

LAB CYCLE:1

EXPERIMENT NO:1

Date:

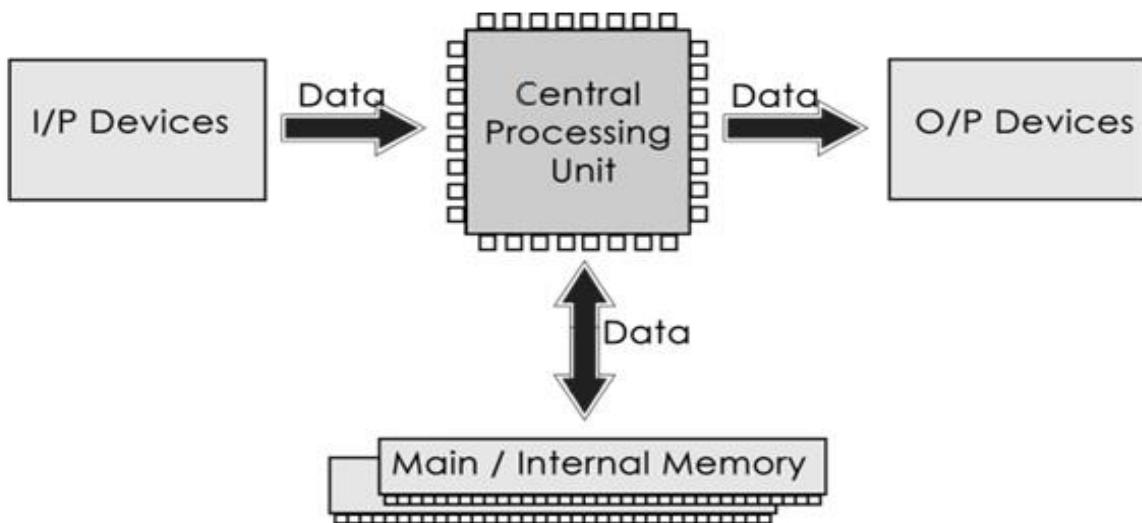
Aim: Familiarisation with computer hardware.

Introduction to Computer hardware: Physical identification of major components of a computer system such as mother board, RAM modules, daughter cards, bus slots, SMPS, internal storage devices, interfacing ports. Specifications of desktop and server class computers. Installation of common operating systems for desktop and server use.

Description:

a) Introduction to Computer hardware

Components of a computer system are the primary elements which make the functioning of an electronic device smooth and faster. Computer systems consist of three components as shown in below image: **Central Processing Unit, Input devices and Output devices**. Input devices provide data input to processor, which processes data and generates useful information that's displayed to the user through output devices. This is stored in computer's memory.



The operations of computer components are given below:

- 1) Inputting:** It is the process of entering raw data, instructions and information into the computer. It is performed with the help of input devices.
- 2) Storing:** The computer has primary memory and secondary storage to store data and instructions. It stores the data before sending it to CPU for processing and also stores the processed data before displaying it as output.
- 3) Processing:** It is the process of converting the raw data into useful information. This process is performed by the CPU of the computer. It takes the raw data from storage, processes it and then sends back the processed data to storage.

4) Outputting: It is the process of presenting the processed data through output devices like monitor, printer and speakers.

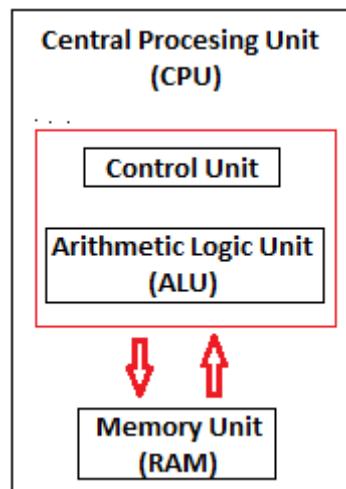
5) Controlling: This operation is performed by the control unit that is part of CPU. The control unit ensures that all basic operations are executed in a right manner and sequence.

Central Processing Unit (CPU)

A Central Processing Unit is also called a processor, central processor, or microprocessor. It carries out all the important functions of a computer. It receives instructions from both the hardware and active software and produces output accordingly. It stores all important programs like operating systems and application software. CPU also helps Input and output devices to communicate with each other. Owing to these features of CPU, it is often referred to as the brain of the computer.

CPU has three components:

- ALU (Arithmetic Logic Unit)
- Control Unit
- Memory or Storage Unit



b) Physical identification of major components

Hardware, which is abbreviated as HW, refers to all physical components of a computer system, including the devices connected to it. You cannot create a computer or use software without using hardware. The screen on which you are reading this information is also a hardware

1. Motherboard: The motherboard is generally a thin circuit board that holds together almost all parts of a computer except input and output devices. All crucial hardware like CPU, memory, hard drive, and ports for input and output devices are located on the motherboard. It is the biggest circuit board in a computer chassis. It allocates power to all hardware located on it and enables them to communicate with each other. It is meant to hold the computer's microprocessor chip and let other components connect to it. Each component that runs the

computer or improves its performance is a part of the motherboard or connected to it through a slot or port.



Fig.1

2. RAM Modules: RAM stands for Random Access Memory. It is also called the main memory. RAM is a temporary data storage device in computers and other devices. SRAM, DRAM, SDRAM, DDR etc are the various types of RAM available. A memory module or RAM stick is a narrow-printed circuit board that holds memory chips (RAM chips).

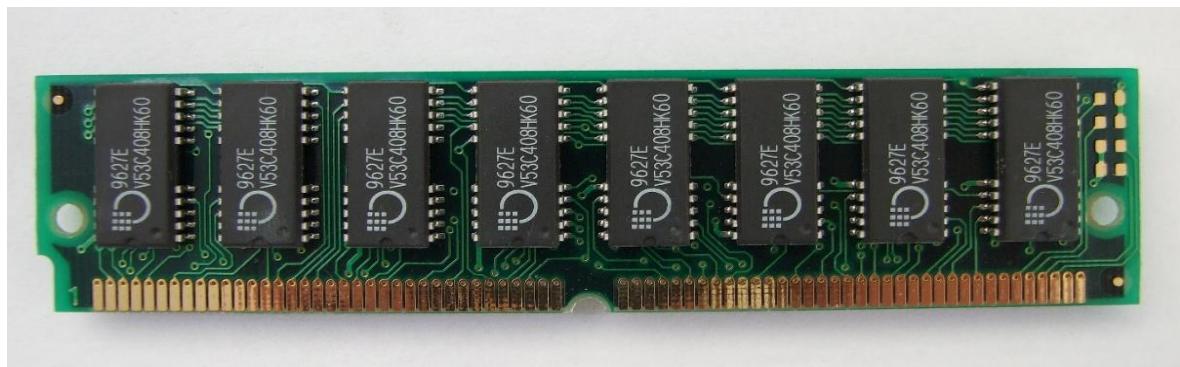


Fig.2

SRAM (static RAM) is random access memory (RAM) that retains data bits in its memory as long as power is being supplied. You can lose data if your SRAM is not powered. SRAM does not offer to refresh programs. SRAM has a low storage capacity (about 1MB).

Dynamic random access memory (DRAM) is a type of semiconductor memory that is typically used for the data or program code needed by a computer processor to function. The advantage of a DRAM is it only requires a single transistor compared to around six in a typical static RAM, SRAM memory cell. The costs of DRAM are much lower than those for SRAM, and they are able to provide much higher levels of memory density (about 1GB).

SDRAM (synchronous DRAM) is a generic name for various kinds of DRAM that are synchronized with the clock speed that the microprocessor is optimized for. That is same external clock pulse can be used to operate both SRAM and processor. This tends to increase the number of instructions that the processor can perform in a given time.

DDR Stands for "Double Data Rate." It is an advanced version of SDRAM, DDR-SDRAM can transfer data twice as fast as regular SDRAM chips. This is because DDR memory can send and receive signals twice per clock cycle. DDR operates about 2.5 V and DDR2 averages about 1.8 V, with DDR3 the voltage is reduced to 1.5 V. DDR3 has transfer rates between 800MT/s and 1600MT/s. DDR4 is the latest generation of DDR. It has the lowest operating voltage of 1.2 V and has higher transfer rates than previous generations. DDR5 launch speeds delivery nearly double the bandwidth of DDR4. It also enables scaling memory performance without degrading channel efficiency at higher speeds under real-world conditions. Crucial DDR5 memory will operate at 4800MT/s at launch, which is 1.5x the maximum standard DDR4 speed.

3. Daughter cards: A daughterboard (daughter card) is a type of circuit board that plugs in or is attached to the motherboard or similar expansion card to extend its features and services.



Fig.3

A daughterboard is connected directly to the motherboard. Like a motherboard, a daughterboard has sockets, pins, plugs and connectors to be attached to other boards. Today, these boards are not found or used in desktop computers. They were replaced with ISA card, PCI card and onboard options. With the rise of connective USB ports and other technology, it has become less necessary to upgrade devices with daughtercards or daughterboards.

4. Bus Slots: An expansion slot is a socket on the motherboard that is used to insert an expansion card, which provides additional features to a computer such as video, sound, advanced graphics, Ethernet or memory.

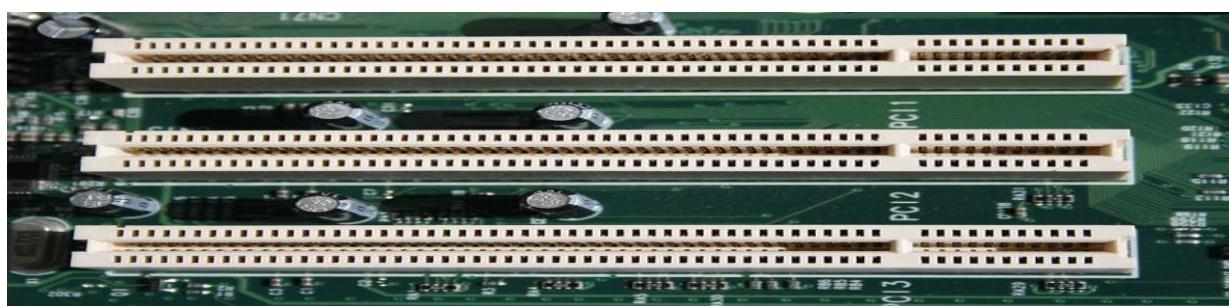


Fig.4

PATA stands for Parallel Advanced Technology Attachment and SATA stands for Serial Advanced Technology Attachment both are two bus interfaces used for connecting secondary storage devices like hard disks, optical drives.

Serial refers to the fact that data is sent one bit at a time down a single connection in each direction. There's a separate connection for data going in to and out of the device. Parallel refers to the fact that data is sent 16 bits at a time through a single 16-bit connection, which is used for data traveling in both directions.

SCSI stands for Small Computer System Interface is a set of standards for physically connecting and transferring data between computers and peripheral devices.

IDE stands for Integrated Drive Electronics is a standard interface for connecting a motherboard to storage devices such as hard drives and CD/DVD drives.

PCI (Peripheral Component Interconnect) is a bus standard that connects the computer motherboard and external devices. PCIe (peripheral component interconnect express) is an interface standard for connecting high-speed components. Every desktop PC motherboard has a number of PCIe slots.

5. SMPS: SMPS stands for Switched-Mode Power Supply. It is an electronic power supply that uses a switching regulator to convert electrical power efficiently.



Fig. 5

It is a power supply unit (PSU) generally used in computers to convert the voltage into the computer acceptable range. Technically briefing, an SMPS in a desktop system that converts 220V AC and 50HZ into +5V, -5V, +12V and +3.3 V DC at various electrical components in the computer.

6. Internal Storage: A storage device is an integral part of the computer hardware which stores information or data to process the result of any computational work. Internal storage is a storage device that's internal (inside the case) and is not a removable storage or external storage. For example, the hard drive inside your computer is an example of internal storage. HDD (Hard Disk Drive) also known as fixed disk uses magnetic tape for the storage of data. HDD has a moving read/write head to access data from storage like a gramophone player and slower to read and write. Unlike HDD, SSD (Solid State Drive) has no moving parts, and it obtains data from storage instantly. SSD can give faster performance than traditional magnetic-based computer storage devices. Although both of them perform the same task.



Fig 6.i



Fig 6.ii

7. Interfacing ports: A port is a connection or a jack provided on a computer to connect external or peripheral devices to the computer, for example, you will need a port on your device to connect a keyboard, mouse, pen-drives, etc. So, it acts as an interface or a point of attachment between computer and external devices. It is also called a communication port, as it is the point where you plug in a peripheral device to allow data transfer or communication between the device and computer. Generally, they are four to six in number and present on the back or sides of the computer.

Based on the type of protocol used for communication, computer ports can be of two types: Serial Ports and Parallel Ports.

i. Serial Ports

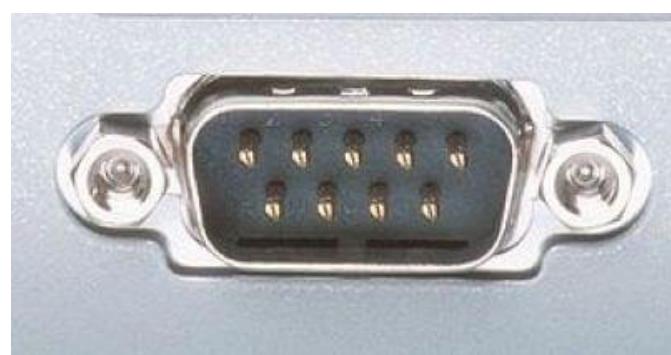


Fig 7.i

This type of ports provides an interface to connect to peripheral devices using a serial protocol. In this port, the rate of transmission of data is one bit at a time through a single communication line. For example, D-Subminiature or D-sub connector is a commonly used serial port, which carries RS-232 signals.

ii. Parallel Ports

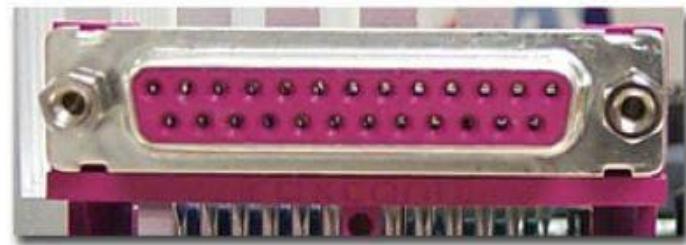


Fig 7.ii

As the name suggests, a parallel port is an interface that allows communication or data transfer between a computer and a device in a parallel manner through more than one communication line. For example, a printer port is a parallel port.

Some computer ports are:

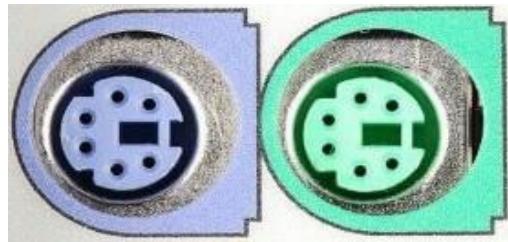


Fig:PS/2



Fig: VGA



Fig:DVI



Fig: RJ-45



Fig: HDMI

8. Specifications of desktop and server class:

Desktop:

Processor	Core i5
Processor speed	3.90 GHz
Number of cores	4
Typical Memory	32GB
Cache size	L1:8KB -1MB, L2:256KB - 3MB
Memory type	DDR4

Web Server:

Processor	Intel® Xeon® Bronze 3206R Processor (Multiple Processors)
Processor speed	1.90 GHz
Number of cores	8
Typical Memory	512GB
Cache size	L1:1-2MB, L2:8MB, L3:32-64MB
Memory type	DDR4

Result:

Familiarisation of computer and hardware done successfully.

LAB CYCLE:1

EXPERIMENT NO:2

Date:

Aim: Familiarisation of OS installation.

Oracle Virtual Box is already installed on your Desktop.

1. Create a Virtual Machine with sufficient RAM (nearly half the RAM of your Desktop).
2. Create a virtual hard disk (vmdk) of 20 GB (variable size).
3. Download Ubuntu 20.04 Desktop iso (64 bit) from
[https://ubuntu.com/download/desktop/thank-you?
version=20.04.4&architecture=amd64](https://ubuntu.com/download/desktop/thank-you?version=20.04.4&architecture=amd64)
(or from <http://10.2.7.253/downloads> for quicker download)
4. Attach this iso to the Virtual Machine as CD Drive.
5. Boot from it. Execute gparted
6. Create 2 Primary partitions of equal size and install Ubuntu in one of them.
7. Make a copy of the vmdk file for later experiments.
8. You can also install another OS to the other partition.

Write down a description of Virtualbox and vmdk format. Take the screenshots of Steps 1,2,4 and 6 and affix.

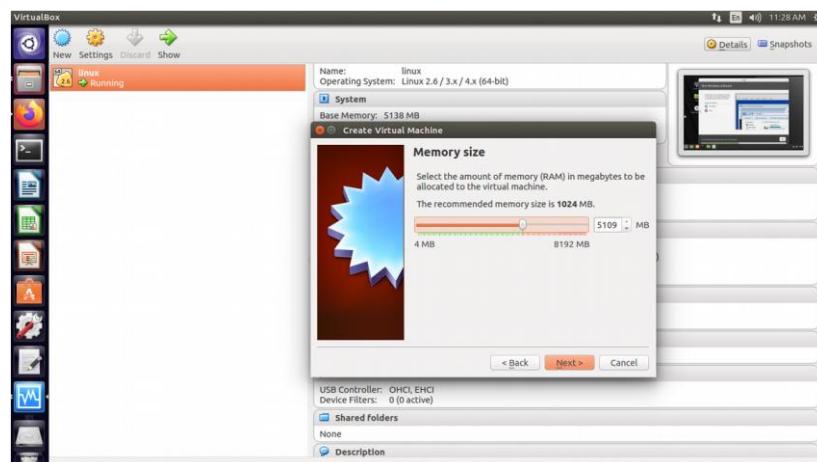
Solution:

VirtualBox is an open-source software for virtualizing the x86 computing architecture. It acts as a hypervisor, creating a VM (virtual machine) where the user can run another OS (operating system).

VMDK (short for Virtual Machine Disk) is a file format that describes containers for virtual hard disk drives to be used in VM.

Installation of Ubuntu using VirtualBox:

1. We have installed VirtualBox and you have downloaded the Ubuntu. Now set to install Linux in VirtualBox.
2. Start VirtualBox, and click on the New symbol. Give the virtual OS a relevant name.
3. Allocate RAM to the virtual OS.

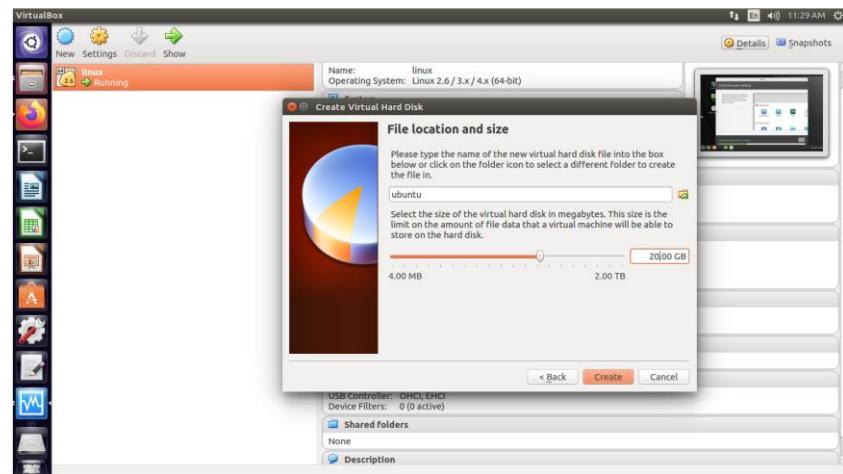


4. Create a virtual disk. This serves as the hard disk of the virtual Linux system.

5. Choose VDI file type as file type for new virtual hard disk.

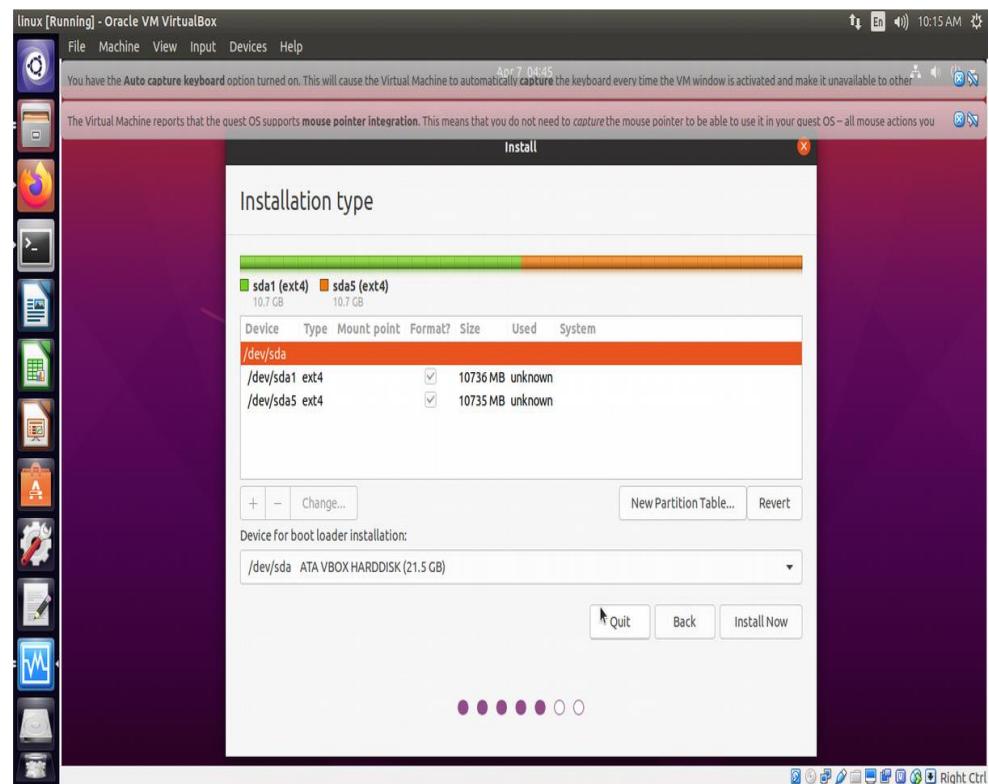
6. Choose either the “Dynamically allocated” or the “Fixed size” option for creating the virtual hard disk.

7. Allocate size for virtual hard disk (recommended size is 20GB).

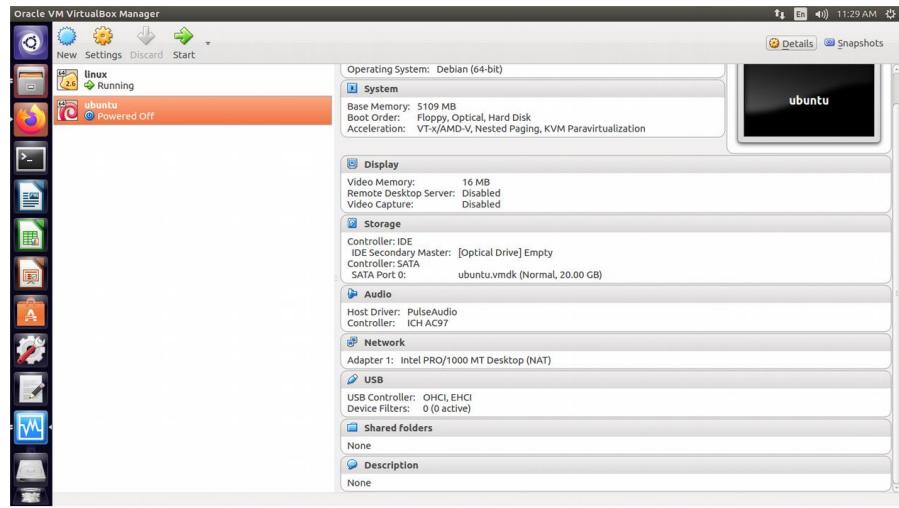


8. Install Ubuntu

9.

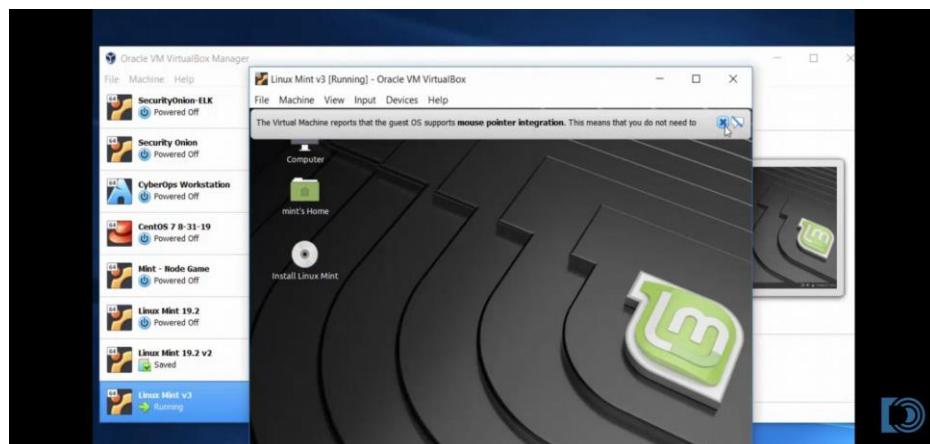
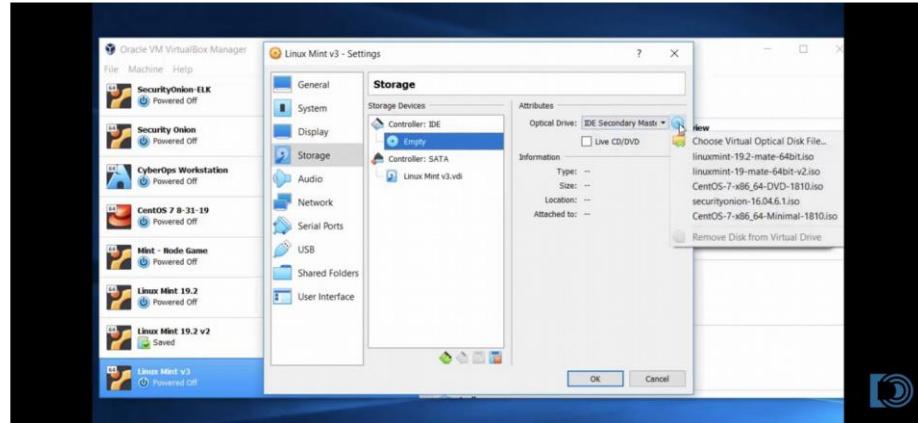


10. Open the VM box. It shows all the details and properties of the virtual box.



Installation of another OS (Linux Mint) to the other partition:

1. Download Linux Mint OS.
2. Choose



- 3.
4. Install linux mint.

Result:

Program executed successfully and output is verified.

LAB CYCLE:2

EXPERIMENT NO: 3

Date:

TEXT EDITOR

Aim: Study of a terminal based text editor such as Vim or Emacs.

There are many ways to edit files in Unix. Editing files using the screen-oriented text editor vi is one of the best ways. This editor enables you to edit lines in context with other lines in the file. An improved version of the vi editor which is called the VIM has also been made available now. Here, VIM stands for Vi IMproved. The vi editor was developed by William Joy as a more visual version of his own command line editor program called ex, which was becoming popular as a text editor.

The vi editor uses the terminal window for editing a file. For an example, run the following command to open a new file or an existing file of the same name:

`vi filename`

There are two ways of working in vi:

- **Insert Mode:** This mode enables you to insert text into the file. Everything that's typed in this mode is interpreted as input and placed in the file. To come out of the insert mode, press the Esc key, which will take you back to the command mode.
- **Command Mode:** This mode enables you to perform administrative tasks such as saving the files, executing the commands, moving the cursor, cutting (yanking) and pasting the lines or words, as well as finding and replacing. In this mode, whatever you type is interpreted as a command.

Commands and descriptions:

- `vi filename`
#Creates a new file if it already does not exist, otherwise opens an existing file.
- `vi -R filename`
#Opens an existing file in the read-only mode.
- `view filename`
#Opens an existing file in the read-only mode.

Create a new file testfile if it already does not exist in the current working directory –

```
ubuntu@ubuntu:/Desktop/NSA/dlr1/dlr2/dlr3$ vim test.py
ubuntu@ubuntu:/Desktop/NSA/dlr1/dlr2/dlr3$
```

The above command will generate the following output –



The tilde (~) on each line following the cursor. A tilde represents an unused line. If a line does not begin with a tilde and appears to be blank, there is a space, tab, newline, or some other non-viewable character present.

a) Cursor operations

In command mode we can position the cursor anywhere in the file. Since you begin all basic edits (changing, deleting, and copying text) by placing the cursor at the text that you want to change, you want to be able to move the cursor to that place as quickly as possible.

There are vi commands to move the cursor:

- Up, down, left, or right—one character at a time.
- Forward or backward by blocks of text such as words, sentences, or paragraphs.
- Forward or backward through a file, one screen at a time.

An underscore marks the present cursor position. Circles show movement of the cursor from its current position to the position that would result from various vi commands.

Single Movements

The keys h, j, k, and l, right under your fingertips, will move the cursor:

h: Left, one space

j: Down, one line

k: Up, one line

l: Right, one space

You can also use the cursor arrow keys (\leftarrow , \downarrow , \uparrow , \rightarrow), + and - to go up and down, or the ENTER and BACKSPACE keys.

b) Manipulate text

1. Open a new or existing file with vim filename.
2. Type i to switch into insert mode so that you can start editing the file.
Enter or modify the text with your file.
3. Once you're done, press the escape key Esc to get out of insert mode and back to command mode.
4. Type :wq to save and exit your file.

Vim commands for editing#:

Those who use Vim tend to use the term "yank" where most people would use the terms copy and paste. Therefore, the command for copying a word is yw, which stands for yank word, and the command for pasting whatever has been copied is p, meaning put. If you look up additional commands in the future, it can be confusing if you don't know what yank and put mean when using Vim.

You also have two options for how to select text. You can either use commands like dd, which deletes a single line, and yy, which copies a single line, or you can highlight text and then copy it to the unnamed register. The paste commands work the same whether you've highlighted text or used a command to automatically copy it.

As with movement commands, putting a number in front of the command can increase the number of times a task is completed. For instance, putting a number in front of yy will increase the number of lines copied, so 5yy will copy five lines.

yy - Copies a line

yw - Copies a word

y\$ - Copies from where your cursor is to the end of a line

v - Highlight one character at a time using arrow buttons or the h, k, j, l buttons

V - Highlights one line, and movement keys can allow you to highlight additional lines

p - Paste whatever has been copied to the unnamed register

d - Deletes highlighted text

dd - Deletes a line of text

dw - Deletes a word

D - Deletes everything from where your cursor is to the end of the line

. - Repeats the last action

one

Vim commands for working with multiple files#:

You can also edit more than one text file at a time. Vim gives you the ability to either split your screen to show more than one file at a time or you can switch back and forth between documents. As with other functions, commands make going between documents or buffers, as they're referred to with Vim, as simple as a few keystrokes.

:bn - Switch to next buffer

:bp - Switch to previous buffer

:bd - Close a buffer

:sp [filename] - Opens a new file and splits your screen horizontally to show more than one buffer

:vsp [filename] - Opens a new file and splits your screen vertically to show more than one buffer

:ls - Lists all open buffers

Ctrl + ws - Split windows horizontally

Ctrl + ww - Split windows vertically

Ctrl + ww - Switch between windows

Ctrl + wq - Quit a window

Ctrl + wh - Moves your cursor to the window to the left

Ctrl + wl - Moves your cursor to the window to the right

Ctrl + wj - Moves your cursor to the window below the one you're in

Ctrl + wk - Moves your cursor to the window above the one you're in

c) Search for patterns:

Vim commands for searching text#:

Like many other text editors, Vim allows you to search your text and find and replace text within your document. If you opt to replace multiple instances of the same keyword or phrase, you can set Vim up to require or not require you to confirm each replacement depending on how you put in the command.

/[keyword] - Searches for text in the document where keyword is whatever keyword, phrase or string of characters you're looking for

?[keyword] - Searches previous text for your keyword, phrase or character string

n - Searches your text again in whatever direction your last search was

N - Searches your text again in the opposite direction

:%s/[pattern]/[replacement]/g - This replaces all occurrences of a pattern without confirming each one

:%s/[pattern]/[replacement]/gc - Replaces all occurrences of a pattern and confirms each

We can use the slash to search for a word, and then use the dot to replace it.

open the sample.txt file using the Vim editor:

```
$ vim sample.txt
```

we need to press the forward-slash(/) key, then search for the word “article”:

```
/article
```

This will highlight the first occurrence of the word “article” and we can press the Enter key to jump to it.

d) Global search and replace

We can use the slash to search for a word, and then use the dot to replace it.

open the file using the Vim editor:

```
$ vim filename
```

we need to press the forward-slash(/) key, then search for the word:

```
/word to be searched
```

This will highlight the first occurrence of the word and we can press the Enter key to jump to it.

We can then type in the cgn command combo:

```
cgn
```

This Vim editor command finds the last thing we searched for, deletes it, and then put us into insert mode.

We can then press the Esc key to return to normal mode.

Next, we need to press the “N” key to jump to the next occurrence of the word and press the Dot(.) key to auto-replace it with the word.

This is the simplest method to perform a basic search and replace in Vim editor.

Search and Replace Using the substitute Command

Basic syntax:

```
:s/<search_phrase>/<replace_phrase>/options
```

- All Occurrences
 `:%s/article/tutorial/g`
- Case-Insensitive
 `:%s/vim/baeldung/gi`
- With Confirmation
 `:%s/article/tutorial/gc`
- Within Specific Lines
 `:start_line_number, end_line_number s/<search_term>/<replace_term>/g`
- Whole Word
 `:s/\<cover\>/go through/gi`

Result:

Study of text editor has been done successfully.

LAB CYCLE:2

EXPERIMENT NO:4

Date:

BASIC LINUX COMMANDS

Aim: Basic Linux commands, familiarity with following commands/operations expected.

1. man: is used to display the user manual of any command that we can run on the terminal. It provides a detailed view of the command which includes NAME, SYNOPSIS, DESCRIPTION, OPTIONS, EXIT STATUS, RETURN VALUES, ERRORS, FILES, VERSIONS, EXAMPLES, AUTHORS and SEE ALSO.

```
exam@CSCC2-19:~$ man ls
[4]+  Stopped                  man ls
exam@CSCC2-19:~$ 

LS(1)                               User Commands                               LS(1)
NAME
ls - list directory contents
SYNOPSIS
ls [OPTION]... [FILE]...
DESCRIPTION
List information about the FILEs (the current directory by default).
Sort entries alphabetically if none of -cftuvSUX nor --sort is specified.

Mandatory arguments to long options are mandatory for short options
too.

-a, --all
      do not ignore entries starting with .

-A, --almost-all
      do not list implied . and ..

--author
      Manual page ls(1) line 1 (press h for help or q to quit)
```

2. ls, echo, read

ls: is a Linux shell command that lists directory contents of files and directories. Some practical examples of ls command are shown below.

Options:

- t: It sorts the file by modification time, showing the last edited file first.
- l: To show long listing information about the file/directory.
- lh: To display file size in easy-to-read format.
- a: To show all the hidden files in the directory.

```
exam@CSCC2-19:~$ ls
cpu.class          RGA-NCA
cpu.java           ritu.cpp
'cpuprocessor.class'  'Screenshot from 2023-04-05 10-30-12.png'  'Screenshot from 2023-04-05 10-37-09.png'  Student.class
'cpuProcessor.class' 'Screenshot from 2023-04-05 10-32-56.png'  'Screenshot from 2023-04-05 10-37-16.png'  Student.java
else               'Screenshot from 2023-04-05 10-33-03.png'  stringsort.class
exam@CSCC2-19:~$
```

echo: used for displaying lines of text or string which are passed as arguments on the command line.

```
exam@CSCC2-19:~$ echo "welcome"  
welcome  
exam@CSCC2-19:~$
```

read: is used to read from a file descriptor.

```
exam@CSCC2-19:~$ read -p "Enter name" name  
Enter name pradnya  
exam@CSCC2-19:~$ echo "$name"  
pradnya  
exam@CSCC2-19:~$
```

3. more, less, cat

more: reads files and displays the text one screen at a time.

```
exam@CSCC2-19:~/mca-nsa$ more file1.txt  
welcome  
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
exam@CSCC2-19:~/mca-nsa$
```

less: used for filtering and viewing text files one screen page at a time.

```
exam@CSCC2-19:~/mca-nsa$ less file1.txt  
[7]+  Stopped                  less file1.txt  
exam@CSCC2-19:~/mca-nsa$
```

```
file1.txt 19p  
welcome  
1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
-  
-  
-  
-  
-  
-  
-  
-  
-  
-  
-  
-  
[END]
```

cat: used to display the content of a file, copy content from one file to another, concatenate the contents of multiple files, display the line number, display \$ at the end of the line, etc.

```
exam@CSCC2-19:~/mca-nsa$ cat >file1.txt
welcome
exam@CSCC2-19:~/mca-nsa$ cat file1.txt
welcome
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
exam@CSCC2-19:~/mca-nsa$
```

4. cd, mkdir, pwd, find

cd: cd command in linux known as change directory command. It is used to change current working directory.

Syntax: cd [directory_name]

```
exam@CSCC2-19:~/mca-nsa$ cd ..
exam@CSCC2-19:~$ cd mca-nsa
exam@CSCC2-19:~/mca-nsa$
```

mkdir: mkdir command in Linux allows the user to create directories (also referred to as folders in some operating systems). This command can create multiple directories at once as well as set the permissions for the directories.

Syntax: mkdir [options...] [directories ...]

```
exam@CSCC2-19:~/sreera$ cd ..
exam@CSCC2-19:~$ mkdir mca-nsa
exam@CSCC2-19:~$ ls
cpu.class          elle           'Screenshot From 2023-04-05 10-32-56.png'  stringsort.java
cpu.java           mca-nsa         'Screenshot From 2023-04-05 10-33-03.png'  Student.class
'cpuProcessor.class'  rithu.cpp      'Screenshot From 2023-04-05 10-30-12.png'  stringsort.class
'cpuUsran.class'    sreeraJ
exam@CSCC2-19:~$
```

pwd: pwd stands for Print Working Directory. It prints the path of the working directory, starting from the root.

Syntax: pwd -L: Prints the symbolic path.

pwd -P: Prints the actual path.

```
exam@CSCC2-19:~/mca-nsa/d1$ pwd
/home/exam/mca-nsa/d1
exam@CSCC2-19:~/mca-nsa/d1$
```

find: The find command in UNIX is a command line utility for walking a file hierarchy. It can be used to find files and directories and perform subsequent operations on them. It supports searching by file, folder, name, creation date, modification date, owner and permissions.

Syntax: find [where to start searching from]

[expression determines what to find] [-options] [what to find]

```
exam@CSCC2-19:~/mca-nsa$ find file1.txt
file1.txt
exam@CSCC2-19:~/mca-nsa$ 
```

5. mv, cp, rm, tar

mv: mv stands for move. mv is used to move one or more files or directories from one place to another in a file system like UNIX. It has two distinct functions:

- (i) It renames a file or folder.
- (ii) It moves a group of files to a different directory.

Syntax: mv [Option] source destination

```
exam@CSCC2-19:~/mca-nsa$ mkdir d1
exam@CSCC2-19:~/mca-nsa$ mv file1.txt d1
exam@CSCC2-19:~/mca-nsa$ cd d1
exam@CSCC2-19:~/mca-nsa/d1$ ls
file1.txt
exam@CSCC2-19:~/mca-nsa/d1$ 
```

cp: cp stands for copy. This command is used to copy files or group of files or directory. It creates an exact image of a file on a disk with different file name. cp command require at least two filenames in its arguments.

Syntax: cp [OPTION] Source Destination

```
exam@CSCC2-19:~/mca-nsa$ ls
d1 file.txt
exam@CSCC2-19:~/mca-nsa$ cp file.txt d1
exam@CSCC2-19:~/mca-nsa$ cd d1
exam@CSCC2-19:~/mca-nsa/d1$ ls
file1.txt file.txt mca-nsa
exam@CSCC2-19:~/mca-nsa/d1$ 
```

rm: rm stands for remove here. rm command is used to remove objects such as files, directories, symbolic links and so on from the file system like UNIX. To be more precise, rm removes references to objects from the filesystem, where those objects might have had multiple references.

Syntax: rm [OPTION]... FILE...

```
exam@CSCC2-19:~/mca-nsa/d1$ rm mca-nsa
exam@CSCC2-19:~/mca-nsa/d1$ ls
file1.txt file.txt
exam@CSCC2-19:~/mca-nsa/d1$ 
```

tar: The Linux ‘tar’ stands for tape archive, is used to create Archive and extract the Archive files. tar command in Linux is one of the important commands which provides archiving functionality in Linux. We can use Linux tar command to create compressed or uncompressed Archive files and also maintain and modify them.

Syntax: tar [options] [archive-file] [file or directory to be archived]

```

lab@lab-Lenovo-IdeaPad-Z400:~/dir1$ cd
lab@lab-Lenovo-IdeaPad-Z400:~$ tar -czvf mydir.tar.gz dir1
dir1/
dir1/F3
dir1/dir2/
dir1/dir2/set.c
dir1/dir2/testfile
dir1/dir2/result
dir1/dir2/out2.txt
dir1/dir2/dir3/
dir1/dir2/dir3/testfile3
dir1/dir2/dir3/v
dir1/dir2/dir3/sample
dir1/dir2/dir3/age
dir1/dir2/dir3/marks
dir1/dir2/dir3/testfile
dir1/dir2/dir3/s
dir1/dir2/dir3/name
dir1/dir2/dir3/csvfile
dir1/dir2/dir3/file1
dir1/dir2/dir3/testfile
dir1/dir2/dir3/testfile2

```

6.wc, cut, paste

wc: wc stands for word count. It is used to find out number of lines, word count, byte and characters count in the files specified in the file arguments.

Syntax: wc [OPTION]... [FILE]...

```

exam@CSCC2-19:~/mca-nsa/d1$ wc file1.txt
21 21 59 file1.txt
exam@CSCC2-19:~/mca-nsa/d1$ wc -l file1.txt
21 file1.txt
exam@CSCC2-19:~/mca-nsa/d1$ wc -c file1.txt
59 file1.txt
exam@CSCC2-19:~/mca-nsa/d1$ wc -w file1.txt
21 file1.txt
exam@CSCC2-19:~/mca-nsa/d1$ 

```

cut: The cut command in UNIX is a command for cutting out the sections from each line of files and writing the result to standard output. It can be used to cut parts of a line by byte position, character and field.

Syntax: cut OPTION... [FILE]...

```

exam@CSCC2-19:~/mca-nsa/d1$ cut -c 1,3,7 file.txt
h t
exam@CSCC2-19:~/mca-nsa/d1$ cut -c 1,3,7 file1.txt
1
2
3
4
5
6
7
8
9
1
1
1
1
1
1
1
1
2
exam@CSCC2-19:~/mca-nsa/d1$ 

```

paste: paste command is one of the useful commands in Unix or Linux operating system. It is used to join files horizontally (parallel merging) by outputting lines consisting of lines from each file specified, separated by tab as delimiter, to the standard output.

Syntax: paste [OPTION]... [FILES]...

```

exam@CSCC2-19:~/mca-nsa/d1$ paste -s number file.txt file1.txt
paste: number: No such file or directory
hi hello
welcome 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
8 19 20
exam@CSCC2-19:~/mca-nsa/d1$ 

```

7. head, tail, grep, expr:

head: it prints the first 10 lines of the specified files. If more than one file name is provided then data from each file is preceded by its file name.

Syntax: head [OPTION]... [FILE]...

```
exam@CSCC2-19:~/mca-nsa/d1$ head -10 file1.txt
welcome
1
2
3
4
5
6
7
8
9
exam@CSCC2-19:~/mca-nsa/d1$
```

tail: it prints the last 10 lines of the specified files. If more than one file name is provided then data from each file is preceded by its file name.

Syntax: tail [OPTION]... [FILE]...

```
exam@CSCC2-19:~/mca-nsa/d1$ tail -10 file1.txt
11
12
13
14
15
16
17
18
19
20
exam@CSCC2-19:~/mca-nsa/d1$
```

grep: the grep filter searches a file for a particular pattern of characters, and displays all lines that contain that pattern. The pattern that is searched in the file is referred to as the regular expression (grep stands for global search for regular expression and print out).

Syntax: grep [options] pattern [files]

```
exam@CSCC2-19:~/mca-nsa/d1$ grep -i "wel" file1.txt
welcome
exam@CSCC2-19:~/mca-nsa/d1$
```

8. chmod, chown:

chmod: the chmod command is used to change the access mode of a file. The name is an abbreviation of change mode.

Syntax: chmod [reference][operator][mode] file...

```
exam@CSCC2-19:~/mca-nsa/d1$ chmod +x file1.txt
exam@CSCC2-19:~/mca-nsa/d1$ ls
file1.txt  file.txt
exam@CSCC2-19:~/mca-nsa/d1$
```

chown: it is used to set read, write, execute permission for user. To protect and secure files and directory in Linux we use permissions to control what a user can do with a file or directory.

Syntax: chown [OPTION]... [OWNER][:[GROUP]] FILE...

chown [OPTION]... --reference=FILE FILE...

```
Number or days or warning before password expires : /  
lab@lab-Lenovo-IdeaPad-Z400:/home$ sudo chown -R u_ser1:u_ser1 dir2  
chown: cannot access 'dir2': No such file or directory  
lab@lab-Lenovo-IdeaPad-Z400:/home$ sudo chown -R u_ser1:u_ser1 /home/lab/dir1/dir2
```

9. Redirections & Piping:

Redirection: whenever an individual runs a command, it can take input, give output, or do both. Redirection helps us redirect these input and output functionalities to the files or folders we want, and we can use special commands or characters to do so.

Append redirection

“>>” standard output

“<<” standard input

```
exam@CSCC2-19:~/mca-nsa/d1$ ls -l >>lsoutput  
exam@CSCC2-19:~/mca-nsa/d1$ cat lsoutput  
file1.txt  
file.txt  
lsoutput  
total 12  
-rwxrwxr-x 1 exam exam 59 Apr 5 10:43 file1.txt  
-rw-rw-r-- 1 exam exam 9 Apr 5 10:54 file.txt  
-rw-rw-r-- 1 exam exam 28 Apr 5 11:15 lsoutput  
exam@CSCC2-19:~/mca-nsa/d1$ █
```

Overwrite Redirection

“>” standard output

“<” standard input

```
exam@CSCC2-19:~/mca-nsa/d1$ ls  
file1.txt file.txt  
exam@CSCC2-19:~/mca-nsa/d1$ ls >lsoutput  
exam@CSCC2-19:~/mca-nsa/d1$ cat lsoutput  
file1.txt  
file.txt  
lsoutput  
exam@CSCC2-19:~/mca-nsa/d1$ █
```

Piping: Pipe is used to combine two or more commands, and in this, the output of one command acts as input to another command, and this command's output may act as input to the next command and so on. It can also be visualized as a temporary connection between two or more commands/ programs/ processes. The command line programs that do the further processing are referred to as filters.

Syntax: command_1 | command_2 | command_3 | | command_N

```
exam@CSCC2-19:~/mca-nsa/d1$ ls -l | more
total 12
-rwxrwxr-x 1 exam exam 59 Apr 5 10:43 file1.txt
-rw-rw-r-- 1 exam exam 9 Apr 5 10:54 file.txt
-rw-rw-r-- 1 exam exam 182 Apr 5 11:16 lsoutput
exam@CSCC2-19:~/mca-nsa/d1$
```

10. useradd, usermod, userdel, passwd:

useradd: is a command in Linux that is used to add user accounts to your system. It is just a symbolic link to adduser command in Linux and the difference between both of them is that useradd is a native binary compiled with system whereas adduser is a Perl script which uses useradd binary in the background.

Syntax: useradd [options] name_of_the_user

```
lab@lab-Lenovo-IdeaPad-Z400:/home$ sudo useradd -s /bin/bash -m -d /home/u_ser1 u_ser1
lab@lab-Lenovo-IdeaPad-Z400:/home$ sudo chage -l u_ser1
Last password change : May 08, 2022
Password expires     : never
Password inactive   : never
Account expires      : never
```

usermod: is a command in Linux that is used to change the properties of a user in Linux through the command line. After creating a user we have to sometimes change their attributes like password or login directory etc. so in order to do that we use the Usermod command.

Syntax: sudo usermod -c "This is test user" test_user

```
lab@lab-Lenovo-IdeaPad-Z400:/home$ sudo useradd -s /bin/bash -m -d /home/u_ser1 u_ser1
lab@lab-Lenovo-IdeaPad-Z400:/home$ sudo chage -l u_ser1
Last password change : May 08, 2022
Password expires     : never
Password inactive   : never
Account expires      : never
```

userdel: is used to delete a user account and related files. This command basically modifies the system account files, deleting all the entries which refer to the username LOGIN. It is a low-level utility for removing the users.

Syntax: userdel [options] LOGIN

```
lab@lab-Lenovo-IdeaPad-Z400:~$ sudo userdel u_ser1
```

passwd: passwd command in Linux is used to change the user account passwords. The root user reserves the privilege to change the password for any user on the system, while a normal user can only change the account password for his or her own account.

Syntax: passwd [options] [username]

11. df,top, ps:

df: is used to displays the amount of disk space available on the file system containing each file name argument.

Syntax: df [OPTION]...[FILE]...

```
lab@lab-Lenovo-IdeaPad-Z400:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
tmpfs          580M   1.9M  578M  1% /run
/dev/sda7       281G   19G  248G  8% /
tmpfs          2.9G   93M  2.8G  4% /dev/shm
tmpfs          5.0M   4.0K  5.0M  1% /run/lock
tmpfs          4.0M     0  4.0M  0% /sys/fs/cgroup
tmpfs          580M   1.3M  579M  1% /run/user/1000
lab@lab-Lenovo-IdeaPad-Z400:~$
```

top: top command is used to show the Linux processes. It provides a dynamic real-time view of the running system. Usually, this command shows the summary information of the system and the list of processes or threads which are currently managed by the Linux Kernel.

```
top - 00:05:26 up 12:05,  1 user,  load average: 0.26, 0.32, 0.34
Tasks: 260 total,  1 running, 259 sleeping,  0 stopped,  0 zombie
Cpu(s): 11.4 us, 2.6 sy, 0.0 nt, 83.5 id, 2.5 wa, 0.0 ht, 0.0 st
Mem:  5797.5 total, 682.1 free, 2352.4 used, 2763.0 buff/cache
Swap: 11443.0 total, 11443.0 free, 0.0 used   2787.8 avail Mem

      PID USER      PR  NI    VIRT    RES    SHR %CPU %MEM TIME+ COMMAND
 35342 lab        20   0 402444 44192 33592 5 15.6  0.7 0:00:47 gnome-screensho
 35333 lab        20   0 21584 4012 3336 R  0.7  0.1 0:00:12 top
 35313 root       20   0     0  0 I  0.0  0.0 0:00:00 kworker/0:3-cgroup_destroy
 35244 root       20   0     0  0 I  0.0  0.0 0:00:00 kworker/0:0-events
 35241 root       20   0     0  0 I  0.0  0.0 0:00:09 kworker/u16:0-events_unbound
 35193 lab        20   0 1108.5g 63928 48524 S  0.0  1.1 0:00:04 chrome
 35181 lab        20   0 1108.5g 166884 101196 S  2.0  2.8 0:16.81 chrome
 35173 lab        20   0 20.3g 42584 31328 S  0.0  0.7 0:00:02 chrome
 35131 root       20 -20     0  0 I  0.0  0.0 0:00:00 kworker/u17:0
 35112 root       20   0     0  0 I  0.0  0.0 0:00:09 kworker/312-events
 35101 root       20   0     0  0 I  0.0  0.0 0:00:14 power
 35051 lab        20   0 17228 2550 2284 S  0.0  0.0 0:00:14 power
 35043 root       20   0     0  0 I  0.0  0.0 0:00:19 kworker/0:2-events
 35025 root       20   0     0  0 I  0.0  0.0 0:00:08 kworker/1:0-events
 34983 root       20   0     0  0 I  0.0  0.0 0:00:08 kworker/2:0-events
 34874 root       20   0     0  0 I  0.0  0.0 0:00:38 kworker/u16:2-iwlwifi
 34870 root       20 -20     0  0 I  0.0  0.0 0:00:00 kworker/u17:1-rb_allocator
 34836 root       20   0     0  0 I  0.0  0.0 0:00:11 kworker/0:1-cgroup_destroy
 34808 root       20   0     0  0 I  0.3  0.0 0:00:18 kworker/2:1-events
 34691 root       20   0     0  0 I  0.0  0.0 0:00:78 kworker/u16:1-iwlwifi
 34497 root       20   0     0  0 I  0.0  0.0 0:00:24 kworker/31:1-events
 34257 root       20   0     0  0 I  0.1  0.0 0:00:45 kworker/u17:2-i915_flip
 34254 root       20   0     0  0 I  0.0  0.0 0:00:01 kworker/1:2-events
 32506 root       20   0 39536 29828 25188 S  0.0  0.5 0:00:67 kworker/0:0
 31950 lab        20   0 18716 4264 3604 S  0.0  0.1 0:00:11 bash
 31576 lab        20   0 18716 4420 3752 S  0.0  0.1 0:00:16 bash
 24267 lab        20   0 434172 71360 45500 S  5.0  1.2 1:24.22 gnome-terminal-
 17368 lab        20   0 3001548 134688 44836 S  0.0  2.3 0:09:03 gjs
 17246 root       -51   0     0  0 S  0.0  0.0 0:00:00 irq/28-mel_ne
 15010 lab        20   0 919828 121340 54424 S  0.0  2.0 1:25.03 nautilus
 15010 lab        20   0 919828 121340 54424 S  0.0  2.0 1:25.03 nautilus
```

ps: it allows multiple processes to operate simultaneously without interfering with each other. Process is one of the important fundamental concept of the Linux OS.

Syntax: ps [options]

```
lab@lab-Lenovo-IdeaPad-Z400:~$ ps -T
PID TTY          PSR    %CPU %MEM    VSZ   RSS COMMAND
 1 ?        00:00:03 systemd
 2 ?        00:00:00 kthreadd
 3 ?        00:00:00 rcu_gp
 4 ?        00:00:00 rcu_par_gp
 6 ?        00:00:00 kworker/0:0H-events_highpri
 9 ?        00:00:00 mm_percpu_wq
10 ?        00:00:00 migration/0
11 ?        00:00:00 rCU_tasks_trace
12 ?        00:00:00 ksoftirqd/0
13 ?        00:00:00 rcu_sched
14 ?        00:00:00 migration/0
15 ?        00:00:00 idle_inject/0
16 ?        00:00:00 cpuhp/0
17 ?        00:00:00 migration/1
18 ?        00:00:00 idle_inject/1
19 ?        00:00:00 migration/1
20 ?        00:00:00 ksoftirqd/1
22 ?        00:00:00 kworker/1:0H-kblockd
23 ?        00:00:00 cpuhp/2
24 ?        00:00:00 idle_inject/2
25 ?        00:00:00 migration/2
26 ?        00:00:00 ksoftirqd/2
28 ?        00:00:00 kworker/2:0H-events_highpri
29 ?        00:00:00 migration/3
30 ?        00:00:00 idle_inject/3
31 ?        00:00:00 migration/3
32 ?        00:00:00 ksoftirqd/3
33 ?        00:00:00 kworker/3:0H-events_highpri
35 ?        00:00:00 kdevtmpfs
36 ?        00:00:00 netns
37 ?        00:00:00 iether_frag_wq
38 ?        00:00:00 kauditd
```

12. ssh, scp, ssh-keygen, ssh-copy-id:

ssh: stands for “Secure Shell”. It is a protocol used to securely connect to a remote server/system. ssh is secure in the sense that it transfers the data in encrypted form between the host and the client. It transfers inputs from the client to the host and relays back the output. ssh runs at TCP/IP port 22.

Syntax: ssh user_name@host(IP/Domain_name)

```
dnyce@LinuxShellTips:~$ ssh ubuntu@18.118.208.79
ubuntu@18.118.208.79's password:
Welcome to Ubuntu 20.04.2 LTS (GNU/Linux 5.4.0-1045-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

 System information as of Mon Sep 13 07:42:19 UTC 2021

 System load:  0.0          Processes:           121
 Usage of /:   37.5% of  7.69GB  Users logged in:      0
 Memory usage: 43%          IPV4 address for eth0: 172.31.0.248
 Swap usage:   0%

 * Ubuntu Pro delivers the most comprehensive open source security and
 compliance features.

 https://ubuntu.com/aws/pro

74 updates can be applied immediately.
1 of these updates is a standard security update.
To see these additional updates run: apt list --upgradable

*** System restart required ***
Last login: Mon Sep 13 07:40:24 2021 from 154.123.208.40
ubuntu@ip-172-31-0-248:~$
```

scp: scp (secure copy) command in Linux system is used to copy file(s) between servers in a secure way. The SCP command or secure copy allows secure transferring of files in between the local host and the remote host or between two remote hosts. It uses the same authentication and security as it is used in the Secure Shell (SSH) protocol. SCP is known for its simplicity, security and pre-installed availability.

Syntax: scp [-346BCpqrTv] [-c cipher] [-F ssh_config] [-i identity_file] [-l limit] [-o ssh_option] [-P port] [-S program] [[user@]host1:]file1 ... [[user@]host2:]file2

```
pratik@Linuxbuzz:~$ scp -v /var/log/syslog root@10.4.3.201:/root/
Executing: program /usr/bin/ssh host 10.4.3.201, user root, command scp -v -t /root/
OpenSSH_8.2p1 Ubuntu-4ubuntu0.2, OpenSSL 1.1.1f 31 Mar 2020
```

ssh-keygen: Secure Shell(SSH) is a cryptographic network protocol used for operating remote services securely. It is used for remote operation of devices on secure channels using a client-server architecture that generally operates on Port 22. SSH is the successor of Telnet. SSH uses public and private keys to validate and authenticate users. ssh-keygen is used to generate these key pairs.

```
ubuntu@ubuntu-VirtualBox:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ubuntu/.ssh/id_rsa): my_key
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in my_key.
Your public key has been saved in my_key.pub.
The key fingerprint is:
5d:48:47:39:3b:fd:e4:75:b3:74:26:f8:04:81:91:7b ubuntu@ubuntu-VirtualBox
The key's randomart image is:
+--[ RSA 2048]----+
          .o...o.
          ..o*..o*
          ..E o.o
          S . . .
          + . .
+-----+
```

ssh-copy-id: is a command that copies the public key of the local host to the authorized keys file of the remote host, allowing password-less and automatic login via SSH.

```
ubuntu01@linux:~$ ssh-copy-id kali@192.168.239.134
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
kali@192.168.239.134's password:

Number of key(s) added: 1

Now try logging into the machine, with: "ssh 'kali@192.168.239.134'"
and check to make sure that only the key(s) you wanted were added.

ubuntu01@linux:~$
```

Basic Linux commands activity questions

1. Command to display the following message as (Use “New line).

“God!Bless us.

We are starting Shell Scripting”

```
ubuntu@ubuntu:~$ cd Desktop/NSA
bash: cd: Desktop/NSA: No such file or directory
ubuntu@ubuntu:~$ cd Desktop
ubuntu@ubuntu:~/Desktop$ mkdir NSA
ubuntu@ubuntu:~/Desktop$ cd NSA
ubuntu@ubuntu:~/Desktop/NSA$ echo -e "\"God! Bless us..\n We are starting Shell Scripting\""
"God! Bless us..
 We are starting Shell Scripting"
ubuntu@ubuntu:~/Desktop/NSA$
```

2. Get the manual page of ‘ls’ command. Search for the word “alpha”. Find the next occurrence and then find the previous occurrence.

```
ubuntu@ubuntu:~/Desktop/NSA$ man ls
[1]+ Stopped                  man ls
ubuntu@ubuntu:~/Desktop/NSA$
```

```
List information about the FILES (the current directory by default). Sort entries alphabetically if none of
-cftuvSUX nor --sort is specified.

Mandatory arguments to long options are mandatory for short options too.

-a, --all
      do not ignore entries starting with .

-A, --almost-all
      do not list implied . and ..

--author
      with -l, print the author of each file

-b, --escape
      print C-style escapes for nongraphic characters

--block-size=SIZE
      with -l, scale sizes by SIZE when printing them; e.g., '--block-size=M'; see SIZE format below

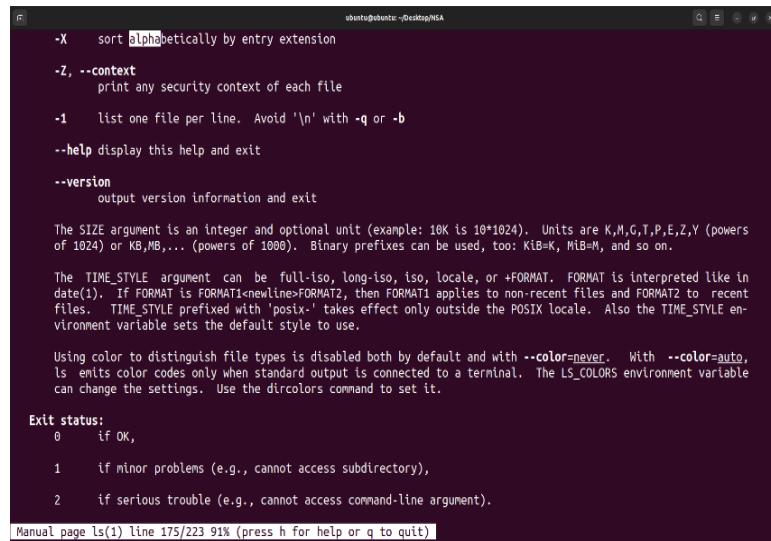
-B, --ignore-backups
      do not list implied entries ending with ~

-c      with -lt: sort by, and show, ctime (time of last modification of file status information); with -l: show
        ctime and sort by name; otherwise: sort by ctime, newest first

-C      list entries by columns

--color[=WHEN]
      colorize the output; WHEN can be 'always' (default if omitted), 'auto', or 'never'; more info below

Manual page ls(1) line 10/223 16% (press h for help or q to quit).
```



The screenshot shows a terminal window with the command `man ls` running. The output displays the manual page for the `ls` command, which includes various options like `-X`, `-Z`, and `--version`. It also provides information about file sizes and time styles. At the bottom of the page, there is a note about exit status: 0 for OK, 1 for minor problems, and 2 for serious trouble.

```
ubuntu@ubuntu: ~Desktop/NSA$ man ls
-X      sort alphabetically by entry extension
-Z, --context
        print any security context of each file
-1     list one file per line. Avoid '\n' with -q or -b
--help display this help and exit
--version
        output version information and exit

The SIZE argument is an integer and optional unit (example: 10K is 10*1024). Units are K,M,G,T,P,E,Z,Y (powers of 1024) or KB,MB,... (powers of 1000). Binary prefixes can be used, too: KiB=K, MiB=M, and so on.

The TIME_STYLE argument can be full-iso, long-iso, iso, locale, or +FORMAT. FORMAT is interpreted like in date(1). If FORMAT is FORMAT1<newline>FORMAT2, then FORMAT1 applies to non-recent files and FORMAT2 to recent files. TIME_STYLE prefixed with 'postx.' takes effect only outside the POSIX locale. Also the TIME_STYLE environment variable sets the default style to use.

Using color to distinguish file types is disabled both by default and with --color=never. With --color=auto, ls emits color codes only when standard output is connected to a terminal. The LS_COLORS environment variable can change the settings. Use the dircolors command to set it.

Exit status:
0      if OK,
1      if minor problems (e.g., cannot access subdirectory),
2      if serious trouble (e.g., cannot access command-line argument).

Manual page ls(1) line 175/223 91% (press h for help or q to quit)
```

3. Read your name from the keyboard and display it.



The screenshot shows a terminal window with the command `read -p "Enter your name:"` running. The user has typed "Kelly" and pressed Enter. The command then runs `echo $name` to display the input.

```
ubuntu@ubuntu: ~/Desktop/NSA$ read -p "Enter your name:" n
Enter your name:Kelly
ubuntu@ubuntu: ~/Desktop/NSA$ echo $n
Kelly
ubuntu@ubuntu: ~/Desktop/NSA$
```

4. Create the directory structure dir1/dir4 and dir1/dir2/dir3 with a single command and then change directory to dir3.



The screenshot shows a terminal window with the command `mkdir -p dir1/dir4 dir1/dir2/dir3` running. The user then changes the current directory to `dir3` using the command `cd dir1/dir2/dir3`.

```
ubuntu@ubuntu: ~/Desktop/NSA$ mkdir -p dir1/dir4 dir1/dir2/dir3
ubuntu@ubuntu: ~/Desktop/NSA$ cd dir1/dir2/dir3
ubuntu@ubuntu: ~/Desktop/NSA/dir1/dir2/dir3$
```

5. Create some files using Vim.

- Creating a file using vim:
- Start vim by typing vim filename
- To insert text press i
- Now start editing text. Add new text or delete unwanted text.
- One can press Esc and type :wq to save changes to a file and exit from vim]

6. Display the current directory.

```
ubuntu@ubuntu:~/Desktop/NSA/dr1/dr2/dr3$ pwd  
/home/ubuntu/Desktop/NSA/dr1/dr2/dr3  
ubuntu@ubuntu:~/Desktop/NSA/dr1/dr2/dr3$
```

7. Listing files and folders.

- a. Listing the contents of dir1 (Qn.4) and all its descendants.

- b. Listing the contents of dir3 (Qn.4) in
 - i. Alphabetical order
 - ii. Sorted on Time of modification, newest first
 - iii. Sorted on Size
 - iv. Reverse of all above
 - v. Long listing of files Sorted on Size with smallest first and size
 - vi. Displayed in human readable form

```
[4]ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls
a1.txt avg.c test.py
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l
total 12
-rw-rw-r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
-rw-rw-r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-rw-r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -S
a1.txt avg.c test.py
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -r
test.py avg.c a1.txt
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -lrs
total 12
-rw-rw-r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
-rw-rw-r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-rw-r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -h
a1.txt avg.c test.py
Ubuntu@Ubuntu:~/Desktop/NSA/dir1/dir2$
```

8. Execute **ls** and store the output to a file **lsoutput**.

```

ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$ ls -l > lsoutput
ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$ cat lsoutput
total 12
-rw-r--r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
-rw-r--r-- 1 ubuntu ubuntu 0 May 27 02:14 lsoutput
-rw-r--r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-r--r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$ 

```

9. Display the file

- a. starting with the first 10 lines and

```

ubuntu@ubuntu:~/Desktop/NSA/diri/dir$ more -10 cal.c
#include <stdio.h>
#include <conio.h>
void Main()
{
    int n1,n2,add,sub,prod,quot,remain;
    clrscr();
    printf("ENTER NUMBER 1: ");
    scanf("%d",&n1);
    printf("ENTER NUMBER 2: ");
    scanf("%d",&n2);
--More--(39%)

```

- b. starting with the 10th line with provision for

- i. Scrolling Up

```

ubuntu@ubuntu:~/Desktop/NSA/diri/dir$ ls
cal.c  dir3
ubuntu@ubuntu:~/Desktop/NSA/diri/dir$ more +10 cal.c
scanf("%d",&n2);
add=n1+n2;
sub=n1-n2;
prod=n1*n2;
quot=n1/n2;
remain=n1%n2;
printf("\nADDITION OF THE NUMBERS: %d",add);
printf("\nSUBTRACTION OF THE NUMBERS: %d",sub);
printf("\nPRODUCTION OF THE NUMBERS: %d",prod);
printf("\nQUOTIENT OF THE NUMBERS: %d",quot);
printf("\nREMAINDER OF THE NUMBERS: %d",remain);
getch();
}
ubuntu@ubuntu:~/Desktop/NSA/diri/dir$ 

```

- ii. Scrolling Up and Down

```

ubuntu@ubuntu:~/Desktop/NSA/diri/dir$ less +10 cal.c
[3]+  Stopped                  less +10 cal.c
ubuntu@ubuntu:~/Desktop/NSA/diri/dir$ 

scanf("%d",&n2);
add=n1+n2;
sub=n1-n2;
prod=n1*n2;
quot=n1/n2;
remain=n1%n2;
printf("\nADDITION OF THE NUMBERS: %d",add);
printf("\nSUBTRACTION OF THE NUMBERS: %d",sub);
printf("\nPRODUCTION OF THE NUMBERS: %d",prod);
printf("\nQUOTIENT OF THE NUMBERS: %d",quot);
printf("\nREMAINDER OF THE NUMBERS: %d",remain);
getch();
```

```

## 10. Execute **ls -l** and add the output to **lsoutput**, at the end.

```

ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$ cd dir3
ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$ ls -l >> lsoutput
ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$ cat lsoutput
total 12
-rw-r--r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
-rw-r--r-- 1 ubuntu ubuntu 0 May 27 02:14 lsoutput
-rw-r--r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-r--r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
total 16
-rw-rw-r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
-rw-rw-r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-rw-r-- 1 ubuntu ubuntu 219 May 27 02:14 lsoutput
-rw-rw-r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
ubuntu@ubuntu:~/Desktop/NSA/diri/dir2$

```

11. Execute `ls -l` and feed the result to less command, to scroll through the directory listing.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ ls -l | less
[4]+ Stopped ls --color=auto -l | less
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$
```

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ ls -l
total 16
-rw-rw-r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
-rw-rw-r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-rw-r-- 1 ubuntu ubuntu 438 May 27 02:26 lsoutput
-rw-rw-r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
(END)
```

12. Copy the file file1 to newfile.

- a) If newfile already exists, it should be replaced.
- b) If newfile already exists, it should not be replaced.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cd /home
ubuntu@ubuntu:/home$ cd /home/ubuntu/Desktop/NSA/dir1/dir2/dir3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ ls
a1.txt avg.c file1 file2 lsoutput test.py
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cat file1
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cp file1 newfile
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cat newfile
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cat >> file1
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cat file1
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cp -n file1 newfile
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cat newfile
Hello,
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$
```

- c) If newfile already exists, it should be replaced, but only with the consent of the user.
- d) If newfile already exists, it should be replaced only if its contents is older than that of file1.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cat file1
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cp -i file1 newfile
cp: overwriting 'newfile' (y/n)? y
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cat newfile
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cat >> file1
to all
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cp -u file1 newfile
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cat newfile
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$
```

- e) Even if newfile is read only.
- f) Create a link instead of copying.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ chmod 444 newfile
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cat >> file1
Students
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cp -s file1 newfile
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cat newfile
Hello,
Good Morning
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cp -s file1 newfile
cp: cannot create symbolic link 'newfile' to 'file1': File exists
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cp -s file1 newfile
cp: missing destination file operand after 'newfile'
Try 'cp --help' for more information.
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cp -s file1 newf
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ ls
a1.txt avg.c file1 file2 lsoutput newf newfile test.py
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ ls -l
total 29
-rw-rw-r-- 1 ubuntu ubuntu 1012 May 27 02:05 a1.txt
-rw-rw-r-- 1 ubuntu ubuntu 275 May 27 02:07 avg.c
-rw-rw-r-- 1 ubuntu ubuntu 37 May 27 02:43 file1
-rw-rw-r-- 1 ubuntu ubuntu 11 May 27 02:31 file2
-rw-rw-r-- 1 ubuntu ubuntu 438 May 27 02:26 lsoutput
lrwxrwxrwx 1 ubuntu ubuntu 5 May 27 02:46 newf -> file1
-rw-rw-r-- 1 ubuntu ubuntu 25 May 27 02:08 test.py
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir$ cd
ubuntu@ubuntu: $ cp -R dir
```

- g) Copy the entire directory tree from dir1 of Qn.4 to a new directory dir5

```

ubuntu@ubuntu:~/Desktop/NSA$ cd /home/ubuntu/Desktop/NSA/dir1/dir2/dir3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ cd
ubuntu@ubuntu:~/Desktop/NSA$ cp -R dir1 dir5
cp: cannot stat 'dir1': No such file or directory
ubuntu@ubuntu:~/Desktop/NSA$ cd NSA
ubuntu@ubuntu:~/Desktop/NSA$ cp -R dir1 dir5
ubuntu@ubuntu:~/Desktop/NSA$ ls
dir1 dir5
ubuntu@ubuntu:~/Desktop/NSA$

```

**13. Create a new directory, dir6 inside dir1**

- Move all files in dir5 into it.
- Delete all files where the name starts with a vowel character, upper or lower case.

```

ubuntu@ubuntu:~/Desktop/NSA$ mkdir -p dir1/dir6
ubuntu@ubuntu:~/Desktop/NSA$ mv dir5 dir1/dir6
ubuntu@ubuntu:~/Desktop/NSA$ cd dir1/dir6
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir6$ ls
dir5
ubuntu@ubuntu:~/Desktop/NSA$ mv dir5 dir1
ubuntu@ubuntu:~/Desktop/NSA$ cd ..
ubuntu@ubuntu:~/Desktop/NSA$ mv dir1/dir6/* ./dir5
ubuntu@ubuntu:~/Desktop/NSA$ mv dir5/* ./dir5
ubuntu@ubuntu:~/Desktop/NSA$ ls
ai.txt avg.c file1 file2 lsoutput newf oldfile test.py
ubuntu@ubuntu:~/Desktop/NSA$

```

- Delete all files where the name is at least 3 characters long.

- Delete all hidden folders, and files.

```

ubuntu@ubuntu:~/Desktop/NSA$ mv file1 dir1/dir2/file3
mv: cannot stat 'file1': No such file or directory
ubuntu@ubuntu:~/Desktop/NSA$ mv file1 dir1/dir2/file3
ubuntu@ubuntu:~/Desktop/NSA$ cd dir1/dir2/dir3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2/dir3$ rm [a,e,i,o,u,A,E,I,O,U]*
ubuntu@ubuntu:~/Desktop/NSA$ ls
file1 file2 lsoutput newf test.py
ubuntu@ubuntu:~/Desktop/NSA$ rm ???
ubuntu@ubuntu:~/Desktop/NSA$ ls
ubuntu@ubuntu:~/Desktop/NSA$ ls -A
ubuntu@ubuntu:~/Desktop/NSA$
ubuntu@ubuntu:~/Desktop/NSA$ cd ..
ubuntu@ubuntu:~/Desktop/NSA$ rm -rf dir3
ubuntu@ubuntu:~/Desktop/NSA$ ls
ubuntu@ubuntu:~/Desktop/NSA$ ls -A
ubuntu@ubuntu:~/Desktop/NSA$
ubuntu@ubuntu:~/Desktop/NSA$ ls -a
Command 'ls' not found, did you mean:
 command 'l's': From deb coreutils (8.32-4.1ubuntu1)
 command 'l's': From deb hfsutils (3.2.6-15build2)
 command 'l's': From deb lvm2 (2.03.11-2.1ubuntu4)
Try: sudo apt install <deb name>
ubuntu@ubuntu:~/Desktop/NSA$ ls -a
... cal.c
ubuntu@ubuntu:~/Desktop/NSA$ rm -rf .*
rm: refusing to remove '.', or '..', directory: skipping '..'
rm: refusing to remove '.', or '..', directory: skipping '..'
ubuntu@ubuntu:~/Desktop/NSA$ ls -a
... cal.c
ubuntu@ubuntu:~/Desktop/NSA$

```

**14. Create a file testfile1 using Vim**

vim testfile1

- Set line number

vim testfile1

Press esc

Type :set number

```

ubuntu@ubuntu:~$ vim testfile1
ubuntu@ubuntu:~$
ubuntu@ubuntu:~$:set number
1
ubuntu@ubuntu:~$

```

- Type your name and address with district and pincode

```
1 Stephan , xyz , SM street , Erode , Tamilnadu-638001
2 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
3 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
4 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
5 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
6 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
7 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
8 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
9 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
10 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
11 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001

-- INSERT --
```

c) Copy paste the contents 10 times.

1. Place the cursor in the desired location(at beginning) .
2. Press Esc key then press ‘v’ [To change to visual mode] .
3. Press the ‘y’ key followed by movement command ,‘\$’ .
4. Move the cursor to the location where you want to paste the contents.
5. Press ‘10p’ to paste the contents.

d) Replace all occurrence of your district with a neighbouring district.

1. Press Esc key [To change to normal mode].
2. Type “:%s/Erode/Dindigul/gi”

```
1 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
2 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
3 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
4 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
5 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
6 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
7 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
8 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
9 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
10 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001
11 Stephan , xyz , SM street , Dindigul , Tamilnadu-638001

11 substitutions on 11 lines

1 Stephan , xyz , SM street , Erode , Tamilnadu-638001
2 Stephan , xyz , SM street , Erode , Tamilnadu-638001
3 Stephan , xyz , SM street , Erode , Tamilnadu-638001
4 Stephan , xyz , SM street , Erode , Tamilnadu-638001
5 Stephan , xyz , SM street , Erode , Tamilnadu-638001
6 Stephan , xyz , SM street , Erode , Tamilnadu-638001
7 Stephan , xyz , SM street , Erode , Tamilnadu-638001
8 Stephan , xyz , SM street , Erode , Tamilnadu-638001
9 Stephan , xyz , SM street , Erode , Tamilnadu-638001
10 Stephan , xyz , SM street , Erode , Tamilnadu-638001
11 Stephan , xyz , SM street , Erode , Tamilnadu-638001

:%s/erode/Dindigul/gi■
```

15. Create 2 files testfile2 and testfile3 using Vim.

- a. Modify the permissions of testfile2 using symbolic mode.
  - i. Add read permission to others
  - ii. Revoke write from owner
  - iii. Set only execute to Group.

- iv. Add write to owner, revoke read from others and set read only to group.
- v. Set read and write to all.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ vim testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ vim testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 666 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 777 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 666 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod g+r testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 777 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod o+r,g=r testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 666 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod a=rw testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 754 testfile3
Command 'chmod' not found, did you mean:
 command 'chmod' from deb coreutils (8.32-4.1ubuntu1)
Try: sudo apt install -ddeb name>
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 754 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 777 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$
```

- b. Modify the permissions of testfile3 using numeric mode
  - i. Set read and write to all.
  - ii. set read,write and execute to owner, read and execute to group and read only to others.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile3
-rw-rw-r-- 1 ubuntu ubuntu 469 May 27 03:23 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 666 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile3
-rw-rw-rw- 1 ubuntu ubuntu 469 May 27 03:23 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 754 testfile3
Command 'chmode' not found, did you mean:
 command 'chmod' from deb coreutils (8.32-4.1ubuntu1)
Try: sudo apt install -ddeb name>
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 754 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ chmod 754 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$ ls -l testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1/dir2$
```

- c. Set the permissions of testfile2 the same as that of testfile3

```
ubuntu@ubuntu:~/Desktop/NSA/dir1$ ls -l testfile3
-rw-rw-r-- 1 ubuntu ubuntu 469 May 27 03:23 testfile3
ubuntu@ubuntu:~/Desktop/NSA/dir1$ ls -l testfile2
-rw-rw-rw- 1 ubuntu ubuntu 320 May 27 03:22 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1$ chmod --reference=testfile3 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1$ ls -l testfile2
-rw-rw-r-- 1 ubuntu ubuntu 320 May 27 03:22 testfile2
ubuntu@ubuntu:~/Desktop/NSA/dir1$
```

16. Use **head** and **tail** piped with cat /etc/passwd to display the details of
- a. The first 12 users in the system.
  - b. The last 7 users in the system.

```
ubuntu@ubuntu:~/Desktop/NSA$ cat /etc/passwd|head -12
root:x:0:root:/root:/bin/bash
daemon:x:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:bin:/bin:/usr/sbin/nologin
sys:x:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
ubuntu@ubuntu:~/Desktop/NSA$ cat /etc/passwd|tail -7
color:x:123:130:color colour management daemon,,,:/var/lib/color:/usr/sbin/nologin
geoclue:x:124:131:/var/lib/geoclue:/usr/sbin/nologin
pulse:x:125:132:PulseAudio daemon,,,:/run/pulse:/usr/sbin/nologin
gnome-initial-setup:x:126:65534:::/run/gnome-initial-setup/:/bin/false
hplip:x:127:7:HPLIP system user,,,:/run/hplip:/bin/false
gdm:x:128:134:Gnome Display Manager:/var/lib/gdm3:/bin/false
ubuntu:x:999:999:Live session user,,,:/home/ubuntu:/bin/bash
ubuntu@ubuntu:~/Desktop/NSA$
```

- c. All but the first 3.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1$ cat /etc/passwd | tail +4
sync:x:4:65534:sync:/bin:/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-network:x:100:102:system Network Management,,,:/run/systemd:/usr/sbin/nologin
systemd-resolve:x:101:103:system Resolver,,,:/run/systemd:/usr/sbin/nologin
messagebus:x:102:105::/nonexistent:/usr/sbin/nologin
systemd-timesync:x:103:106:system Time Synchronization,,,:/run/systemd:/usr/sbin/nologin
syslog:x:104:111::/home/syslog:/usr/sbin/nologin
_apt:x:105:65534::/nonexistent:/usr/sbin/nologin
tss:x:106:112:TPM software stack,,,:/var/lib/tpm:/bin/false
```

- d. All but the last 5.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1$ cat /etc/passwd | head -n -5
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin.sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
news:x:9:9:news:/var/spool/news:/usr/sbin/nologin
uucp:x:10:10:uucp:/var/spool/uucp:/usr/sbin/nologin
proxy:x:13:13:proxy:/bin:/usr/sbin/nologin
www-data:x:33:33:www-data:/var/www:/usr/sbin/nologin
backup:x:34:34:backup:/var/backups:/usr/sbin/nologin
list:x:38:38:Mailing List Manager:/var/list:/usr/sbin/nologin
irc:x:39:39:ircd:/run/ircd:/usr/sbin/nologin
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/usr/sbin/nologin
nobody:x:65534:65534:nobody:/nonexistent:/usr/sbin/nologin
systemd-network:x:100:102:system Network Management,,,:/run/systemd:/usr/sbin/nologin
systemd-resolve:x:101:103:system Resolver,,,:/run/systemd:/usr/sbin/nologin
messagebus:x:102:105::/nonexistent:/usr/sbin/nologin
systemd-timesync:x:103:106:system Time Synchronization,,,:/run/systemd:/usr/sbin/nologin
syslog:x:104:111::/home/syslog:/usr/sbin/nologin
_apt:x:105:65534::/nonexistent:/usr/sbin/nologin
tss:x:106:112:TPM software stack,,,:/var/lib/tpm:/bin/false
```

- e. Only the 9 th.

```
ubuntu@ubuntu:~/Desktop/NSA/dir1$ cat /etc/passwd | head -9|tail -1
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
ubuntu@ubuntu:~/Desktop/NSA/dir1$
```

## 17. Use grep to

- Display all lines in a file that contains the string “abc”
- Display all lines in a file that *does not* contain the string “abc”

```

ubuntu@ubuntu:~/Desktop/NSA/d1r1$ cat > txtfile
abc
abc is a string
these are english alphabets
ubuntu@ubuntu:~/Desktop/NSA/d1r1$ grep abc txtfile
abc
abc is a string
ubuntu@ubuntu:~/Desktop/NSA/d1r1$ grep -v abc txtfile
these are english alphabets

```

## 18. Using expr

- Read two integers X and Y. Display the sum, difference, product, quotient and remainder of these variables.
- Read a string, S, a position, p and a length l. Display the substring of length l starting at position p from the string S.

```

lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ read -p "enter two numbers: " x y
enter two numbers: 12 5
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ echo "sum is : `expr $x + $y`"
sum is : 17
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ echo "Difference is : `expr $x - $y`"
Difference is : 7
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ echo "Product is : `expr $x * $y`"
Product is : 60
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ echo "Quotient is : `expr $x / $y`"
Quotient is : 2
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ echo "Reminder is : `expr $x % $y`"
Reminder is : 2
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ read -p "enter a string: " s
enter a string: notebook
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ read -p "enter the position: " p
enter the position: 5
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ read -p "enter the length: " l
enter the length: 4
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$ echo "Substring: `expr substr $s $p $l`"
Substring: book
lab@lab-Lenovo-IdeaPad-Z400:~/dir1/dir6/dir5/dir2$

```

19. a. Add a normal user, user1. Create (if it does not exist) the folder /user1 and set /user1 as the home directory of user1. Also set /bin/bash as the login shell (*Use a single command*).  
b. Modify the user account of user1, to expire it after a specific date.

```

user@user-VirtualBox:~$ sudo useradd -s /bin/bash -m -d /home/u_ser1 u_ser1
[sudo] password for user:
user@user-VirtualBox:~$ sudo change -l u_ser1
sudo: change: command not found
user@user-VirtualBox:~$ sudo chage -l u_ser1
Last password change : Jun 06, 2023
Password expires : never
Password inactive : never
Account expires : never
Minimum number of days between password change : 0
Maximum number of days between password change : 99999
Number of days of warning before password expires: 7
user@user-VirtualBox:~$ sudo chage -E 2022-06-9 u_ser1
sudo: change: command not found
user@user-VirtualBox:~$ sudo chage -E 2022-06-9 u_ser1
user@user-VirtualBox:~$ sudo chage -l u_ser1
Last password change : Jun 06, 2023
Password expires : never
Password inactive : never
Account expires : Jun 09, 2022
Minimum number of days between password change : 0
Maximum number of days between password change : 99999
Number of days of warning before password expires: 7
user@user-VirtualBox:~$ cd /home/u_ser1
chown: cannot access '/home/Documents/dir1/dir2': No such file or directory
user@user-VirtualBox:~$ sudo chown -R u_ser1:u_ser1 /Documents/dir1/dir2
chown: cannot access '/Documents/dir1/dir2': No such file or directory
user@user-VirtualBox:~$ sudo chown -R u_ser1:u_ser1 /home/user/Documents/dir1/
user@user-VirtualBox:~$ cd ..
user@user-VirtualBox:~/home$ ls -l
total 8
drwxr-x--- 18 user user 4096 Jun 6 21:22 user
drwxr-x--- 2 u_ser1 u_ser1 4096 Jun 6 22:06 u_ser1
user@user-VirtualBox:~/home$ cd Documents
bash: cd: Documents: No such file or directory
user@user-VirtualBox:~/home$ cd ..
user@user-VirtualBox:~/home$ cd Documents
bash: cd: Documents: No such file or directory
user@user-VirtualBox:~/home$

```

- c. Change the owner and group of the directory tree from dir2 and all its contents to user1.

```

user@user-VirtualBox:~/Documents/dirs$ ls -l
total 18
drwxrwxr-x 3 u_ser1 u_ser1 4096 Jun 6 21:13 dir1
drwxrwxr-x 2 u_ser1 u_ser1 4096 Jun 6 21:12 dir2
drwxrwxr-x 3 u_ser1 u_ser1 4096 Jun 6 21:10 dir3
drwxrwxr-x 2 u_ser1 u_ser1 4096 Jun 6 21:11 sum.py
-rw-rw-r-- 1 u_ser1 u_ser1 0 Jun 6 21:08 test1.txt
user@user-VirtualBox:~/Documents/dirs$ ls -l
total 18
drwxrwxr-x 2 u_ser1 u_ser1 4096 Jun 6 21:15 dir1
-rw-rw-r-- 1 u_ser1 u_ser1 10 Jun 6 21:13 testfile1.txt
-rw-rw-r-- 1 u_ser1 u_ser1 21 Jun 6 21:14 testfile2.txt
user@user-VirtualBox:~/Documents/dirs$

```

d. Delete the user account user1

- i. By retaining the home folder
- ii. By deleting the home folder

```

user@user-VirtualBox:~/Documents/dirs$ cd Documents
user@user-VirtualBox:~/Documents/dirs$ cd dirs
user@user-VirtualBox:~/Documents/dirs$ ls -l
total 12
drwxrwxr-x 3 u_ser1 u_ser1 4096 Jun 6 21:13 dir2
drwxrwxr-x 2 u_ser1 u_ser1 4096 Jun 6 21:12 dir4
drwxrwxr-x 3 u_ser1 u_ser1 4096 Jun 6 21:10 dir3
-rw-rw-r-- 1 u_ser1 u_ser1 0 Jun 6 21:11 sum.py
-rw-rw-r-- 1 u_ser1 u_ser1 0 Jun 6 21:08 test1.txt
user@user-VirtualBox:~/Documents/dirs$ ls -l
total 12
drwxrwxr-x 2 u_ser1 u_ser1 4096 Jun 6 21:15 dir2
-rw-rw-r-- 1 u_ser1 u_ser1 13 Jun 6 21:13 testfile1.txt
-rw-rw-r-- 1 u_ser1 u_ser1 21 Jun 6 21:14 testfile2.txt
user@user-VirtualBox:~/Documents/dirs$ sudo userdel u_ser1
[User] userdel: user u_ser1 does not exist
user@user-VirtualBox:~/Documents/dirs$ sudo userdel u_ser1 -r u_ser1
Usage: userdel [options] LOGIN
Options:
 -f, --force force some actions that would fail otherwise
 or ignore errors with long file names
 -h, --help display this help message and exit
 -r, --remove remove home directory and mail spool
 -R, --root CHROOT_DIR
 -P, --prefix PREFIX_DIR
 --extrausers Use the extra users database
 -Z, --selinux user remove any SELinux user mapping for the user
user@user-VirtualBox:~/Documents/dirs$

```

## 20. Miscellaneous

a. Using **tar** create a tar.gz file of the folder dir1 of Qn.4 with the name mydir.tar.gz.

```

user@VirtualBox:~/Documents/dirs$ cd
user@VirtualBox:~$ tar -czvf mydir.tar.gz dir1
tar: Cannot stat: No such file or directory
Exiting with failure status due to previous errors
user@VirtualBox:~$ cd Documents
user@VirtualBox:~/Documents$ tar -czvf mydir.tar.gz dir1
sum.py
dir2/
dir2/dir3/
dir2/dir3/armstrong.c
dir2/testfile2.txt
dir2/testfile1.txt
test1.txt
dir4/
dir4/sample.c
dir4/average.c
user@VirtualBox:~/Documents$

```

b. Extract the contents of mydir.tar.gz to dir6 of Qn.14.

```

user@user-VirtualBox:~/Documents$ tar -xvf mydir.tar.gz -C dir1/dir6
dir1/
dir1/sun.py
dir1/dir2/
dir1/dir2/dir1/
dir1/dir2/dir1/gromstrong.c
dir1/dir2/testfile2.txt
dir1/dir2/testfile1.txt
dir1/test1.txt
dir1/dir4/
dir1/dir4/sample.c
dir1/dir4/average.c
user@user-VirtualBox:~/Documents$
```

c. Use **top** to display processes sorted on

i. Process id

1. Type top

2. Press N

```

top - 21:34:09 up 49 min, 2 users, load average: 0.09, 0.09, 0.09
Tasks: 229 total, 1 running, 228 sleeping, 0 stopped, 0 zombie
CPU(s): 0.3 us, 0.0 sy, 0.0 nt, 99.7 id, 0.0 wa, 0.0 hi, 0.0 sl, 0.0 st
Mem Mem : 4685.0 total, 1654.5 free, 1713.1 used, 1613.8 buff/cache
Mem Swap: 4096.0 total, 4096.0 free, 0.0 used, 2971.8 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
1642 user 20 0 5081956 525256 168664 S 1.7 10.9 2:36.78 gnome-shell
2259 user 39 19 782444 32780 18944 S 0.3 0.7 0:01.05 tracker-miner-f
2782 user 20 0 643092 57804 46032 S 0.3 1.2 0:05.48 gnome-terminal-
5375 user 20 0 23024 5504 3328 R 0.3 0.1 0:00.02 top
1 root 20 0 168440 12724 88800 S 0.0 1.3 0:00.00 kthreadd
2 root 20 0 0 0 0 I 0.0 0.0 0:00.00 kthreadd
3 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 rCU_gP
4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 rCU_pAr_gP
5 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 sLub_fLushw
6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 ksoftIrrad
8 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/0:0H-events_highpri
10 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 mm_percpu_wq
11 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_kthread
12 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_rude_kthread
13 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_race_kthread
14 root 20 0 0 0 0 S 0.0 0.0 0:00.03 ksoftIrrad/0
15 root 20 0 0 0 0 I 0.0 0.0 0:00.78 rCU_pReempt
16 root rt 0 0 0 0 S 0.5 0.0 0.0 0:00.02 migration/0
17 root 51 0 0 0 0 I 0.0 0.0 0:00.00 rCU_pRebind/0
18 root 20 0 0 0 0 I 0.0 0.0 0:00.18 kworker/0:1-events
19 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0
20 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1
21 root -51 0 0 0 0 I 0.0 0.0 0:00.00 idle_inject/1
22 root 0 -1 0 0 0 0 I 0.0 0.0 0:00.00 idle_inject/1
23 root 20 0 0 0 0 S 0.0 0.0 0:00.03 ksoftIrrad/1
24 root 20 0 0 0 0 I 0.0 0.0 0:00.22 kworker/1:0-events
25 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/1:0H-events_highpri
26 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/2
27 root 51 0 0 0 0 S 0.5 0.0 0:00.26 migration/2
28 root rt 0 0 0 0 S 0.0 0.0 0:00.26 migration/2
29 root 20 0 0 0 0 S 0.0 0.0 0:00.00 ksoftIrrad/2
31 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/2:0H-events_highpri
32 root 20 0 0 0 0 S 0.5 0.0 0.0 0:00.00 cpuhp/3
33 root -51 0 0 0 0 S 0.0 0.0 0:00.00 idle_inject/3
```

ii.CPU%

1. Type top

2. Press P

```

top - 21:33:24 up 48 min, 2 users, load average: 0.09, 0.09, 0.10
Tasks: 229 total, 1 running, 228 sleeping, 0 stopped, 0 zombie
CPU(s): 0.3 us, 0.0 sy, 0.0 nt, 99.7 id, 0.0 wa, 0.0 hi, 0.0 sl, 0.0 st
Mem Mem : 4685.0 total, 1652.0 free, 1716.6 used, 1611.8 buff/cache
Mem Swap: 4096.0 total, 4096.0 free, 0.0 used, 2968.3 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
5351 user 20 0 23024 5632 3456 R 0.3 0.1 0:00.03 top
5351 root 20 0 16884 2175 2048 S 0.0 0.0 0:00.00 anacron
5295 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_kthread
5294 root 20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/0:1-flush-0:0
5258 root 20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/4:1-events
5258 root 20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/4:1-events
5240 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_kthread
5191 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_race_kthread
5163 root 20 0 0 0 0 I 0.0 0.0 0:00.10 kworker/12:0-events_power_efficient
5153 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rCU_tasks_kthread
5107 root 20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/0:0-group_destroy
4230 user 20 0 2519536 242452 107860 S 0.0 5.1 0:24.86 gnome-text-edit-
4219 root 20 0 0 0 0 I 0.0 0.0 0:00.18 kworker/12:2-events_power_efficient
3551 user 20 0 868160 26368 14848 S 0.0 0.0 0:00.00 snap
3269 root 20 0 0 0 0 I 0.0 0.0 0:00.16 kworker/12:3-events_unbound
3137 root 20 0 0 0 0 I 0.0 0.0 0:00.42 kworker/5:2-events
3133 root 20 0 0 0 0 I 0.0 0.0 0:00.00 kworker/2:0
2869 user 20 0 19480 4064 3580 S 0.0 0.0 0:00.06 bash
2782 user 20 0 642860 57676 46832 S 1.2 1.2 0:00.00 gnome-terminal-
2751 user 20 0 396400 8664 7296 S 0.0 0.2 0:00.01 gvfsd-recent
2672 user 20 0 3029392 64592 48508 S 0.0 1.3 0:00.87 gjs
2661 user 20 0 2673386 319420 124752 S 0.0 6.7 0:00.00 nautilus
2552 user 20 0 40960 4096 4096 S 0.0 0.7 0:00.31 update-notifier
2449 root 20 0 479412 33728 28232 S 0.0 0.7 0:00.62 fwupd
2373 user 20 0 244796 6400 5888 S 0.0 0.1 0:00.01 gvfsd-metadata
2369 user 20 0 168652 2876 1795 S 0.0 0.0 0:00.00 gvfsd-client
2391 user 20 0 287350 2874 2800 S 0.0 0.0 0:00.00 VboxClient
2299 user 20 0 227352 2824 2560 S 0.0 0.1 0:00.26 VboxClient
2294 user 20 0 28548 1544 1280 S 0.0 0.0 0:00.00 VboxClient
2288 user 20 0 230386 3000 2048 S 0.0 0.0 0:00.00 VboxClient
2206 user 20 0 28400 1544 280 S 0.0 0.0 0:00.00 VboxClient
2266 user 20 0 1576112 86496 66668 S 0.0 1.8 0:00.65 mutter-x11-fram
2259 user 39 19 784244 33008 18944 S 0.0 0.7 0:00.99 tracker-miner-f
2251 user 20 0 275376 24700 18116 S 0.0 0.5 0:00.21 ibus-x11
```

- d. Use **ps** to display
- Processes associated with the current terminal.
  - All processes in the system.

```
user@user-VirtualBox:~/Documents$ ps -T
 PID SPID TTY TIME CMD
 2801 2801 pts/0 00:00:00 bash
 5424 5424 pts/0 00:00:00 ps
user@user-VirtualBox:~/Documents$ ps -A
 PID TTY TIME CMD
 1 ? 00:00:01 systemd
 2 ? 00:00:00 kthreadd
 3 ? 00:00:00 rcu_gp
 4 ? 00:00:00 rcu_par_gp
 5 ? 00:00:00 slub_flushwq
 6 ? 00:00:00 netns
 8 ? 00:00:00 kworker/0:0H-events_highpri
 10 ? 00:00:00 mm_percpu_wq
 11 ? 00:00:00 rcu_tasks_kthread
 12 ? 00:00:00 rcu_tasks_rude_kthread
 13 ? 00:00:00 rcu_tasks_trace_kthread
 14 ? 00:00:00 ksoftirqd/0
 15 ? 00:00:00 rcu_prempt
 16 ? 00:00:00 migration/0
 17 ? 00:00:00 idle_inject/0
 18 ? 00:00:00 kworker/0:1-events
 19 ? 00:00:00 cpuhp/0
 20 ? 00:00:00 cpuhp/1
 21 ? 00:00:00 idle_inject/1
 22 ? 00:00:00 migration/1
 23 ? 00:00:00 ksoftirqd/1
 24 ? 00:00:00 kworker/1:0-events
 25 ? 00:00:00 kworker/1:0H-events_highpri
 26 ? 00:00:00 cpuhp/2
 27 ? 00:00:00 idle_inject/2
 28 ? 00:00:00 migration/2
 29 ? 00:00:00 ksoftirqd/2
 31 ? 00:00:00 kworker/2:0H-events_highpri
 32 ? 00:00:00 cpuhp/3
 33 ? 00:00:00 idle_inject/3
 34 ? 00:00:00 migration/3
 35 ? 00:00:00 ksoftirqd/3
 37 ? 00:00:00 kworker/3:0H-kblockd
 38 ? 00:00:00 cpuhp/4
 39 ? 00:00:00 idle_inject/4
 40 ? 00:00:00 migration/4
```

- e. Use **df** to display the storage available in each partition in human readable form.

```
user@user-VirtualBox:~/Documents$ df -h
Filesystem Size Used Avail Use% Mounted on
tmpfs 469M 1.6M 467M 1% /run
/dev/sda2 25G 13G 11G 57% /
tmpfs 2.3G 0 2.3G 0% /dev/shm
tmpfs 5.0M 8.0K 5.0M 1% /run/lock
tmpfs 469M 116K 469M 1% /run/user/1000
user@user-VirtualBox:~/Documents$
```

## Result:

Commands executed successfully and output is verified.

## LAB CYCLE:3

### EXPERIMENT NO: 5

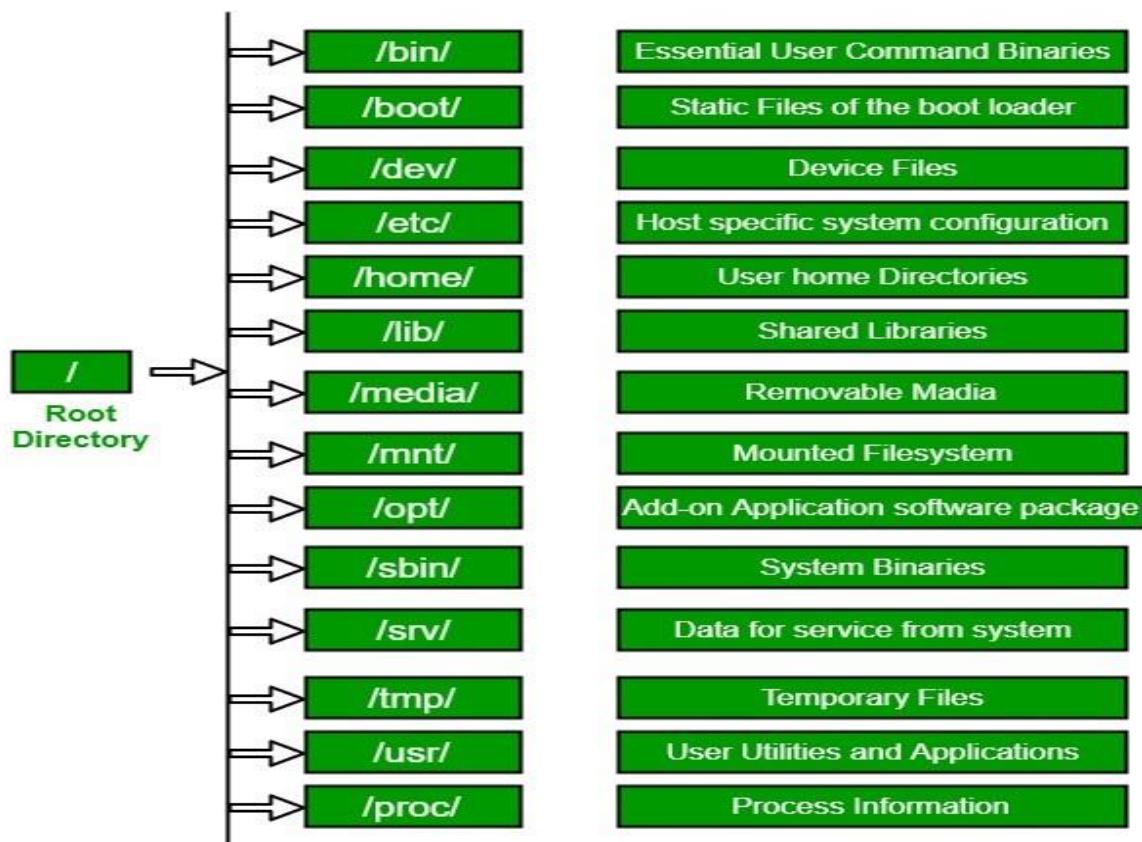
Date:

### FILE SYSTEM HIERARCHY, PERMISSION, CONFIGURATION FILES AND LOG FILES

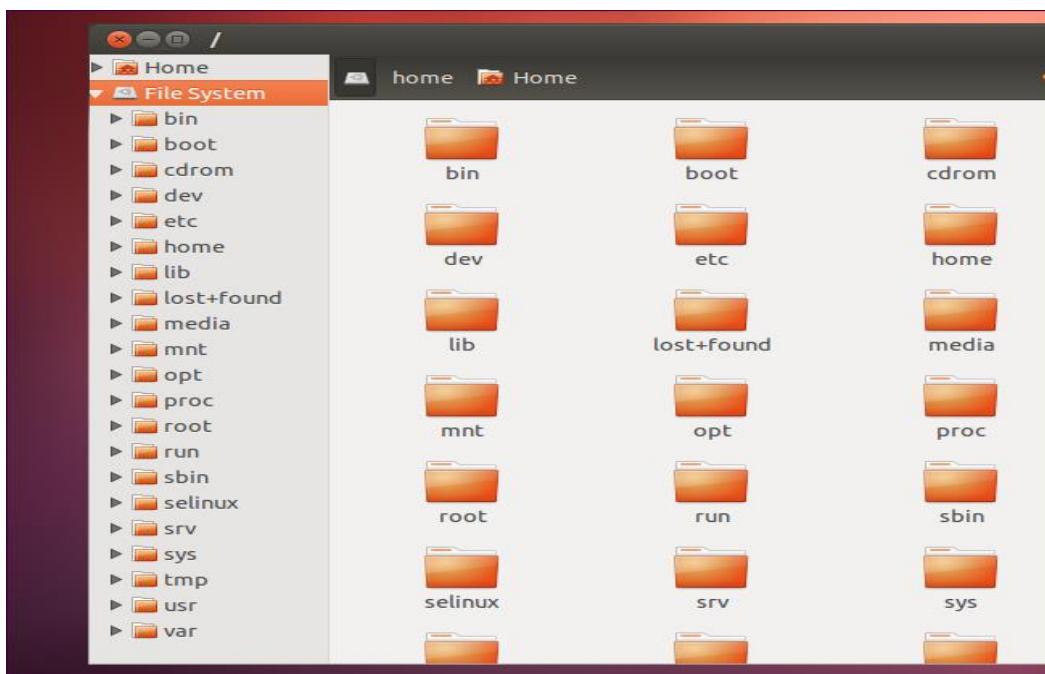
- Aim:** a) File system hierarchy in a common Linux distribution,  
b) File and device permissions,  
c) Study of system configuration files in /etc,  
d) Familiarizing log files for system events, user activity, network events.

#### a) File system hierarchy in a common Linux distribution

The Linux File Hierarchy Structure or the File System Hierarchy Standard (FHS) defines the directory structure and directory contents in Unix-like operating systems. It is maintained by the Linux Foundation. In the FHS, all files and directories appear under the root directory /, even if they are stored on different physical or virtual devices.

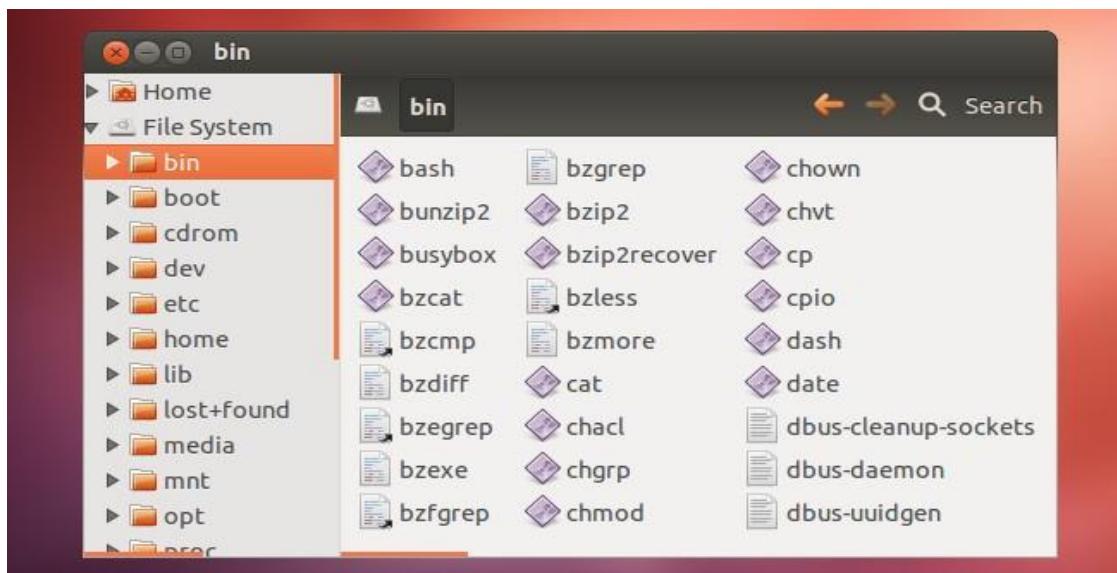


## 1. The Root Directory



- Every single file and directory starts from the root directory.
- The only root user has the right to write under this directory.
- /root is the root user's home directory, which is not the same as /.

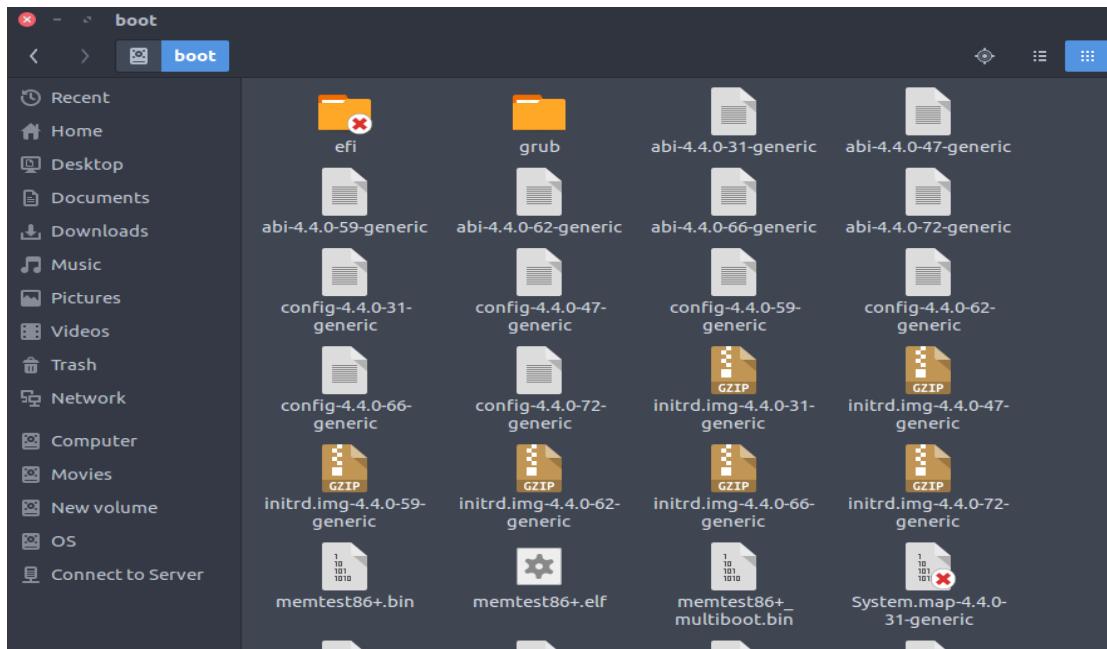
## 2. ./bin- User binaries



- Contains binary executables
- Common Linux commands you need to use in single-user modes are located under this directory.

- Commands used by all the users of the system are located here  
e.g. ps, ls, ping, grep, cp, cat, ls.

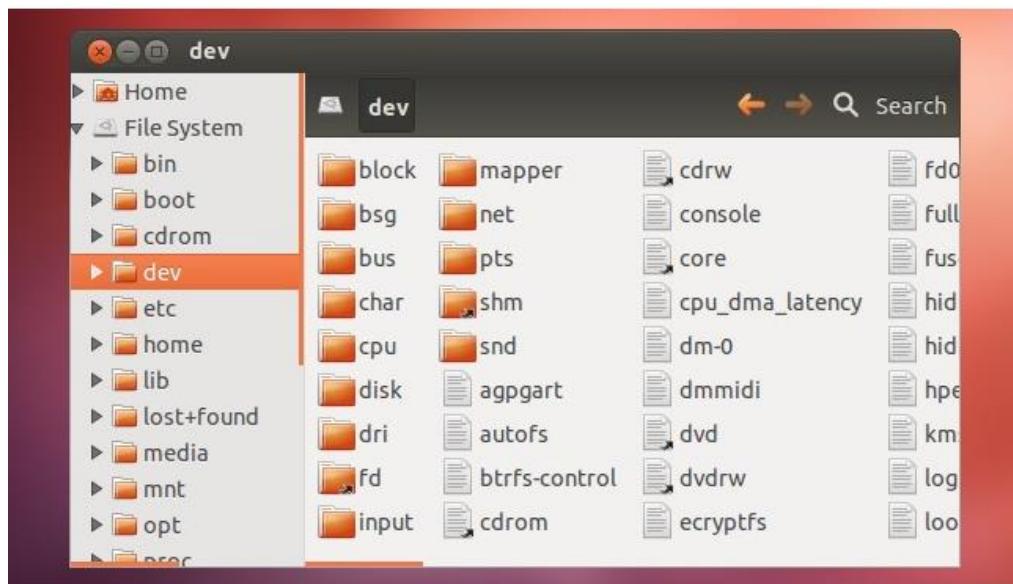
### 3. /boot – Static Boot Files



- Boot loader files
- Kernel initrd, vmlinuz, grub files are located under /boot

Example: initrd.img-2.6.32-24-generic, vmlinuz-2.6.32-24-generic

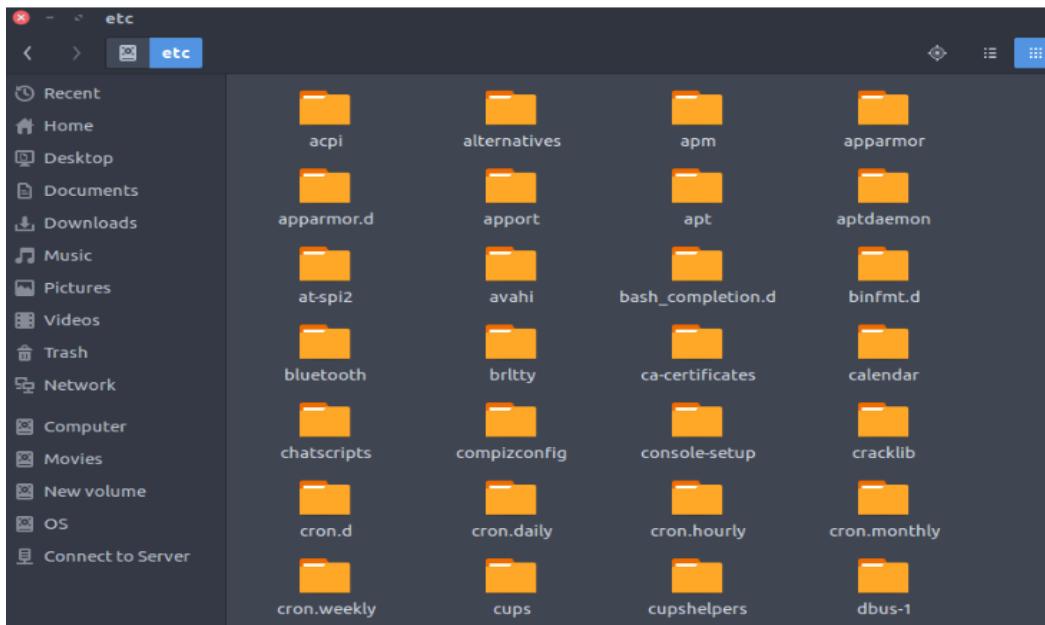
### 4. /dev-Device Files



- Contains device files
- These include terminal devices, usb, or any device attached to the system.

- These are not actual files as we know them, but they appear as files – for example, /dev/sda represents the first SATA drive in the system. If you wanted to partition it, you could start a partition editor and tell it to edit /dev/sda.
- This directory also contains pseudo-devices, which are virtual devices that don't actually correspond to hardware.

## 5. /etc- Configuration Files



- Contains configuration files required by all programs.
- This also contains start-up and shutdown shell scripts used to start/stop individual programs.

Example: /etc/resolv.conf

### b) File and device permissions

Since Ubuntu is a multi-user operating system, so it has security to prevent people from accessing each other's confidential files. When you do so, each file will be listed on a separate line in a long format.

\$ls -l

1. There's a lot of information in those lines.
2. The first character = ‘-‘, which means it's a file
3. ‘d’, which means it's a directory.
4. The next nine characters = (rw-r-r-) show the security
5. The next column shows the owner of the file. (Here it is `root`)
6. The next column shows the group owner of the file.
7. The next column shows the size of the file in bytes.
8. Last Column = File\_name or Directory\_name.

```
ubuntu@ubuntu:~/Desktop/NSA$ ls -l
total 0
drw-rw-r-- 5 ubuntu ubuntu 100 May 27 02:53 dir1
ubuntu@ubuntu:~/Desktop/NSA$ man ls chmod
```

## Security Permissions

|      |       |       |
|------|-------|-------|
| rwx  | rwx   | rwx   |
| user | group | other |

## Letters Definition

- ‘r’: “read” the file’s contents.
- ‘w’: “write”, or modify, the file’s contents.
- ‘x’ : “execute” the file. This permission is given only if the file is a program.

## Operators Definition

- `+`: Add permissions
- `-`: Remove permissions
- `=: Set the permissions to the specified values

## Reference Class Description

`u`(user): The user permissions apply only to the owner of the file or directory, they will not impact the actions of other users.

`g`(group): The group permissions apply only to the group that has been assigned to the file or directory, they will not affect the actions of other users.

`o`(others): The other permissions apply to all other users on the system, this is the permission group that you want to watch the most.

`a`(All three): All three (owner, groups, others)

## Changing security permissions

The command you use to change the security permissions on files is called “chmod“, which stands for “change mode” because the nine security characters are collectively called the security “mode” of the file.

### Adding execute permission

```
chmod o+x filename
```

### Change multiple permissions at once

```
chmod ugo-rwx filename
```

### Revoke execute(x) permission from others(o)

```
chmod ug+rwx,o-x filename
```

## Octal values

When Linux file permissions are represented by numbers, it's called numeric mode. In numeric mode, a three-digit value represents specific file permissions (for example, 744.) These are called octal values. The first digit is for owner permissions, the second digit is for group permissions, and the third is for other users. Each permission has a numeric value assigned to it:

r (read): 4

w (write): 2

x (execute): 1

In the permission value 744, the first digit corresponds to the user, the second digit to the group, and the third digit to others. By adding up the value of each user classification, you can find the file permissions.

For example, a file might have read, write, and execute permissions for its owner, and only read permission for all other users. That looks like this:

Owner: rwx = 4+2+1 = 7

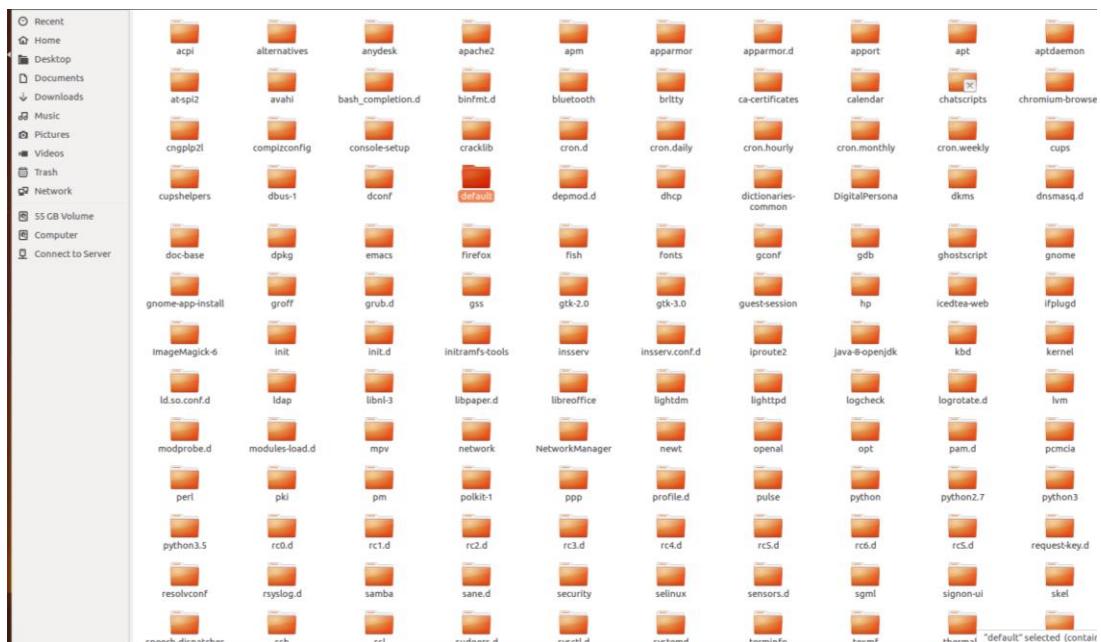
Group: r-- = 4+0+0 = 4

Others:  $r_{--} = 4+0+0 = 4$

The results produce the three-digit value 744.

### c) Study of system configuration files in /etc

Linux configuration files enable the Kernel to know about users, their login state, and manage file permissions and user groups. Most of the configuration files in Linux are usually under the /etc folder./etc(et-see) directory is where a linux configuration file live. The configuration files are static and cannot be executable. They are used to control the operation of various Linux programs.



## Types of Configuration Files in /etc

1. Access files
2. Booting and login/logout
3. File system
4. System administration
5. Networking
6. System commands
7. Daemons

### 1. Access files

Access files tell the network domain how to look up host names.

Access files include:

- /etc/hosts.config
- /etc/hosts
- /etc/hosts.allow
- /etc/hosts.deny

### 2. Booting and login/logout

These files contain configuration information for booting up the system.

/etc/issue & /etc/issue.net

/etc/rc.d/rc

/etc/rc.d/rc.sysinit

/etc/rc.d/rc/rc X.d

### 3. File system

Linux provides /proc, a virtual file system that can be used to display various system data structures and parameters.

Many programs access this file system to gain statistical information about the system, such as the devices mounted on the system, the memory usage, etc.

/etc/mtab

/etc/fstab

/etc/mtools.conf

#### 4. System administration

This group of files contains information about the users and user groups, as well as the file permissions and credentials of all users. These files include the following configuration files:

/etc/group  
/etc/nologin  
/etc/passwd  
/etc/securetty  
/etc/shadow

#### 5. Networking

/etc/networks

Lists names and addresses of networks accessible from the network to which the machine is connected. Used by route command. Allows use of name for network.

/etc/protocols

Lists the currently available protocols

/etc/services

Translates network service names to port number/protocol.

#### 6. System commands

System commands are meant to be used exclusively by the system. Programs like login or bash are all system commands. These are important files containing information about the system commands and include the following files.

/etc/lilo.conf  
/etc/logrotate.conf  
/etc/ld.so.conf  
/etc/inittab  
/etc/termcap

#### 7. Daemons

Daemons are programs that run in the background without user interference.

These are often related to networking stacks, where they wait for connections to arrive so that they can provide services through them.

/etc/syslogd.conf  
\*/etc/httpd.conf\*

\*/etc/conf.modules\*

#### **d) Familiarizing log files for system events, user activity, network events.**

Log files are a set of records that Linux maintains for the administrators to keep track of important events.

They contain messages about the server, including the kernel, services and applications running on it.

Linux provides a centralized repository of log files that can be located under the /var/log directory.

When issues arise, analyzing log files is the first thing an administrator needs to do.

How can Linux Log files help

##### 1. Troubleshooting

When something goes wrong on a Linux system, logs can help pinpoint the issue.

By examining system logs, application logs, and service logs, it's possible to identify errors, warnings, and other messages that indicate what went wrong.

##### 2. Diagnosing Performance Issues

System logs can help identify performance issues like memory leaks or disk I/O bottlenecks.

Examining application logs can also help identify performance issues with specific applications.

##### 3. Monitoring System Health

Linux logs can be used to monitor system health and detect issues before they become critical.

By monitoring system logs, administrators can identify trends and patterns that could indicate a problem is brewing.

##### 4. Compliance and Auditing

Many organizations are required to maintain logs for compliance and auditing purposes.

Linux logs can help organizations meet these requirements by providing a record of system activity.

##### 5. Security

Linux logs are an essential tool for monitoring and detecting security issues.

System logs can be used to detect unauthorized access attempts, while application logs can help identify suspicious activity within specific applications.

By monitoring logs, administrators can quickly identify and respond to security incidents.

The log files generated in a Linux environment can typically be classified into four different categories:

- Application Logs
- Event Logs
- Service Logs

- System Logs

### 1. System Logs

These logs contain information about the system's operation, such as boot messages, kernel messages, and hardware events.

System logs are essential for troubleshooting system issues, and monitoring system performance.

### 2. Application Logs

These logs contain information about the behaviour of an application, including errors, warnings, and other messages.

Application logs are used to diagnose problems with applications and to analyze application performance.

### 3. Service Logs

These logs contain information about services running on the system, including network services and daemons.

Service logs are used to monitor service activity, and optimize service performance.

### 4. Event Logs

These logs contain information about events on the system, such as user logins, system shutdowns, and security events.

Event logs are used to audit system activity, track user activity, and investigate security incidents

Which Linux log files to monitor?

Monitoring and analyzing all of them can be a challenging task.

The sheer volume of logs can sometimes make it frustrating just to drill down and find the right file that contains the desired information.

1. /var/log/messages
2. /var/log/auth.log
3. /var/log/secure
4. /var/log/boot.log
5. /var/log/dmesg
6. /var/log/kern.log
7. /var/log/faillog
8. /var/log/cron
9. /var/log/yum.log

10. /var/log/maillog or /var/log/mail.log
11. var/log/httpd/
12. /var/log/mysqld.log or /var/log/mysql.log

**Result:**

Familiarisation with file system hierarchy, permission, configuration files and log files has been done successfully.

### **Shell script program questions.**

1. Write a script to show current date,time and current directory.

```
#!/bin/bash
echo "Current date is `date`"
echo "Current directory is `pwd`"
```

#### **Output:**

```
exam@cec-H110M-S2:~/mca_nsa$ cd mca_nsa
exam@cec-H110M-S2:~/mca_nsa$./dtdir.sh
Current date is Wed Apr 5 11:52:41 IST 2023
Current directory is /home/exam/mca_nsa mj
exam@cec-H110M-S2:~/mca_nsa$ █
```

2. Write shell script to find reverse of a number.

```
#!/bin/bash
echo enter the no:
read n
num=0
while [$n -gt 0]
do
 num=$(expr $num * 10)
 k=$(expr $n % 10)
 num=$(expr $num + $k)
 n=$(expr $n / 10)
done
echo Reversed number is $num
```

#### **Output:**

```
exam@cec-H110M-S2:~/mca_nsa$./reverse.sh
enter the no:
458
Reversed number is 854
exam@cec-H110M-S2:~/mca_nsa$ █
```

3. Write a script to find largest among three numbers.

```
#!/bin/bash
echo Enter the 1st no:
```

```
read m
echo Enter the 2nd no:
read n
echo Enter the 3rd no:
read o
if [$m -gt $n] && [$m -gt $o]
then
echo Largest is $m
elif [$n -gt $m] && [$n -gt $o]
then
echo Largest is $n
else
echo Largest is $o
fi
```

#### Output:

```
exam@cec-H110M-S2:~/mca_nsa$./largest.sh
Enter the 1st no:
45
Enter the 2nd no:
12
Enter the 3rd no:
6
Largest is 45
exam@cec-H110M-S2:~/mca_nsa$ █
```

4. Write a script to check whether a number is armstrong or not.

```
#!/bin/bash
echo "Enter a number: "
read c
x=$c
sum=0
r=0
n=0
while [$x -gt 0]
do
r=`expr $x % 10`
```

```

n=`expr $r * $r * $r`
sum=`expr $sum + $n`
x=`expr $x / 10`
done
if [$sum -eq $c]
then
echo "It is an Armstrong Number."
else
echo "It is not an Armstrong Number."
fi

```

**Output:**

```

exam@cec-H110M-S2:~/mca_nsa$./armstrong.sh
Enter a number:
153
It is an Armstrong Number.
exam@cec-H110M-S2:~/mca_nsa$./armstrong.sh
Enter a number:
412
It is not an Armstrong Number.
exam@cec-H110M-S2:~/mca_nsa$

```

5. Write a script to check password and login.

```

#!/bin/bash
read -p 'Username: ' user
read -sp 'Password: ' pass
if (($user == "Admin" && $pass == "admin123"))
then
 echo -e "\nWelcome! You are Sucessfull login\n"
else
 echo -e "\nUnsuccessful login\n"
fi

```

**Output:**

```

exam@cec-H110M-S2:~/mca_nsa$./checkpwd.sh
Username: Admin
Password:
Welcome! You are Sucessfull login

exam@cec-H110M-S2:~/mca_nsa$./checkpwd.sh
Username: admin
Password: ./checkpwd.sh: line 6: (: pass: expression recursion level exceeded (error token is "pass")
Unsuccessful login
exam@cec-H110M-S2:~/mca_nsa$

```

6. Write a script to count the prime numbers in specific range

```
#!/bin/bash
```

```
echo "Enter a lower limit"
```

```
read i
```

```
echo "Enter a upper limit"
```

```
read limit
```

```
echo "prime numbers upto $limit are :"
```

```
while [$i -le $limit]
```

```
do
```

```
 flag=1
```

```
 j=2
```

```
 while [$j -lt $i]
```

```
 do
```

```
 rem=$(($i % $j))
```

```
 if [$rem -eq 0]
```

```
 then
```

```
 flag=0
```

```
 break
```

```
 fi
```

```
 j=$(($j+1))
```

```
 done
```

```
 if [$flag -eq 1]
```

```
 then
```

```
 echo "$i"
```

```
 fi
```

```
i=$(($i+1))
```

```
done
```

## Output:

```
^C
exam@CC2-33:~/test$ chmod +x prime.sh
exam@CC2-33:~/test$./prime.sh
Enter a limit
20
prime numbers upto 20 are :
1
2
3
5
7
11
13
17
19
exam@CC2-33:~/test$ █
```

7. Write a script to convert the contents of a given file from uppercase to lowercase and also count the number of lines, words and characters of the resultant file. Also display the resultant file in descending order.

```
#!/bin/bash

getFile()

{
 # Reading txtFileName to convert it's content
 echo -n "Enter File Name:"

 read filename

 # Checking if file exist
 if [! -f $filename]; then
 echo "File Name $filename does not exists."
 exit 1
 fi

}

echo "1. Uppercase to Lowercase "
echo "2. Count the number of characters,words,lines"
echo "3. Exit "

echo -n "Enter your Choice(1-3):"
read ch

case "$ch" in
 1)
```

```
Function Call to get File
getFile

Converting to lower case if user choose 1
echo "Converting Upper-case to Lower-Case "
tr '[A-Z]' '[a-z]' <$filename

;;
2)
echo Enter the filename
read file
c=`cat $file | wc -c`
w=`cat $file | wc -w`
l=`grep -c "." $file`
echo Number of characters in $file is $c
echo Number of words in $file is $w
echo Number of lines in $file is $l
;;
*) # exiting for all other cases
echo "Exiting..."
exit
;;
esac
```

## Output:

```
Enter your Choice(1-3):^Cexam@cec-H110M-S2:~/mca_nsa$./fileop.sh
1. Uppercase to Lowercase
2. Count the number of characters,words,lines
3. Exit
Enter your Choice(1-3):1
Enter File Name:sample.txt
Converting Upper-case to Lower-Case
welcome to linux operating system.
this is second line.
this is third line.
exam@cec-H110M-S2:~/mca_nsa$./fileop.sh
1. Uppercase to Lowercase
2. Count the number of characters,words,lines
3. Exit
Enter your Choice(1-3):2
Enter the filename
sample.txt
Number of characters in sample.txt is 76
Number of words in sample.txt is 13
Number of lines in sample.txt is 3
exam@cec-H110M-S2:~/mca_nsa$./fileop.sh
1. Uppercase to Lowercase
2. Count the number of characters,words,lines
3. Exit
Enter your Choice(1-3):3
Exiting...
exam@cec-H110M-S2:~/mca_nsa$ █
```

8. Write a script to perform following basic math operation as:

Addition, subtraction, multiplication, division

```
#!/bin/sh
```

```
echo "Enter the two numbers to perform arithmetic operations "
```

```
read a b
```

```
val=`expr $a + $b`
```

```
echo "a + b : $val"
```

```
val=`expr $a - $b`
```

```
echo "a - b : $val"
```

```
val=`expr $a * $b`
```

```
echo "a * b : $val"
```

```
if [$a -gt $b]
```

```
then
```

```
 val=`expr $a / $b`
```

```
 echo "a / b : $val"
```

```
else
```

```

val=`expr $b / $a`
echo "b / a : $val"

fi
```

### Output:

```

exam@cec-H110M-S2:~/mca_nsa$./arithmetic.sh
Enter the two numbers to perform arithmetic operations
20 10
a + b : 30
a - b : 10
a * b : 200
a / b : 2
exam@cec-H110M-S2:~/mca_nsa$ █
```

9. Read 3 marks of a student and find the average. Display the grade of the student based on the average. (if..then..elif..fi)

S >= 90%

A < 90%, but >= 80%

B < 80%, but >= 60%

P < 80%, but >= 40%

F < 40%

```

#!/bin/bash

read -p "Enter three marks out of 100 each : " m1 m2 m3
s=$((m1+m2+m3))
avg=$(echo "scale=2;$s / 3" | bc)
echo -e "Average: $avg"
if [[$(echo "if (${avg} >= 90) 1 else 0" | bc) -eq 1]]
then
 echo "Grade: S"
elif [[$(echo "if (${avg} < 90) 1 else 0" | bc) -eq 1]] &&
[[$(echo "if (${avg} >= 80) 1 else 0" | bc) -eq 1]]
then
 echo "Grade: A"
elif [[$(echo "if (${avg} < 80) 1 else 0" | bc) -eq 1]] &&
```

```

[[$(echo "if (${avg} >= 60) 1 else 0" | bc) -eq 1]]
then
 echo "Grade: B"
elif [[$(echo "if (${avg} < 60) 1 else 0" | bc) -eq 1]] &&
[[$(echo "if (${avg} >= 40) 1 else 0" | bc) -eq 1]]
then
 echo "Grade: P"
else
 echo "Grade: F"
fi

```

### **Output:**

```

lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgrms$ bash prgrm2.sh
Enter three marks out of 100 each : 63 77 96
Average: 78.66
Grade: B
lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgrms$

```

10. Read the name of an Indian state and display the main language according to the table. For other states, the output may be “Unknown”. Use “|” to separate states with same language (*case..esac*)

| State            | Main Language |
|------------------|---------------|
| Andhra Pradesh   | Telugu        |
| Assam            | Assamese      |
| Bihar            | Hindi         |
| Himachal Pradesh | Hindi         |
| Karnataka        | Kannada       |
| Kerala           | Malayalam     |
| Lakshadweep      | Malayalam     |
| Tamil Nadu       | Tamil         |

```

#!/bin/bash
read -p "Enter the Indian state: " state
state=$(echo $state | tr '[:upper:]' '[:lower:]')
case $state in
 "andhra pradesh")

```

```

 echo "Language: Telugu";;
 "assam")
 echo "Language: Assamese";;
 "bihar"|"himachal pradesh")
 echo "Language: Hindi";;
 "karnataka")
 echo "Language: Kannada";;
 "kerala"|"lakshadweep")
 echo "Language: Malayalam";;
 "tamil nadu")
 echo "Language: Tamil";;
*)
 echo "Language: Unknown";;
esac

```

### **Output:**

```

Lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgrms$ bash prgrm3.sh
Enter the Indian state: Andhra pradesh
Language: Telugu
Lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgrms$ bash prgrm3.sh
Enter the Indian state: gujarat
Language: Unknown
Lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgrms$
```

11.Change the home folder of all users whose name start with stud from /home/username to /usr/username. Also change the password of username to username123 (e.g., /home/stud25 changes to /usr/stud25 and his/her password changes to stud25123) - (Use for .. in)

```

#!/bin/bash
result=$(grep stud* /etc/passwd)
result=$(echo "${result}"| cut -d: -f 1)
echo $result
for f in $result
do
```

```
p="${f}123"
sudo usermod -p $(echo $p | openssl passwd -1 -stdin) $f
sudo usermod -m -d /usr $f
done
```

### Output:

```
stud:x:1003:1003::/home:/bin/sh
students:x:1006:1006::/home:/bin/sh

user@user-VirtualBox:~/shellpg$ bash usermod.sh
stud students
usermod: directory /usr exists
usermod: directory /usr exists

stud:x:1003:1003::/usr:/bin/sh
students:x:1006:1006::/usr:/bin/sh
```

12. Read a number and display the multiplication table of the number up to 10 lines. -  
(Use for((..)))

```
#!/bin/bash
read -p "Enter a number: " num
echo "Multiplication table of $num : "
for ((i=1; i<=10; i++))
do
 val=$((num * i))
 echo "$i * $num = $val"
done
```

### Output:

```
lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgrms$ bash prgrm5.sh
Enter a number: 5
Multiplication table of 5 :
1 * 5 = 5
2 * 5 = 10
3 * 5 = 15
4 * 5 = 20
5 * 5 = 25
6 * 5 = 30
7 * 5 = 35
8 * 5 = 40
9 * 5 = 45
10 * 5 = 50
```

13. Read a Decimal number. Convert it to Binary and display the result. -

(Use while)

```
#!/bin/bash
read -p "Enter a decimal number: " n
val=0
power=1
while [$n -ne 0]
do
 r=`expr $n % 2`
 val=`expr $r * $power + $val`
 power=`expr $power * 10`
 n=`expr $n / 2`
done
echo "Binary equivalent : $val"
```

### Output:

```
lab@lab-Lenovo-IdeaPad-Z400:~/shell_prgms$ bash prgrm6.sh
Enter a decimal number: 15
Binary equivalent : 1111
```

### Result:

Shell script program has done successfully and output is verified.