c

It is not printed

2. ExecRepeatedly.c

Exercise 5

Ex: 5. (i). MultiProcessServer.c

Server:
```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01$ ./server
Recieved: Hi! I connected second and typed the message first

Recieved: Hi! I connected first and typed the message second.
```

Client 1:
```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01$ nc 127.0.0.1 1
2345
I am the server process handling you
Hi! I connected first and typed the message second.
Thank you for the message:
Hi! I connected first and typed the message second.
```

Client 2:
```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01$ nc 127.0.0.1 123
45
I am the server process handling you
Hi! I connected second and typed the message first
Thank you for the message:
Hi! I connected second and typed the message first
```

Ex: 5. (ii). MultiProcessServerWait.c
This server code also can serve multiple clients. But it will serve the clients in the order they connected to the server one by one. (FIFO).

Server:
```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01$ ./serverWait
Recieved: I connected first and typed the message second!

Recieved: I connected second and typed the message first!
```

Client 1:
```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01$ nc 127.0.0.1 1
2345
I am the server process handling you
I connected first and typed the message second!
Thank you for the message:
I connected first and typed the message second!
```

Client 2:
```
gihanchanaka@gihanchanaka-Inspiron-3542:~/tesla/CO327 OS/Lab01$ nc 127.0.0.1 123
45
I connected second and typed the message first!
I am the server process handling you
Thank you for the message:
I connected second and typed the message first!
```

Ex: 5. (iii). The child process that is serving the client will keep running if the server suddenly closes while serving a client. It will become a child of the init (systemed) process (PID 1).
Even when the server is restarted, the port is occupied by the processes from the previous server.

Solution: MultiProcessServerWaitSignalHandler.c

Ex: 5. (iv). MutiProcessFileReadServer.c
Yes. Two or more concurrent clients can request the same file. Problems might occur if both tries to write to the file.