Learning diary and answers

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Save the final version of this document as PDF and submit it for peer reviews via Moodle's workshop tool before the deadline. Last course week is for peer reviews.

Some courses may have 5 weeks, and some may have 8 weeks of assignments. This is a generic learning diary template. Adapt and edit the document accordingly.

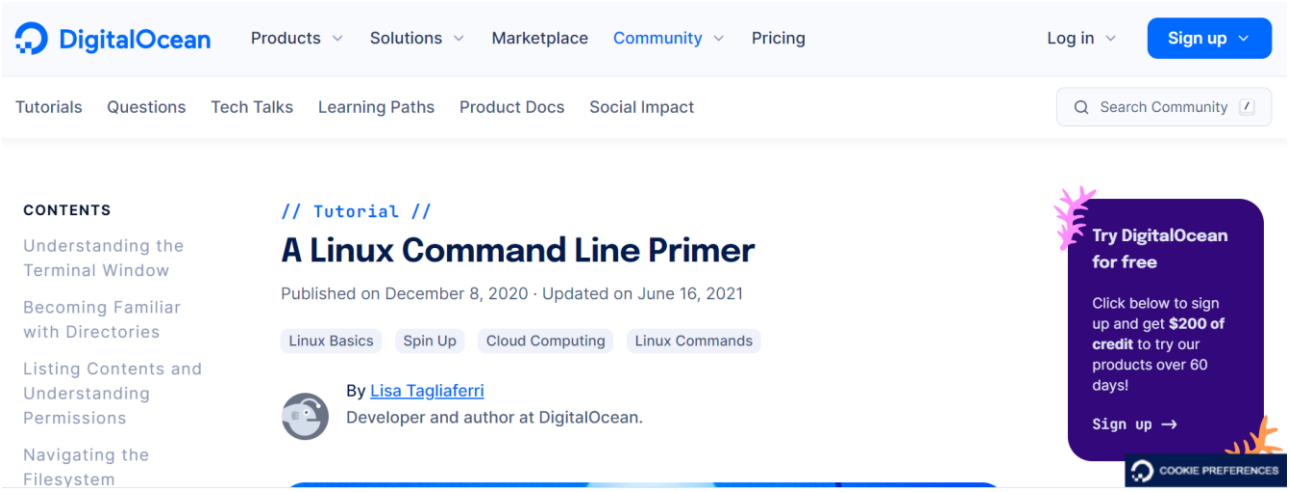
Week 1

Question 1: Install Ubuntu Linux to VMware, VirtualBox, Hyper-V or KVM.

Answer 1: I already started to using Ubuntu Linux.

Question 2: Browse this Linux Command Line Primer

Answer 2:



Question 3: Describe the following commands and concepts:

Answer 3:

- man, apropos

  -man: It is the short form of manual page. This command delivers a detailed view of the command which includes NAME, SYNOPSIS, DESCRIPTION, OPTION, ERRORS, FILES, EXAMPLES and so on.

  -apropos: This command uses to find any command using its man pages. Simply, when user don't remember the accurate command but knows a few keywords connected to the command that define its users or functionality.

- man date: Show the current time or set the system date in manual page.
- ls: This command is essential and one of the most used. Through this, the list of files and sub-directories in the current directory can be seen.
- ls --help: this command lists all available command.
- date: This command shows the current date and time.
- date --help: It helps to print the time in different formats and calculate future and past dates.
- cd: It is change directory command. Through this, change into a subdirectory, move back into the parent directory.

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- cd -: It is used to change directory to the home directory.
- cd .. : It is used to move to the parent directory of current directory.
- ls -lat: It shows total number of directories and files sorted from current to previous with date and time
- ls -s aaaa*: Shows how many files this aaa name have and their size.
- pwd: This command stands for print working directory. It prints the path of the working directory and starting from the root.
- chown: It is stands for change owner.
- chmod: This command is used to change the access mode of a file and directories. It is stands for change mode.
- chgrp: This command is used to changes ownership of files to specified group.
- Chmod 644 file: It means the master of the file has read and access, while the group members and other users on the system only have read access.
- Chmod g+x myfile: This command for changing myfile permissions for group execute to everyone.
- Which: It is used to look in the path environment variable to find the executable file linked to the specified command.
- rm: It is used to delete files and directories from the command line.
- rm -r mydoc: -r means recursive. This command will repeatedly remove mydoc and its content.
- cp primary secondary: This command creates a copy of the primary file and renames the new file to secondary file.
- mv file2 file1: This command means rename or move files. Whole command stands for moves the contents of file 2 to file 1 and deletes file 2.
- Wc -l myfile: wc is used to determine the number of words, bytes, characters, and newline counts in a file supplied by the file parameters. Wc -l is prints the number of lines in myfile.
- mkdir mydata: It means create a new directory names mydata at current folder.
- rmdir mydata: It stands for remove the contents of the mydata files and then deletes the empty directory.
- more, less:

    -more: It stands for show the contents of the file one screen at a time.

    -less: It is used to read one page at a time from a text file. Because it accesses files page by page rather than the entire file if they are huge, it has faster access.

- File: This command is used to recognize the format of a file. .file format may be man-readable or MIME type. This command evaluates every argument in an effort to classify it. It has 3 sets of tests as follows: 1. Filesystem test 2. Magic test 3. Language test

- stat: This command contains data about the file and filesystem. The stat command provides details about the file's size, access rights, user ID, group ID, and birth and access dates.
- df: Using the df command, we can see how much disk space is available for file systems.
- ln: This command is used to make both hard and soft links for files.
- which, whereis: The whereis command is used in the Linux operating system to locate the source/binary file of a command and documentation sections for a certain file.
- find: This command is a tool for navigating a file hierarchy on the command line. It can be used to look for files and folders and then operate on them in the future. It allows for searching by name, creation date, modification date, owner, and permissions for files and folders.
- touch: This command used to make, change and modify timestamps of a file without content.
- touch mynewfile: This command used to create mynewfile at a time.
- cp/tmp/test.txt ~/temp/: Copy the test.txt file from tmp to temporary folder.

Question 4: What is the difference between Linux kernel and GNU/Linux distribution?

Answer 4:

First, Linux is a family of free and open-source applications centered on the Linux Kernel, as opposed to GNU/Linux distribution, an operating system with a significant collection of computer software.
Second, in contrast to Linux kernel, which is an operating system based on GNU, GNU/Linux distribution is an operating system that includes a collection of software created under the GNU project.

Question 5: Name some very common Linux distributions?

Answer 5:

Ubuntu, Kali Linux, Fedora, Red Hat Enterprise Linux, Linux Mint and so on.

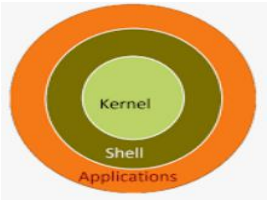
Question 6: What is GPLv2/v3 license? And BSD style license?

Answer 6:

GPL means General Public License. It is a series of broadly used free software licenses that guarantee end users the four freedoms to run, study, share and modify the software. It has 3 version. GPLv2 is an older version of GPLv3. The new GPLV3, which is twice as long as the GPLV2 was, covers topics that needed improvement and explanation in the earlier version. These include of internalization, patent indemnity, and license infringement remedies.

Open-source software that is covered by a BSD license has fewer restrictions and no restrictions on redistribution. Many freeware, shareware, and open-source programs are distributed under Berkeley Source Distribution (BSD) licenses because they have few requirements and restrictions.

Question 7: What is (operating system) shell?



Answer 7: The operating system's shell is its topmost layer. Shells use a programming language to start and manage other applications, as well as to control processes and files. The shell controls how you and the operating system interact by asking you for input, interpreting that input for the operating system, and handling any output the operating system produces as a result.

Question 8: What are case sensitive file names?

Answer8: Case sensitive means the capitalization of the file name which are uppercase and lowercase.

Question 9: Describe common purpose of files and directories in “/etc”, “/usr/bin” and “/var”

Answer 9:”/etc”: It is the brain center of the Linux system. It holds system configuration files for all installed scripts, services and third-party programs.

“/usr/bin”: It is used to contains binary files for user programs.

“/var”: It means variable files which can find the content of the files under this directory that are anticipated to increase.

Question 10: What is shell PATH? What is the difference between absolute and relative path?

Answer 10:

Shell PATH: In Linux and other Unix-like operating systems, PATH is an environmental variable that instructs the shell where to look for executable files in response to user commands. It is regarded as the single most significant environmental variable that improves both the convenience and safety of such operating systems.

An absolute path indicates a destination from the root directory, but a relative path is connected to the current directory. This is the difference between an absolute path and a relative path. Another difference between an absolute pathway begins with a delimiting character, like "/," but a relative pathway never does.

Question 11: What is the purpose of tilde character (~) for most Linux shells. For example, ls ~/

Answer 11: (~): It is a Linux “shortcut” that is used to represent the user’s home directory. Like $ echo ~

ls ~/: It means to list the contents in the users' home directory.

Question 12: How do you recognise a hidden file in any common Unix/Linux file systems?

Answer 12: The simple way to recognise a hidden file in any common Unix/Linux file systems is to use ls command with “-a” or “-A” flag that means all.

Question 13: What is the meaning of “piping data between commands”?

Answer 13: A pipe transfers the output of one command as an input to the other command. Piping is used in many Linux (Unix) based variants.

In Linux, the symbol | is used for the purpose of piping.

Example: “ls | wc -l”, ‘ls’ is used to see the contents of a directory and ‘wc’ is used to count the number of lines. Combine these two commands using a pipe. Feed the output of ls as an input to wc using a pipe.

Question 14: What are set-uid (suid) and set-gid (sgid) bits for file permissions?

Answer 14:

Set-uid (suid): Set user ID

Set-gid(sgid): Set group ID

The set-uid bit merely tells the executable to adjust its permissions to those of the owner (user who produced it) when it is run, as opposed to setting them to the user who launched it. A similar bit called set-gid accomplishes the same thing with the gid. Both files and directories are impacted by the set-gid command.

Question 15: What is a “sticky-bit”?

Answer 15:

The original purpose of the sticky bit was to "stick" the text segment of an executable program in the swap area even after the program had finished running to speed up subsequent runs of the same program. The sticky bit, though, indicates something altogether different today.

Only the file owner, directory owner, and root user can delete or rename files in a directory when the sticky bit is set. The sticky bit can be set using the command listed below**.**

Question 16: Use manual pages and explain what will command “uname -a” do?

Answer 16:

“uname -a” is a Linux command-line that shows basic system information of my Linux operating system computer.

```
ubuntu@linux128:~$ uname -a
Linux linux128 5.15.0-52-generic #58-Ubuntu SMP Thu Oct 13 08:03:55 UTC 2022 x86
_64 x86_64 x86_64 GNU/Linux
ubuntu@linux128:~$
```

Kernel name: Linux.

Host node name: Linux128

Kernel release: 5.15.0-52-generic

Kernel version and build time: #58-Ubuntu SMP Thu Oct 13 08:03:55 UTC 2022

Processor type, hardware platform and architecture of processor: x86 _64 x86_64 x86_64

Operating system name: GNU/Linux.

Question 17: Use manual pages and explain what will command “wc -l” do?

Answer 17: “wc -l” count the number of lines in a text file.

```
ubuntu@linux128:~$ wc -l test.txt
0 test.txt
```

Question 18: Linux file handling intro:

Answer 18:

•List five largest files in /usr/lib -directory:

du -sh /usr/lib/* | sort -h | tail -5

```
ubuntu@linux128:~$ du -sh /usr/lib/* | sort -h | tail -5
24M     /usr/lib/python3.10
76M     /usr/lib/python3
76M     /usr/lib/snapd
198M    /usr/lib/x86_64-linux-gnu
218M    /usr/lib/modules
ubuntu@linux128:~$
```

•Find out what is the group for /bin/ls file?

```
ubuntu@linux128:~$ ls -l /bin/ls
-rwxr-xr-x 1 root root 138208 Feb  7  2022 /bin/ls
ubuntu@linux128:~$
```

Owner: root; Group: root

- How do you change file or directory owner and group?

```
ubuntu@linux128:~$ ls -la test.txt
-rw-rw-r-- 1 root ubuntu 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$ sudo chown ubuntu test.txt
ubuntu@linux128:~$ ls -la test.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$ sudo chgrp root test.txt
ubuntu@linux128:~$ ls -la test.txt
-rw-rw-r-- 1 ubuntu root 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$
```

- How do you change file permissions so that file user has all rights (read, write and execute), group and others have none?

```
ubuntu@linux128:~$ ls -la test.txt
-rw-rw-r-- 1 ubuntu root 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$ chmod 700 test.txt
ubuntu@linux128:~$ ls -la test.txt
-rwx------ 1 ubuntu root 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$
```

- How do you change file permissions so that file user has read and write access (no execute), group and others have read access?

```
ubuntu@linux128:~$ chmod 644 test.txt
ubuntu@linux128:~$ ls -la test.txt
-rw-r--r-- 1 ubuntu root 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$
```

- How do you change file permissions so that file user, group and others have only read and execute (no write) access?

```
ubuntu@linux128:~$ chmod 555 test.txt
ubuntu@linux128:~$ ls -la test.txt
-r-xr-xr-x 1 ubuntu root 0 Nov 17 23:41 test.txt
ubuntu@linux128:~$
```

- Describe following file permissions and ownership:
  drwxr-x--- 2 teemu root 4096 Jul 2 2002 webalizer

  User: Read, Write and Execute permissions

  Group: Read and Execute permissions

  Others: none.

  Owner: teemu.

- Create directory “exercise1” under you home directory

```
ubuntu@linux128:~$ mkdir exercise1
ubuntu@linux128:~$ ls
exercise1
ubuntu@linux128:~$
```

- Create empty file (length 0 bytes) “qwerty.txt” to that directory

```
ubuntu@linux128:~$ cd exercise1
ubuntu@linux128:~/exercise1$ touch qwerty.txt
ubuntu@linux128:~/exercise1$ ls -la qwerty.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Nov 20 21:27 qwerty.txt
ubuntu@linux128:~/exercise1$
```

- Change directory name “exercise1” to “exer2”?

```
ubuntu@linux128:~$ ls
exercise1
ubuntu@linux128:~$ mv exercise1 exer2
ubuntu@linux128:~$ ls
exer2
ubuntu@linux128:~$
```

- Change file qwerty.txt file permissions so that only you have just a read access to it and nothing else

```
ubuntu@linux128:~$ cd exer2/
ubuntu@linux128:~/exer2$ ls -la qwerty.txt
-rw-rw-r-- 1 ubuntu ubuntu 0 Nov 20 21:27 qwerty.txt
ubuntu@linux128:~/exer2$ chmod 464 qwerty.txt
ubuntu@linux128:~/exer2$ ls -la qwerty.txt
-r--rw-r-- 1 ubuntu ubuntu 0 Nov 20 21:27 qwerty.txt
ubuntu@linux128:~/exer2$
```

- Create symbolic link to you home directory “this_is_my_link” and make it point to the exer2-directory

```
ubuntu@linux128:~/exer2$ cd
ubuntu@linux128:~$ ln -s exer2 This_is_my_link
ubuntu@linux128:~$ ls -la
total 40
drwxr-x--- 5 ubuntu ubuntu 4096 Nov 20 21:36 .
drwxr-xr-x 3 root   root   4096 Oct 24 08:17 ..
-rw------- 1 ubuntu ubuntu  436 Nov 20 20:15 .bash_history
-rw-r--r-- 1 ubuntu ubuntu  220 Jan  6  2022 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Jan  6  2022 .bashrc
drwx------ 2 ubuntu ubuntu 4096 Nov 14 10:19 .cache
-rw------- 1 ubuntu ubuntu   20 Nov 16 01:04 .lesshsQ
-rw-r--r-- 1 ubuntu ubuntu  807 Jan  6  2022 .profile
drwx------ 2 ubuntu ubuntu 4096 Oct 24 08:17 .ssh
-rw-r--r-- 1 ubuntu ubuntu    0 Nov 20 04:26 .sudo_as_admin_successful
lrwxrwxrwx 1 ubuntu ubuntu    5 Nov 20 21:36 This_is_my_link -> exer2
drwxrwxr-x 2 ubuntu ubuntu 4096 Nov 20 21:27 exer2
ubuntu@linux128:~$
```

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- How can you find out your current directory location and path? How far (in directories) are you from file system root?

  Using pwd

```
ubuntu@linux128:~$ pwd
/home/ubuntu
ubuntu@linux128:~$
```

  Far (in directories) from file system root: /home/ubuntu

Question 19: Remove files and directories which I created on this exercise.

Answer 19:

```
ubuntu@linux128:~$ ls
This_is_my_link  exer2
ubuntu@linux128:~$ rm -r
rm: missing operand
Try 'rm --help' for more information.
ubuntu@linux128:~$ rm -r This_is_my_link
ubuntu@linux128:~$ rm -r exer2
rm: remove write-protected regular empty file 'exer2/qwerty.txt'? y
ubuntu@linux128:~$ ls
ubuntu@linux128:~$
```

Week 2

Question 20: Watch some live coding Twitch streams, select one and answer:

- What is the programming language/languages used?

  Python

- Which programming libraries and frameworks are being used?

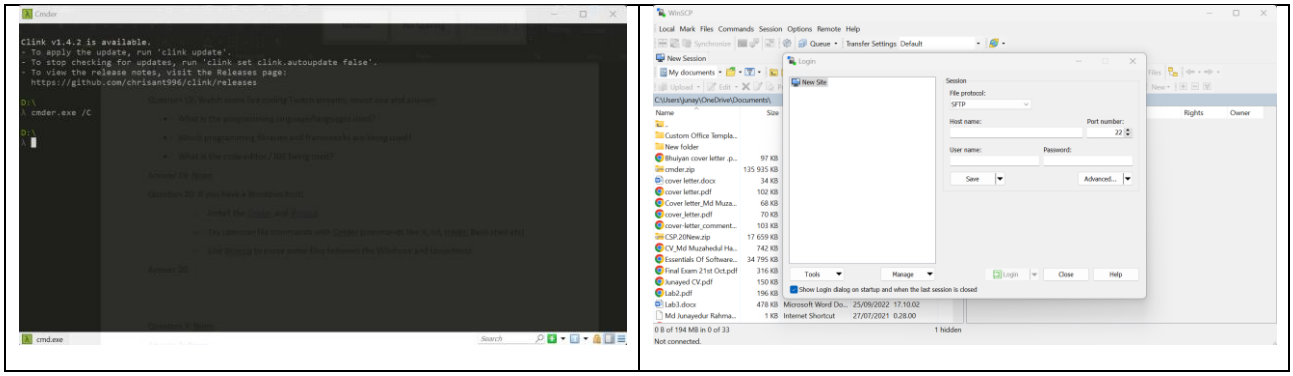
  React Native

- What is the code editor / IDE being used?

  VIM

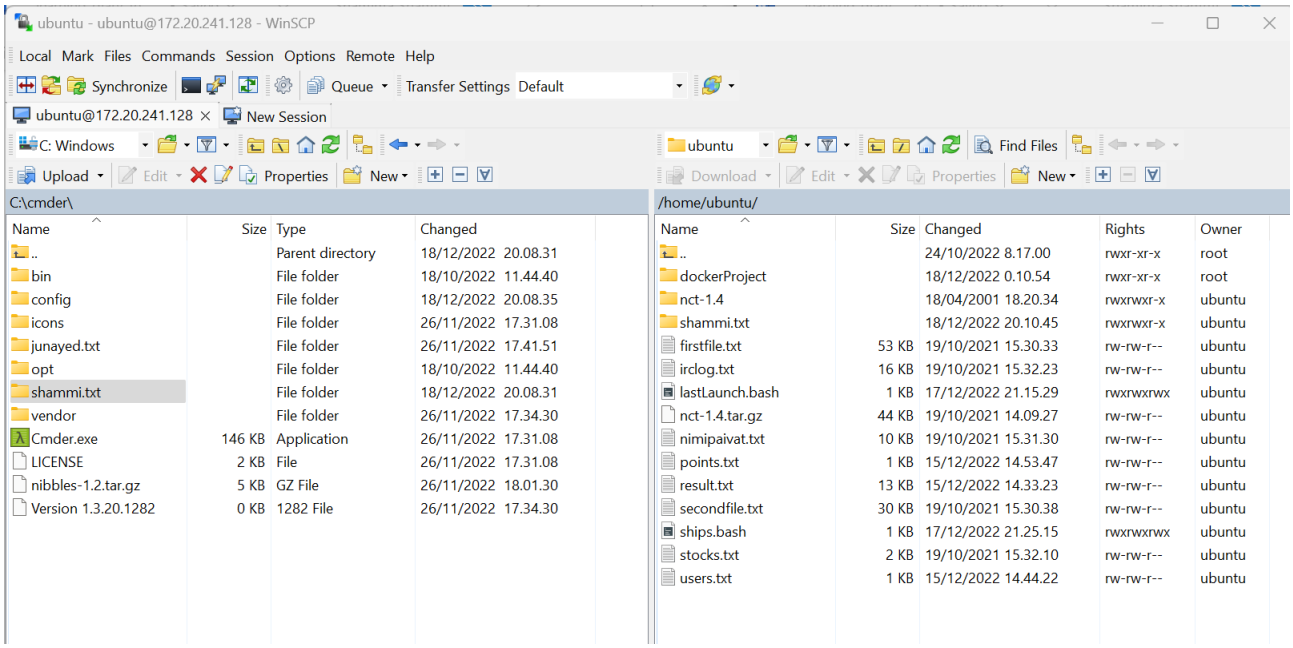
Question 21: If you have a Windows host:

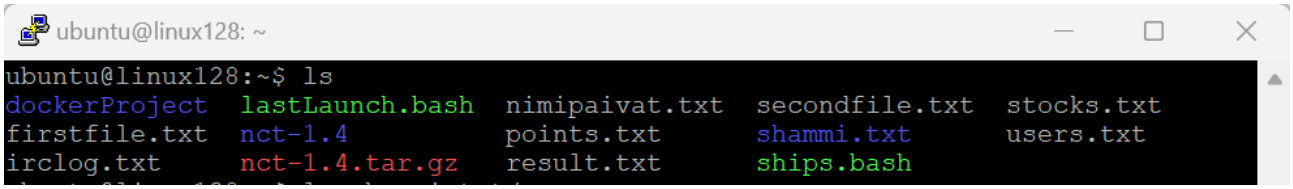
- Install the Cmder and Winscp



- Try common file commands with Cmder (commands like ls, cd, mkdir, Bash shell etc)

- Use Winscp to move some files between the Windows and Linux hosts





Question 22: Study and explain shortly following commands and concepts:

- zip, unzip
- tar
- gzip
- xz
- zcat, zgrep
- compress
- bzip2
- 7z
- ldd
- gnu gcc / g++

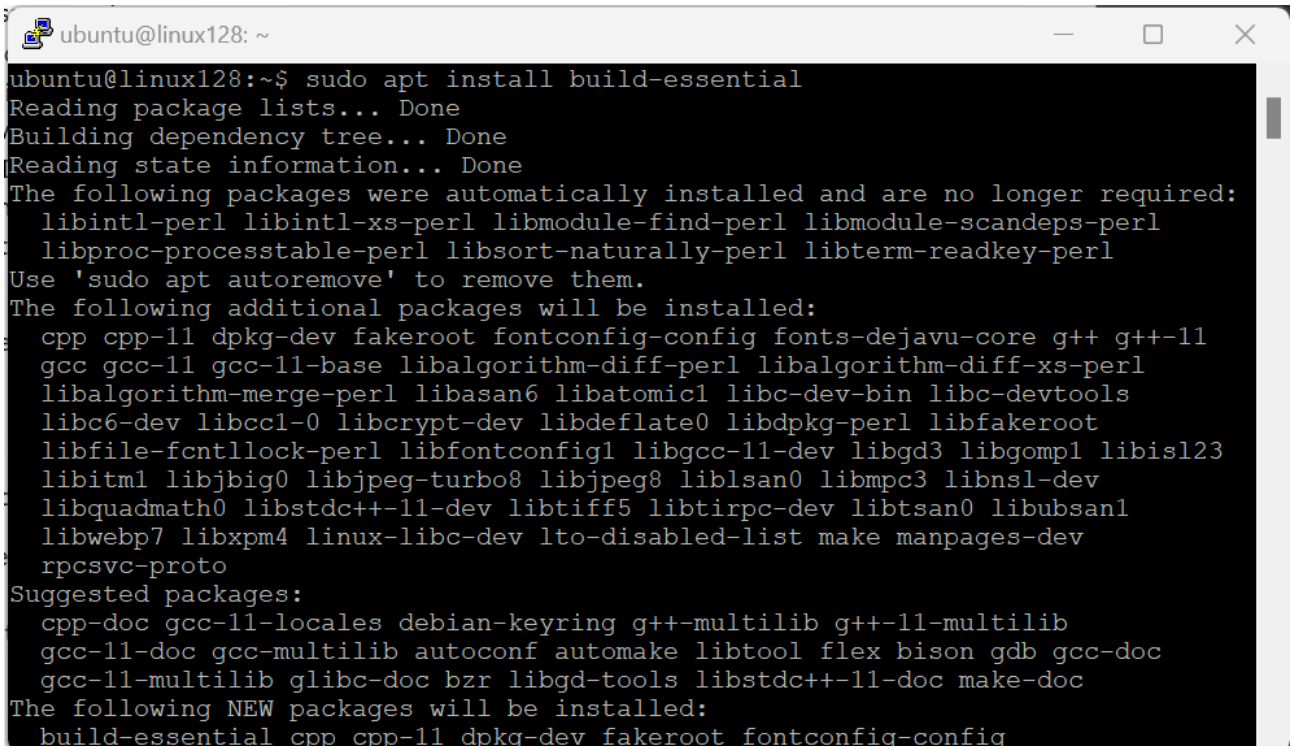
Answer 22:

- **Zip:** Zip is used to compress the files to reduce file size and used as file package utility. zip is available in many operating systems like unix, linux, windows etc.
- **Unzip:** Unzip will list, test, or extract files from a ZIP archive, commonly found on Unix systems

- **Tar:** The most popular archiving tool in Linux systems is the tar command, which stands for Tape Archiver. The tar command can be used to create, extract, and list archive contents straight from the terminal.
- **Gzip:** This command is used for compresses files.
- **Xz:** This command starts the x server and show server that runs on bitmapped terminals. [-a: Number], [-c: Volume], [-co: File] and so on.
- **zcat, zgrep:** zcat command is used for allows the user to expand and view a compressed file without uncompressing it.
  Zgrep command is used to find the contents of a compressed file without uncompressing it.
- **Compress:** This is same as zip.
- **Bzip2:** It is use for compress and decompress the file in Linux system.
- **7z:** Data compression, encryption, and pre-processing methods are all supported by the compressed archive file format 7z.
- **Ldd:** List Dynamic Dependencies prints the shared libraries required by each program or shared object specified on the command line.
- **Gnu gcc / g++:** It stands for gnu compiler collection which is used to compile c and c++ language (binary file).

Question 23: Install build-essential meta package (containing development tools) to your server with: *sudo apt install build-essential.*

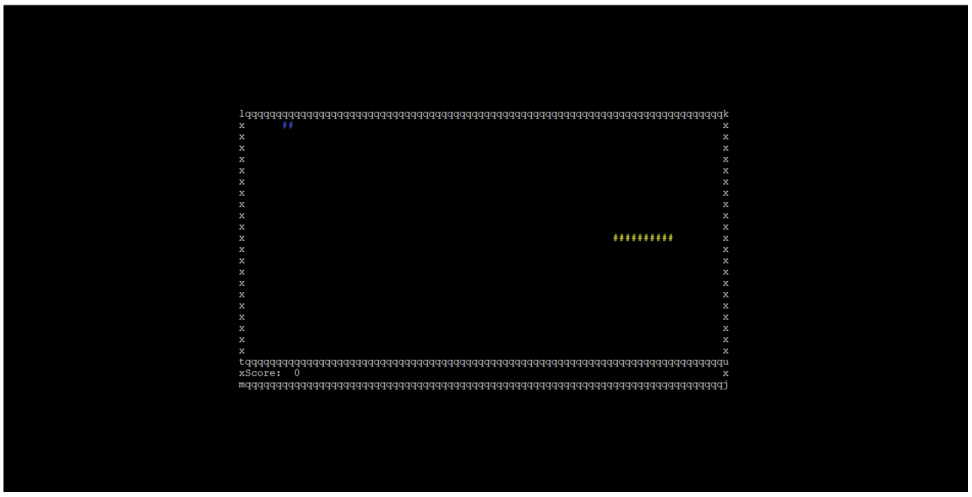
Answer 23:



Question 24: Get the source code for curses-based (“text-graphics”) worm game nibbles-1.2.tar.gz

Unpack the source package to a some temporary directory under your home directory
Compile the game and try playing it. Note: Ubuntu does not have ncursed development libraries installed by default. Use apt install to install the missing library dependencies: *sudo apt install libncurses-dev*

Answer 24:

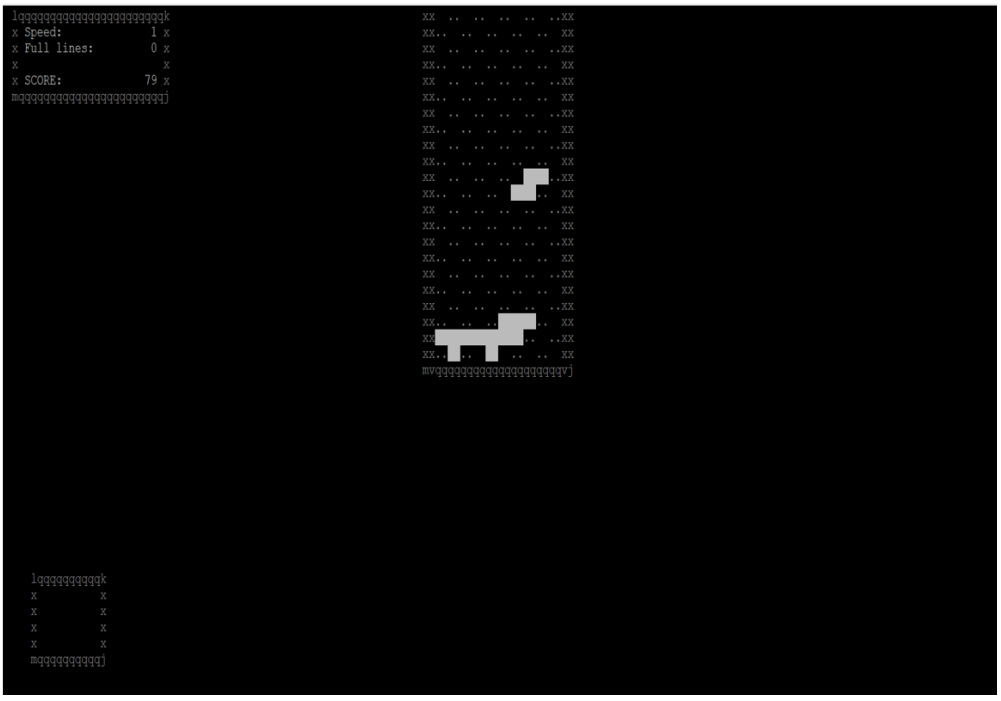


Question25: Get the source code for another curses-based (“text-graphics”) Tetris game nct-1.4.tar.gz

Unpack source package to temporary directory in your home directory.

Use source package’s configure script to generate Makefile with installation prefix pointing to your home directory. Compile source code and install compiled files. Test if game works. Remove temporary game directory

Answer 25:



Question 26: Download the file harj_zip_paketti.zip. Zip-package has following hierarchy:

```
paahakemisto
        hakemisto_a
                karate_kat.jpg
                lazy.jpg

        hakemisto_b
                etherkill.jpg

        jap-inv3.jpg
        tekstia.txt
```

Answer 26:

```
ubuntu@linux128: ~
ubuntu@linux128:~$ wget https://tl.oamk.fi/cdos/dl/harj_zip_paketti.zip
--2022-12-11 18:37:35--  https://tl.oamk.fi/cdos/dl/harj_zip_paketti.zip
Resolving tl.oamk.fi (tl.oamk.fi)... 193.167.100.28
Connecting to tl.oamk.fi (tl.oamk.fi)|193.167.100.28|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 269942 (264K) [application/zip]
Saving to: 'harj_zip_paketti.zip'

harj_zip_paketti.zi 100%[===================>] 263.62K  --.-KB/s    in 0.004s

2022-12-11 18:37:35 (59.6 MB/s) - 'harj_zip_paketti.zip' saved [269942/269942]

ubuntu@linux128:~$ ls
harj_zip_paketti.zip  junayed.txt  nibbles-1.2          test.txt
jubayer.txt           kkk.txt      nibbles-1.2.tar.gz
ubuntu@linux128:~$ unzip harj_zip_paketti.zip
Archive:  harj_zip_paketti.zip
   creating: paahakemisto/
   creating: paahakemisto/hakemisto_a/
  inflating: paahakemisto/hakemisto_a/karate_kat.jpg
  inflating: paahakemisto/hakemisto_a/lazy.jpg
   creating: paahakemisto/hakemisto_b/
  inflating: paahakemisto/hakemisto_b/etherkill.jpg
  inflating: paahakemisto/jap-inv3.jpg
  inflating: paahakemisto/tekstia.txt
ubuntu@linux128:~$
```

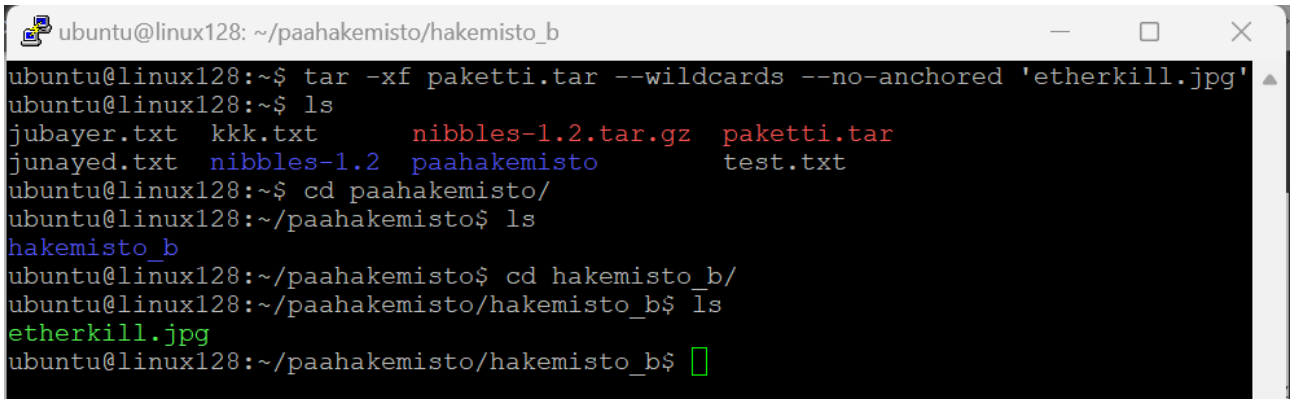
Question 27 & Answer 27:

With the ZIP file:

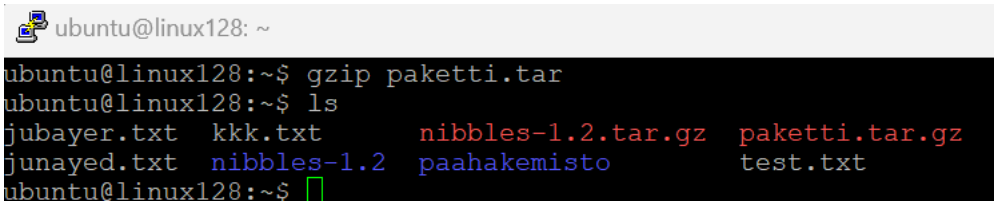
Unpack package and all subdirectories to a temporary directory in your home directory. Create tar archive from unpacked files and directories and name it to a paketti.tar. List contents of the paketti.tar. If everything is correct, delete paahakemisto directory and all subdirectories under it. Delete also the harj_zip_paketti.zip file. Don't delete the paketti.tar -file you just created.

```
ubuntu@linux128: ~
ubuntu@linux128:~$ ls
harj_zip_paketti.zip  junayed.txt  nibbles-1.2         paahakemisto
jubayer.txt           kkk.txt      nibbles-1.2.tar.gz  test.txt
ubuntu@linux128:~$ tar -cf paketti.tar paahakemisto
ubuntu@linux128:~$ ls
harj_zip_paketti.zip  junayed.txt  nibbles-1.2         paahakemisto  test.txt
jubayer.txt           kkk.txt      nibbles-1.2.tar.gz  paketti.tar
ubuntu@linux128:~$ tar -tvf paketti.tar
drwxr-xr-x ubuntu/ubuntu     0 2004-11-21 09:07 paahakemisto/
-rw-rw-r-- ubuntu/ubuntu 154458 2004-11-21 09:07 paahakemisto/tekstia.txt
-rwxr--r-- ubuntu/ubuntu  29991 2004-02-12 11:34 paahakemisto/jap-inv3.jpg
drwxr-xr-x ubuntu/ubuntu      0 2004-02-12 11:36 paahakemisto/hakemisto_b/
-rwxr--r-- ubuntu/ubuntu  95051 2004-02-12 11:35 paahakemisto/hakemisto_b/etherk
ill.jpg
drwxr-xr-x ubuntu/ubuntu      0 2004-02-12 11:36 paahakemisto/hakemisto_a/
-rwxr--r-- ubuntu/ubuntu  30036 2004-02-12 11:34 paahakemisto/hakemisto_a/karate
_kat.jpg
-rwxr--r-- ubuntu/ubuntu  68409 2004-02-12 11:34 paahakemisto/hakemisto_a/lazy.j
pg
ubuntu@linux128:~$ rm paahakemisto harj_zip_paketti.zip
rm: cannot remove 'paahakemisto': Is a directory
ubuntu@linux128:~$ rm -r paahakemisto
ubuntu@linux128:~$ ls
jubayer.txt  kkk.txt      nibbles-1.2.tar.gz  test.txt
junayed.txt  nibbles-1.2  paketti.tar
ubuntu@linux128:~$
```

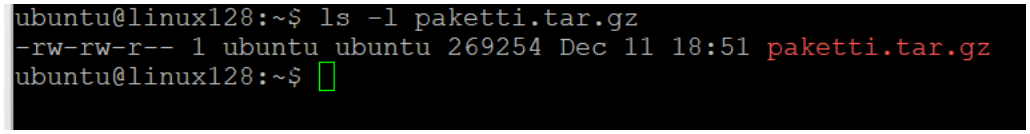
Unpack only the etherkill.jpg file from tar archive.



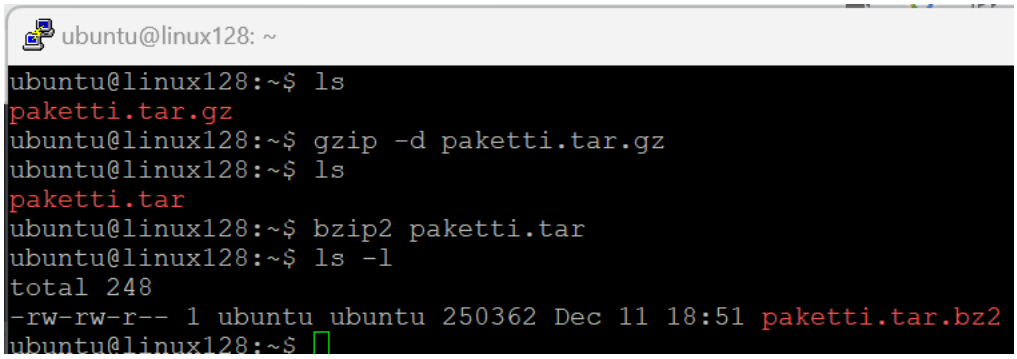
Compress paketti.tar archive with a gzip command.

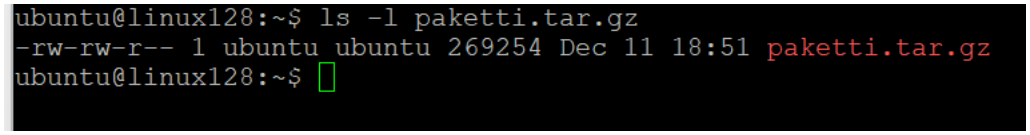


What is the size of paketti.tar.gz now?



Uncompress paketti.tar.gz and compress it again, but now with bzip2. Check the size again. Any difference?





Create some gzipped tar archive and use SSH (scp) to copy it to the students.oamk.fi (students.oamk.fi is a Linux server you can use with your Oamk user account credentials)

```
t2shsh00@students: ~
ubuntu@linux128:~$ mkdir testFile
ubuntu@linux128:~$ tar -czvf testFile.tar.gz testFile
testFile/
ubuntu@linux128:~$ ls
dockerProject    nct-1.4         result.txt      stocks.txt
firstfile.txt    nct-1.4.tar.gz  secondfile.txt  testFile
irclog.txt       nimipaivat.txt  shammi.txt      testFile.tar.gz
lastLaunch.bash  points.txt      ships.bash      users.txt
ubuntu@linux128:~$ scp testFile.tar.gz t2shsh00@students.oamk.fi:
The authenticity of host 'students.oamk.fi (193.167.100.97)' can't be establishe
d.
ECDSA key fingerprint is SHA256:zQawTZRwOPe+A8skvMxhNVBHfgRppVGVvs05vB1TS3c.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'students.oamk.fi' (ECDSA) to the list of known hosts
.
t2shsh00@students.oamk.fi's password:
testFile.tar.gz                               100%  117    17.2KB/s   00:00
ubuntu@linux128:~$ ssh t2shsh00@students.oamk.fi
t2shsh00@students.oamk.fi's password:
Linux students 4.19.0-6-amd64 #1 SMP Debian 4.19.67-2+deb10u2 (2019-11-11) x86_6
4

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

--

Kysymykset, purnaukset ja ehdotukset osoitteeseen helpdesk@oamk.fi

--
t2shsh00@students:~$ ls
testFile.tar.gz
t2shsh00@students:~$
```

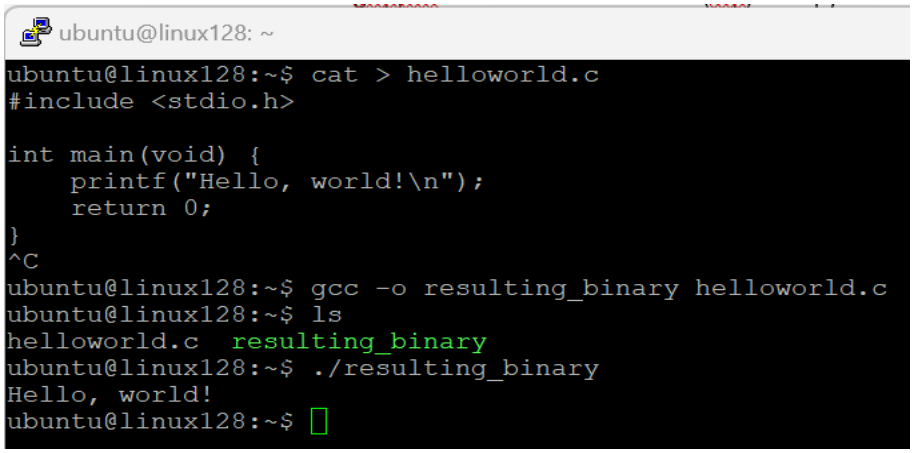
Delete temporary files and directories created on this practice

```
ubuntu@linux128: ~
ubuntu@linux128:~$ ls
paketti.tar.bz2
ubuntu@linux128:~$ rm paketti.tar.bz2
ubuntu@linux128:~$ ls
ubuntu@linux128:~$
```

Question 28: Compile this C source code with gcc and check if it works. helloworld.c source code:

```c
#include <stdio.h>

int main(void) {
    printf("Hello, world!\n");
    return 0;
}
```

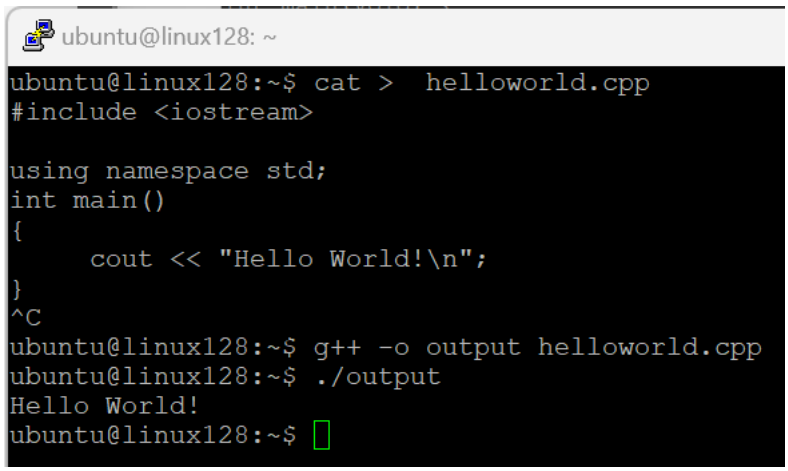
Answer 28:



Question 29: Compile this C++ source code with g++ and test it. helloworld.cpp source code:

```cpp
#include <iostream>

using namespace std;
int main()
{
     cout << "Hello World!\n";
}
```

Answer 29:

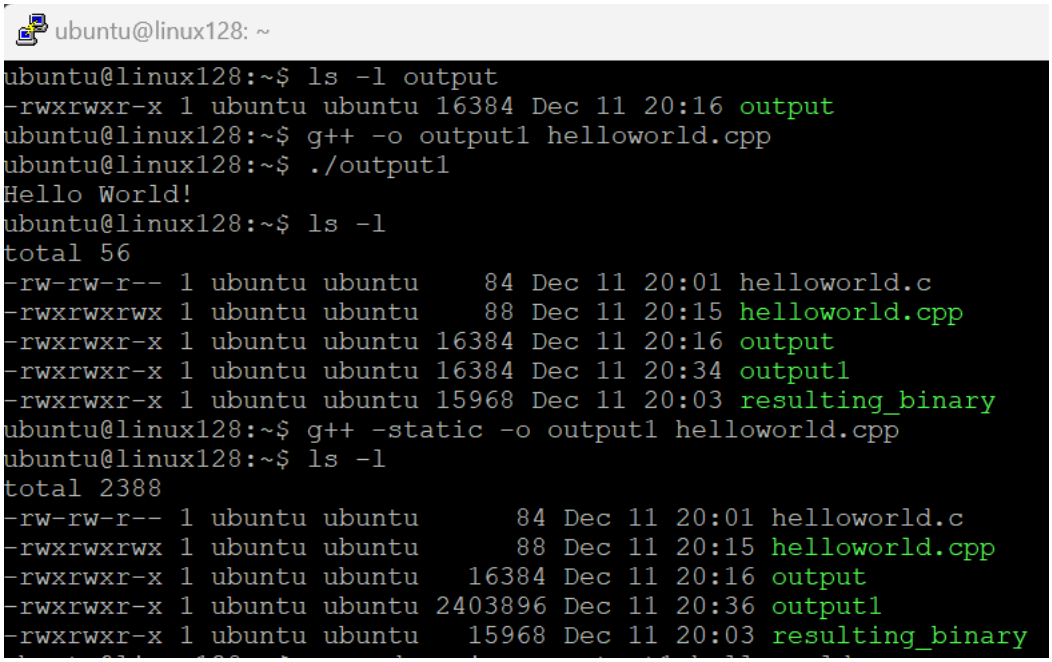


Question 30: With previously compiled helloworld C++ binary:

- What are statically linked libraries? Why would you use them?

Answer: A static library, often known as a statically linked library, is a collection of functions that are resolved at build time and copied by a compiler into a target application. A static library, often known as a statically linked library, is a collection of functions that are resolved at build time and copied by a compiler into a target application.

- Inspect the size of ready binary file (that compiled helloworld binary). Compile it again and use some different output filename. With g++, use now statically linked libraries (with compiler's -static parameter). Compare the file sizes of statically and dynamically linked binaries



- Use strace to inspect interiors (system calls) of ls command: "strace ls" and compare the output to a "strace chmod". Check _exit -values. Why chmod returns 1 and ls returns 0?

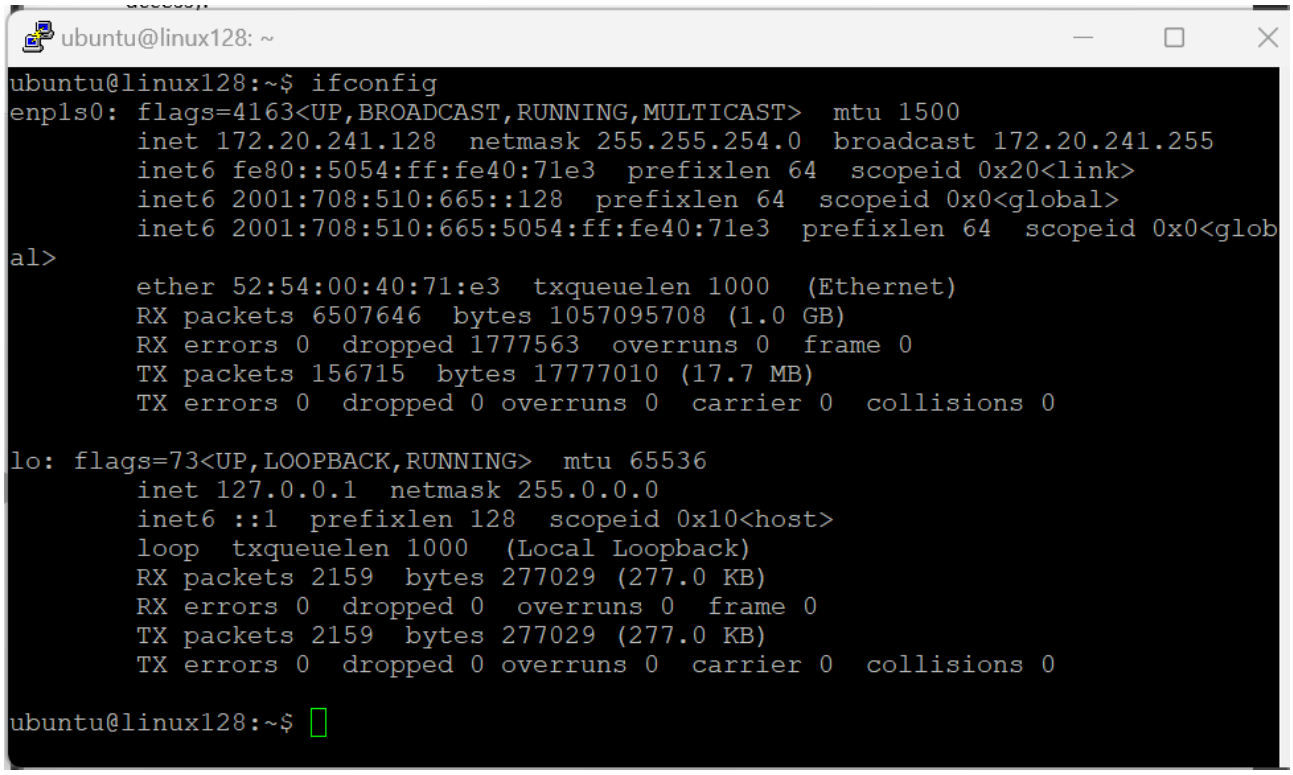
"strace ls " command doesnot required any parameters. But strace chmod require parameters. Without any parameter chmod doednot give correct output, thats is why it gives exit value = 1.

- Why and when Unix administrators and programmers use system call tracing programs and debuggers such as gdb and strace?

To see low level what happen in system because in the application has some errors, but user cannot see. Or library miss … etc.

Question 31: Solve these service management assignments (Note: most assignments will require root access):

- Check what network adapters your Linux host/server has with command: ip addr or ifconfig (ifconfig is not necessary installed by default)



- Listen inbound ICMP traffic in your server with tcpdump command line protocol analyzer and test if you can see the traffic when you ping your server: tcpdump -n -i YOUR_NETWORK_ADAPTER_NAME_HERE icmp

```
ubuntu@linux128:~$ sudo tcpdump -n -i enp1s0 icmp
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on enp1s0, link-type EN10MB (Ethernet), snapshot length 262144 bytes
20:49:18.771787 IP 10.2.124.81 > 172.20.241.128: ICMP echo request, id 1, seq 17
, length 40
20:49:18.771956 IP 172.20.241.128 > 10.2.124.81: ICMP echo reply, id 1, seq 17,
length 40
20:49:19.755588 IP 10.2.124.81 > 172.20.241.128: ICMP echo request, id 1, seq 18
, length 40
20:49:19.755617 IP 172.20.241.128 > 10.2.124.81: ICMP echo reply, id 1, seq 18,
length 40
20:49:20.825794 IP 10.2.124.81 > 172.20.241.128: ICMP echo request, id 1, seq 19
, length 40
20:49:20.825825 IP 172.20.241.128 > 10.2.124.81: ICMP echo reply, id 1, seq 19,
length 40
20:49:21.873224 IP 10.2.124.81 > 172.20.241.128: ICMP echo request, id 1, seq 20
, length 40
20:49:21.873259 IP 172.20.241.128 > 10.2.124.81: ICMP echo reply, id 1, seq 20,
length 40
^C
8 packets captured
8 packets received by filter
0 packets dropped by kernel
ubuntu@linux128:~$
```

- Install apache web server with apt install apache2 and test that you can access your server with a web browser

This is my profile.

- Listen TCP/80 (web) traffic in your server with tcpdump and test if you can see the inbound TCP SYN segments after you try to access your server with a web browser: tcpdump -n -i YOUR_NETWORK_ADAPTER_NAME_HERE tcp port 80

```
ubuntu@linux128:~$ sudo tcpdump -n -i enp1s0 tcp port 80
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on enp1s0, link-type EN10MB (Ethernet), snapshot length 262144 bytes
21:08:51.416142 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [S], seq 3886203
723, win 64240, options [mss 1286,nop,wscale 8,nop,nop,sackOK], length 0
21:08:51.416260 IP 172.20.241.128.80 > 10.2.124.81.61201: Flags [S.], seq 210863
4157, ack 3886203724, win 64240, options [mss 1460,nop,nop,sackOK,nop,wscale 7],
 length 0
21:08:51.438732 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [.], ack 1, win
1024, length 0
21:08:51.438993 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [P.], seq 1:543,
 ack 1, win 1024, length 542: HTTP: GET /test.html HTTP/1.1
21:08:51.439048 IP 172.20.241.128.80 > 10.2.124.81.61201: Flags [.], ack 543, wi
n 501, length 0
21:08:51.440418 IP 172.20.241.128.80 > 10.2.124.81.61201: Flags [P.], seq 1:450,
 ack 543, win 501, length 449: HTTP: HTTP/1.1 200 OK
21:08:51.514668 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [.], ack 450, wi
n 1023, length 0
21:08:56.445901 IP 172.20.241.128.80 > 10.2.124.81.61201: Flags [F.], seq 450, a
ck 543, win 501, length 0
21:08:56.528446 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [.], ack 451, wi
n 1023, length 0
21:09:41.674062 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [.], seq 542:543, ack 451, win 1023, length 1: HTTP
21:09:41.674102 IP 172.20.241.128.80 > 10.2.124.81.61201: Flags [.], ack 543, win 501, length 0
21:10:27.162416 IP 10.2.124.81.61201 > 172.20.241.128.80: Flags [.], seq 542:543, ack 451, win 1023, length 1: HTTP
21:10:27.162503 IP 172.20.241.128.80 > 10.2.124.81.61201: Flags [R], seq 2108634608, win 0, length 0
^C
13 packets captured
13 packets received by filter
0 packets dropped by kernel
ubuntu@linux128:~$
```

- Explain what is runlevel?

Answer: A runlevel is one of the modes that a Unix-based, dedicated server or a VPS server OS will run on. Each runlevel has a certain number of services stopped or started, giving the user control over the behaviour of the machine. Conventionally, seven runlevels exist, number from zero to six.

- Explain what is systemd

Answer: Systemd is contentious for several reasons, including the fact that it replaces something that many Linux users do not believe needs to be replaced and the creators' antics, which have not been well received. Contrarily, as shown in this well-known LKML thread where Linus Torvalds expelled systemd developer Kay Sievers from the Linux kernel, this is the case.

- Explain what are the files in /etc/init.d/ directory?

init.d is the sub-directory of /etc directory in Linux file system. init.d basically contains the bunch of start/stop scripts which are used to control (start,stop,reload,restart) the daemon while the system is running or during boot. If you look at /etc/init.d then you will notice all the scripts for different services of your system.

The scripts within the directory varies as per the applications installed in your system. In server system you'll find many network related scripts while in desktop there will be the only basic ones like 'networking'.

```
ubuntu@linux128:~$ ls -la /etc/init.d
total 140
drwxr-xr-x  2 root root 4096 Dec 11 20:55 .
drwxr-xr-x 98 root root 4096 Dec 11 20:55 ..
-rwxr-xr-x  1 root root 2489 Sep  8 06:07 apache-htcacheclean
-rwxr-xr-x  1 root root 8181 Sep  8 06:07 apache2
-rwxr-xr-x  1 root root 3740 Feb 23  2022 apparmor
-rwxr-xr-x  1 root root 2915 May 10  2022 apport
-rwxr-xr-x  1 root root 1232 Nov 22  2021 console-setup.sh
-rwxr-xr-x  1 root root 3062 Mar 18  2021 cron
-rwxr-xr-x  1 root root  937 Jan 13  2022 cryptdisks
-rwxr-xr-x  1 root root  896 Jan 13  2022 cryptdisks-early
-rwxr-xr-x  1 root root 3152 Jun 28  2021 dbus
-rwxr-xr-x  1 root root  985 Apr 16  2022 grub-common
-rwxr-xr-x  1 root root 1748 Feb 21  2022 hwclock.sh
-rwxr-xr-x  1 root root 2638 Oct 30  2021 irqbalance
-rwxr-xr-x  1 root root 1503 Jan 19  2022 iscsid
-rwxr-xr-x  1 root root 1479 Jul 24  2021 keyboard-setup.sh
-rwxr-xr-x  1 root root 2044 Jan  8  2021 kmod
-rwxr-xr-x  1 root root  695 May 19  2021 lvm2
-rwxr-xr-x  1 root root  586 May 19  2021 lvm2-lvmpolld
-rwxr-xr-x  1 root root 2827 Feb 18  2022 multipath-tools
-rwxr-xr-x  1 root root 2433 Jan 19  2022 open-iscsi
-rwxr-xr-x  1 root root 1846 Jan  4  2022 open-vm-tools
-rwxr-xr-x  1 root root 1386 Feb 23  2022 plymouth
-rwxr-xr-x  1 root root  760 Feb 23  2022 plymouth-log
-rwxr-xr-x  1 root root  959 Feb 25  2022 procps
-rwxr-xr-x  1 root root 4417 Nov  2  2021 rsync
-rwxr-xr-x  1 root root 1222 Feb 18  2021 screen-cleanup
-rwxr-xr-x  1 root root 4060 Feb 26  2022 ssh
-rwxr-xr-x  1 root root 6871 Mar  8  2022 udev
-rwxr-xr-x  1 root root 2083 Sep 19  2021 ufw
-rwxr-xr-x  1 root root 1391 Feb 19  2021 unattended-upgrades
-rwxr-xr-x  1 root root 1306 Feb 21  2022 uuidd
ubuntu@linux128:~$
```

Question 32: Test these service management commands with your web server and use web browser to verify the operation whether the server is running or not:

```
Somewhat bad or at least old way of some or older distros:

service apache2 stop
service apache2 start
service apache2 restart
```

Answer 32:

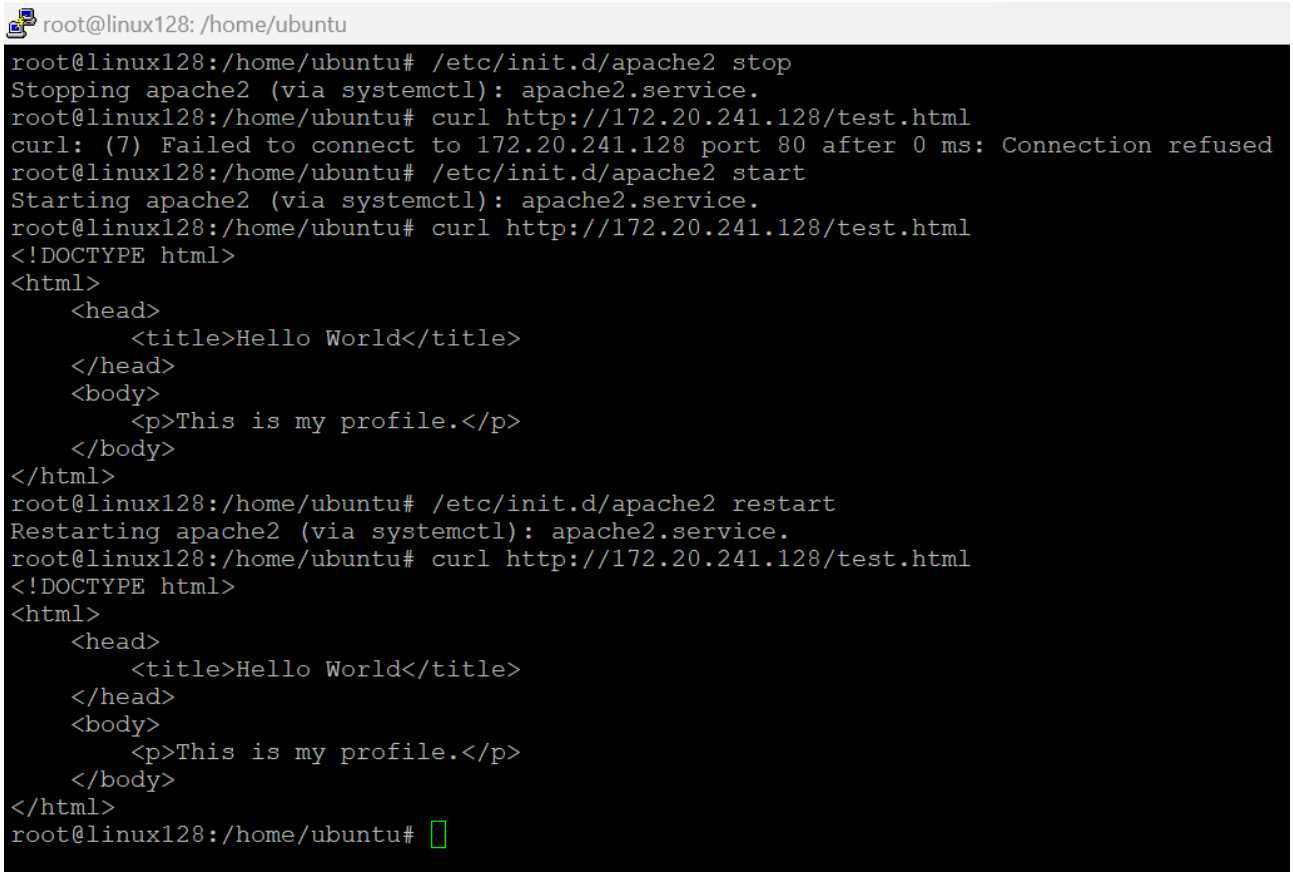
root@linux128: /home/ubuntu

```
root@linux128:/home/ubuntu# service apache2 stop
root@linux128:/home/ubuntu# curl http://172.20.241.128/test.html
curl: (7) Failed to connect to 172.20.241.128 port 80 after 0 ms: Connection ref
used
root@linux128:/home/ubuntu# service apache2 start
root@linux128:/home/ubuntu# curl http://172.20.241.128/test.html
<!DOCTYPE html>
<html>
    <head>
        <title>Hello World</title>
    </head>
    <body>
        <p>This is my profile.</p>
    </body>
</html>
root@linux128:/home/ubuntu# service apache2 restart
root@linux128:/home/ubuntu# curl http://172.20.241.128/test.html
<!DOCTYPE html>
<html>
    <head>
        <title>Hello World</title>
    </head>
    <body>
        <p>This is my profile.</p>
    </body>
</html>
root@linux128:/home/ubuntu#
```

Question 33: Test these service management commands with your web server and use web browser to verify the operation whether the server is running or not:

```
Generic System V style, also old school:

/etc/init.d/apache2 stop
/etc/init.d/apache2 start
/etc/init.d/apache2 restart
```

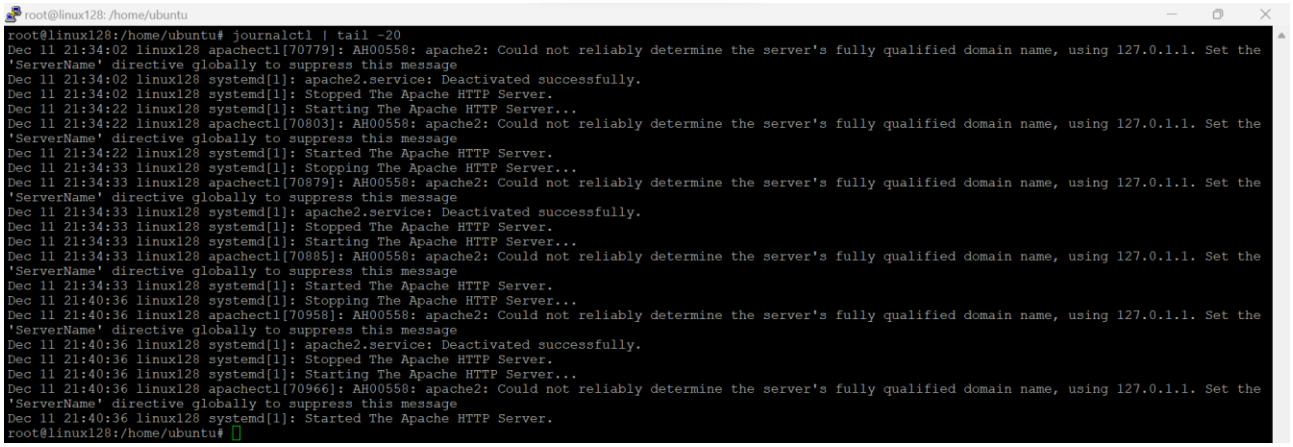
Answer 33:

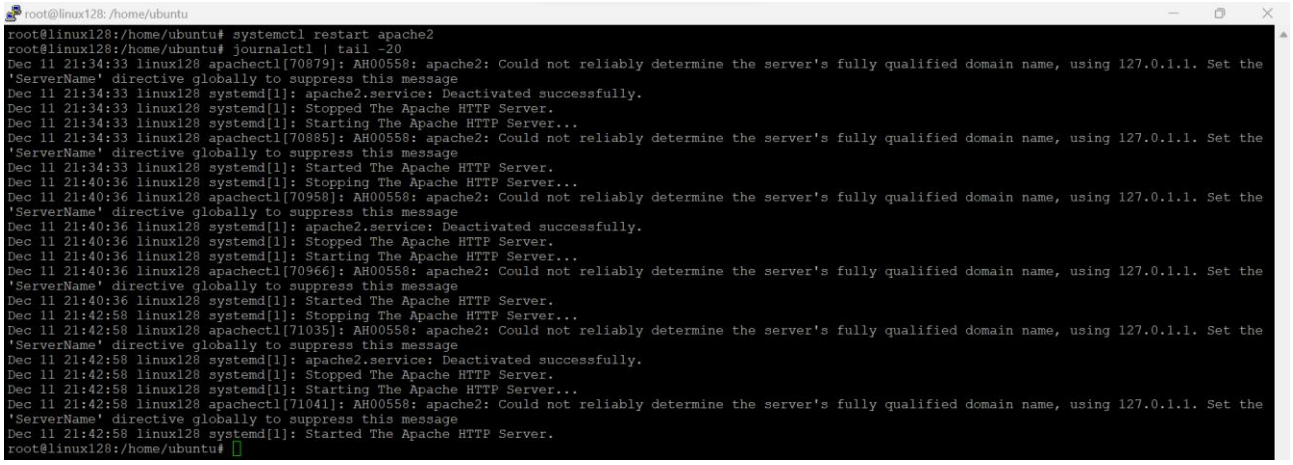


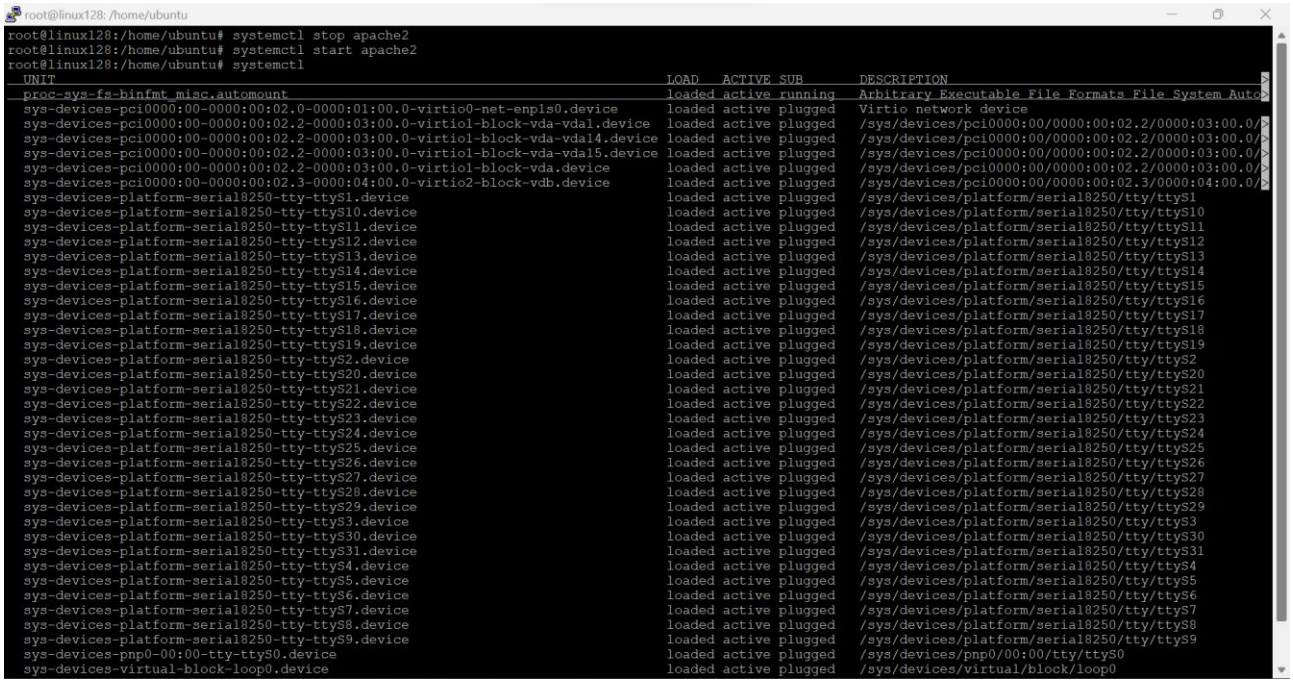
Question 34: Test these service management commands with your web server and use web browser to verify the operation whether the server is running or not. Try and explain:

```
Modern way for distros using systemd:

journalctl | tail -20
systemctl restart apache2
journalctl | tail -20
systemctl stop apache2
systemctl start apache2
systemctl
```

Answer 34:

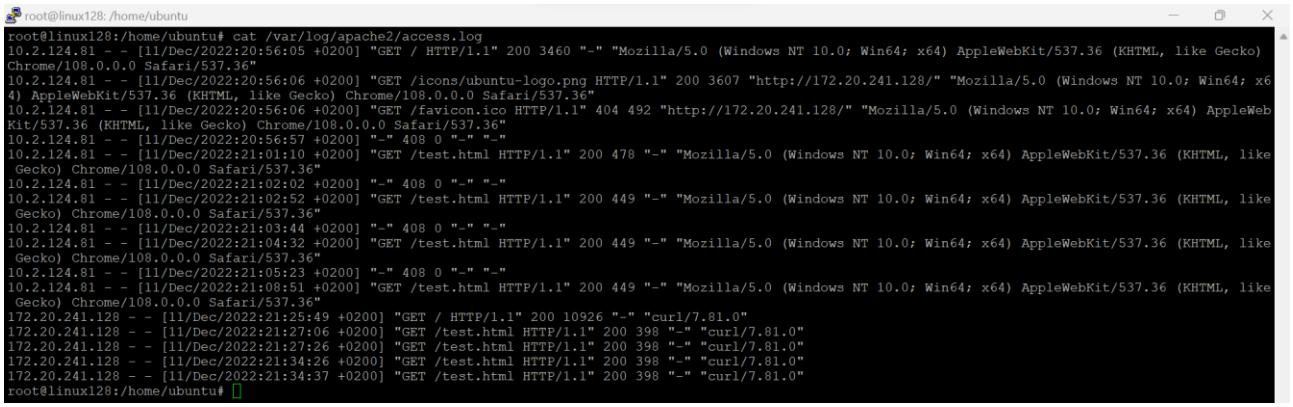

root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# journalctl | tail -20
Dec 11 21:34:02 linux128 apachectl[70779]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:34:02 linux128 systemd[1]: apache2.service: Deactivated successfully.
Dec 11 21:34:02 linux128 systemd[1]: Stopped The Apache HTTP Server.
Dec 11 21:34:22 linux128 systemd[1]: Starting The Apache HTTP Server...
Dec 11 21:34:22 linux128 apachectl[70803]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:34:22 linux128 systemd[1]: Started The Apache HTTP Server.
Dec 11 21:34:33 linux128 systemd[1]: Stopping The Apache HTTP Server...
Dec 11 21:34:33 linux128 apachectl[70879]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:34:33 linux128 systemd[1]: apache2.service: Deactivated successfully.
Dec 11 21:34:33 linux128 systemd[1]: Stopped The Apache HTTP Server.
Dec 11 21:34:33 linux128 systemd[1]: Starting The Apache HTTP Server...
Dec 11 21:34:33 linux128 apachectl[70885]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:34:33 linux128 systemd[1]: Started The Apache HTTP Server.
Dec 11 21:40:36 linux128 systemd[1]: Stopping The Apache HTTP Server...
Dec 11 21:40:36 linux128 apachectl[70958]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:40:36 linux128 systemd[1]: apache2.service: Deactivated successfully.
Dec 11 21:40:36 linux128 systemd[1]: Stopped The Apache HTTP Server.
Dec 11 21:40:36 linux128 systemd[1]: Starting The Apache HTTP Server...
Dec 11 21:40:36 linux128 apachectl[70966]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:40:36 linux128 systemd[1]: Started The Apache HTTP Server.
root@linux128:/home/ubuntu#


root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# systemctl restart apache2
root@linux128:/home/ubuntu# journalctl | tail -20
Dec 11 21:34:33 linux128 apachectl[70879]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:34:33 linux128 systemd[1]: apache2.service: Deactivated successfully.
Dec 11 21:34:33 linux128 systemd[1]: Stopped The Apache HTTP Server.
Dec 11 21:34:33 linux128 systemd[1]: Starting The Apache HTTP Server...
Dec 11 21:34:33 linux128 apachectl[70885]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:34:33 linux128 systemd[1]: Started The Apache HTTP Server.
Dec 11 21:40:36 linux128 systemd[1]: Stopping The Apache HTTP Server...
Dec 11 21:40:36 linux128 apachectl[70958]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:40:36 linux128 systemd[1]: apache2.service: Deactivated successfully.
Dec 11 21:40:36 linux128 systemd[1]: Stopped The Apache HTTP Server.
Dec 11 21:40:36 linux128 systemd[1]: Starting The Apache HTTP Server...
Dec 11 21:40:36 linux128 apachectl[70966]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:40:36 linux128 systemd[1]: Started The Apache HTTP Server.
Dec 11 21:42:58 linux128 systemd[1]: Stopping The Apache HTTP Server...
Dec 11 21:42:58 linux128 apachectl[71035]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:42:58 linux128 systemd[1]: apache2.service: Deactivated successfully.
Dec 11 21:42:58 linux128 systemd[1]: Stopped The Apache HTTP Server.
Dec 11 21:42:58 linux128 systemd[1]: Starting The Apache HTTP Server...
Dec 11 21:42:58 linux128 apachectl[71041]: AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Dec 11 21:42:58 linux128 systemd[1]: Started The Apache HTTP Server.
root@linux128:/home/ubuntu#


root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# systemctl stop apache2
root@linux128:/home/ubuntu# systemctl start apache2
root@linux128:/home/ubuntu# systemctl
UNIT LOAD ACTIVE SUB DESCRIPTION
proc-sys-fs-binfmt_misc.automount loaded active running Arbitrary Executable File Formats File System Auto
sys-devices-pci0000:00-0000:00:02.0-0000:01:00.0-virtio0-net-enp1s0.device loaded active plugged Virtio network device
sys-devices-pci0000:00-0000:00:02.2-0000:03:00.0-virtio1-block-vda-vda1.device loaded active plugged /sys/devices/pci0000:00/0000:00:02.2/0000:03:00.0/
sys-devices-pci0000:00-0000:00:02.2-0000:03:00.0-virtio1-block-vda-vda14.device loaded active plugged /sys/devices/pci0000:00/0000:00:02.2/0000:03:00.0/
sys-devices-pci0000:00-0000:00:02.2-0000:03:00.0-virtio1-block-vda-vda15.device loaded active plugged /sys/devices/pci0000:00/0000:00:02.2/0000:03:00.0/
sys-devices-pci0000:00-0000:00:02.2-0000:03:00.0-virtio1-block-vda.device loaded active plugged /sys/devices/pci0000:00/0000:00:02.2/0000:03:00.0/
sys-devices-pci0000:00-0000:00:02.3-0000:04:00.0-virtio2-block-vdb.device loaded active plugged /sys/devices/pci0000:00/0000:00:02.3/0000:04:00.0/
sys-devices-platform-serial8250-tty-ttyS1.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS1
sys-devices-platform-serial8250-tty-ttyS10.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS10
sys-devices-platform-serial8250-tty-ttyS11.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS11
sys-devices-platform-serial8250-tty-ttyS12.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS12
sys-devices-platform-serial8250-tty-ttyS13.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS13
sys-devices-platform-serial8250-tty-ttyS14.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS14
sys-devices-platform-serial8250-tty-ttyS15.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS15
sys-devices-platform-serial8250-tty-ttyS16.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS16
sys-devices-platform-serial8250-tty-ttyS17.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS17
sys-devices-platform-serial8250-tty-ttyS18.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS18
sys-devices-platform-serial8250-tty-ttyS19.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS19
sys-devices-platform-serial8250-tty-ttyS2.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS2
sys-devices-platform-serial8250-tty-ttyS20.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS20
sys-devices-platform-serial8250-tty-ttyS21.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS21
sys-devices-platform-serial8250-tty-ttyS22.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS22
sys-devices-platform-serial8250-tty-ttyS23.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS23
sys-devices-platform-serial8250-tty-ttyS24.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS24
sys-devices-platform-serial8250-tty-ttyS25.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS25
sys-devices-platform-serial8250-tty-ttyS26.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS26
sys-devices-platform-serial8250-tty-ttyS27.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS27
sys-devices-platform-serial8250-tty-ttyS28.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS28
sys-devices-platform-serial8250-tty-ttyS29.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS29
sys-devices-platform-serial8250-tty-ttyS3.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS3
sys-devices-platform-serial8250-tty-ttyS30.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS30
sys-devices-platform-serial8250-tty-ttyS31.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS31
sys-devices-platform-serial8250-tty-ttyS4.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS4
sys-devices-platform-serial8250-tty-ttyS5.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS5
sys-devices-platform-serial8250-tty-ttyS6.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS6
sys-devices-platform-serial8250-tty-ttyS7.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS7
sys-devices-platform-serial8250-tty-ttyS8.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS8
sys-devices-platform-serial8250-tty-ttyS9.device loaded active plugged /sys/devices/platform/serial8250/tty/ttyS9
sys-devices-pnp0-00:00-tty-ttyS0.device loaded active plugged /sys/devices/pnp0/00:00/tty/ttyS0
sys-devices-virtual-block-loop0.device loaded active plugged /sys/devices/virtual/block/loop0

Question 35: Check Apache access.log file contents in /var/log/apache2/ directory. Can you find your connections to the web server?

Answer 35:



Week 3

Question 36 & **Answer 36:** Study and explain shortly following commands and concepts:

- ytsh, bash, zsh

- sh: command invokes the default shell and uses its syntax and flags. The shell linked to the /usr/bin/sh path is the default shell. The standard configuration of the operating system links the /usr/bin/sh path to the Korn shell.

-Bash: is an interpreter for the sh command language that can run scripts that are read from files or the standard input. Additionally, bash integrates helpful elements from the Korn and C shells (ksh and csh).

- zsh: is a Unix shell that may be used as a command interpreter for shell scripting as well as an interactive login shell. Zsh is an improved version of the Bourne shell that incorporates some Bash, ksh, and tcsh features. Shell Z.

- screen and tmux

-**screen:** A single ssh session can launch and use many shell sessions thanks to the screen command in Linux. When a process is started using the command "screen," the session can be removed from the process, and it can subsequently be reattached. The process that was initially started from the screen is still running and is being controlled by the screen itself when the session is detached. The terminals are still there when the session is re-attached, exactly as it was before, thanks to the process.

- tmux: A terminal multiplexer called Tmux enables you to make numerous "pseudo terminals" out of a single terminal. The ability to run many programs simultaneously is a huge benefit when it comes to using the internet for business (SSH).

- ps, pgrep, pstree, pidof

-ps: The ps command, which stands for Process Status, is a command-line tool used to show or inspect details about the processes that are currently active in a Linux system.

-pgrep: The pgrep command on Unix-like operating systems looks for processes that are currently active on the system using a whole or incomplete process name or other supplied attributes.

-pstree: The Linux command pstree displays the active processes as a tree, which is a more practical approach to represent the processes hierarchy and improves the output's aesthetics.

-pidof: To determine the process IDs of a particular running program, use the pidof command. In essence, each process is given one when it is created; it serves as an identification number.

- jobs, disown

-jobs: In the present shell environment, the jobs command shows the status of any jobs that have been begun. If the JobID option is not used to specify a single job, all active jobs' status information is shown. When a reported job termination occurs, the shell removes the process ID of that job from the list of those that the present shell environment is aware of.

-**disown:** The Unix ksh, bash, and zsh shells all provide the disown command, which is used to remove tasks from the current shell.

- fg, bg

-fg: A background job can be brought to the front with the fg command in Linux.

-bg: bg command in linux is used to place foreground jobs in background.

- top, htop

-top: To display the processes running on Linux, use top. It offers a dynamic, real-time perspective of the system as it operates. This command often displays the system's summary data as well as a list of the processes or threads that the Linux Kernel is currently in charge of.

-htop: The Linux system's htop command line utility enables users to interactively monitor the server's or system's critical resources in real time. htop is a more recent application than top command, and it provides several upgrades to top command.

- nice, renice

-nice: In Linux, the "nice" command facilitates the execution of a program or process with altered scheduling priority. It starts a process with a scheduling priority that the user specifies. In this, the Kernel will give a process extra CPU time if we assign it a higher priority

-renice: You can alter the scheduling priority of an active process by using the renice command. The Linux Kernel schedules each process and allots CPU time in accordance with its needs.

- su, sudo

-su: The su command is sometimes referred to as switch (-) user by a lot of Linux users since it is used to switch to another user, or change user ID, during a regular login session.

-sudo: In Linux, the sudo (Super User DO) command is frequently used as a prefix to a command that only superusers are permitted to execute. Any command that has the "sudo" prefix will run with elevated privileges, or in other words, allow a user with the necessary permissions to execute a command in the role of another user, such as the superuser. This is comparable to Windows' "run as administrator" option. We can have several administrators thanks to sudo.These users must have an entry in the "/etc/sudoers" file to be able to use the sudo command.

- Sleep

-sleep: The sleep command is used to pause the execution of any script for a predetermined period of time. This command is used with a specific time value when the programmer needs to pause the execution of a command for a specific reason.

- Xargs

-xargs: Xargs is a fantastic command that produces and executes command lines while reading streams of data from standard input. It can take the output of one command and provide it as a parameter to another command.

- Nohup

-nohup: Nohup, which stands for "no hang up," is a command that allows Linux systems to continue running programs even after closing the shell or terminal. Processes or tasks cannot receive the SIGHUP (Signal Hang UP) signal while Nohup is enabled. When a terminal is closed or exited, a signal is sent to a process.

- Kill

-kill: The built-in command kill in Linux (found in /bin/kill) is used to manually terminate processes. A process is terminated with the kill command, which delivers a signal to the process.

- pkill, killall

-pkill: A command-line tool called pkill sends signals to a program's executing processes depending on predetermined criteria. The complete or partial names of the processes, the person who is operating them, or other details can be used to identify them.

-killall: All processes you initiated are terminated by the killall command, with the exception of those that generated the killall process. This command offers a handy way to stop any processes started by the shell you are in control of.

- w, who

-w: Administrators can obtain details about users who are currently logged in using the built-in w command. This includes their username, the computer they are using to log in, and what they are doing right now.

-who: The who command is used to get information about currently logged in user on to system.

- write, wall

-write: In Linux, the write command establishes a channel of communication between two logged-in users via the terminal. By copying text from one terminal to another, the command enables real-time messaging between users.

-wall: The wall command sends a message to every logged-in user. The wall command reads the message from standard input until it hits an end-of-file character if the Message parameter is not given. Then, all currently logged-in users receive the message.

- Aliases

-aliases: the alias command asks the shell to swap out one string for another.When we frequently need to utilize a single large command several times, we designate an alias for that command. Alias functions similarly to a shortcut command and has the same functionality as the full command.

- source, .bashrc

-source: Source is a built-in shell command in Linux operating systems that reads and executes file content in the current shell. Typically, these files include a set of commands that are sent to the TCL interpreter to read and execute.

- .bashrc: When a user logs in, a script file called .bashrc is executed. Several configurations for the terminal session are contained in the file itself. Setting up or enabling these features involves creating command aliases, coloring, completion, and shell history.

- shell build-in variables, export

-shell build-in variables: Built-in variables are frequently used in shell scripts and are automatically established by the shell. The above-described patterns of variable substitution can be used to built-in variables.

-export: The Bash shell includes a built-in command called export. To designate variables and functions for passing to child processes, use this symbol. A variable will essentially be present in child process contexts without influencing other surroundings.

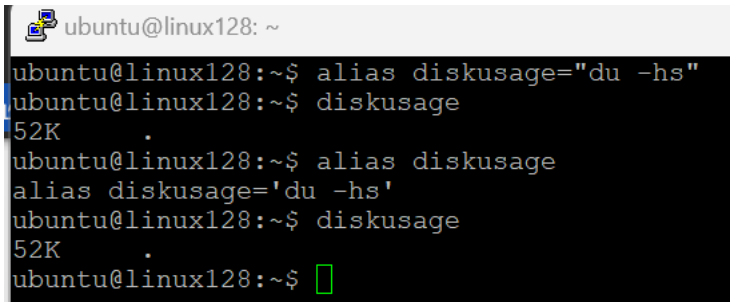
Question 37: How and when you start new shells? How to exit a shell?

Answer 37: If you want to run a program at a new environment, then you can start new shells to run.

Just use exit command, it will exit the current shell.

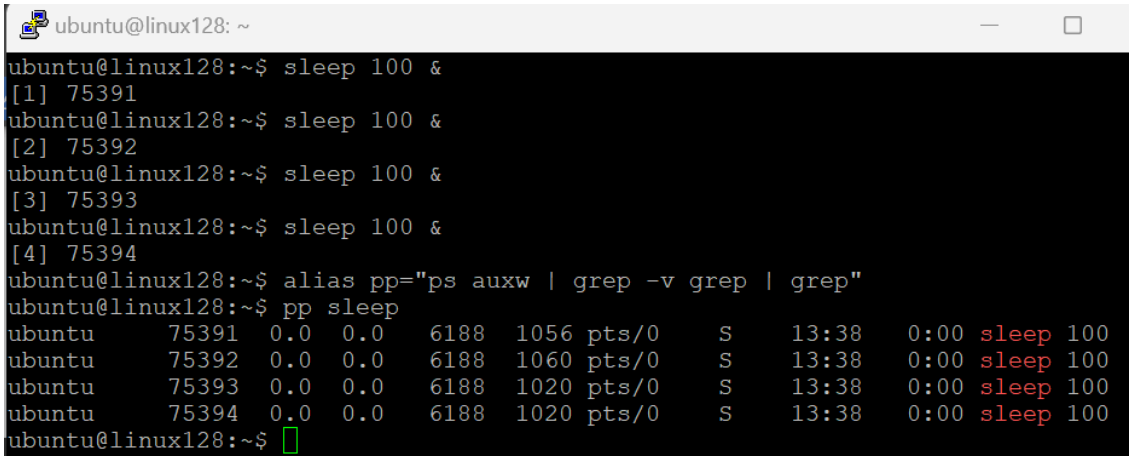
Question 38: Add shell alias “diskusage” to your shell startup-files (example .bashrc). Alias should print only current disk usage of your home directory

Answer 38:



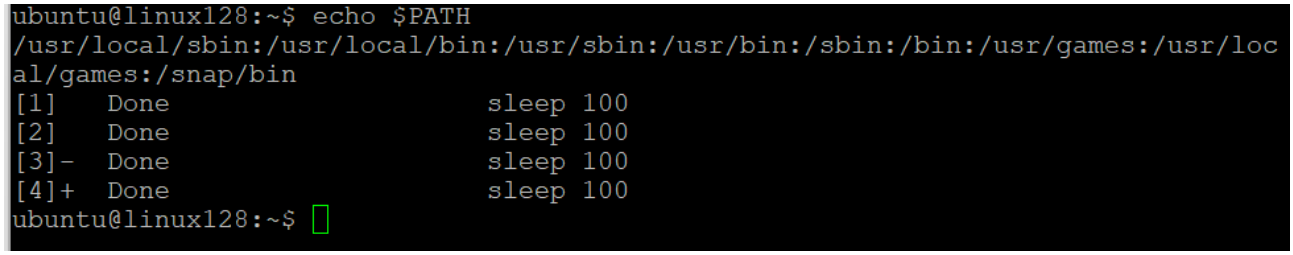
Question 39: Create shell alias “pp” which requires one parameter and will print all running processes including details with that name. Usage example:

Answer 39:



Question 40: Which directories are currently in you PATH variable?

Answer 40:



Question 41: How do you start process directly into background when entering a command?

Answer 41: A foreground process must first be put to sleep before being moved into the background to be placed there.

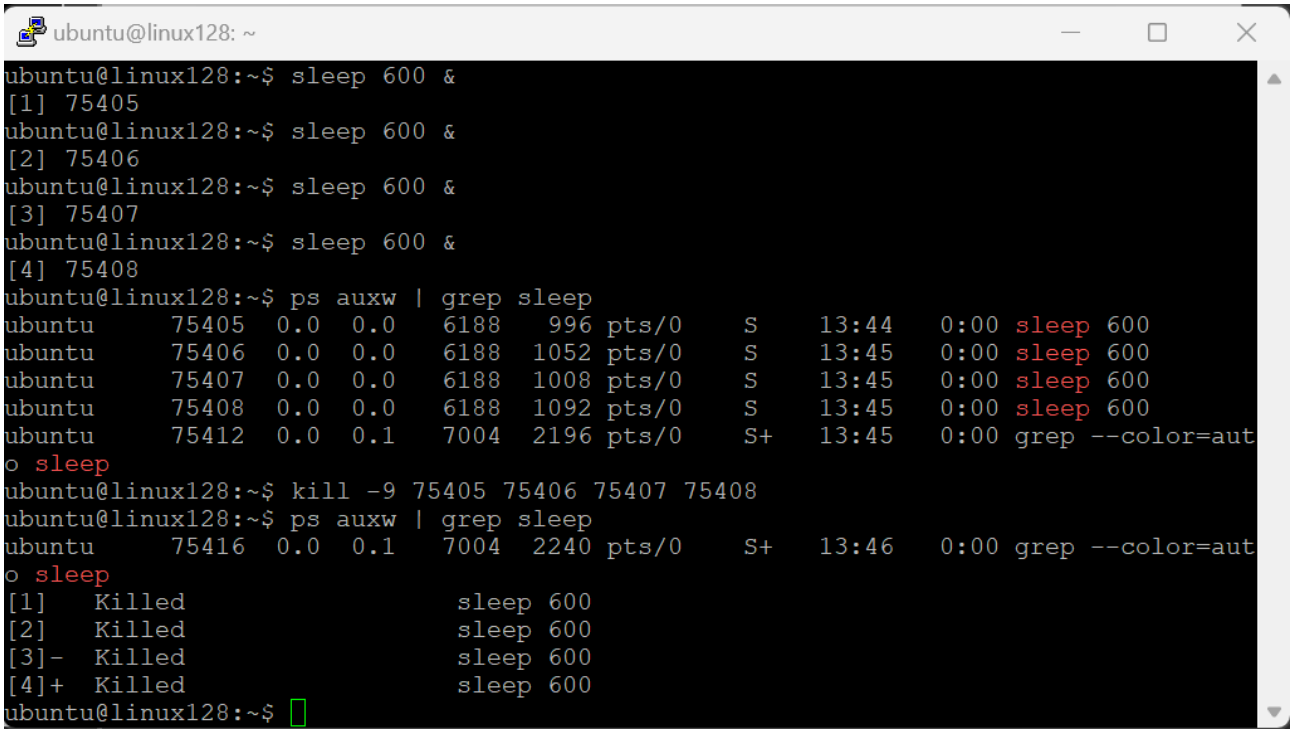
1. Run the specified command to start your process.

2. To put the process to sleep, press CTRL+Z.

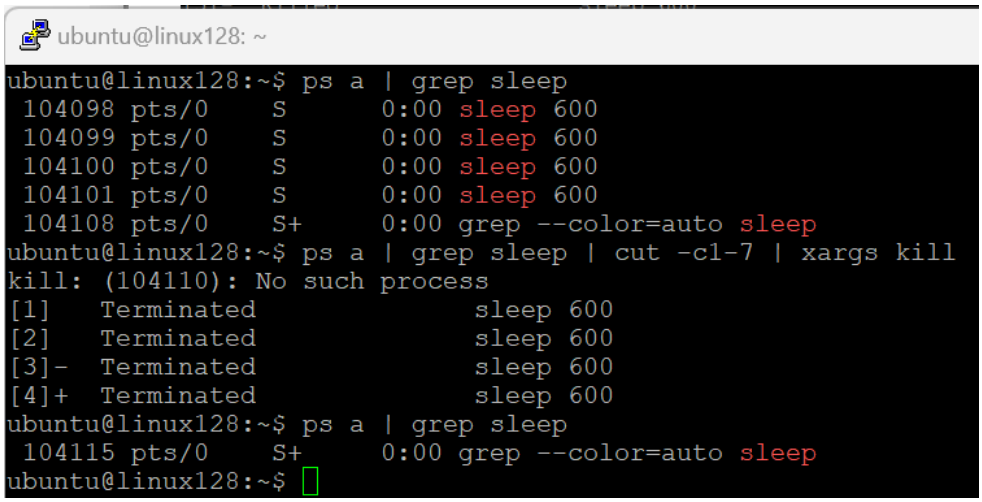
3. Use the bg command to start and continue the process in the background.

Question 42: Start few *sleep 60* processes (one minute idle loop) to the background and:

- How can you find and terminate them all with one-liner? Try not to use pkill, killall or xargs -commands.



How would you do the previous killing task with xargs?



Start one 1000 second sleep to the foreground.

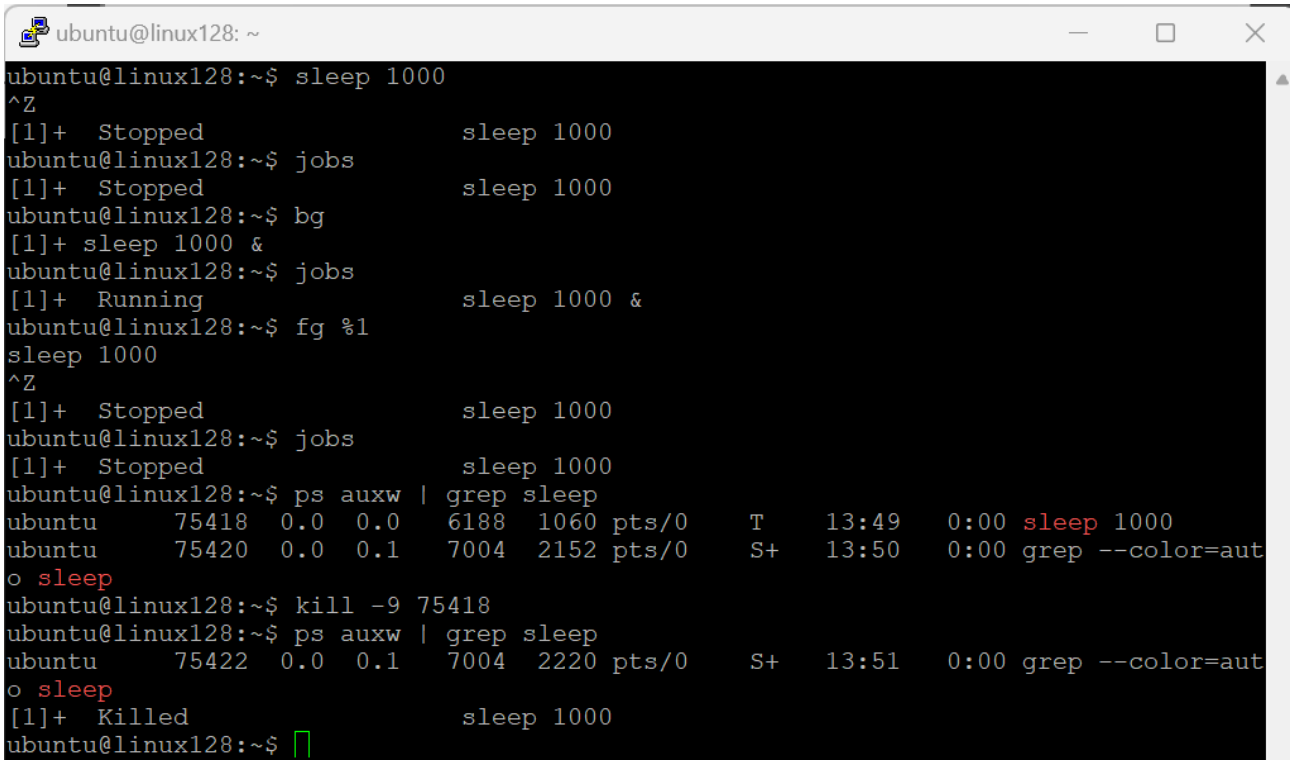
How do you suspend it?

How do you list current jobs?

How do you get previous sleep process back to foreground?

Suspend process again and send it to background.

Kill previous sleep process from background.



Question 43: What is the difference between kill -9 and kill -1?

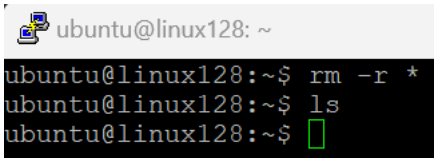
Answer 43: Both Kill -1 and Kill -9 are used to end a process to add it to the foreground. However, the difference can be seen in the behaviour of the process that received the Kill -1 or Kill -9.

To ask a process to end gracefully or liberate memory or take care of other child processes, Kill -1 will send out a SIGTERM signal. Because it was gracefully terminated, killing a process with kill will not have any negative impacts, such as unreleased memory.

Like kill -9, doesn't wait for the application to exit gracefully. Kill -9 sends out a SIGKILL signal that immediately kills the process without checking its condition.

Question 44: Delete unnecessary files created in this practice.

Answer 44:



Week 4

Question 45 & **Answer 45:** Study and explain shortly following commands and concepts:

- cat, tac

-cat: In Linux, the Cat (concatenate) command is often used. It extracts data from the file and outputs its contents. It aids in file creation, viewing, and concatenation.

-tac: In Linux, the tac command is used to concatenate and print files backward. The last line of each FILE will be sent to standard output first by this command. The standard input will be read when no file is specified.

- grep / egrep

-grep / egrep: The grep command on Linux operating systems reads text line by line and outputs any lines that match a predefined pattern.

The egrep command, which searches for patterns, is a member of the grep function family. It functions in the same way as grep -E. The lines that match the pattern are printed out after treating the pattern like an extended regular expression.

- Wc

-wc: The word count command in Linux is abbreviated as "wc". A text file's lines, words, bytes, and even characters and bytes can all be counted using this command.

- Sort

-sort: In Linux, the sort command is used to print a file's output in a specific order. This command organizes your data—the content of the file or the output of any program—in the form that you specify, making it easier for us to read the data quickly.

- Cut

-cut: In Linux, the cut command can be used to separate the sections from each line of files and report the results to standard output. It can be used to remove certain characters, bytes, or fields from a line. The cut command basically separates the text from a line. If an option is not specified with the command, an error will result.

- Awk

-awk: The Linux utility and programming language known as the awk command enables users to handle and manipulate data as well as create prepared reports. The tool offers a number of advanced text processing functions and makes it easier to explain complex data selections.

- Sed

-sed: The Linux sed command, which stands for stream editor, has a wide range of file-related capabilities, including searching, find-and-replace, insertion, and deletion. Although the sed command is most frequently used in Linux for substitution or find and replace.

- Tr

-tr: A Linux command-line tool for character translation or deletion is called tr. It offers a variety of changes, such as converting letters from capital to lowercase, condensing repetitive characters, erasing characters, and simple search and replace. tr stands for translate.

- expand, unexpand

-expand: The expand command replaces the tab characters with one or more space characters before writing the named files or standard input to standard output

-unexpand: There is a command line tool called unexpand command that can turn leading spaces and tabs into tabs.Every space is automatically converted to a tab by the unexpand command when publishing the output to standard output.

- uniq

-uniq: A command-line tool in Linux called uniq reports or removes repetitive lines from a file. Simply said, Uniq is a program that both finds and removes duplicate lines that are next to each other in a line. Uniq removes the adjacent matching lines from the input file (which must be provided as an argument) and writes the filtered data to the output file.

- head

-head: The head command prints the first N numbers of data from the specified input, as the name suggests. It prints the first 10 lines of the selected files by default. Data from each file is preceded by its file name if more than one file name is given.

- tail

-tail: It is head command's complementary. The tail command prints the last N numbers of data from the specified input, as the name suggests. It prints the last 10 lines of the selected files by default. Data from each file is preceded by its file name if more than one file name is given.

- echo

-echo: Linux uses the echo command to display a line of text or string that is supplied as an argument. This built-in command is frequently used to output status text to the screen or a file in shell scripts and batch files.

- column

-column: When using Linux, the column command is used to display a file's contents in columns. The standard input or a file may be used as the source of the input. The input is essentially divided into several columns by this command. Columns are filled after rows.

- fold

-fold: In Linux, with the fold command, each line in an input file is wrapped to fit a specific width before being sent to standard output. Lines are wrapped by default at a maximum width of 80 columns, however this can be changed. Pass a file or standard input to the fold command to fold input.

join

-join: Using a common field from both files as the connection between related lines in the files, the join command enables us to combine two files. When we want to join two or more tables in a relational database, we can conceive of the Linux join command in the same way we think of SQL joins.

- paste

-paste: One of the helpful commands in the Unix or Linux operating system is paste. By writing lines to standard output that are composed of lines from each of the given files, separated by tab as the delimiter, it is possible to connect files horizontally (parallel merging).

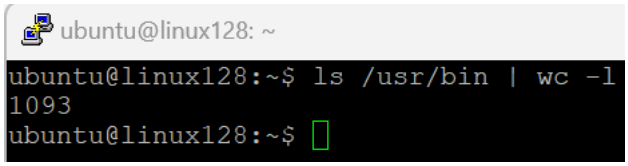
-tee: The tee command reads the standard input and writes it to one or more files as well as the standard output. The plumbing tool known as a T-splitter inspired the name of the command. In essence, it separates a program's output so that it can be both displayed and saved in a file. It concurrently completes both jobs, copies the outcome into the designated files or variables, and displays the outcome.

- nl

-nl: The File parameter (standard input by default) is read by the nl command, which then numbers the input lines and outputs the numbered lines to standard output. The nl command uses the flags you specify on the command line to number the lines on the left in the output. Logical pages must be used to write the input text.

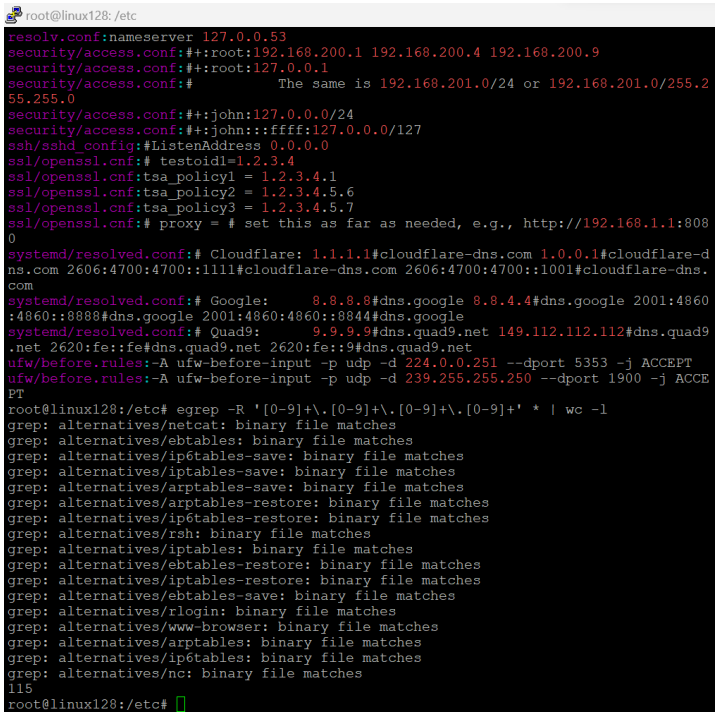
Question 46: Use word counter and piping to count how many files or directories are in /usr/bin -directory?

Answer 46:



Question 47: Use grep and extended regular expression syntax to list all files from /etc directory recursively which have IPv4 addresses mentioned inside.

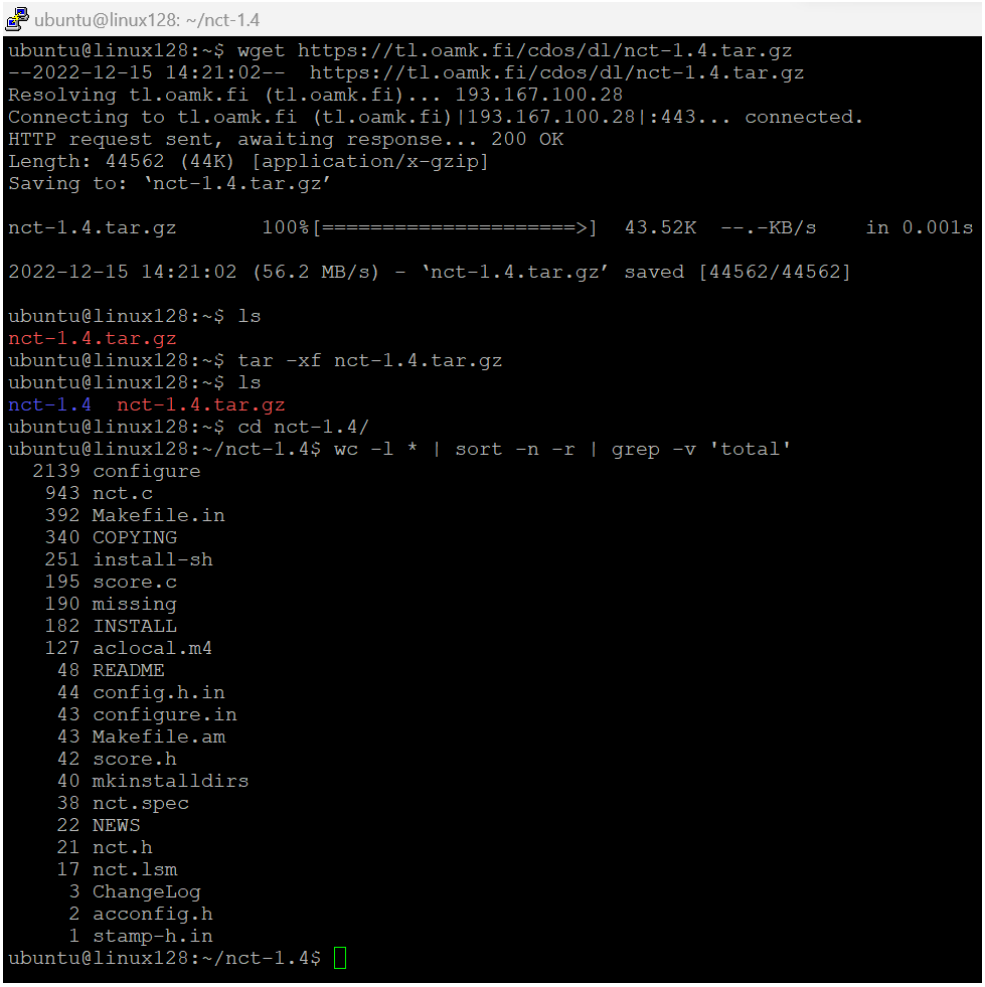
Answer 47:



Question 48: Download and extract Tetris game source file nct-1.4.tar.gz and

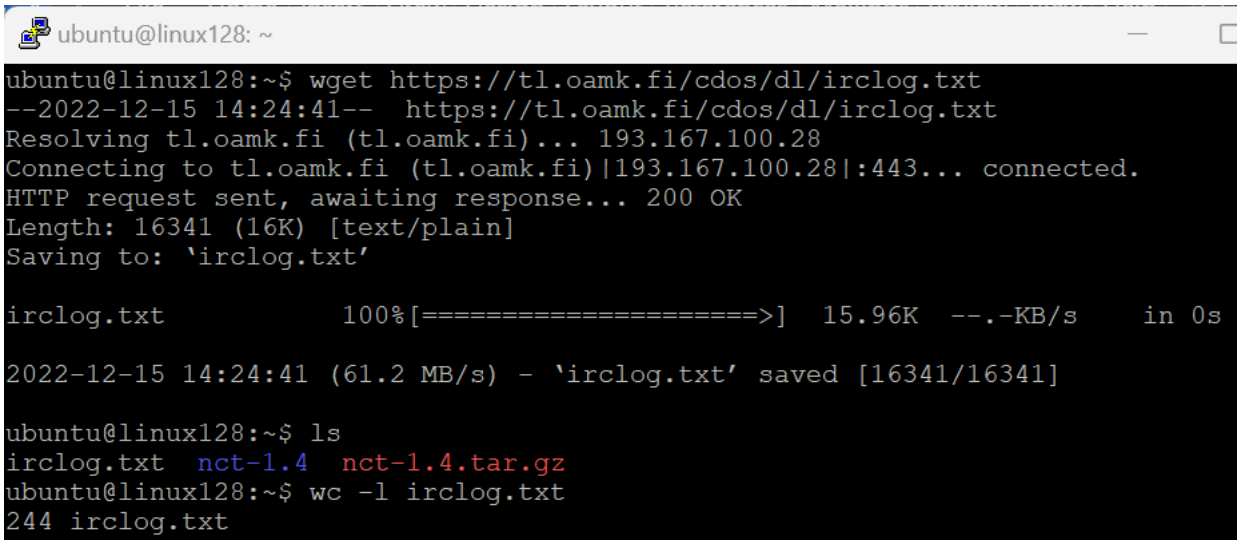
Use grep to find which files contain string ncurses.h
Use wc command to list line counts of each file and sort the output from longest to shortest file.
Use data filtering command to remove the total amount of lines line in the beginning of sort output. Final result should be something like this:

```
2139 configure
943 nct.c
392 Makefile.in
340 COPYING
251 install-sh
195 score.c
190 missing
182 INSTALL
127 aclocal.m4
48 README
44 config.h.in
43 Makefile.am
43 configure.in
42 score.h
40 mkinstalldirs
38 nct.spec
22 NEWS
21 nct.h
17 nct.lsm
3 ChangeLog
2 acconfig.h
1 stamp-h.in
```

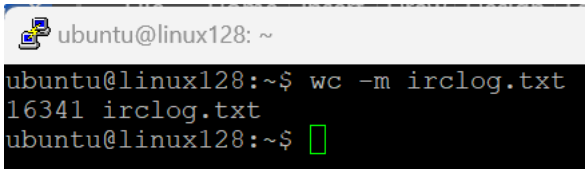


Question 49: Use wget to download this irclog.txt and answers to these questions:

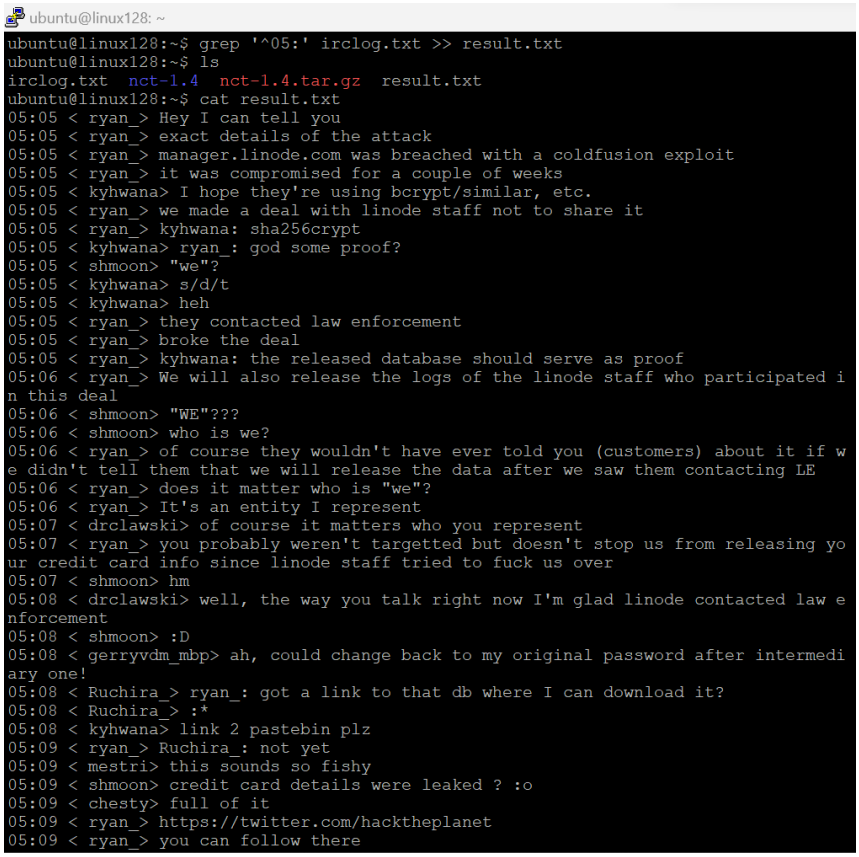
- How many lines are in the file?



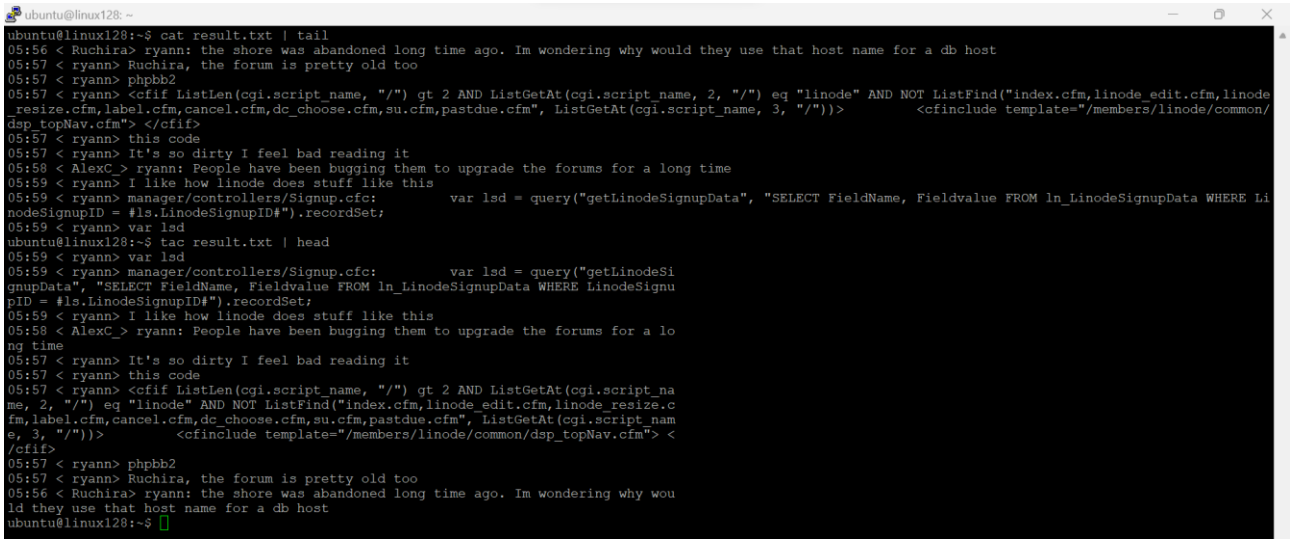
- How many characters are in the file?



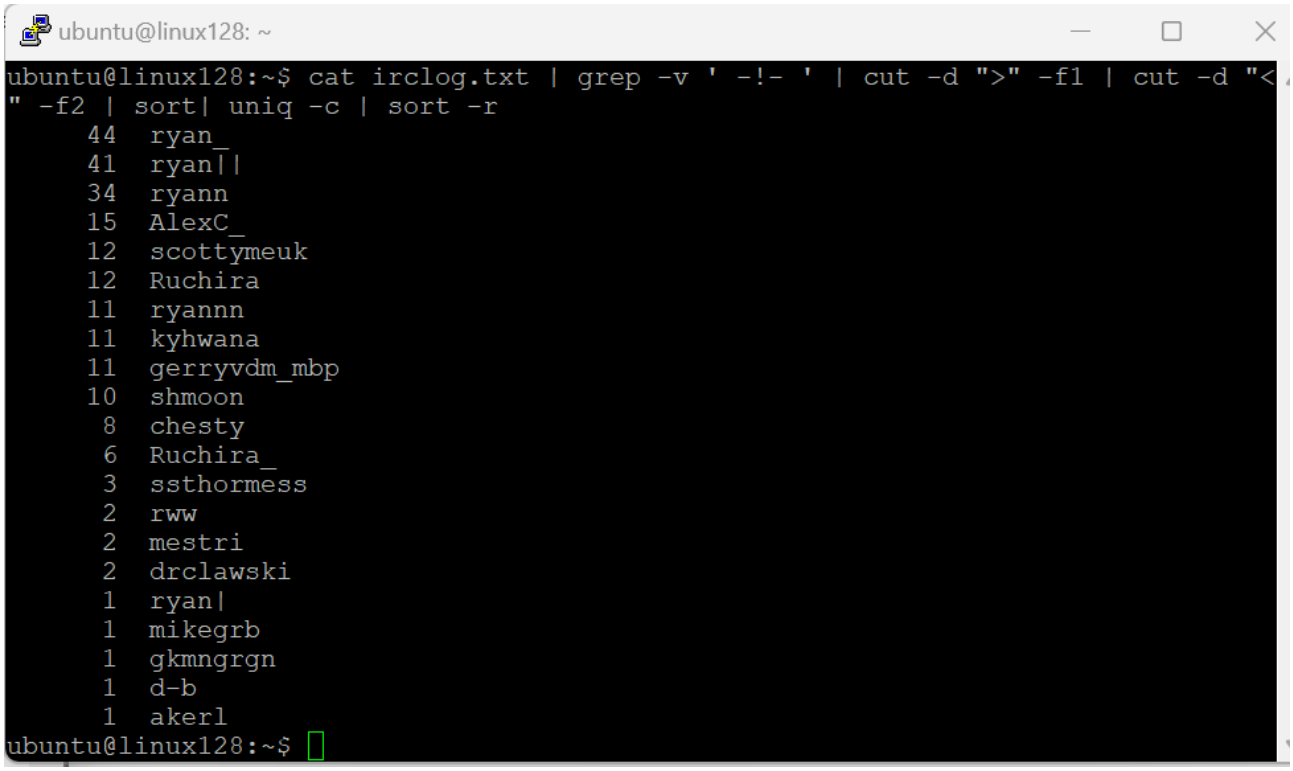
- List only lines where the timestamp starts with 05 and save the output to a file called result.txt



- Print result.txt in reverse order



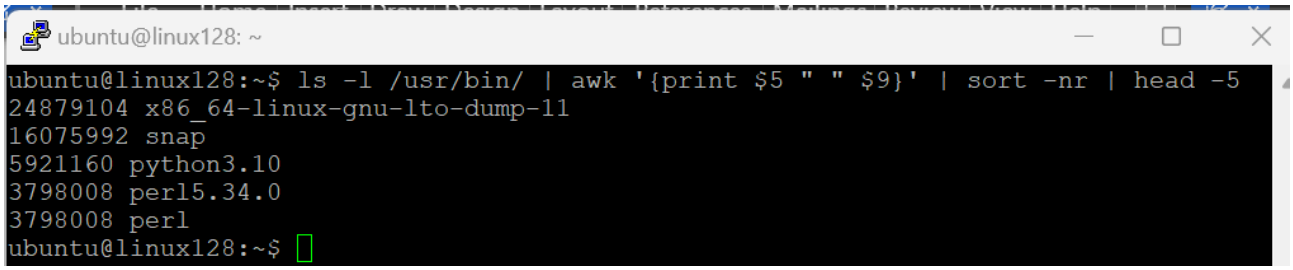
- Create numerical statistics from the irclog.txt file: How many lines each nickname wrote. Use only those lines where someone actually said something and ignore the all other lines



Question 50: List only 5 largest files from /usr/bin -directory. (Starting from largest file.)

> Print largest files first. Try to not use the ls command's -S option but use use sort command (and related text processing commands if necessary)

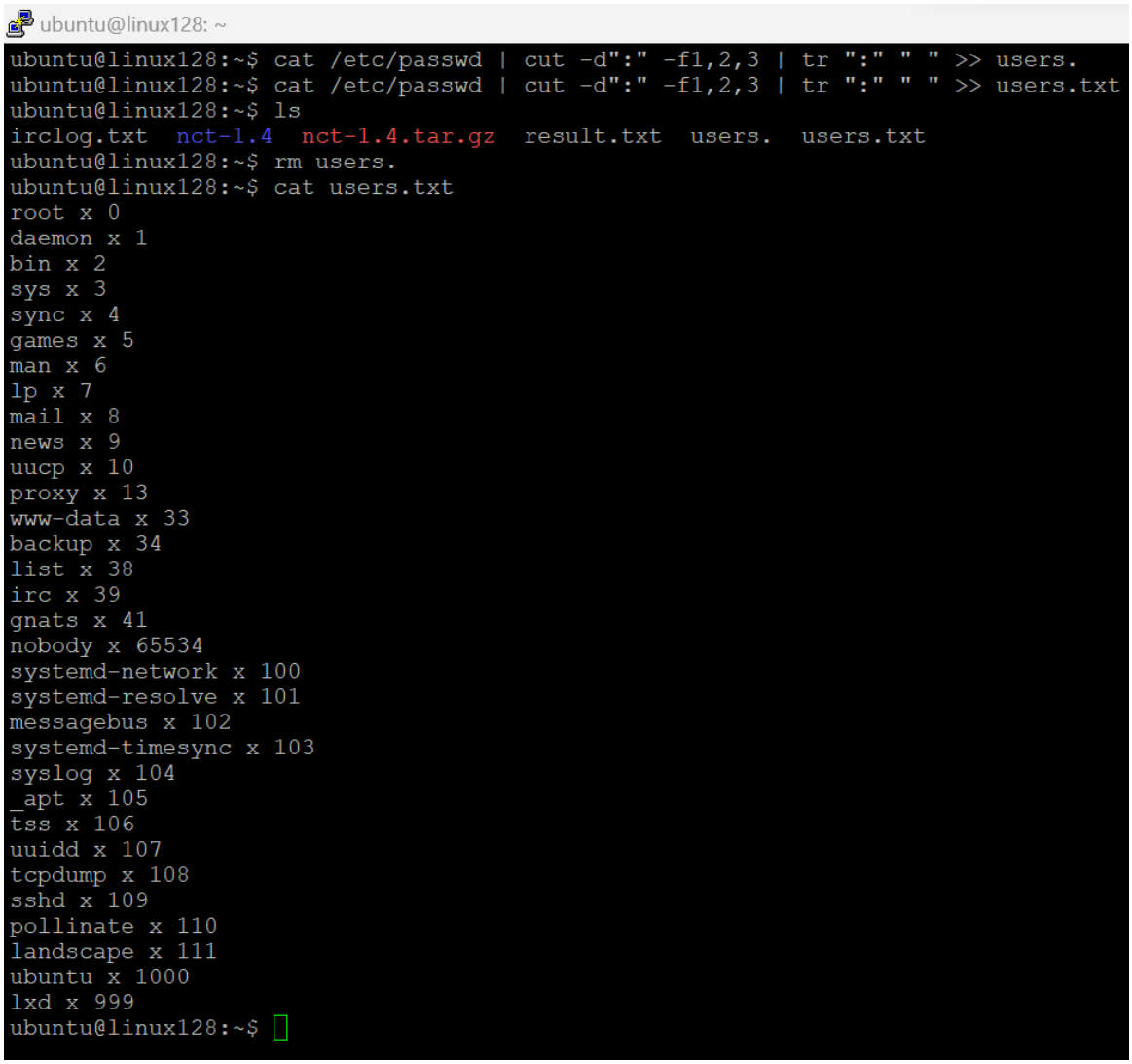
Answer 50:



Question 51: Print only usernames, UID and GID numbers from /etc/passwd -file. Replace all colons with a whitespace. Redirect output to file a “users.txt” in your home directory. Tip: In this example line from /etc/passwd the UID = 101 and GID = 50:

username:x:101:50:Teemu Korpela:/home/tkorpela:/bin/bash

Answer 51:

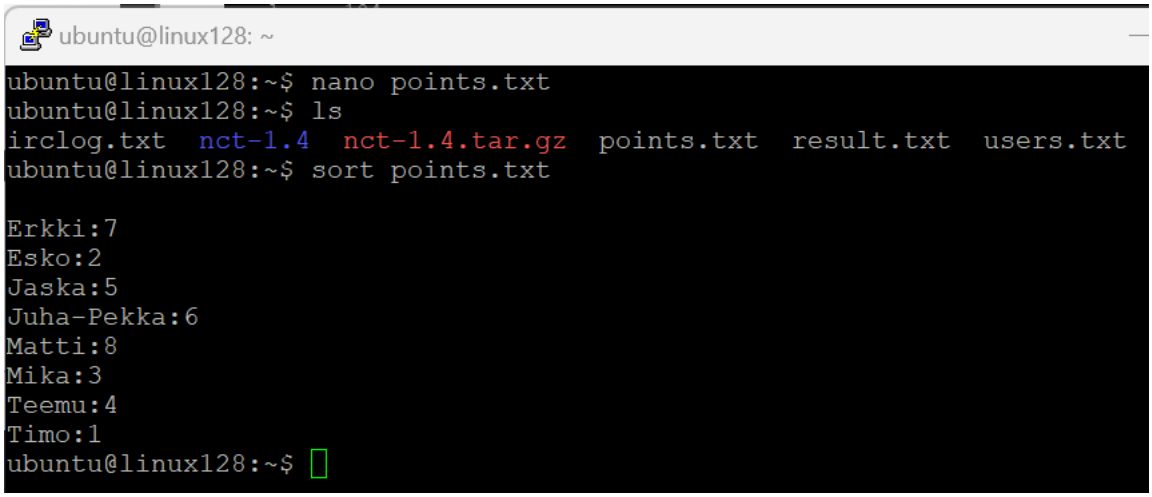


Question 52: Use text editor nano to create a points.txt file to your home directory with following content. This list presents first names and some game scores. Who has most points, wins

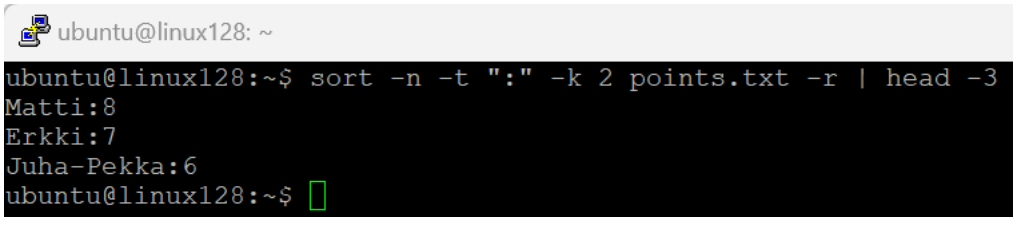
points.txt file:

```
Teemu:4
Matti:8
Juha-Pekka:6
Timo:1
Mika:3
Esko:2
Jaska:5
Erkki:7
```

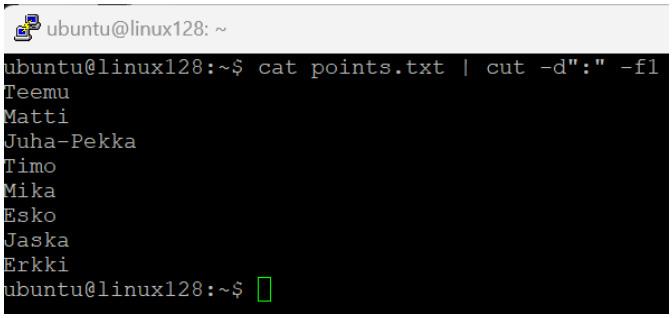
- List contents of points.txt in alphabetic order to STDOUT



- List contens of file on to STDOUT, but now order is score based. List only best three players with most points



- How do you list only player names and filter all other data



- List only first three characters from the beginning of each line of points.txt

```
ubuntu@linux128:~$ cat points.txt | cut -c1-3
Tee
Mat
Juh
Tim
Mik
Esk
Jas
Erk
ubuntu@linux128:~$
```

- List points.txt but translate all characters to upper-case

```
ubuntu@linux128:~$ cat points.txt | tr [:lower:] [:upper:]
TEEMU:4
MATTI:8
JUHA-PEKKA:6
TIMO:1
MIKA:3
ESKO:2
JASKA:5
ERKKI:7
ubuntu@linux128:~$
```

List points.txt so that points are printed before names

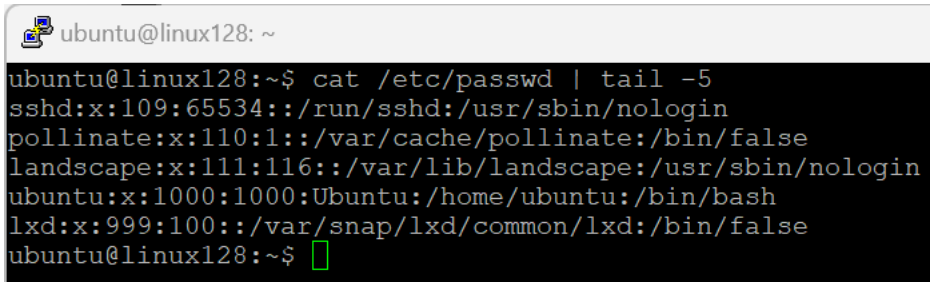
```
ubuntu@linux128:~$ cat points.txt | sed 's/:/ /' | awk '{print $2 ":" $1}'
4:Teemu
8:Matti
6:Juha-Pekka
1:Timo
3:Mika
2:Esko
5:Jaska
7:Erkki
ubuntu@linux128:~$
```

- Sort points.txt in alphabetic order and add line numbers in front of lines

```
ubuntu@linux128:~$ sort points.txt | nl
     1  Erkki:7
     2  Esko:2
     3  Jaska:5
     4  Juha-Pekka:6
     5  Matti:8
     6  Mika:3
     7  Teemu:4
     8  Timo:1
ubuntu@linux128:~$
```

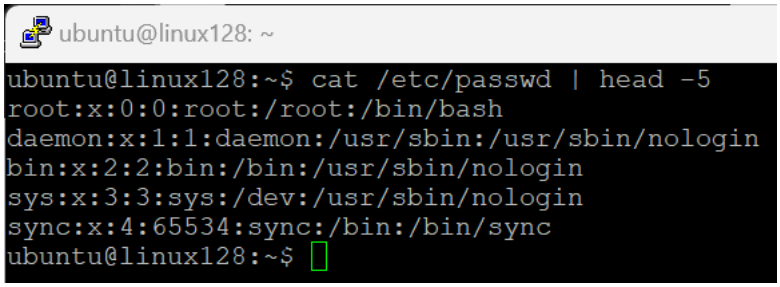
Question 53: How do you list last 5 lines from the /etc/passwd file?

Answer 53:



Question 54: How do you list first 5 lines from the /etc/passwd file?

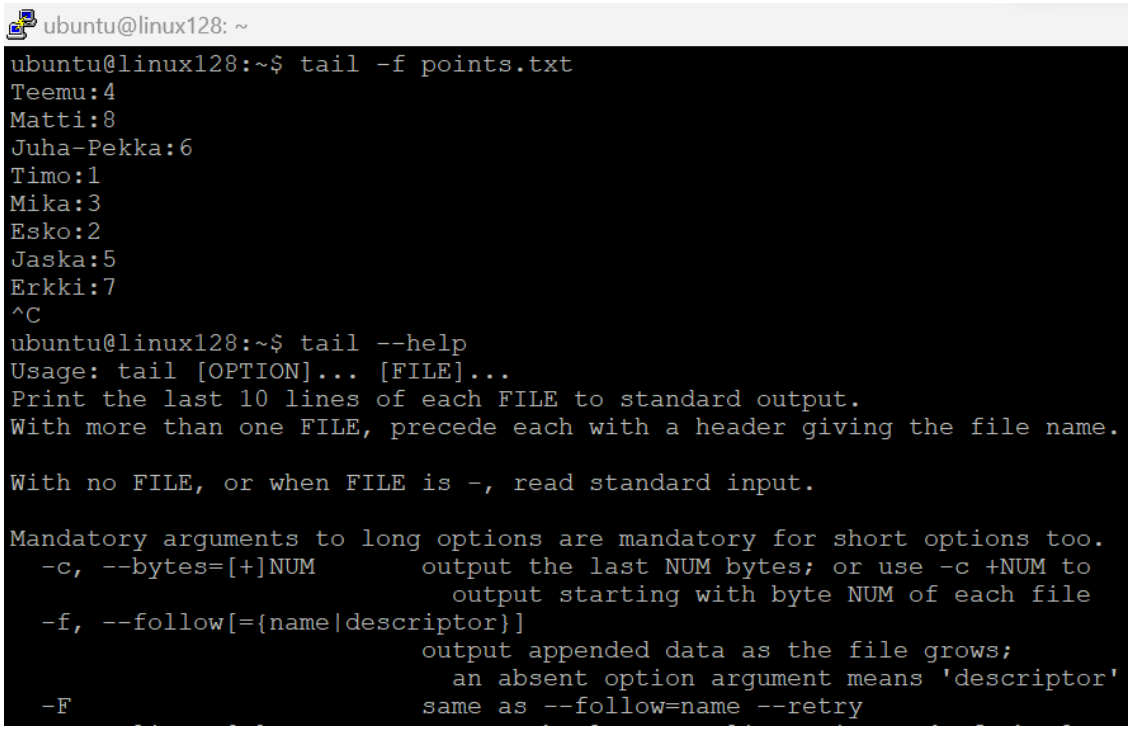
Answer 54:



Question 55: What does tail -f filename command do?

Answer 55:

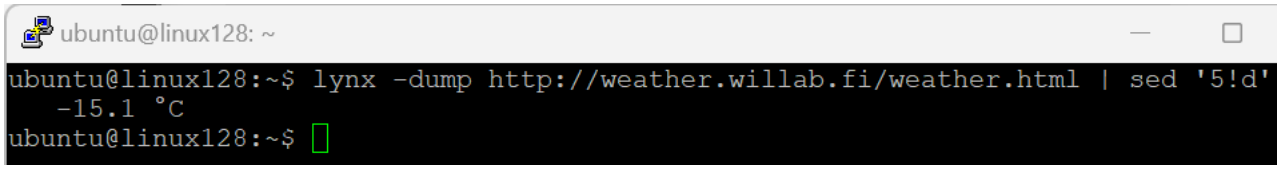
With --follow (-f), tail defaults to following the file descriptor, which means that even if a tail'ed file is renamed, tail will continue to track its end. This default behaviour is not desirable when I really want to track the actual name of the file, not the file descriptor (e.g., log rotation). Use --follow=name in that case. That causes tail to track the named file in a way that accommodates renaming, removal and creation.



Question 56: Fetch current weather in Oulu with lynx (TIP: if there is no lynx, install it with: *sudo apt install lynx*). The command to download Oulu's weather data is: *lynx -dump http://weather.willab.fi/weather.html*

- Filter the output so that only temperature is displayed and nothing else

Answer 56:

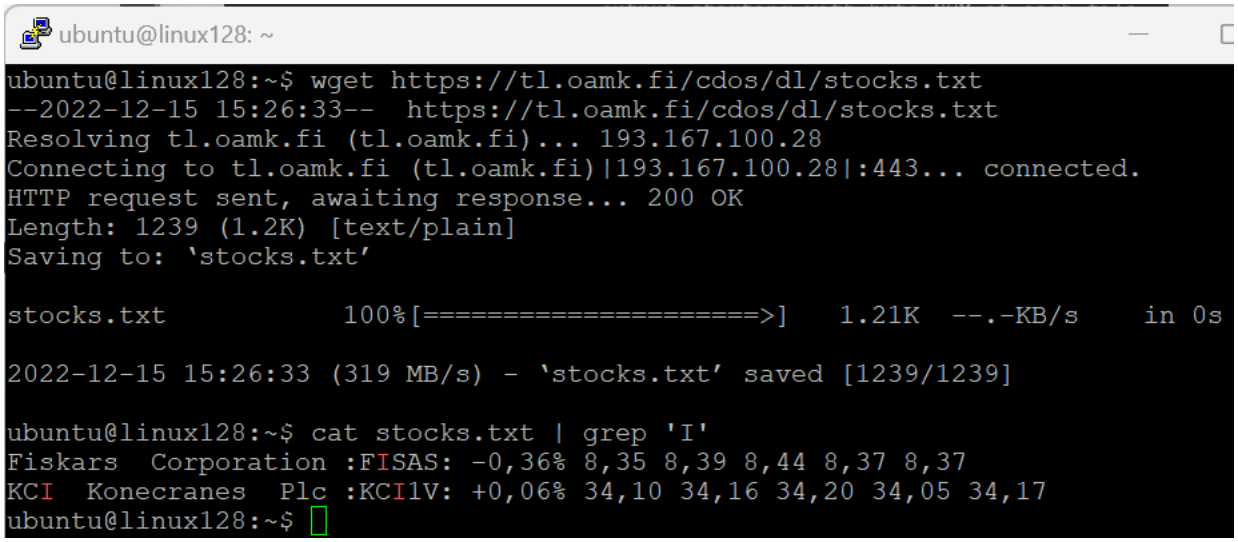


Question 57 & **Answer 57:** Use wget to download this stock market textfile

Example line and explanation from file:

```
Name                    code    change buy   sell lowest highest last
Fiskars  Corporation :FISAS: -0,36% 8,35 8,39  8,44   8,37   8,37
```

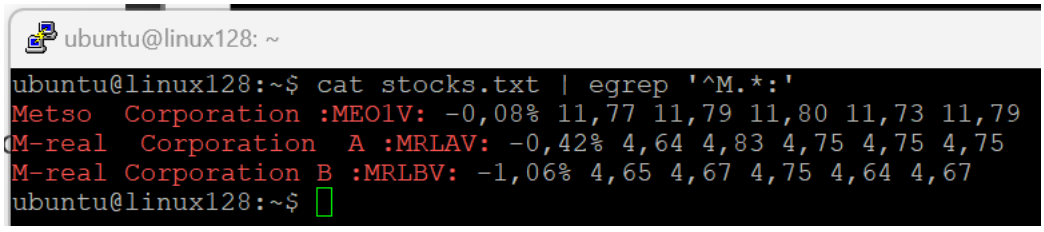
- Use grep (or egrep) and regular expressions to list only companies with "I" anywhere in in code part.



- List (only) company names and stock values starting with character "M".

  Output should be:

```
Metso  Corporation :MEO1V: -0,08% 11,77 11,79 11,80 11,73 11,79
M-real  Corporation  A :MRLAV: -0,42% 4,64 4,83 4,75 4,75 4,75
M-real Corporation B :MRLBV: -1,06% 4,65 4,67 4,75 4,64 4,67
```



- Print line only if the company name begins with a character "R" and last stock value is 8,xx

Output should be:

```
Rautaruukki  Corporation :RTRKS: +0,24% 8,46 8,50 8,52 8,42
Rocla Oyj :ROC1V: -0,60% 8,20 8,25 8,25 8,20 8,25
```

```
ubuntu@linux128:~$ cat stocks.txt | grep '^R' | grep '8,..$'
Rautaruukki  Corporation :RTRKS: +0,24% 8,46 8,50 8,52 8,42
Rocla Oyj :ROC1V: -0,60% 8,20 8,25 8,25 8,20 8,25
ubuntu@linux128:~$
```

- List all companies except the names starting with characters “R” or “W”

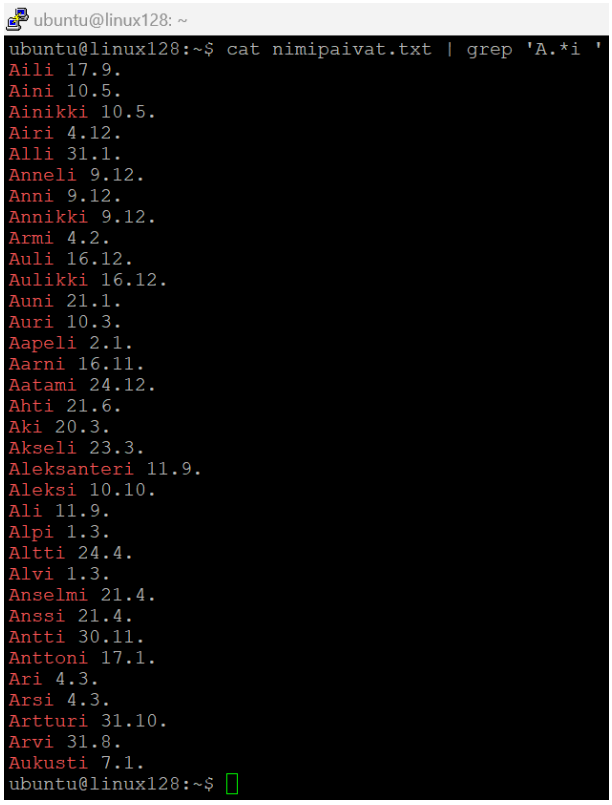
```
ubuntu@linux128: ~
ubuntu@linux128:~$ cat stocks.txt | egrep -v '^R|W|Metalliteolli|Metsäteolli'
Componenta  Corporation :CTH1V: +2,06% 5,90 5,99 5,95 5,89 5,95
Fiskars  Corporation :FISAS: -0,36% 8,35 8,39 8,44 8,37 8,37
KCI  Konecranes  Plc :KCI1V: +0,06% 34,10 34,16 34,20 34,05 34,17
Kone  Corporation B :KONBS: -0,67% 60,92 61,00 62,01 60,73 60,99
Metso  Corporation :MEO1V: -0,08% 11,77 11,79 11,80 11,73 11,79
Nordic Aluminium Plc :NOA1V: -0,04% 9,32 9,49 0,00 0,00 9,49
Outokumpu  Oyj  :OUT1V: +0,98% 13,36 13,37 13,42 13,27 13,36
Ponsse Oyj 1 :PON1V:   +0,66% 15,16 15,20 15,25 15,13 15,20

M-real  Corporation  A :MRLAV: -0,42% 4,64 4,83 4,75 4,75 4,75
M-real Corporation B :MRLBV: -1,06% 4,65 4,67 4,75 4,64 4,67
Stora  Enso Oyj A :STEAV: +1,31% 11,50 11,58 11,58 11,53 11,58
Stora  Enso Oyj R :STERV: -1,04% 11,37 11,38 11,49 11,34 11,38
Stromsdal Corporation B :STMBS: +0,43% 2,00 2,06 0,00 0,00 2,10
UPM-Kymmene  Corporation  :UPM1V: -0,66% 16,59 16,60 16,80 16,54 16,59
ubuntu@linux128:~$
```

- List only those stocks which have positive change value (i.e. +xx,xx%) in the list

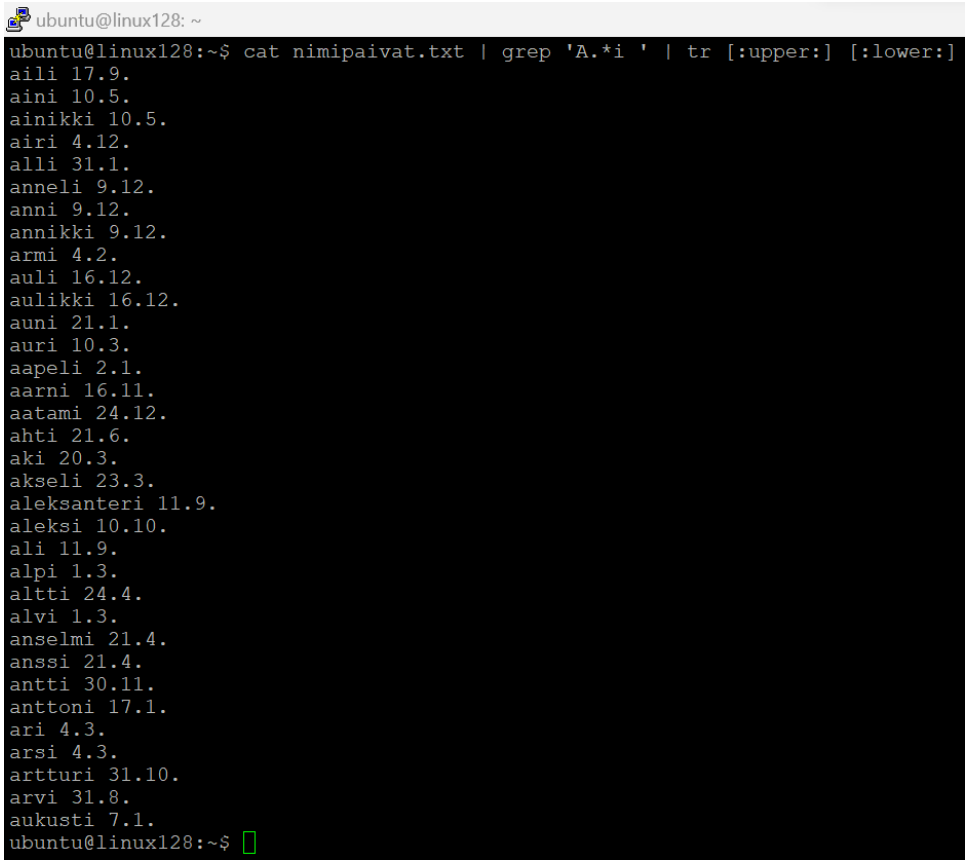
```
ubuntu@linux128: ~
ubuntu@linux128:~$ cat stocks.txt | grep "+.,..%"
Componenta  Corporation :CTH1V: +2,06% 5,90 5,99 5,95 5,89 5,95
KCI  Konecranes  Plc :KCI1V: +0,06% 34,10 34,16 34,20 34,05 34,17
Outokumpu  Oyj  :OUT1V: +0,98% 13,36 13,37 13,42 13,27 13,36
Ponsse Oyj 1 :PON1V:   +0,66% 15,16 15,20 15,25 15,13 15,20
Rautaruukki  Corporation :RTRKS: +0,24% 8,46 8,50 8,52 8,42
Wärtsilä  Corporation  A  :WRTAV: +3,47% 16,82 17,00 17,00 16,74 17,00
Wärtsilä  Corporation  B  :WRTBV: +1,59% 17,20 17,21 17,29 16,93 17,21
Stora  Enso Oyj A :STEAV: +1,31% 11,50 11,58 11,58 11,53 11,58
Stromsdal Corporation B :STMBS: +0,43% 2,00 2,06 0,00 0,00 2,10
ubuntu@linux128:~$
```

Question 58 & **Answer 58:** Get nimipaivat.txt (Finnish name days) textfile from here [nimipaivat.txt]

- From nimipaivat.txt, find out how many names start with a letter A and end to a letter i?



- How can you convert previous names to lower-case?



- From previous names, who are celebrating in December?

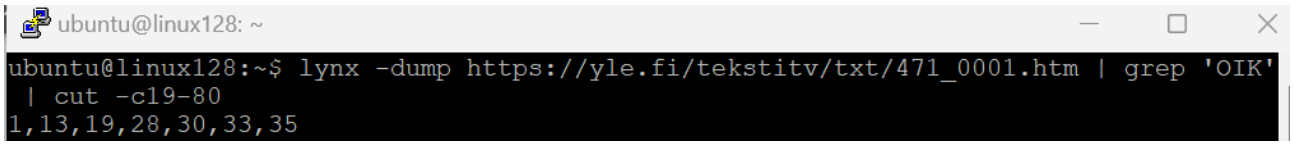
```
ubuntu@linux128: ~
ubuntu@linux128:~$ cat nimipaivat.txt | grep 'A.*i ' | grep '12.$'
Airi 4.12.
Anneli 9.12.
Anni 9.12.
Annikki 9.12.
Auli 16.12.
Aulikki 16.12.
Aatami 24.12.
ubuntu@linux128:~$
```

- From all names in nimipaivat.txt, search those who celebrate either 1st, 2nd or 3rd day in any month.

```
ubuntu@linux128: ~
ubuntu@linux128:~$ cat nimipaivat.txt | egrep " 1\.| 2\.| 3\."
Aamu 2.2.
Anelma 2.12.
Jemina 2.2.
Kukka-Maaria 2.7.
Linnea 3.8.
Maaria 2.7.
Maija 2.7.
Maiju 2.7.
Maikki 2.7.
Maire 1.8.
Mari 2.7.
Maria 2.7.
Marika 2.7.
Meeri 2.7.
Meri 3.12.
Nea 3.8.
Orvokki 3.6.
Outi 3.5.
Pulmu 1.4.
Raita 1.4.
Riitta 1.2.
Sini 2.9.
Sinikka 2.9.
Soila 3.9.
Soile 3.9.
Soili 3.9.
Unelma 2.12.
Valpuri 1.5.
Vanamo 3.8.
Vappu 1.5.
Vellamo 3.12.
Venla 2.6.
Viivi 2.5.
Viola 3.6.
Virva 2.3.
Virve 2.3.
Vuokko 2.5.
Aapeli 2.1.
Aaro 1.7.
Aaron 1.7.
Alpi 1.3.
Alpo 1.3.
Alvi 1.3.
```

Question 59 & **Answer 59**: Use *lynx -dump "url"* to print webpage to STDOUT

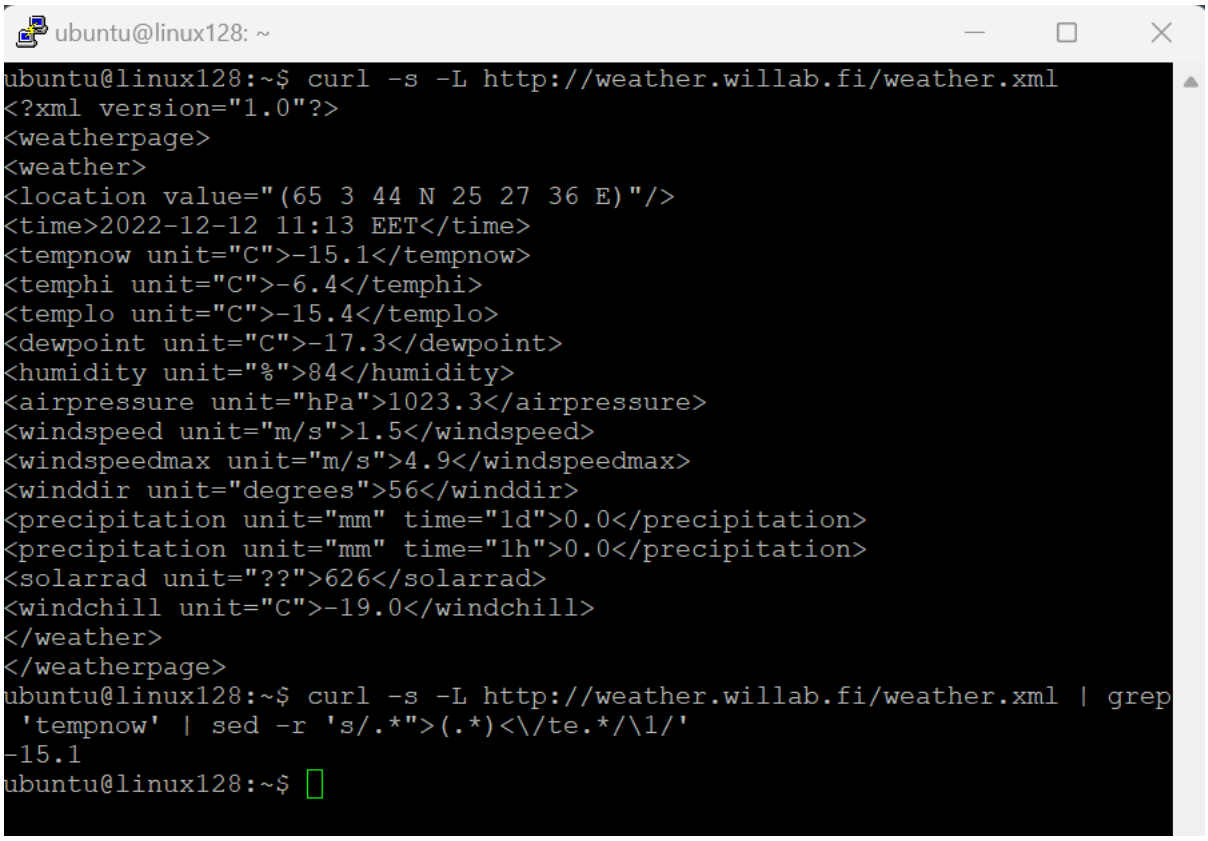
Filter output so that you will get only the current Lotto numbers, but nothing else from the webpage
Lotto numbers are available here: https://yle.fi/tekstitv/txt/471_0001.htm



Question 60 & **Answer 60:** HTTP access to XML:

Use Gnu tools or Cmder's Curl and Grep (and maybe other command line tools) to create a one-liner, which downloads the XML file and parses current temperature from VTT's weather station. One-liner must print only the current temperature in Oulu and nothing else. Command line one-liner and output should look something like this:

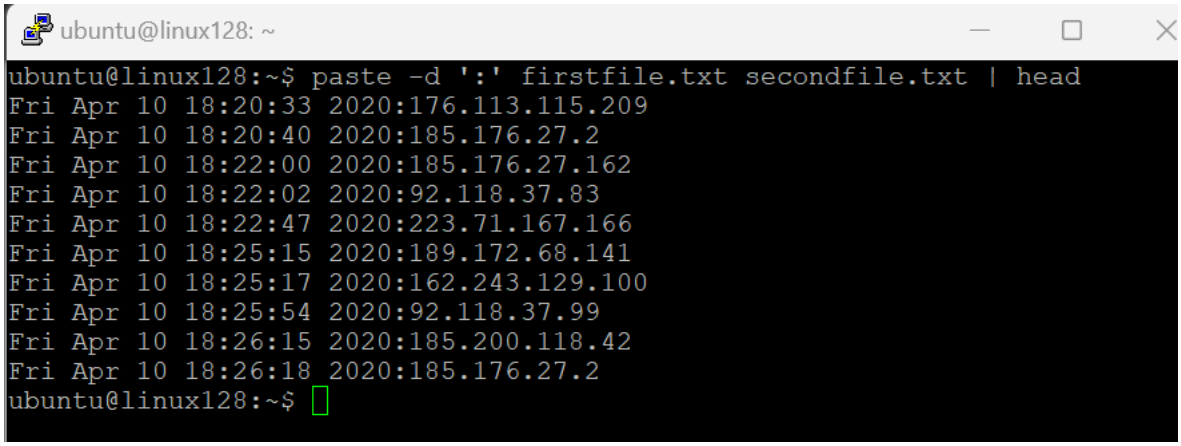
curl -s -L http://weather.willab.fi/weather.xml | _replace_with_your_commands_options_and_code_12.3



Question 61 & **Answer 61:** Combine these two files to a single file with command line Gnu text tools

The first file has timestamps and the second file has IP addresses
Use : as delimeter between columns. Output should look something like this:

```
...
Sat Apr 11 11:03:42 2020:185.176.27.26
Sat Apr 11 11:03:43 2020:188.26.0.66
Sat Apr 11 11:04:15 2020:185.176.27.34
Sat Apr 11 11:04:57 2020:87.251.74.250
Sat Apr 11 11:05:00 2020:94.102.52.57
...
```



Question 62 & **Answer 62:** Delete unnecessary files created in this practice

Using **rm -r *** deleted all unnecessary files created in this practice.

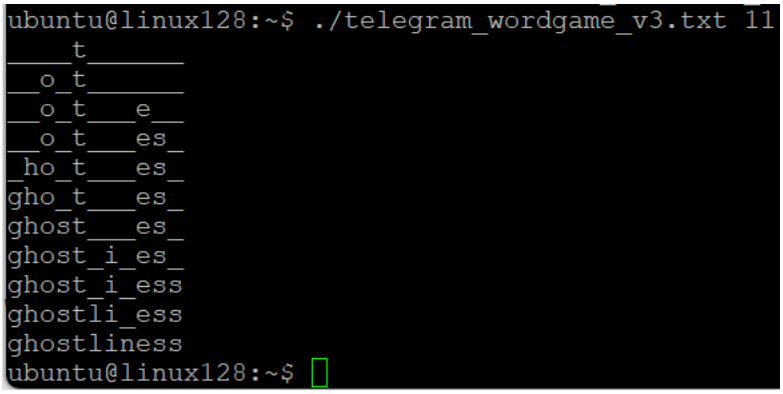
Week 5

Question 63: Study this Telegram bot game version 0.1, this improved version 0.2 and even more improved version 0.3

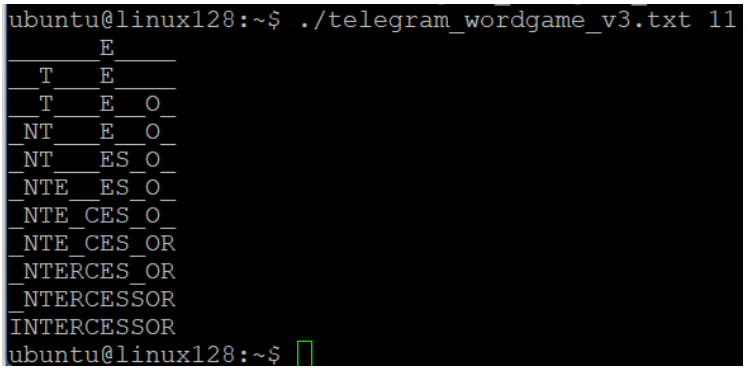
Output should look like this:

```
$ ./telegram_wordgame_v3.bash 11
01 _____M_____
02 ___O_M_____
03 ___ORM_____
04 A__ORM_____
05 A__ORM__I__
06 A__ORM__I_Y
07 A__ORM_LI_Y
08 A_NORM_LI_Y
09 A_NORM_LITY
10 ABNORM_LITY
11 ABNORMALITY
```

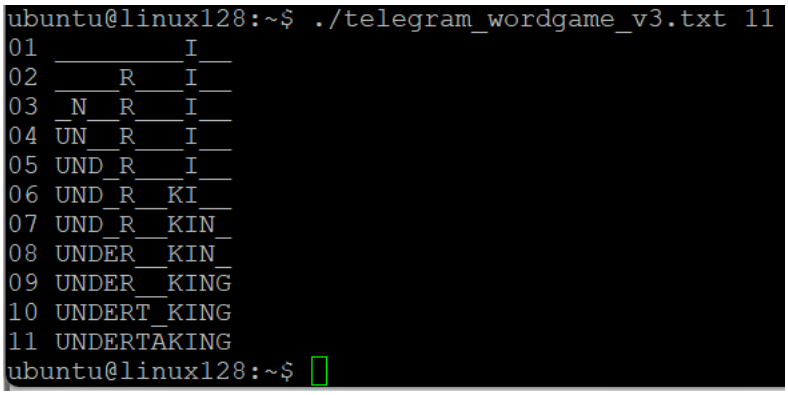
- Compare all three scripts
- Download the 3rd script (version 0.3) and related word list files (Github addresses are listed in the beginning of the script) with wget and run the script



- Modify the script to output all characters UPPER CASE



- Modify the script to add zero padded line numbers into the beginning of each line



Week 6

Question 72 & **Answer 72:** Install Apache web server to your Linux server if it isn't installed already

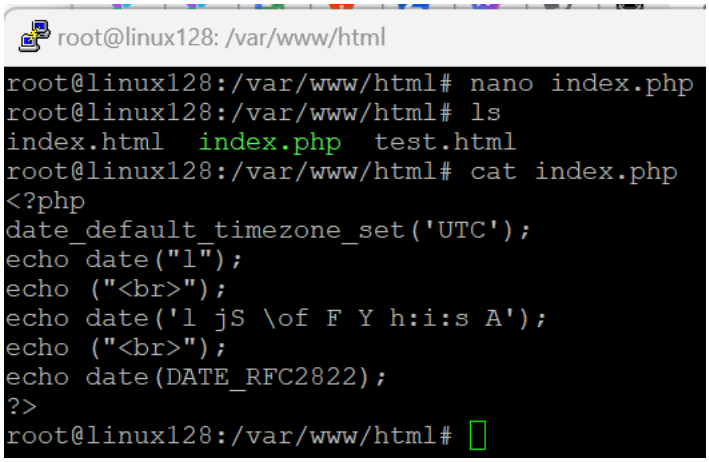
Ignore/skip possible ufw (firewall) parts. Ufw has been disabled intentionally on student virtual servers

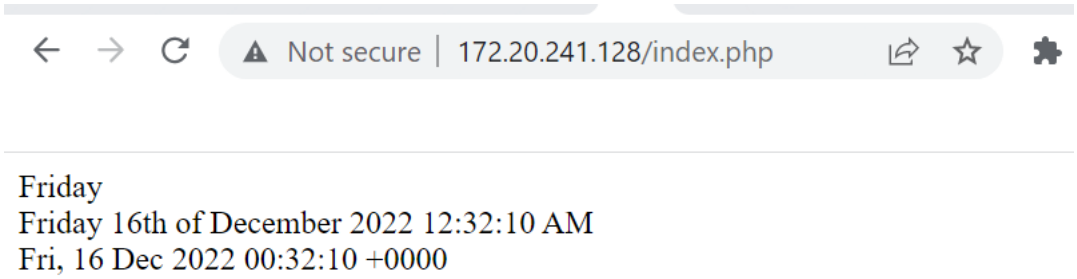
Add PHP support to your Apache web server. See the MySQL example with PHP for required software packages

I added PHP SUPPORT to my Apache web server.

Create following PHP script under the web server document root (/var/www/html) and test that your server is executing the PHP script when requesting it with a web browser (address is: http://server/scriptname.php):

```
<?php
date_default_timezone_set('UTC');
echo date("l");
echo ("<br>");
echo date('l jS \of F Y h:i:s A');
echo ("<br>");
echo date(DATE_RFC2822);
?>
```





Question 73 & **Answer 73:** Modify the Apache web server configuration to redirect HTTP GET requests to the directory /weather/ to https://wttr.in/. You will most likely need to enable the redirect module for Apache

- So, visiting your server http://IP_or_DNSname/weather/ takes the browser to wttr.in. Check with web browser that the redirect works as intended

root@linux128: /etc/apache2/sites-enabled

```
root@linux128:/var/www/html# cd /etc/apache2/sites-enabled/
root@linux128:/etc/apache2/sites-enabled# nano 000-default.conf
root@linux128:/etc/apache2/sites-enabled# cat 000-default.conf
<VirtualHost *:80>
        # The ServerName directive sets the request scheme, hostname and p
ort that
        # the server uses to identify itself. This is used when creating
        # redirection URLs. In the context of virtual hosts, the ServerNam
e
        # specifies what hostname must appear in the request's Host: heade
r to
        # match this virtual host. For the default virtual host (this file
) this
        # value is not decisive as it is used as a last resort host regard
less.
        # However, you must set it for any further virtual host explicitly
.
        #ServerName www.example.com

        ServerAdmin webmaster@localhost
        DocumentRoot /var/www/html

        # Available loglevels: trace8, ..., trace1, debug, info, notice, w
arn,
        # error, crit, alert, emerg.
        # It is also possible to configure the loglevel for particular
        # modules, e.g.
        #LogLevel info ssl:warn

        ErrorLog ${APACHE_LOG_DIR}/error.log
        CustomLog ${APACHE_LOG_DIR}/access.log combined

        # For most configuration files from conf-available/, which are
        # enabled or disabled at a global level, it is possible to
        # include a line for only one particular virtual host. For example
 the
        # following line enables the CGI configuration for this host only
        # after it has been globally disabled with "a2disconf".
        #Include conf-available/serve-cgi-bin.conf
</VirtualHost>

# vim: syntax=apache ts=4 sw=4 sts=4 sr noet
Redirect 301 /weather/ https://wttr.in/
root@linux128:/etc/apache2/sites-enabled#
```

```
root@linux128:/etc/apache2/sites-enabled# curl 172.20.241.128/weather/
<!DOCTYPE HTML PUBLIC "-//IETF//DTD HTML 2.0//EN">
<html><head>
<title>301 Moved Permanently</title>
</head><body>
<h1>Moved Permanently</h1>
<p>The document has moved <a href="https://wttr.in/">here</a>.</p>
<hr>
<address>Apache/2.4.52 (Ubuntu) Server at 172.20.241.128 Port 80</address>
</body></html>
root@linux128:/etc/apache2/sites-enabled#
```

Question 74 & **Answer 74:** Check last entries in Apache access and error log files in /var/log/apache2/

```
root@linux128:/etc/apache2/sites-enabled# cd /var/log/apache2/
root@linux128:/var/log/apache2# ls
access.log    error.log    error.log.2.gz  error.log.4.gz
access.log.1  error.log.1  error.log.3.gz  other_vhosts_access.log
root@linux128:/var/log/apache2# cat access.log | tail -5
172.20.241.128 - - [16/Dec/2022:04:03:28 +0200] "GET / HTTP/1.1" 200 10926
 "-" "curl/7.81.0"
172.20.241.128 - - [16/Dec/2022:04:03:46 +0200] "GET /weather HTTP/1.1" 40
4 437 "-" "curl/7.81.0"
172.20.241.128 - - [16/Dec/2022:04:04:39 +0200] "GET /weather HTTP/1.1" 40
4 437 "-" "curl/7.81.0"
172.20.241.128 - - [16/Dec/2022:04:05:22 +0200] "GET /weather/ HTTP/1.1" 3
01 501 "-" "curl/7.81.0"
10.2.124.81 - - [16/Dec/2022:04:05:41 +0200] "GET /weather/ HTTP/1.1" 301
557 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHT
ML, like Gecko) Chrome/108.0.0.0 Safari/537.36"
root@linux128:/var/log/apache2#
```

```
root@linux128:/var/log/apache2# cat error.log | tail -5
[Fri Dec 16 04:02:40.987923 2022] [mpm_prefork:notice] [pid 84254] AH00163
: Apache/2.4.52 (Ubuntu) configured -- resuming normal operations
[Fri Dec 16 04:02:40.988007 2022] [core:notice] [pid 84254] AH00094: Comma
nd line: '/usr/sbin/apache2'
[Fri Dec 16 04:04:35.138332 2022] [mpm_prefork:notice] [pid 84254] AH00170
: caught SIGWINCH, shutting down gracefully
[Fri Dec 16 04:04:35.276384 2022] [mpm_prefork:notice] [pid 84282] AH00163
: Apache/2.4.52 (Ubuntu) configured -- resuming normal operations
[Fri Dec 16 04:04:35.276471 2022] [core:notice] [pid 84282] AH00094: Comma
nd line: '/usr/sbin/apache2'
root@linux128:/var/log/apache2#
```

Question 75 & **Answer 75:** Install MySQL server and create some basic database there with one or more tables and insert some data into the table(s). See the basic MySQL example with PHP

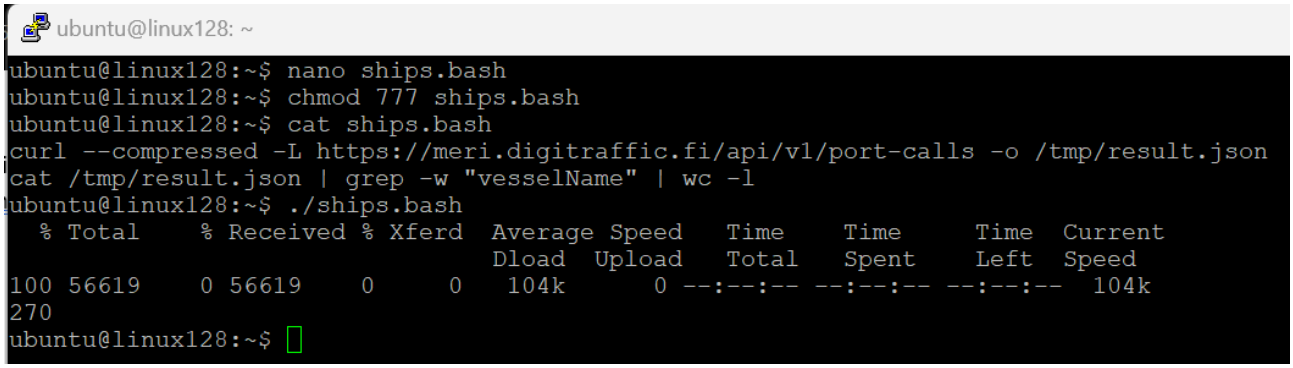
```
mysql> DESCRIBE rawdata;
+-------------+--------------+------+-----+-------------------+-------------------+
| Field       | Type         | Null | Key | Default           | Extra             |
+-------------+--------------+------+-----+-------------------+-------------------+
| id          | int          | NO   | PRI | NULL              | auto_increment    |
| timestamp   | timestamp    | NO   |     | CURRENT_TIMESTAMP | DEFAULT_GENERATED |
| watts       | int          | NO   |     | 0                 |                   |
| sensor      | int          | NO   |     | 0                 |                   |
| temperature | float        | NO   |     | 0                 |                   |
| location    | varchar(256) | NO   |     | 0                 |                   |
+-------------+--------------+------+-----+-------------------+-------------------+
6 rows in set (0.00 sec)

mysql> INSERT INTO rawdata (watts, sensor, temperature, location) VALUES ('1000', '1', '23', 'Oamk kotkantie 1');
Query OK, 1 row affected (0.09 sec)

mysql> INSERT INTO rawdata (watts, sensor, temperature, location) VALUES ('800', '2', '21', 'Oamk kotkantie 1');
Query OK, 1 row affected (0.06 sec)

mysql> INSERT INTO rawdata (watts, sensor, temperature, location) VALUES ('1100', '1', '22', 'Oamk kotkantie 1');
Query OK, 1 row affected (0.03 sec)

mysql> select * from rawdata
    -> select * from rawdata;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near 'se
lect * from rawdata' at line 2
mysql> select * from rawdata;
+----+---------------------+-------+--------+-------------+------------------+
| id | timestamp           | watts | sensor | temperature | location         |
+----+---------------------+-------+--------+-------------+------------------+
|  1 | 2022-12-16 04:19:48 |  1000 |      1 |          23 | Oamk kotkantie 1 |
|  2 | 2022-12-16 04:19:48 |   800 |      2 |          21 | Oamk kotkantie 1 |
|  3 | 2022-12-16 04:19:51 |  1100 |      1 |          22 | Oamk kotkantie 1 |
+----+---------------------+-------+--------+-------------+------------------+
3 rows in set (0.00 sec)

mysql>
```

Question 76 & **Answer 76:** Create a Bash script which will fetch and process data from [marine traffic API]

- Script must download the JSON-file from marine traffic port call API and print how many ships are currently there? (Search vesselName from the JSON)
- Command line example with curl to get things started:

  curl --compressed -L https://meri.digitraffic.fi/api/v1/port-calls -o /tmp/result.json

- Filter the /tmp/result.json file data with jq or with GNU text utilities such as sed, awk, cut, grep etc. to only show how many ships are currently there? (Search vesselName from the JSON)

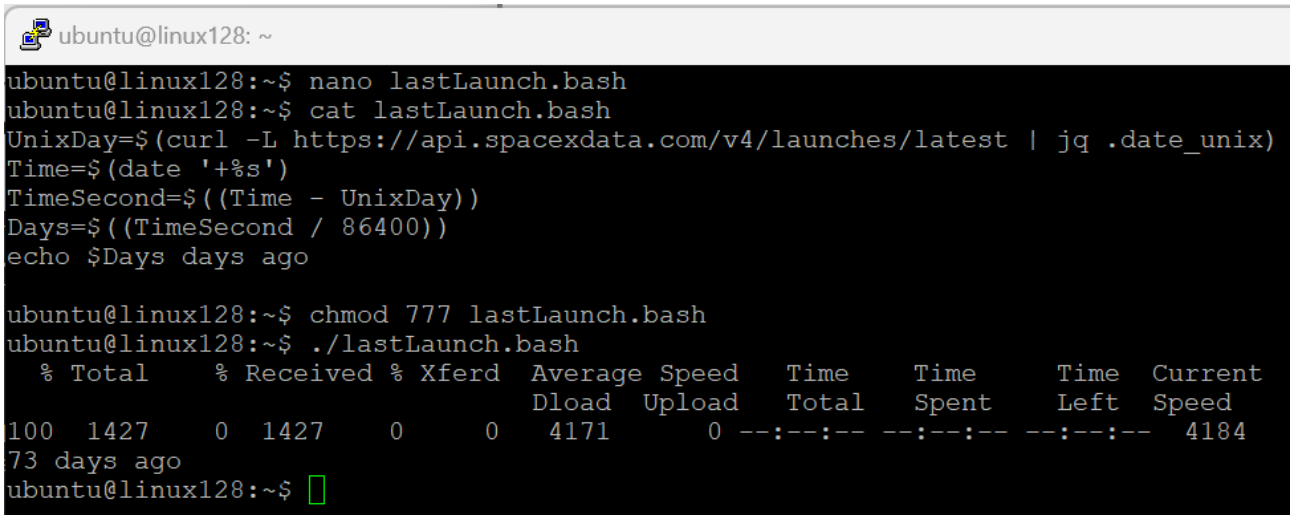


Question 77 & **Answer 77:** Create a Bash script which checks [spaceX launch schedule API] and tells how many days ago was the last launch. Result should be something like this:

ubuntu@linux100:/tmp$ ./whenwasthelaunch.bash

4 days ago

- Tip: Use unix epoch timestamp from the API reply and current Unix epoch time from date command to calculate and show the time difference

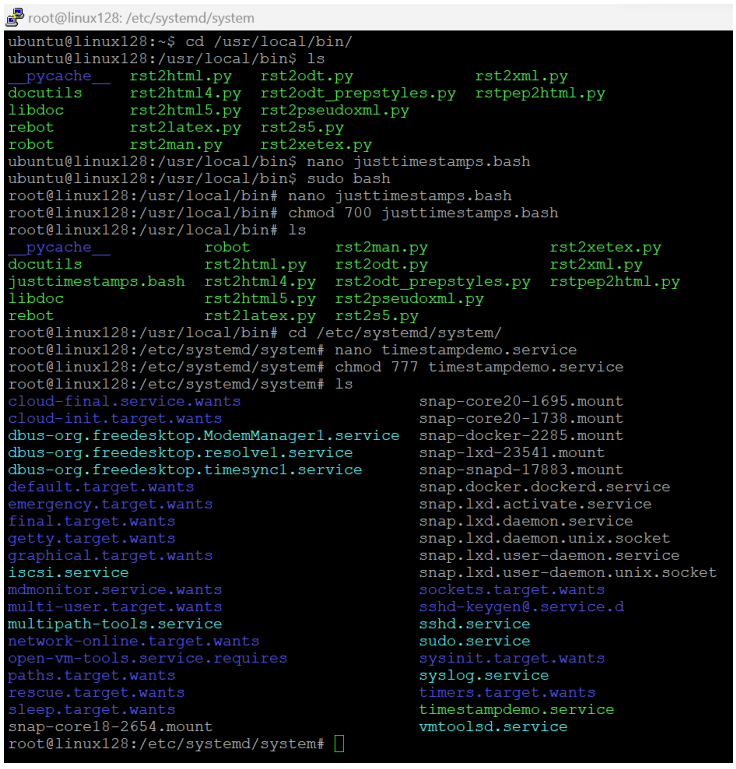


Question 78: Create this Bash script to /usr/local/bin directory. Name it to justtimestamps.bash and set the file permissions to 700 (root user has full access, others none). Check that the root is the file owner:

```
#!/bin/bash

while true; do # this is endless loop
    date >> /root/timestamps.txt # writing timestamp to a file
    sleep 60 # 60 second delay
done
```

- Create a new systemd service configuration file *timestampdemo.service* to the /etc/systemd/system directory with contents:

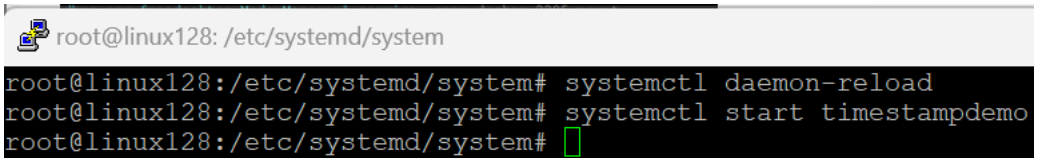
```
[Unit]
Description=My automatic service writing timestamps to a file in
/tmp
After=network.target

[Service]
Type=simple
User=root
Group=root
ExecStart=/usr/local/bin/justtimestamps.bash
WorkingDirectory=/tmp
Restart=on-failure

[Install]
WantedBy=multi-user.target
```



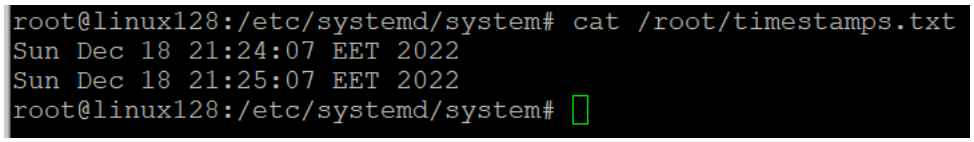
- Manage the service:

  Reload service files with: *systemctl daemon-reload*

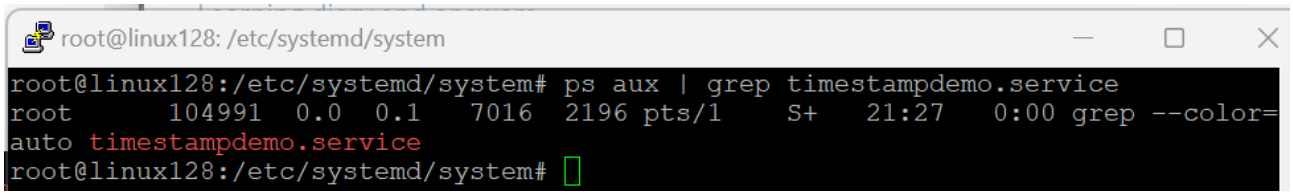
  Start the service with: *systemctl start timestampdemo*



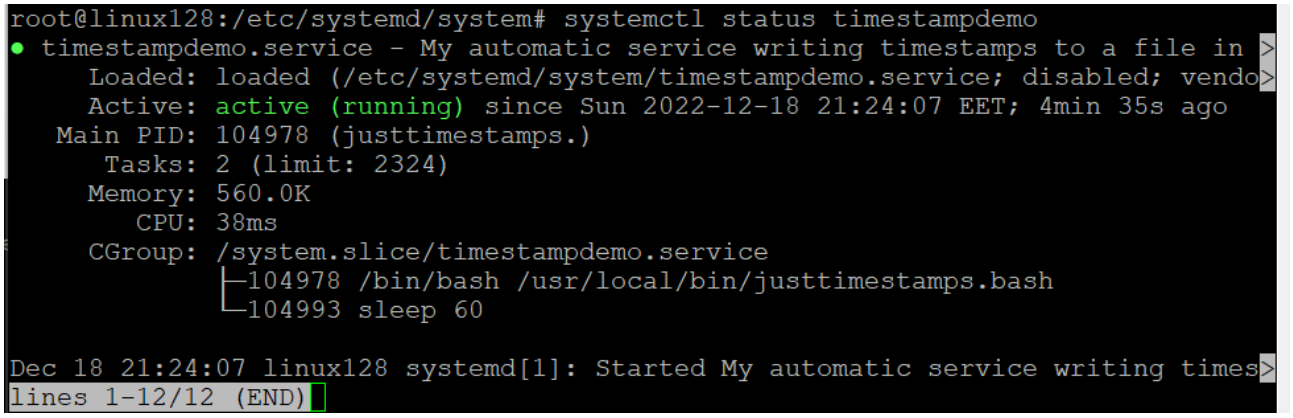
  Check that /root/timestamp.txt file was created with the timestamp content (that date command should be running once per minute)



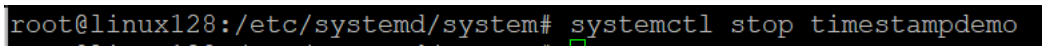
  Check the process list to verify that the script is running



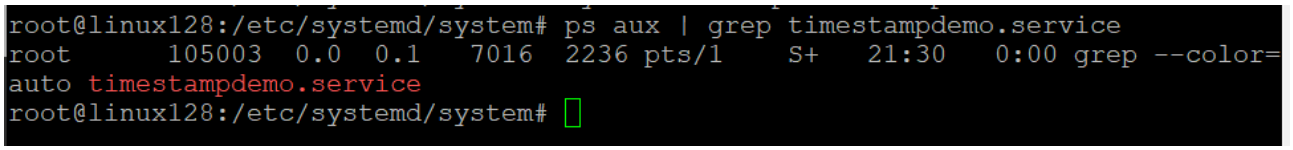
  - Use command: *systemctl status timestampdemo* to check the service status



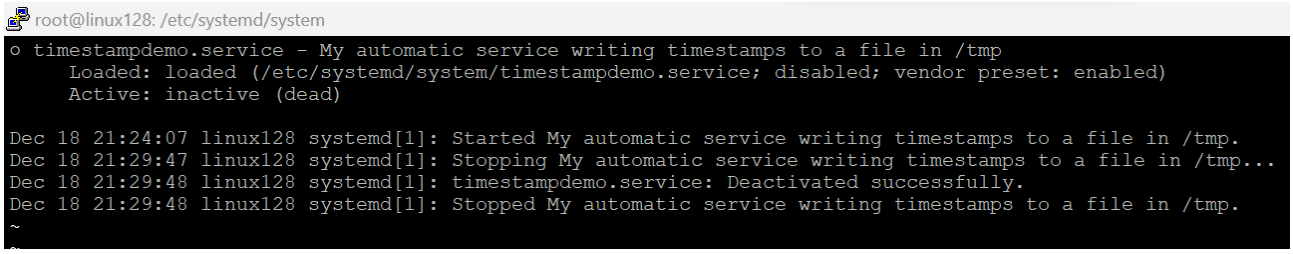
  Stop the script with: *systemctl stop timestampdemo*



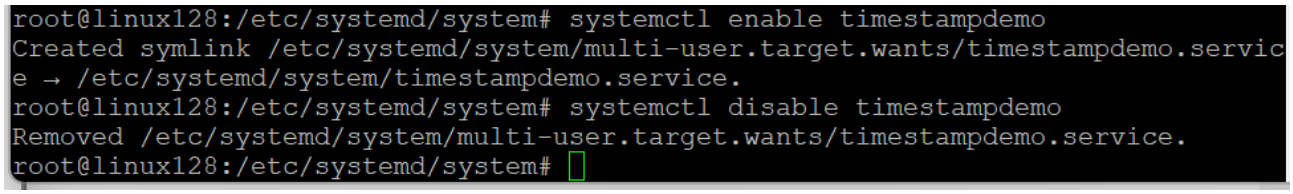
  Verify from process list that service is not running anymore



Use *systemctl status timestampdemo* to check the service status



Try running *systemctl enable timestampdemo* and *systemctl disable timestampdemo* (enables/disables the service during the server startup)



Week 7

Question 79: What is a Linux container? (With any technology such as LXC/LXD, Docker, Podman). Generic description what is a Linux container is enough.

Answer 79: A Linux container is a set of 1 or more processes that are isolated from the rest of the system. All the files necessary to run them are provided from a distinct image, meaning Linux containers are portable and consistent as they move from development, to testing, and finally to production.

A virtual machine and system container manager of the future is called LXD. It provides a uniform user interface for entire Linux systems running in virtual or containerized environments.

LXD is an image-based system that offers images for many different Linux distributions. With support for numerous storage backends and network types as well as the opportunity to deploy on hardware ranging from a single laptop or cloud instance to a whole server rack, it offers flexibility and scalability for a variety of use scenarios.

Question 80: What is the difference between chroot, containers and full operating system virtualization (like Virtualbox, VMware, Hyper-V etc.)?

Answer 80: While containerization runs a single OS instance with several user spaces to isolate processes from one another, virtualization tries to operate multiple OS instances on a single server. Therefore, containerization makes sense for a single AWS cloud customer who want to execute several tasks at once.

Question 81: What is Kubernetes?

Answer 81: An open-source container orchestration technology called Kubernetes (sometimes referred to as k8s or "kube") automates a lot of the labor-intensive steps needed in setting up, running, and scaling containerized systems.

Question 82: What is Ansible?

Answer 82: Ansible is an open-source IT automation platform that automates numerous manual IT activities, including provisioning, configuration management, application deployment, orchestration, and many more. Contrary to more straightforward management tools, Ansible users (such as system administrators, developers, and architects) can use Ansible automation to deploy software, automate routine tasks, provision infrastructure, enhance security and compliance, patch systems, and distribute automation throughout the entire company.

Question 83: What is Terraform?

Answer 83: In order to automate numerous infrastructure activities, DevOps teams frequently use the IAC tool Terraform. One of the primary use cases for Terraform is the provisioning of cloud resources, for example. It is an open-source, cloud-independent provisioning tool made by HashiCorp in the Go programming language.

Question 84 & **Answer 84:** Install Docker engine (docker.io) package to your server from standard package repository or from the Docker official repository

- Use *docker* CLI command to search package *searx* with most stars

```
root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# docker search searx
NAME                      DESCRIPTION                                     STARS     OFFICIAL   AUTOMATED
searx/searx               Privacy-respecting metasearch engine            55
searxng/searxng           SearXNG is a metasearch engine. Users are ne…   40
hoellen/searx             Searx meta-search engine.                       15                   [OK]
cyrilix/searx             A privacy-respecting, hackable metasearch en…   3                    [OK]
angristan/searx           Alpine-based Docker image for the Searx meta…   1
paulgoio/searxng          SearXNG image with changed simple theme, set…   1
mazzolino/searx           searx search engine                             1                    [OK]
gscloudcz/searx           searX is a metasearch engine, inspired by th…   1
nerzhul/searx-arm64       A searx metaengine image to use on ARM64        1
vojkovic/searxng          A custom SearXNG image, a privacy-respecting…   0
ston3o/searx              Privacy-respecting metasearch engine https:/…   0                    [OK]
adonisd/searx             Searx Multi platform (armv7, arm64, amd64) b…   0
risea/searx               Searx meta search engine                        0                    [OK]
luzifer/searx                                                             0
spcodes/searx             DEPRECATED: Use the official image instead.     0
avpnusr/searx             Searx docker build-chain for various archite…   0
unixfox/searx-custom      Based on woahbase/alpine-searx with addition…   0
adeweever91/searx_ss      searx with ssl using nginx/uwsgi                0                    [OK]
freenas/searx             A metasearch engine with basic privacy, insp…   0                    [OK]
monogramm/searx           Privacy-respecting metasearch engine            0
paulgoio/searx            deprecated; go to paulgoio/searxng instead!     0
icebal/searx                                                              0
egon0/searx-multiarch                                                     0
endormi2/searxng          My version of searxng. Adding my preferred c…   0
rpidckr/searx                                                             0
root@linux128:/home/ubuntu#
```

- Use *docker* CLI to pull *searx/searx* Docker container image from Docker repository (Searx is a self-hosted metasearch engine, combining multiple web search engine results)

```
root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# docker pull searx/searx
Using default tag: latest
latest: Pulling from searx/searx
9621f1afde84: Pull complete
a76a3d536a25: Pull complete
b61ddb62068b: Pull complete
da205aaf9423: Pull complete
e608bf698ae3: Pull complete
0f568b33fc72: Pull complete
75ca5485c233: Pull complete
Digest: sha256:f61dc2419f59263ea94ede32740d32d10825a8be77cbcb3f292c156fe8b3a775
Status: Downloaded newer image for searx/searx:latest
docker.io/searx/searx:latest
root@linux128:/home/ubuntu#
```

- List local Docker images with *docker images* command. What is the image id of Searx?

```
root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# docker image ls
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
searx/searx   latest    cdd0c653666a   5 weeks ago      171MB
hello-world   latest    feb5d9fea6a5   14 months ago    13.3kB
root@linux128:/home/ubuntu#
```

The image id of Searx is: cdd0c653666a

- Start the Searx container and redirect inbound TCP 8080 port traffic to the Searx container:

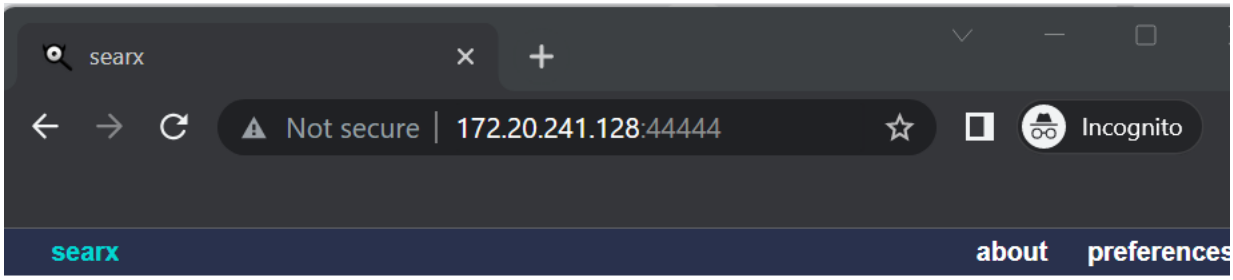
  docker run --rm -d -v /opt/docker/searx/searx:/etc/searx -p 44444:8080 -e BASE_URL=http://localhost:44444/ searx/searx

```
root@linux128:/home/ubuntu# docker run --rm -d -v /opt/docker/searx/searx:/et
c/searx -p 44444:8080 -e BASE_URL=http://localhost:44444/ searx/searx
f47ec48fdfebeb8f654afdb034cdc0e63763aaa0c301f8b73604160b91135ac9
root@linux128:/home/ubuntu#
```

- Use *docker ps* to verify that Searx container is running

```
root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED              STATUS              PORTS                                       NAMES
f47ec48fdfeb   searx/searx    "/sbin/tini -- /usr/…"   About a minute ago   Up About a minute   0.0.0.0:44444->8080/tcp, :::44444->8080/tcp   musing_goodall
root@linux128:/home/ubuntu#
```

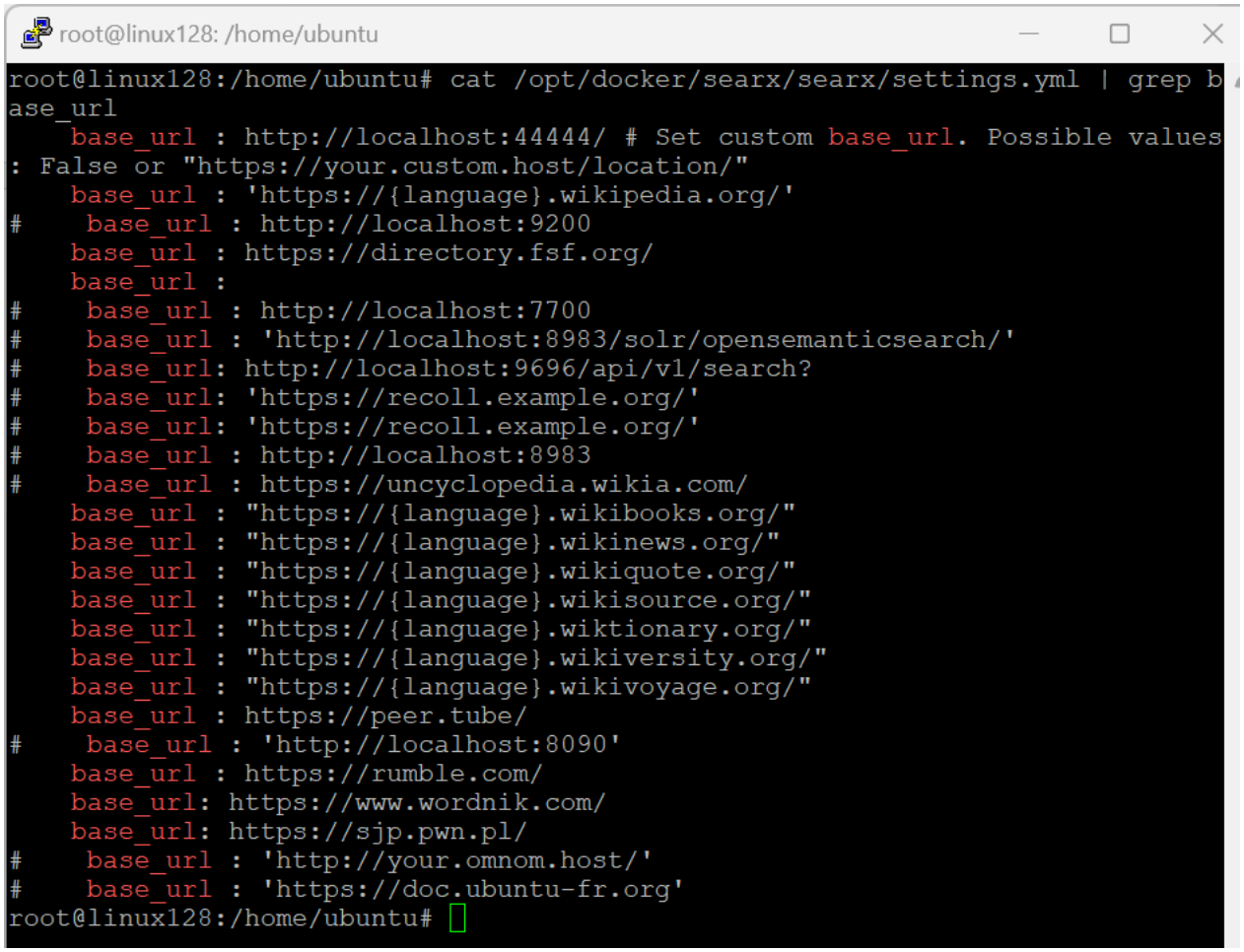
- Verify that you can access your container with your web browser: http://your_server_ip:44444/ (open TCP/44444 port in your host firewall if you are filtering traffic with Netfilter)



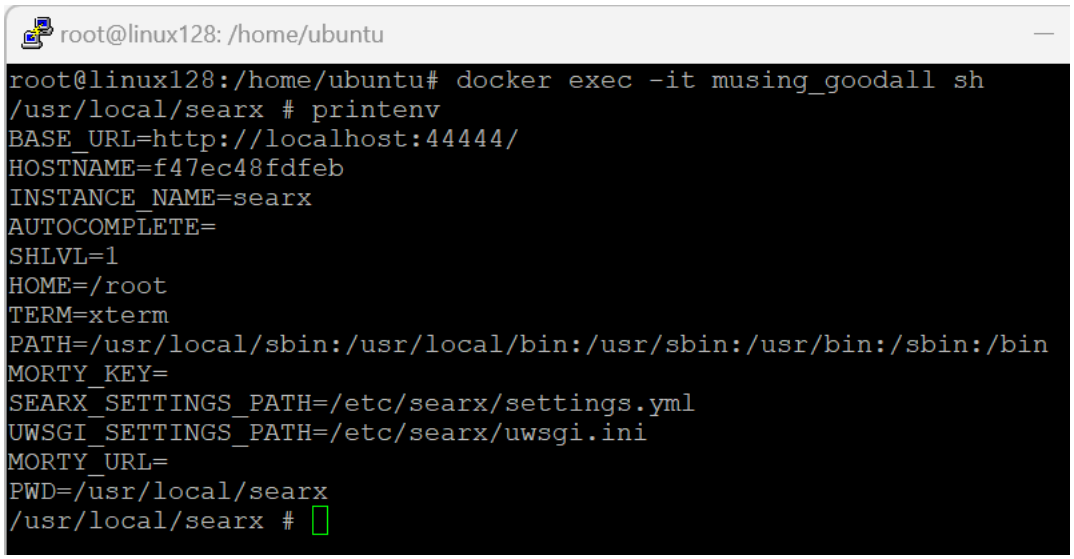
- Check container stats with interactive docker stats command

```
root@linux128: /home/ubuntu
CONTAINER ID   NAME             CPU %     MEM USAGE / LIMIT     MEM %     NET I/O         BLOCK I/O         PIDS
f47ec48fdfeb   musing_goodall   0.02%     255.6MiB / 1.929GiB   12.93%    3.15MB / 339kB   5.57MB / 65.5kB   15
```

- Check Searx default settings in */opt/docker/searx/searx/settings.yml* file.
  See https://docs.docker.com/engine/swarm/configs/ and variables like BASE_URL



- Use *docker exec* to list and explore Searx container filesystem and files. Note: Searx container does not have bash shell but Busybox has SH shell (From CLI: *docker exec -t -i your_containerID sh*)



- Stop the container and verify that is has been stopped. Remove the container image if using it anymore

```
root@linux128: /home/ubuntu
root@linux128:/home/ubuntu# docker stop musing_goodall
musing_goodall
root@linux128:/home/ubuntu# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@linux128:/home/ubuntu# docker container ls
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@linux128:/home/ubuntu# docker image ls
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
searx/searx   latest    cdd0c653666a   5 weeks ago      171MB
hello-world   latest    feb5d9fea6a5   14 months ago    13.3kB
root@linux128:/home/ubuntu# docker rmi searx/searx
Untagged: searx/searx:latest
Untagged: searx/searx@sha256:f61dc2419f59263ea94ede32740d32d10825a8be77cbcb3f
292c156fe8b3a775
Deleted: sha256:cdd0c653666ab2de83635f03807093e2042e26b43409259a3e5dcff1a7cc9
8e1
Deleted: sha256:d3c5625aeb4b5aa914c3889cdb9f75d26d04bd192d2fe6c200faaa9116f02
e06
Deleted: sha256:ff02090c704c4f985e86e006dea168bc5453c36cdf633c1fedc93e550fca0
c70
Deleted: sha256:a346ae2d17ded99b91606ef847f8ee38fb24de29dba23506f7319f40dc928
7b5
Deleted: sha256:311cc744826fb27c49bd0c4433363d1bc3b659175c003b186449fc1ddb94d
114
Deleted: sha256:1b01190a6c21cf8c77e9ec2fdc8eb0a597d5f026757f34e5f704ae49da4b8
b42
Deleted: sha256:de49e2d475524c064d39ac11e693d49aaaeeb634b6ba731dfdf32293adeea
8e4
Deleted: sha256:34d5ebaa5410d2ab4154bbd7c3c99c385ec509eb9c1d03d5486aff01bbd61
8c5
root@linux128:/home/ubuntu# docker image ls
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
hello-world   latest    feb5d9fea6a5   14 months ago    13.3kB
root@linux128:/home/ubuntu#
```

Question 85 & **Answer 85:** Browse these container building tutorials: Create a Docker image running Robot Framework and Docker Build: A Beginner's Guide to Building Docker Images

```
root@linux128: /home/ubuntu/dockerProject
root@linux128:/home/ubuntu/dockerProject# docker-compose up
Starting dockerproject_test_1 ... done
Attaching to dockerproject_test_1
test_1  | robot --console verbose --outputdir /reports /suites/
test_1  | ==============================================================================
test_1  | Suites
test_1  | ==============================================================================
test_1  | Suites.Website Jdriven
test_1  | ==============================================================================
test_1  | Get Request TestWebsite                                               /usr/local/lib/python3.10/site-packages/urllib3/connectionpool.py:1045: Insec
ureRequestWarning: Unverified HTTPS request is being made to host 'www.jdriven.com'. Adding certificate verification is strongly advised. See: https://urllib
3.readthedocs.io/en/1.26.x/advanced-usage.html#ssl-warnings
test_1  |   warnings.warn(
test_1  | /usr/local/lib/python3.10/site-packages/urllib3/connectionpool.py:1045: InsecureRequestWarning: Unverified HTTPS request is being made to host 'jdr
iven.com'. Adding certificate verification is strongly advised. See: https://urllib3.readthedocs.io/en/1.26.x/advanced-usage.html#ssl-warnings
test_1  |   warnings.warn(
test_1  | | PASS |
test_1  | ------------------------------------------------------------------------------
test_1  | Suites.Website Jdriven                                                | PASS |
test_1  | 1 test, 1 passed, 0 failed
test_1  | ==============================================================================
test_1  | Suites                                                                | PASS |
test_1  | 1 test, 1 passed, 0 failed
test_1  | ==============================================================================
test_1  | Output:  /reports/output.xml
test_1  | Log:     /reports/log.html
test_1  | Report:  /reports/report.html
dockerproject_test_1 exited with code 0
root@linux128:/home/ubuntu/dockerProject#
```

root@linux128: /home/ubuntu/dockerProject/reports

```
root@linux128:/home/ubuntu/dockerProject/reports# ll
total 484
drwxr-xr-x 2 root root   4096 Dec 17 23:52 ./
drwxr-xr-x 5 root root   4096 Dec 17 23:43 ../
-rw-r--r-- 1 root root 233723 Dec 17 23:52 log.html
-rw-r--r-- 1 root root  15898 Dec 17 23:52 output.xml
-rw-r--r-- 1 root root 232415 Dec 17 23:52 report.html
root@linux128:/home/ubuntu/dockerProject/reports#
```

```
root@linux128:/home/ubuntu/dockerProject/reports# cp log.html output.xml repo
rt.html /var/www/html/
root@linux128:/home/ubuntu/dockerProject/reports# ll /var/www/html/
total 516
drwxr-xr-x 2 root root   4096 Dec 17 23:55 ./
drwxr-xr-x 3 root root   4096 Dec 11 20:55 ../
-rw-r--r-- 1 root root  10671 Dec 11 20:55 index.html
-rw-r--r-- 1 root root   8659 Dec 16 02:42 index.html.1
-rwxrwxrwx 1 root root    149 Dec 16 02:12 index.php*
-rw-r--r-- 1 root root 233723 Dec 17 23:55 log.html
-rw-r--r-- 1 root root  15898 Dec 17 23:55 output.xml
-rw-r--r-- 1 root root 232415 Dec 17 23:55 report.html
-rw-r--r-- 1 root root    147 Dec 11 21:02 test.html
root@linux128:/home/ubuntu/dockerProject/reports#
```

Not secure | 172.20.241.128/report.html

Suites Report

Generated
20221217 23:52:23 UTC+02:00
4 minutes 48 seconds ago

Summary Information

Status:	All tests passed
Start Time:	20221217 23:52:22.748
End Time:	20221217 23:52:23.768
Elapsed Time:	00:00:01.020
Log File:	log.html

Test Statistics

Total Statistics	Total	Pass	Fail	Skip	Elapsed	Pass / Fail / Skip
All Tests	1	1	0	0	00:00:01	

Statistics by Tag	Total	Pass	Fail	Skip	Elapsed	Pass / Fail / Skip
No Tags						

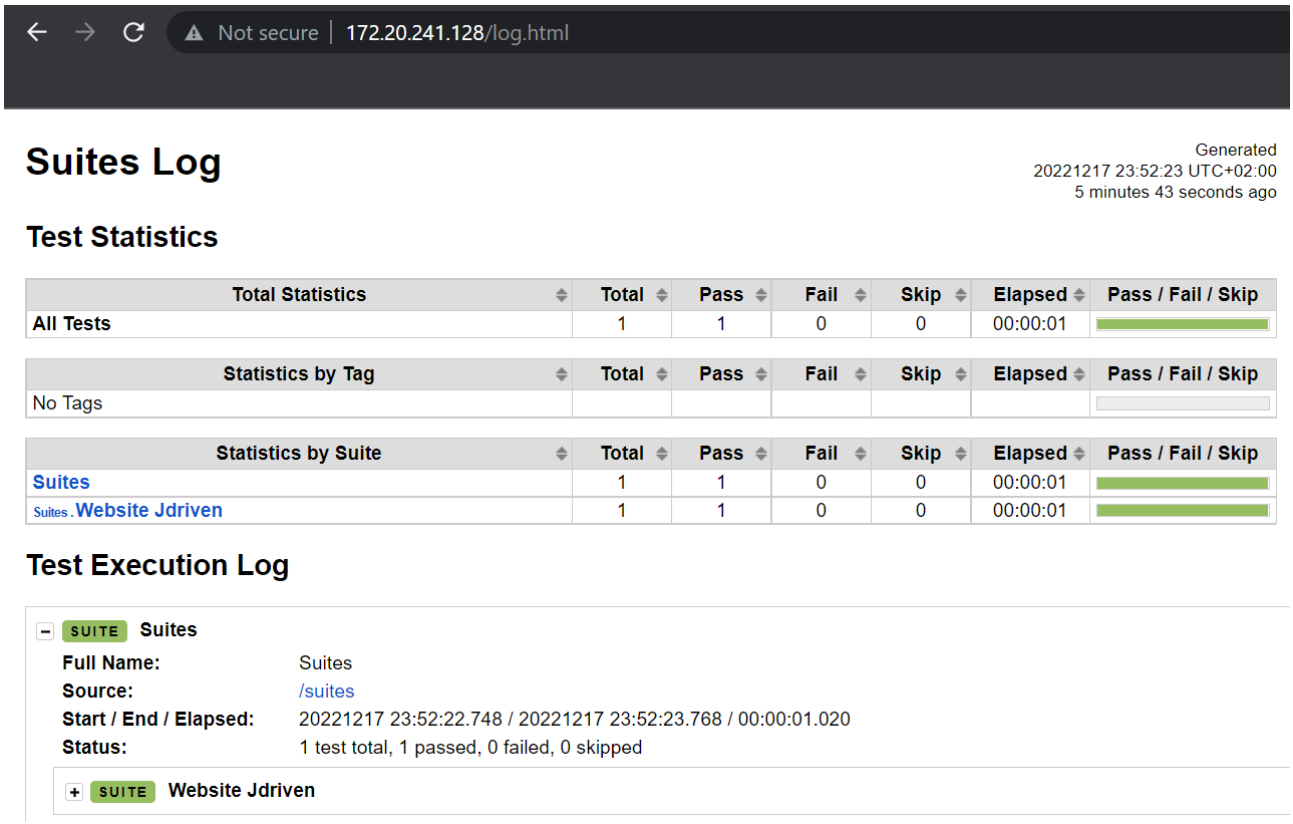
Statistics by Suite	Total	Pass	Fail	Skip	Elapsed	Pass / Fail / Skip
Suites	1	1	0	0	00:00:01	
Suites . Website Jdriven	1	1	0	0	00:00:01	

Test Details

All | Tags | Suites | Search

Suite:

Test:


Not secure | 172.20.241.128/log.html
Suites Log
Generated
20221217 23:52:23 UTC+02:00
5 minutes 43 seconds ago
Test Statistics
Total Statistics | Total | Pass | Fail | Skip | Elapsed | Pass / Fail / Skip
All Tests | 1 | 1 | 0 | 0 | 00:00:01
Statistics by Tag | Total | Pass | Fail | Skip | Elapsed | Pass / Fail / Skip
No Tags
Statistics by Suite | Total | Pass | Fail | Skip | Elapsed | Pass / Fail / Skip
Suites | 1 | 1 | 0 | 0 | 00:00:01
Suites.Website Jdriven | 1 | 1 | 0 | 0 | 00:00:01
Test Execution Log
SUITE Suites
Full Name: Suites
Source: /suites
Start / End / Elapsed: 20221217 23:52:22.748 / 20221217 23:52:23.768 / 00:00:01.020
Status: 1 test total, 1 passed, 0 failed, 0 skipped
SUITE Website Jdriven