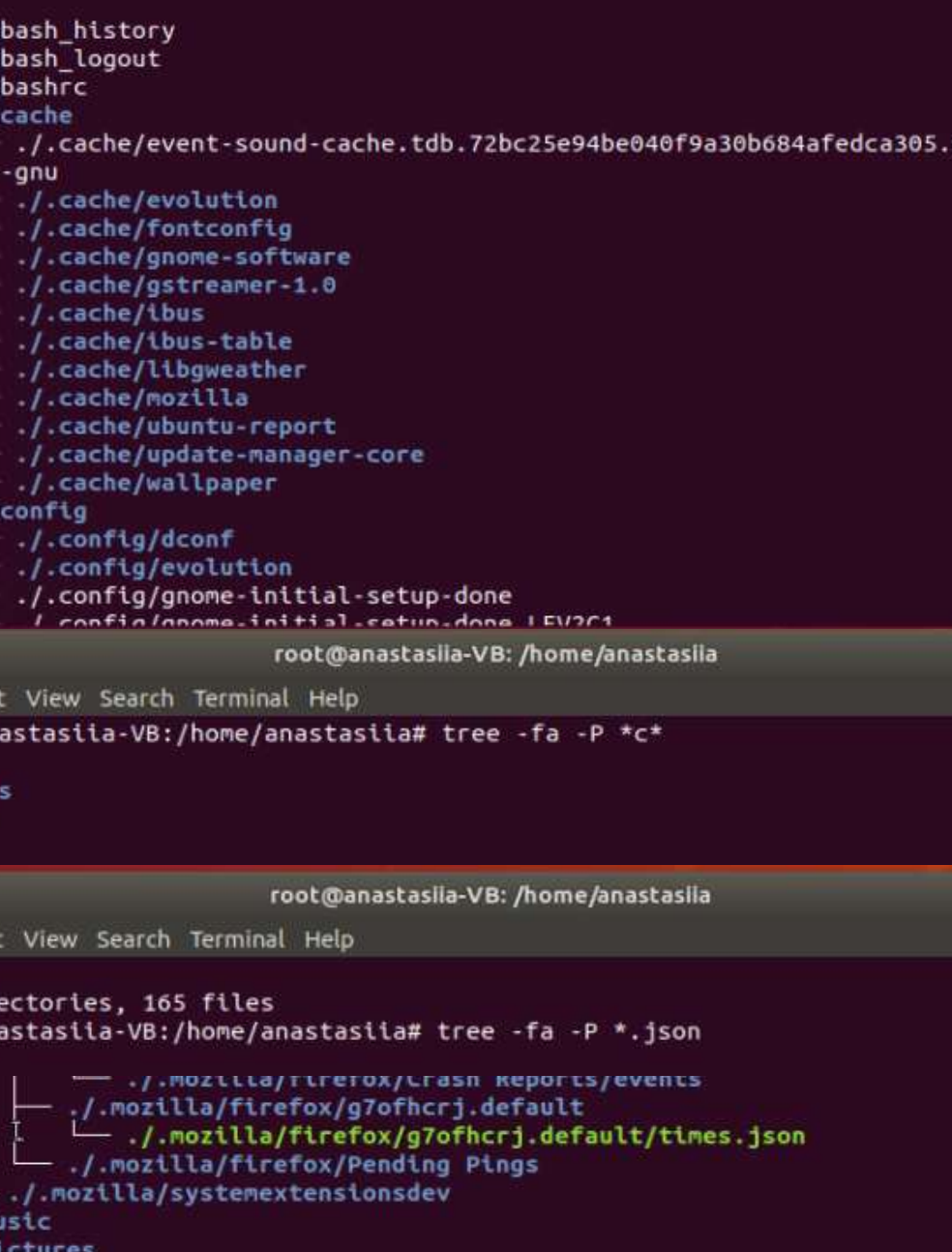


1. Examine the `tree` command. Master the technique of applying a template, for example, display all files that contain a character `c`, or files that contain a specific sequence of characters. List subdirectories of the root directory up to and including the second nesting level.

tree command lists contents of directories in a tree-like format. To list only those files that match the wild-card pattern, use the following command: `tree -P pattern` And to max display depth of the directory tree, use: `tree -L level`



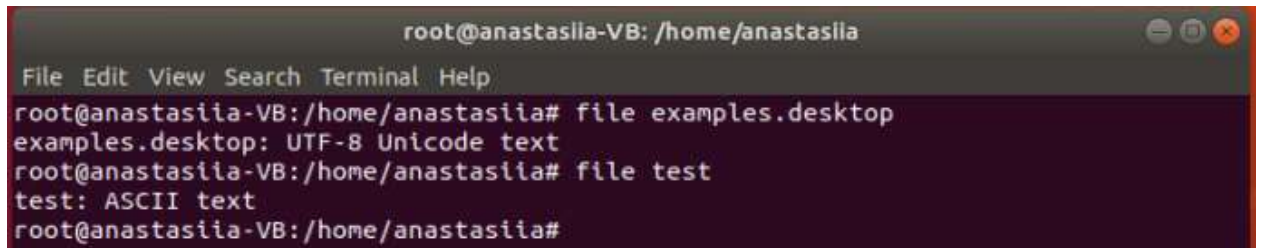
The first screenshot shows a terminal window with the command `tree -fa -L 2` executed. The output lists various files and directories in the `/home/anastasilia` directory, including `./bash_history`, `./cache`, `./config`, and `./linux-gnu`.

The second screenshot shows the same terminal window with the command `tree -fa -P *c*` executed. The output lists directories `Music`, `Pictures`, and `Public`.

The third screenshot shows the same terminal window with the command `tree -fa -P *.json` executed. The output lists directories `./Music`, `./Pictures`, `./Public`, `./Templates`, and `./Videos`, along with a detailed view of the `./mozilla` directory structure, including `./mozilla/firefox/g7ofhcrj.default/times.json`.

2. What command can be used to determine the type of file (for example, text or binary)? Give an example.

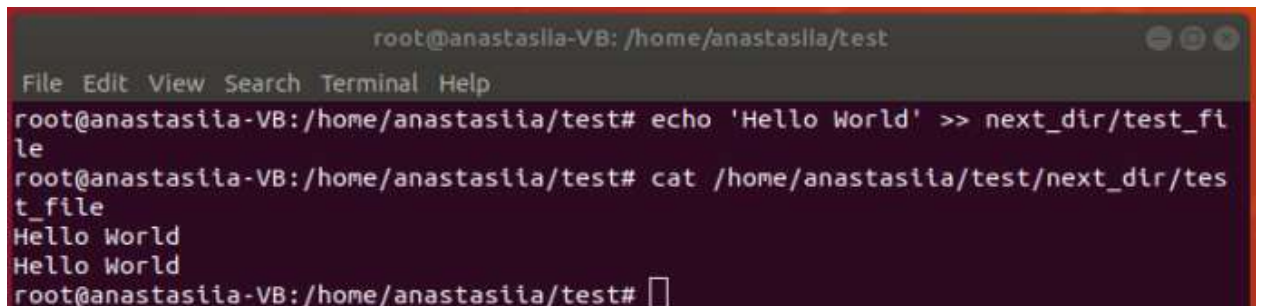
To determine the type of file, use file command. file tests each argument in an attempt to classify it:

A terminal window titled 'root@anastasiia-VB: /home/anastasiia' with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal shows the following commands and output:

```
root@anastasiia-VB:/home/anastasiia# file examples.desktop
examples.desktop: UTF-8 Unicode text
root@anastasiia-VB:/home/anastasiia# file test
test: ASCII text
root@anastasiia-VB:/home/anastasiia#
```

3. Master the skills of navigating the file system using relative and absolute paths. How can you go back to your home directory from anywhere in the filesystem?

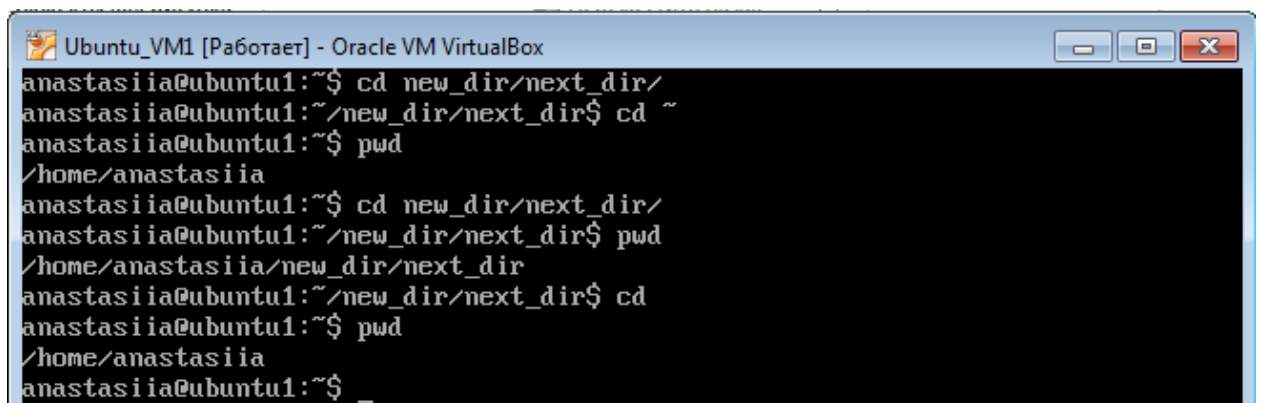
An absolute path is defined as the specifying the location of a file or directory from the root directory(/). In other words we can say absolute path is a complete path from start of actual filesystem from / directory. Relative path is defined as path related to the present working directory(pwd).

A terminal window titled 'root@anastasiia-VB: /home/anastasiia/test' with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal shows the following commands and output:

```
root@anastasiia-VB:/home/anastasiia/test# echo 'Hello World' >> next_dir/test_file
root@anastasiia-VB:/home/anastasiia/test# cat /home/anastasiia/test/next_dir/test_file
Hello World
Hello World
root@anastasiia-VB:/home/anastasiia/test#
```

To go back to your home directory from anywhere in the filesystem, use: `cd ~`

or `cd`

A terminal window titled 'Ubuntu_VM1 [Работает] - Oracle VM VirtualBox' with a menu bar (minimize, maximize, close). The terminal shows the following commands and output:

```
anastasiia@ubuntu1:~$ cd new_dir/next_dir/
anastasiia@ubuntu1:~/new_dir/next_dir$ cd ~
anastasiia@ubuntu1:~$ pwd
/home/anastasiia
anastasiia@ubuntu1:~$ cd new_dir/next_dir/
anastasiia@ubuntu1:~/new_dir/next_dir$ pwd
/home/anastasiia/new_dir/next_dir
anastasiia@ubuntu1:~/new_dir/next_dir$ cd
anastasiia@ubuntu1:~$ pwd
/home/anastasiia
anastasiia@ubuntu1:~$ _
```

4. Become familiar with the various options for the ls command. Give examples of listing directories using different keys. Explain the information displayed on the terminal using the `-l` and `-a` switches.

```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ ls
new_dir
anastasiia@ubuntu1:~$ ls -a
. . . .bash_history .bash_logout .bashrc .cache new_dir .profile
anastasiia@ubuntu1:~$ ls -l
total 4
drwxrwxr-x 3 anastasiia anastasiia 4096 Nov 21 21:16 new_dir
anastasiia@ubuntu1:~$ ls -la
total 36
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 21:16 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
drwxrwxr-x 3 anastasiia anastasiia 4096 Nov 21 21:16 new_dir
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
anastasiia@ubuntu1:~$
```

5. Perform the following sequence of operations:

- create a subdirectory in the home directory;

```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ mkdir new_dir
```

- in this subdirectory create a file containing information about directories located in the root directory (using I/O redirection operations);

```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ ls -la > new_dir/info
anastasiia@ubuntu1:~$ _
```

- view the created file;

```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ cat new_dir/info
total 36
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 21:22 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 21:26 new_dir
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
```

- copy the created file to your home directory using relative and absolute addressing.

Relative addressing:

```
Ubuntu_VM1 [Работает] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ cp new_dir/info ~
anastasiia@ubuntu1:~$ ls -la
total 40
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 21:29 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
-rw-rw-r-- 1 anastasiia anastasiia  497 Nov 21 21:30 info
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 21:26 new_dir
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
```

Absolute addressing:

```
Ubuntu_VM1 [Работает] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ cp /home/anastasiia/new_dir/info /home/anastasiia
anastasiia@ubuntu1:~$ ls -la
total 40
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 21:29 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
-rw-rw-r-- 1 anastasiia anastasiia  497 Nov 21 21:32 info
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 21:26 new_dir
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
```

- delete the previously created subdirectory with the file requesting removal;

```
Ubuntu_VM1 [Работает] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ rm -rf new_dir
anastasiia@ubuntu1:~$ ls -la
total 36
drwxr-xr-x 3 anastasiia anastasiia 4096 Nov 21 21:34 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
-rw-rw-r-- 1 anastasiia anastasiia  497 Nov 21 21:32 info
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
```

- delete the file copied to the home directory.

```
Ubuntu_VM1 [Работает] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ rm info
anastasiia@ubuntu1:~$ ls -la
total 32
drwxr-xr-x 3 anastasiia anastasiia 4096 Nov 21 21:35 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
```

6. Perform the following sequence of operations:

- create a subdirectory test in the home directory;

```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ mkdir test
anastasiia@ubuntu1:~$ ls -l
total 4
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 21:36 test
```

- copy the .bash_history file to this directory while changing its name to labwork2;

```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ sudo echo /home/anastasiia/.bash_history > test/labwork2
```

- create a hard and soft link to the labwork2 file in the test subdirectory;

```
anastasiia@ubuntu1:~$ ln test/labwork2 test/hardlink
anastasiia@ubuntu1:~$ cd test
anastasiia@ubuntu1:~/test$ ls -la
total 16
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 21:48 .
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 21:36 ..
-rw-rw-r-- 2 anastasiia anastasiia  31 Nov 21 21:43 hardlink
-rw-rw-r-- 2 anastasiia anastasiia  31 Nov 21 21:43 labwork2
anastasiia@ubuntu1:~/test$ cd ~
anastasiia@ubuntu1:~$ ln -s test/labwork2 test/softlink
anastasiia@ubuntu1:~$ ls -la test
total 16
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 21:49 .
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 21:36 ..
-rw-rw-r-- 2 anastasiia anastasiia  31 Nov 21 21:43 hardlink
-rw-rw-r-- 2 anastasiia anastasiia  31 Nov 21 21:43 labwork2
lrwxrwxrwx 1 anastasiia anastasiia  13 Nov 21 21:49 softlink -> test/labwork2
```

- how to define soft and hard link, what do these

concepts;

- change the data by opening a symbolic link. What changes will happen and

why

- rename the hard link file to hard_lnk_labwork2;

```
anastasiia@ubuntu1:~/test$ mv hardlink hard_lnk_labwork2
anastasiia@ubuntu1:~/test$ ls -la
total 16
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 22:16 .
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 22:12 ..
-rw-rw-r-- 2 anastasiia anastasiia  31 Nov 21 21:43 hard_lnk_labwork2
-rw-rw-r-- 2 anastasiia anastasiia  31 Nov 21 21:43 labwork2
```

- rename the soft link file to symb_lnk_labwork2 file;

```

anastasiia@ubuntu1:~/test$ mv softlink soft_lnk_labwork2
anastasiia@ubuntu1:~/test$ ls -la
total 16
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 22:19 .
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 22:18 ..
-rw-rw-r-- 2 anastasiia anastasiia 31 Nov 21 21:43 hard_lnk_labwork2
-rw-rw-r-- 2 anastasiia anastasiia 31 Nov 21 21:43 labwork2
lrwxrwxrwx 1 anastasiia anastasiia 8 Nov 21 22:18 soft_lnk_labwork2 -> labwork2

```

- then delete the labwork2. What changes have occurred and why?

```

anastasiia@ubuntu1:~/test$ rm labwork2
anastasiia@ubuntu1:~/test$ ls -la
total 12
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 22:20 .
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 22:18 ..
-rw-rw-r-- 1 anastasiia anastasiia 31 Nov 21 21:43 hard_lnk_labwork2
lrwxrwxrwx 1 anastasiia anastasiia 8 Nov 21 22:18 soft_lnk_labwork2 -> labwork2

```

When deleting the source file, an error occurs that such a file does not exist, because the source file was actually deleted. Removing the link leaves the original file in place.

When deleting the source file, nothing happened and the link still points to the desired disk section, this is the main difference between a hard link and a symbolic one. We can conclude that the linux hardlink is a regular file. Each file has at least one link, but for some we can create multiple links.

7. Using the locate utility, find all files that contain the squid and traceroute sequence.

```

anastasiia@ubuntu1:~$ locate -w squid
/usr/share/vim/vim74/syntax/squid.vim
anastasiia@ubuntu1:~$ locate -w traceroute
/etc/alternatives/traceroute6
/etc/alternatives/traceroute6.8.gz
/lib/modules/4.4.0-142-generic/kernel/drivers/tty/n_tracerouter.ko
/usr/bin/traceroute6
/usr/bin/traceroute6.iputils
/usr/share/man/man8/traceroute6.8.gz
/usr/share/man/man8/traceroute6.iputils.8.gz
/var/lib/dpkg/alternatives/traceroute6

```

8. Determine which partitions are mounted in the system, as well as the types of these partitions.


```

anastasiia@ubuntu1:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            2.4G   4.0K   2.4G   1% /dev
tmpfs           484M   372K   484M   1% /run
/dev/sda1       122G   1.8G   114G   2% /
none            4.0K     0   4.0K   0% /sys/fs/cgroup
none            5.0M     0   5.0M   0% /run/lock
none            2.4G     0   2.4G   0% /run/shm
none            100M     0   100M   0% /run/user
anastasiia@ubuntu1:~$ lsblk
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda          8:0    0  128G  0 disk
├─sda1       8:1    0 123.1G  0 part /
├─sda2       8:2    0     1K  0 part
└─sda5       8:5    0   4.9G  0 part [SWAP]
sr0         11:0    1  1024M  0 rom

```

```

anastasiia@ubuntu1:~$ mount
/dev/sda1 on / type ext4 (rw,errors=remount-ro)
proc on /proc type proc (rw,noexec,nosuid,nodev)
sysfs on /sys type sysfs (rw,noexec,nosuid,nodev)
none on /sys/fs/cgroup type tmpfs (rw)
none on /sys/fs/fuse/connections type fusectl (rw)
none on /sys/kernel/debug type debugfs (rw)
none on /sys/kernel/security type securityfs (rw)
udev on /dev type devtmpfs (rw,mode=0755)
devpts on /dev/pts type devpts (rw,noexec,nosuid,gid=5,mode=0620)
tmpfs on /run type tmpfs (rw,noexec,nosuid,size=10%,mode=0755)
none on /run/lock type tmpfs (rw,noexec,nosuid,nodev,size=5242880)
none on /run/shm type tmpfs (rw,nosuid,nodev)
none on /run/user type tmpfs (rw,noexec,nosuid,nodev,size=104857600,mode=0755)
none on /sys/fs/pstore type pstore (rw)
systemd on /sys/fs/cgroup/systemd type cgroup (rw,noexec,nosuid,nodev,none,name=systemd)

```

9. Count the number of lines containing a given sequence of characters in a given file.

```

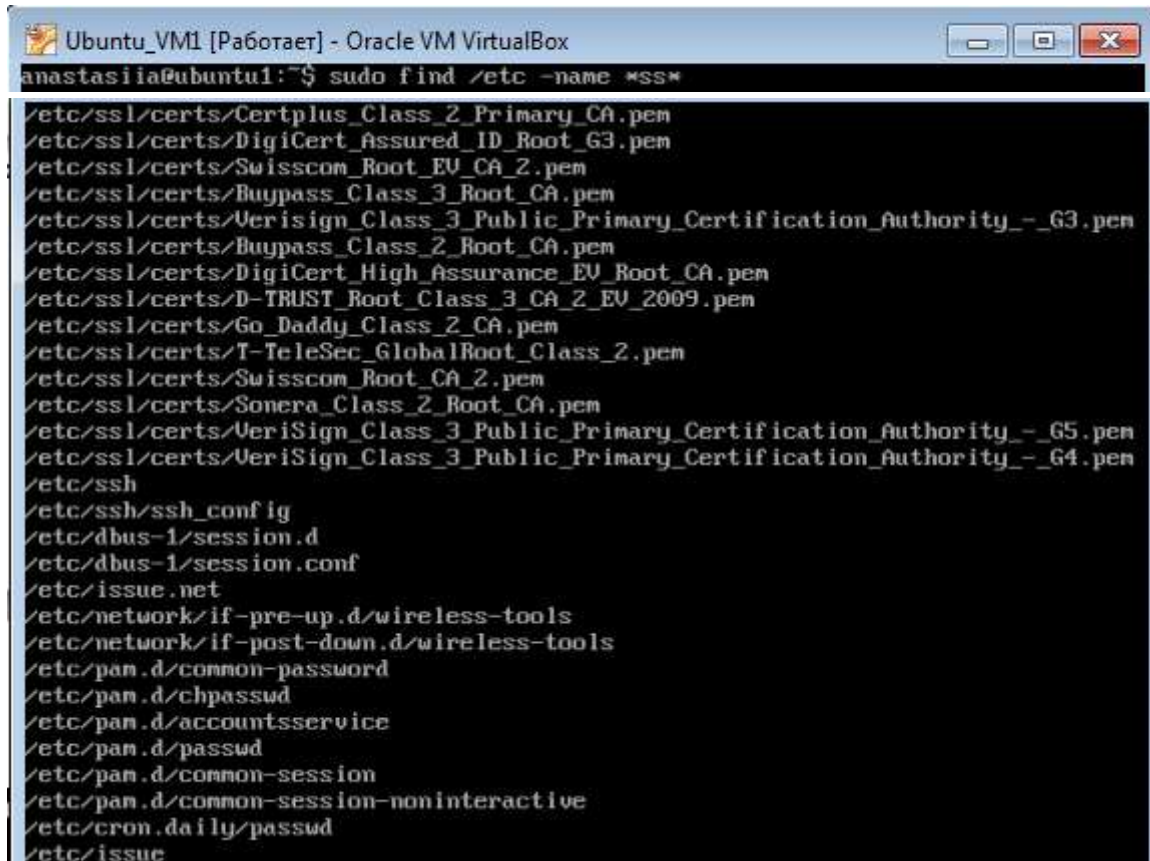
anastasiia@ubuntu1:~$ touch info.txt
anastasiia@ubuntu1:~$ ls -la > info.txt
anastasiia@ubuntu1:~$ cat info.txt
total 36
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 22:45 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
-rw----- 1 anastasiia anastasiia 5543 Nov 21 19:27 .bash_history
-rw-r--r-- 1 anastasiia anastasiia  220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
-rw-rw-r-- 1 anastasiia anastasiia   0 Nov 21 22:45 info.txt
-rw-r--r-- 1 anastasiia anastasiia  675 Nov 19 15:04 .profile
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 22:20 test
anastasiia@ubuntu1:~$ grep good info.txt | wc -l
0
anastasiia@ubuntu1:~$ grep bash info.txt | wc -l
3

```

10. Using the find command, find all files in the /etc directory containing the host character sequence.

```
anastasiia@ubuntu1:~$ sudo find /etc -name *host*  
/etc/hosts  
/etc/host.conf  
/etc/init/hostname.conf  
/etc/dbus-1/system.d/org.freedesktop.hostname1.conf  
/etc/hostname
```

11. List all objects in /etc that contain the ss character sequence. How can I duplicate a similar command using a bunch of grep?



```
anastasiia@ubuntu1:~$ sudo find /etc -name *ss*  
/etc/ssl/certs/Certplus_Class_2_Primary_CA.pem  
/etc/ssl/certs/DigiCert_Assured_ID_Root_G3.pem  
/etc/ssl/certs/Swisscom_Root_EV_CA_2.pem  
/etc/ssl/certs/Buypass_Class_3_Root_CA.pem  
/etc/ssl/certs/Verisign_Class_3_Public_Primary_Certification_Authority_-_G3.pem  
/etc/ssl/certs/Buypass_Class_2_Root_CA.pem  
/etc/ssl/certs/DigiCert_High_Assurance_EV_Root_CA.pem  
/etc/ssl/certs/D-TRUST_Root_Class_3_CA_2_EV_2009.pem  
/etc/ssl/certs/Go_Daddy_Class_2_CA.pem  
/etc/ssl/certs/T-TeleSec_GlobalRoot_Class_2.pem  
/etc/ssl/certs/Swisscom_Root_CA_2.pem  
/etc/ssl/certs/Sonera_Class_2_Root_CA.pem  
/etc/ssl/certs/VeriSign_Class_3_Public_Primary_Certification_Authority_-_G5.pem  
/etc/ssl/certs/VeriSign_Class_3_Public_Primary_Certification_Authority_-_G4.pem  
/etc/ssh  
/etc/ssh/ssh_config  
/etc/dbus-1/session.d  
/etc/dbus-1/session.conf  
/etc/issue.net  
/etc/network/if-pre-up.d/wireless-tools  
/etc/network/if-post-down.d/wireless-tools  
/etc/pam.d/common-password  
/etc/pam.d/chpasswd  
/etc/pam.d/accountsservice  
/etc/pam.d/passwd  
/etc/pam.d/common-session  
/etc/pam.d/common-session-noninteractive  
/etc/cron.daily/passwd  
/etc/issue
```

With grep command


```
Ubuntu_VM1 [Работаer] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ sudo grep "ss" /etc/**/*ss*
/etc/ssl/openssl.cnf:challengePassword_max = 20
/etc/ssl/openssl.cnf:# PKIX recommendations harmless if included in all certificates.
/etc/ssl/openssl.cnf:authorityKeyIdentifier=keyid,issuer
/etc/ssl/openssl.cnf:# This stuff is for subjectAltName and issuerAltname.
/etc/ssl/openssl.cnf:# Import the email address.
/etc/ssl/openssl.cnf:# issuerAltName=issuer:copy
/etc/ssl/openssl.cnf:authorityKeyIdentifier=keyid:always,issuer
/etc/ssl/openssl.cnf:# nsCertType = sslCA, emailCA
/etc/ssl/openssl.cnf:# Include email address in subject alt name: another PKIX recommendation
/etc/ssl/openssl.cnf:# Copy issuer details
/etc/ssl/openssl.cnf:# issuerAltName=issuer:copy
/etc/ssl/openssl.cnf:# Only issuerAltName and authorityKeyIdentifier make any sense in a CRL.
/etc/ssl/openssl.cnf:# issuerAltName=issuer:copy
/etc/ssl/openssl.cnf:# PKIX recommendations harmless if included in all certificates.
/etc/ssl/openssl.cnf:authorityKeyIdentifier=keyid,issuer
/etc/ssl/openssl.cnf:# This stuff is for subjectAltName and issuerAltname.
/etc/ssl/openssl.cnf:# Import the email address.
/etc/ssl/openssl.cnf:# issuerAltName=issuer:copy
/etc/ssl/openssl.cnf:digests = md5, sha1 # Acceptable message digests (mandatory)
/etc/ssl/openssl.cnf:ess_cert_id_chain = no # Must the ESS cert id chain be included?
/etc/sysctl.d/10-console-messages.conf:# the following stops low-level messages on console
```

12. Organize a screen-by-screen print of the contents of the /etc directory. Hint: You must use stream redirection operations.

```

Ubuntu_VM1 [Работает] - Oracle VM VirtualBox
anastasiia@ubuntu1:~$ ls -la /etc | less
total 796
drwxr-xr-x 91 root root    4096 Nov 22 11:58 .
drwxr-xr-x 22 root root    4096 Nov 19 17:51 ..
drwxr-xr-x  3 root root    4096 Nov 19 15:02 acpi
-rw-r--r--  1 root root   2981 Mar  5 2019 adduser.conf
drwxr-xr-x  2 root root    4096 Nov 19 15:14 alternatives
drwxr-xr-x  3 root root    4096 Nov 19 15:01 apm
drwxr-xr-x  3 root root    4096 Nov 19 15:02 apparmor
drwxr-xr-x  9 root root    4096 Nov 19 15:02 apparmor.d
drwxr-xr-x  3 root root    4096 Nov 19 15:02 apport
drwxr-xr-x  7 root root    4096 Nov 19 17:49 apt
-rw-r-----  1 root daemon  144 Oct 21 2013 at.deny
-rw-r--r--  1 root root   2177 Apr  9 2014 bash.bashrc
-rw-r--r--  1 root root    45 Mar 22 2014 bash_completion
drwxr-xr-x  2 root root    4096 Nov 19 17:51 bash_completion.d
-rw-r--r--  1 root root   356 Jan  1 2012 bindresvport.blacklist
-rw-r--r--  1 root root   321 Apr 16 2014 blkid.conf
lrwxrwxrwx  1 root root    15 Nov 19 14:50 blkid.tab -> /dev/blkid.tab
drwxr-xr-x  2 root root    4096 Nov 19 15:02 byobu
drwxr-xr-x  3 root root    4096 Nov 19 15:01 ca-certificates
-rw-r--r--  1 root root   6488 Nov 19 15:02 ca-certificates.conf
drwxr-xr-x  2 root root    4096 Nov 19 15:02 calendar
drwxr-s---  2 root dip     4096 Nov 19 15:02 chatscripts
drwxr-xr-x  2 root root    4096 Nov 19 14:50 console-setup
drwxr-xr-x  2 root root    4096 Nov 19 14:50 cron.d
drwxr-xr-x  2 root root    4096 Nov 19 17:51 cron.daily
drwxr-xr-x  2 root root    4096 Nov 19 14:50 cron.hourly
drwxr-xr-x  2 root root    4096 Nov 19 14:50 cron.monthly
-rw-r--r--  1 root root    722 Feb  9 2013 crontab
:
drwxr-xr-x  4 root root    4096 Nov 19 15:02 ssl
-rw-r--r--  1 root root    24 Nov 19 15:04 subgid
-rw-----  1 root root    0 Nov 19 15:02 subgid-
-rw-r--r--  1 root root    24 Nov 19 15:04 subuid
-rw-----  1 root root    0 Nov 19 15:02 subuid-
-r--r-----  1 root root   755 May 29 2017 sudoers
drwxr-xr-x  2 root root    4096 Nov 19 14:50 sudoers.d
-rw-r--r--  1 root root   2083 Nov 19 18:55 sysctl.conf
drwxr-xr-x  2 root root    4096 Nov 19 14:50 sysctl.d
drwxr-xr-x  3 root root    4096 Nov 19 17:51 systemd
drwxr-xr-x  2 root root    4096 Nov 19 14:50 terminfo
-rw-r--r--  1 root root    18 Nov 19 17:49 timezone
drwxr-xr-x  2 root root    4096 Nov 19 17:51 ubuntu-advantage
-rw-r--r--  1 root root   1260 Jul  1 2013 ucf.conf
drwxr-xr-x  4 root root    4096 Nov 19 17:51 udev
drwxr-xr-x  3 root root    4096 Nov 19 15:02 ufw
-rw-r--r--  1 root root   321 Jun 20 2013 updatedb.conf
drwxr-xr-x  3 root root    4096 Nov 19 17:51 update-manager
drwxr-xr-x  2 root root    4096 Nov 19 17:51 update-notd.d
drwxr-xr-x  2 root root    4096 Nov 19 15:03 update-notifier
-rw-r--r--  1 root root    222 Apr 12 2014 upstart-xsessions
drwxr-xr-x  2 root root    4096 Nov 19 14:50 vim
lrwxrwxrwx  1 root root    23 Nov 19 14:50 vtrgb -> /etc/alternatives/vtrgb
drwxr-xr-x  2 root root    4096 Nov 19 15:02 w3m
-rw-r--r--  1 root root   4812 May  8 2018 wgetrc
drwxr-xr-x  2 root root    4096 Nov 19 17:51 wpa_supplicant
drwxr-xr-x  4 root root    4096 Nov 19 14:50 X11
drwxr-xr-x  2 root root    4096 Nov 19 15:02 xml
-rw-r--r--  1 root root    349 Jun 26 2012 zsh_command_not_found
(END)

```

13. What are the types of devices and how to determine the type of device? Give examples.

```

prw-rw-r-- 1 student student 0 Dec 17 08:51 myPipe
srwxrwxr-x 1 student student 0 Dec 17 08:58 mySocket1.sock
srwxrwxr-x 1 student student 0 Dec 17 08:57 mySocket.sock

```

```
brw-rw---- 1 root disk 8, 0 Dec 16 17:04 /dev/sda
crw-rw-rw- 1 root tty 5, 0 Dec 17 07:30 /dev/tty
```

The columns are as follows from left to right:

- Permissions
- Owner
- Group
- Major Device Number
- Minor Device Number
- Timestamp
- Device Name

Remember in the ls command you can see the type of file with the first bit on each line. Device files are denoted as the following:

c - character

b - block

p - pipe

s - socket

Character Device

These devices transfer data, but one a character at a time. You'll see a lot of pseudo devices (/dev/null) as character devices, these devices aren't really physically connected to the machine, but they allow the operating system greater functionality.

Block Device

These devices transfer data, but in large fixed-sized blocks. You'll most commonly see devices that utilize data blocks as block devices, such as harddrives, filesystems, etc.

Pipe Device

Named pipes allow two or more processes to communicate with each other, these are similar to character devices, but instead of having output sent to a device, it's sent to another process.

Socket Device

Socket devices facilitate communication between processes, similar to pipe devices but they can communicate with many processes at once.

Device Characterization

Devices are characterized using two numbers, **major device number** and **minor device number**. You can see these numbers in the above ls example, they are separated by a comma. For example, let's say a device had the device numbers: **8, 0**:

The major device number represents the device driver that is used, in this case 8, which is often the major number for sd block devices. The minor number tells the kernel which unique device it is in this driver class, in this case 0 is used to represent the first device (a).

14. How to determine the type of file in the system, what types of files are there?

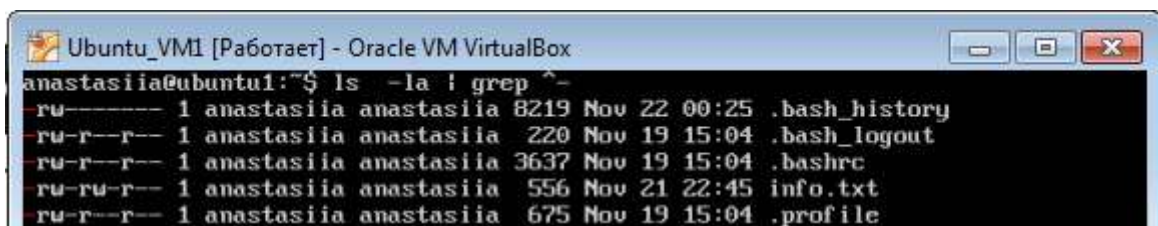
Totally 7 types of files are available in Linux with 3 Major categories. The details are below.

- Regular File
- Directory File
- Special Files (There are five types of files in the special category)
- Link File
- Character Device File
- Socket File
- Named Pipe File
- Block File

Regular file

The regular file is a common file type found everywhere on Linux system. These include text files, script files, images, binary files, and shared libraries, etc.

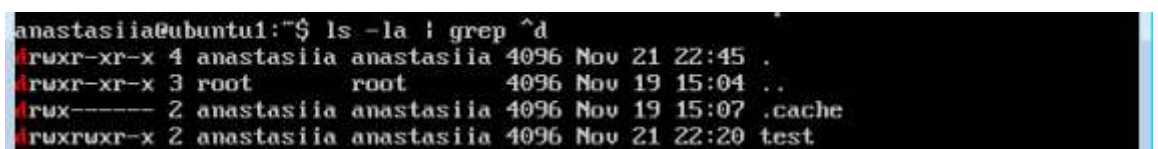
“-” This refers to the identification symbol for the regular file. You can use the rm command to remove a regular file.



```
anastasiia@ubuntu1:~$ ls -la | grep ^-
-rw----- 1 anastasiia anastasiia 8219 Nov 22 00:25 .bash_history
-rw-r--r-- 1 anastasiia anastasiia 220 Nov 19 15:04 .bash_logout
-rw-r--r-- 1 anastasiia anastasiia 3637 Nov 19 15:04 .bashrc
-rw-rw-r-- 1 anastasiia anastasiia 556 Nov 21 22:45 info.txt
-rw-r--r-- 1 anastasiia anastasiia 675 Nov 19 15:04 .profile
```

Directory

The directory is the second most common file type found on a Linux system. This can be created with the mkdir command.



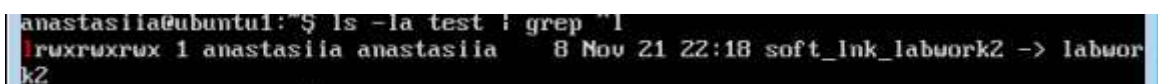
```
anastasiia@ubuntu1:~$ ls -la | grep ^d
drwxr-xr-x 4 anastasiia anastasiia 4096 Nov 21 22:45 .
drwxr-xr-x 3 root      root      4096 Nov 19 15:04 ..
drwx----- 2 anastasiia anastasiia 4096 Nov 19 15:07 .cache
drwxrwxr-x 2 anastasiia anastasiia 4096 Nov 21 22:20 test
```

Link File

A link is a mechanism for creating a shortcut to the original file or directory. It contains information about another file or directory.

Links allow more than one filename to reference the same file.

There are two types of link files available, it's soft link and hard link.



```
anastasiia@ubuntu1:~$ ls -la test | grep ^l
lrwxrwxrwx 1 anastasiia anastasiia    8 Nov 21 22:18 soft_lnk_labwork2 -> labwork2
```

Character Device file

Character device files allow the user and application program to communicate directly with the hardware device. It's not allow programs to read or write single characters at a time.

It is available under the /dev directory.

```
anastasii@ubuntu1:~$ ls -l /dev | grep ^c | head -n 3
crw-rw-rw- 1 root root 10, 235 Nov 22 11:58 autofs
crw-rw-rw- 1 root root 10, 234 Nov 22 11:58 btrfs-control
crw-rw-rw- 1 root root 5, 1 Nov 22 11:58 console
```

Block Device file

Block devices provide buffered access to hardware devices, it's similar to character devices. Unlike character devices, block devices will always allow the programmer to read or write a block of any size at a time.

```
# ls -la | grep ^b
brw-rw-rw- 1 root disk 7, 0 Jan 28 14:05 loop0
brw-rw-rw- 1 root disk 7, 1 Jan 28 14:05 loop1
brw-rw-rw- 1 root disk 7, 2 Jan 28 14:05 loop2
```

Socket file

A socket is a special file used for inter-process communication, which enables communication between two processes.

```
# ls -la | grep ^s
srw-rw-rw- 1 root root 0 Jan 5 16:36 system_bus_socket
```

Named Pipe file (FIFO)

a named pipe (also known as a FIFO) is one of the methods for inter-process communication.

Named pipes are special files that can exist anywhere in the file system. They can be created with the command mkfifo.

A named pipe is marked with a p as the first letter of the mode string.

```
# ls -la | grep ^p
prw-rw-rw- 1 root root 0 Jan 28 14:06 replication-notify-fifo|
prw-rw-rw- 1 root root 0 Jan 28 14:06 stats-mail|
```

15. * List the first 5 directory files that were recently accessed in the /etc directory.

```
anastasii@ubuntu1:~$ ls -la /etc | grep ^d | head -n 5
drwxr-xr-x 91 root root 4096 Nov 22 11:58 .
drwxr-xr-x 22 root root 4096 Nov 19 17:51 ..
drwxr-xr-x 3 root root 4096 Nov 19 15:02 acpi
drwxr-xr-x 2 root root 4096 Nov 19 15:14 alternatives
drwxr-xr-x 3 root root 4096 Nov 19 15:01 apm
```