## A) Process concept.

**Open terminal and start a program (for example game Solitaire with command sol). Try command ps aux (command ps with option a u x) from a new terminal and check if you find a program you have just started. If output doesn't fit in terminal window size, maximize it and run same command again. Close the program. Make sure that program is closed with ps command. See if you can recognize other lines in output, these are active programs. Start a new terminal window and find it with ps command.**

```
:~$ tty
/dev/pts/0
:~$ sol
alt+ctrl+t        - to start a new terminal

:~$ tty           - from new terminal
/dev/pts/1

:~$ ps aux | grep sol
ik0v  3166  0.5  1.3  452304  535892 pts/0  Sl+ .....
```

closing Solitaire

```
:~$ ps aux | less    - program is gone
```

## B) Process hierarchy.

**Start a new terminal with program xterm. This is alternative to s standard terminal. We use it here to distinguish different terminals. Run xterm & command to run xterm on background of first terminal. Try same command with & and without it.**

**Try this command first:**

```
xterm &
```

```
:~$ xterm
```

New terminal was opened, original terminal is inactive now, waiting till xterm is closed.

```
:~$ xterm &
[1] 5545
```

New terminal has opened, original terminal is active also.

**Pay attention to what happens here. Use command ps aux (from original terminal) and see if you can find a new xterm program there. Kill that process with kill comand.**

```
:~$ ps aux
...
```

Here comes a list with active processes.
xterm can be found at the end of that list.

```
:~$ kill -9 5545
:~$ jobs
[1]+ Killed                  xterm
```

new xterm program is closed now

**Try command xterm & again and run ps aux command from a standard terminal. Can you find it in?**

```
:~$ xterm &
:~$ ps aux   - in a new xterm
...
```

Here comes a list with active processes. xterm 5819 is in the end of that list.

**Terminal you have just startet has a white background. Run a command from that xterm:**

```
xterm -bg red &
```

**to get a red terminal window. Try to move red xterm window and check whether black xterm is located on background. Give a command ps aux and check how many lines with xterm you will find now. Each line corresponds to one xterm process.**

```
:~$ xterm -bg red &
:~$ ps aux                    - there are 2 xterm processes
```

**Write next command in a red xterm:**

```
xterm -bg green &
```

**You got now a green xterm window. Run ps aux from a standard terminal, that is still active. Do you see that green xterm in a list?**

```
:~$ xterm -bg green &
:~$ ps aux                    - there are 3 xterm processes now
```

**Start a yellow xterm now (do it from a green xterm) and run ps aux to see that yellow xterm is also presented in i list**

```
:~$ xterm -bg yellow &
```

**Run a following command from a standard terminal:**

```
ps auxf
```

```
:~$ ps auxf
```

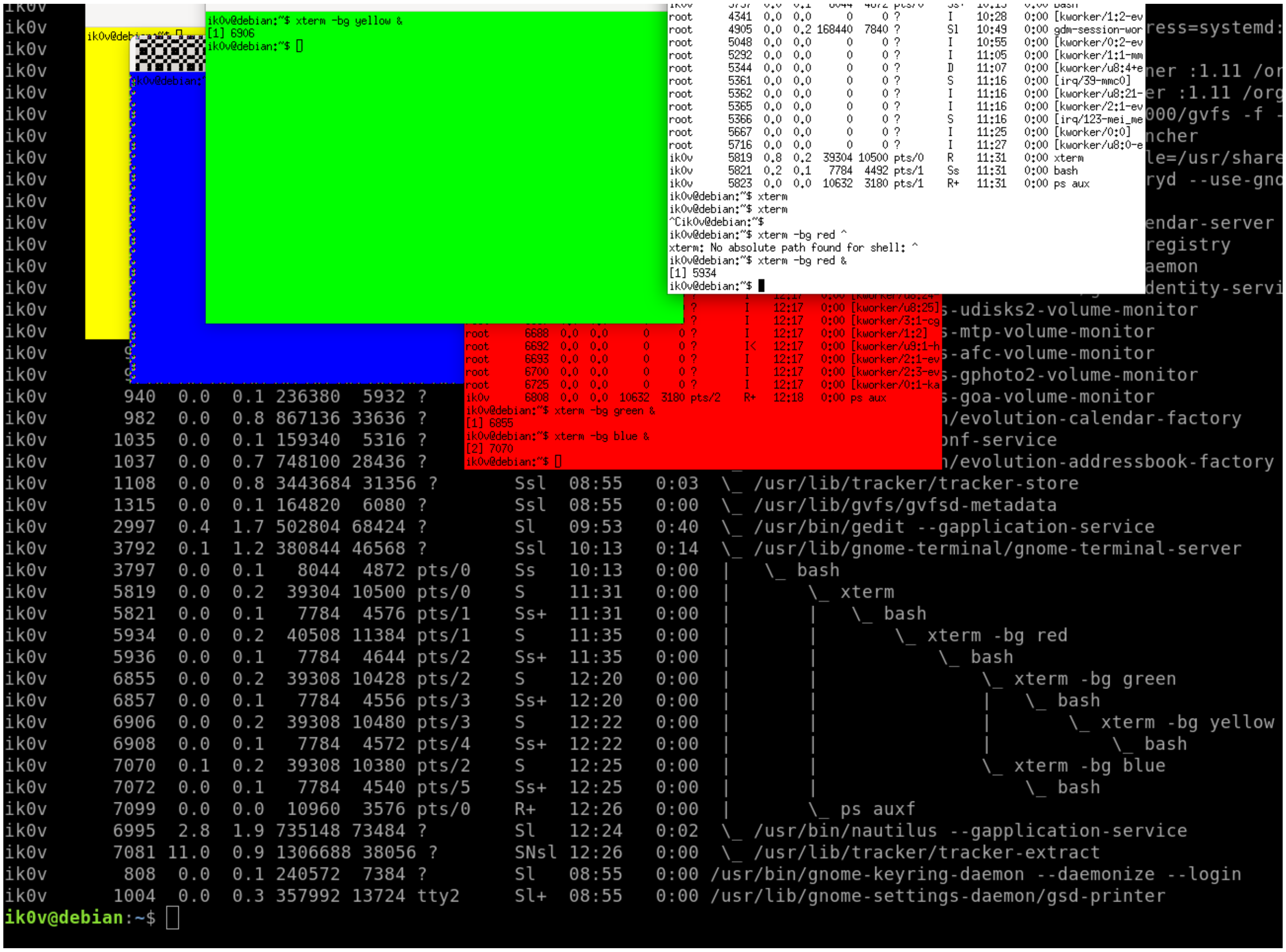
**What do you see there? Maximize a window to see whole lines.**
**Open another xterm window with blue background from a red terminal.**

```
xterm -bg blue &
```

```
:~$ xterm -bg blue &              - from a red xterm
```

**Run command ps auxf from original terminal. What do you see in output?**

```
:~$ ps auxf                       - screenshot shown on next page
```



```
ik0v@debian:~$ xterm
ik0v@debian:~$ xterm
^Cik0v@debian:~$
ik0v@debian:~$ xterm -bg red ^
xterm: No absolute path found for shell: ^
ik0v@debian:~$ xterm -bg red &
[1] 5934
ik0v@debian:~$
```

```
root      4341  0.0  0.0      0     0 ?        I    10:28   0:00 [kworker/1:2-ev
root      4905  0.0  0.2 168440  7840 ?        Sl   10:49   0:00 gdm-session-wor
root      5048  0.0  0.0      0     0 ?        I    10:55   0:00 [kworker/0:2-ev
root      5292  0.0  0.0      0     0 ?        I    11:05   0:00 [kworker/1:1-mm
root      5344  0.0  0.0      0     0 ?        D    11:07   0:00 [kworker/u8:4+e
root      5361  0.0  0.0      0     0 ?        S    11:16   0:00 [irq/39-mmc0]
root      5362  0.0  0.0      0     0 ?        I    11:16   0:00 [kworker/u8:21-
root      5365  0.0  0.0      0     0 ?        I    11:16   0:00 [kworker/2:1-ev
root      5366  0.0  0.0      0     0 ?        S    11:16   0:00 [irq/123-mei_me
root      5667  0.0  0.0      0     0 ?        I    11:25   0:00 [kworker/0:0]
root      5716  0.0  0.0      0     0 ?        I    11:27   0:00 [kworker/u8:0-e
ik0v      5819  0.8  0.2  39304 10500 pts/0    R    11:31   0:00 xterm
ik0v      5821  0.2  0.1   7784  4492 pts/1    Ss   11:31   0:00 bash
ik0v      5823  0.0  0.0  10632  3180 pts/1    R+   11:31   0:00 ps aux
```

```
ik0v@debian:~$ xterm -bg yellow &
[1] 6906
ik0v@debian:~$ 
```

```
ik0v@debian:~$ 
```

```
                                   ?        I    12:17   0:00 [kworker/u8:25]
                                   ?        I    12:17   0:00 [kworker/3:1-cg
root      6688  0.0  0.0      0     0 ?        I    12:17   0:00 [kworker/1:2]
root      6692  0.0  0.0      0     0 ?        I<   12:17   0:00 [kworker/u9:1-h
root      6693  0.0  0.0      0     0 ?        I    12:17   0:00 [kworker/2:1-ev
root      6700  0.0  0.0      0     0 ?        I    12:17   0:00 [kworker/2:3-ev
root      6725  0.0  0.0      0     0 ?        I    12:17   0:00 [kworker/0:1-ka
ik0v      6808  0.0  0.0  10632  3180 pts/2    R+   12:18   0:00 ps aux
ik0v@debian:~$ xterm -bg green &
[1] 6855
ik0v@debian:~$ xterm -bg blue &
[2] 7070
ik0v@debian:~$ 
```

```
ik0v                                                                                  ress=systemd:
ik0v
ik0v                                                                                  ner :1.11 /or
ik0v                                                                                  er :1.11 /org
ik0v                                                                                  000/gvfs -f -
ik0v                                                                                  ncher
ik0v                                                                                  le=/usr/share
ik0v                                                                                  ryd --use-gnc
ik0v
ik0v                                                                                  endar-server
ik0v                                                                                  registry
ik0v                                                                                  aemon
ik0v                                                                                  dentity-servi
ik0v                                                               s-udisks2-volume-monitor
ik0v                                                               s-mtp-volume-monitor
ik0v                                                               s-afc-volume-monitor
ik0v                                                               s-gphoto2-volume-monitor
ik0v       940  0.0  0.1 236380  5932 ?                            s-goa-volume-monitor
ik0v       982  0.0  0.8 867136 33636 ?                            n/evolution-calendar-factory
ik0v      1035  0.0  0.1 159340  5316 ?                            onf-service
ik0v      1037  0.0  0.7 748100 28436 ?                            n/evolution-addressbook-factory
ik0v      1108  0.0  0.8 3443684 31356 ?      Ssl  08:55   0:03  \_ /usr/lib/tracker/tracker-store
ik0v      1315  0.0  0.1 164820  6080 ?       Ssl  08:55   0:00  \_ /usr/lib/gvfs/gvfsd-metadata
ik0v      2997  0.4  1.7 502804 68424 ?       Sl   09:53   0:40  \_ /usr/bin/gedit --gapplication-service
ik0v      3792  0.1  1.2 380844 46568 ?       Ssl  10:13   0:14  \_ /usr/lib/gnome-terminal/gnome-terminal-server
ik0v      3797  0.0  0.1   8044  4872 pts/0   Ss   10:13   0:00  |   \_ bash
ik0v      5819  0.0  0.2  39304 10500 pts/0   S    11:31   0:00  |       \_ xterm
ik0v      5821  0.0  0.1   7784  4576 pts/1   Ss+  11:31   0:00  |       |   \_ bash
ik0v      5934  0.0  0.2  40508 11384 pts/1   S    11:35   0:00  |       |       \_ xterm -bg red
ik0v      5936  0.0  0.1   7784  4644 pts/2   Ss+  11:35   0:00  |       |           \_ bash
ik0v      6855  0.0  0.2  39308 10428 pts/2   S    12:20   0:00  |       |               \_ xterm -bg green
ik0v      6857  0.0  0.1   7784  4556 pts/3   Ss+  12:20   0:00  |       |               |   \_ bash
ik0v      6906  0.0  0.2  39308 10480 pts/3   S    12:22   0:00  |       |               |       \_ xterm -bg yellow
ik0v      6908  0.0  0.1   7784  4572 pts/4   Ss+  12:22   0:00  |       |               |           \_ bash
ik0v      7070  0.1  0.2  39308 10380 pts/2   S    12:25   0:00  |       |               \_ xterm -bg blue
ik0v      7072  0.0  0.1   7784  4540 pts/5   Ss+  12:25   0:00  |       |                   \_ bash
ik0v      7099  0.0  0.0  10960  3576 pts/0   R+   12:26   0:00  |       \_ ps auxf
ik0v      6995  2.8  1.9 735148 73484 ?       Sl   12:24   0:02  \_ /usr/bin/nautilus --gapplication-service
ik0v      7081 11.0  0.9 1306688 38056 ?      SNsl 12:26   0:00  \_ /usr/lib/tracker/tracker-extract
ik0v       808  0.0  0.1 240572  7384 ?       Sl   08:55   0:00 /usr/bin/gnome-keyring-daemon --daemonize --login
ik0v      1004  0.0  0.3 357992 13724 tty2    Sl+  08:55   0:00 /usr/lib/gnome-settings-daemon/gsd-printer
ik0v@debian:~$ 
```

## C) End process with kill command.

**Open couple terminals. Check if they are present in ps list. Stop one terminal with kill command.**

```
:~$ xterm &                 - from original terminal
:~$ xterm -bg gray &    - from a new white xterm
:~$ kill -9 7298           - killing white xterm from original terminal
```

**Start a time-consuming process, like that:**

```
find / -name "*.*" -print -exec grep -n "clock" {} \; &
```

**Start that find process as a background process (with &-char). Process writes quite a lot of text to screen and takes some time. Check if you can find it in ps list.**
**Hint: it can be usefeul to run ps command from another terminal.**

```
:~$ find / -exec ls -l {} \; &       - from original terminal (that command takes more time)

:~$ xterm ps auxf                    - from grey xterm
....
```

Looks like find command is being run from dev0 (original terminal) and has process nr. 30827.

**How can you end this process while it is running? Explain.**

```
:~$ kill -9 30827         - from grey terminal
```

It works fine
Process listing out all files in long format har stopped.
When I press enter it comes a message:

```
[9]+ Killed        find / -exec ls -l {} \;
```

## D) More about parent-child processes.

**Start same find process once again and use piping now. Send output from a first command to less command. Explain a connection between two processes. How can you stop both find and less process?**

```
:~$ xterm &
:~$ find / -exec ls -l {} \; | less &         - from original terminal
:~$ ps auxf                                   - from a new white xterm
:~$ kill -9 17880                             - to kill find process
:~$ kill -9 17881                             - to kill less process
```

Looks like less process runs right after find process, probably they are running together, or less process was called by already running find process.

## E) Daemon-prosesser.

**Use ps aux command again and find all daemon processes from that list. Use Google and find out what kind of processes they are.**

```
:~$ ps aux | grep daemon | wc -l                    - there is 30 daemon processes together.
```

Daemon processes are Linux programs running in background.

## F) Login from another pc.

**Find a daemon process called sshd. It can be installed via Software Center. What does this process? Check in Google. Create then a new user account on your pc. Use ssh command and try to login on that new account from your account.**

SSH – secure shell. It is used for secure connection between two hosts in unsecure network.

```
:~$ ps aux | grep sshd       - no result, ssh shall be installed

:~$ sudo apt-get update
:~$ sudo apt-get install openssh-client       - to install ssh on client pc (pc u will connect from)
:~$ sudo apt-get install openssh-server      - to install ssh on server pc (pc u will connect to)
:~$ sudo systemctl status ssh                - to check that ssh is running
:~$ sudo systemctl start ssh                 - if not, we start it manually
:~$ ip a                                     - to determine your ip address, write it down
:~$ sudo lsof -i -P -n | grep LISTEN         - to check if firewall allows remote access.
                                               Look for open ports, port 22 shall be here.
:~$ ssh user1@(ip address here)
Are you sure you want to continue connecting   - yes
user1@(ip address)’s password: type it

user1@debian:~$
```

That works fine, type exit to go back to your account when you are done.

## G) System Monitor

**Start a System Monitor. Find out following: what is your Linux kernel number? What is Gnome version? Give a definition to Gnome. Find info about RAM and CPU on your PC. Check what processes are running now. Which one uses most CPU time? Most memory? Check total use of CPU. If you have several CPUs find out whether all of them are used.**

```
:~$ uname -r                              - command to check a kernel version
4.19.0-12-amd64
```

```
:~$ gnome-shell –version                  - command to check GNOME version
GNOME Shell 3.30.2
```

GNOME is a free and open-source desktop environment for Unix-like operating systems.
... GNOME 3 is the default desktop environment on many major Linux distributions including Fedora, Debian ..

Starting system monitor..

Memory
1.0GiB(27.3%) of 3.7 GiB

4 CPU, Intel Pentium Silver prosessor.
gnome-system-monitor - uses most cpu-time (around. 4%)
gnome-shell - uses most memory (84.5 MiB)
CPU History - curve goes up to 30%

CPU1 and CPU2 are used, while CPU3 and CPU4 stands still, then otherwise.