ASSIGNMENT - 1

OS INTRODUCTION

1.1 What is an operating system? Explain in detail.

An **Operating System (OS)** is a **system software** that acts as an **intermediary between the user and the computer hardware**. It provides a platform where users can execute programs conveniently and efficiently.
Or
"An operating system is a software that manages the computer hardware and software resources and provides common services for computer programs.

Main Objective:

1. **Convenience:** Makes the computer easier to use.
2. **Efficiency:** Allows hardware resources to be used in an optimal way.
3. **Ability to evolve:** Supports the development and addition of new features.
4. **Resource management:** Manages CPU, memory, I/O devices, and files.

1.2 Explain UNIX architecture and UNIX FILE SYSTEM.

UNIX Architecture

The UNIX operating system follows a layered architecture consisting mainly of three levels: the **Kernel**, the **Shell**, and the **User level**.

1. User Level:

- Users interact with the system using applications and commands.

2. Shell:

- A command interpreter that takes user input and passes it to the kernel.
- Examples: bash, sh, ksh, csh.

3. Kernel:

- The core of UNIX that manages hardware and system resources.
- Functions:
  - **Process management**
  - **Memory management**
  - **File system handling**
  - **Device control**
  - **System calls interface**

UNIX File System

The UNIX file system is a method used by the UNIX OS to organize and store data efficiently. It follows a hierarchical structure where everything is considered a file — including directories and devices.

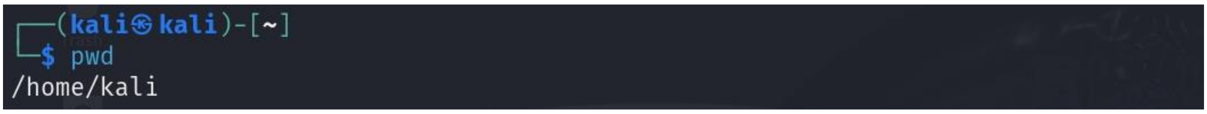
Features of UNIX File System:

1. **Hierarchical Structure:**
    - The file system starts from the **root directory**, represented by a forward slash (/).
    - All files and directories are organized under this root in a tree-like structure.
2. **Inodes:**
    - Every file and directory has an **inode**, which is a data structure containing metadata.
    - Inodes store information such as file type, size, permissions, owner, timestamps, and pointers to data blocks.
3. **Directories:**
    - A directory is a special type of file that contains entries mapping filenames to inode numbers.
    - UNIX uses special directories such as . (current directory) and .. (parent directory).
4. **Superblock:**
    - Each file system has a **superblock**, which contains information about the file system layout, size, number of inodes and blocks, and status.
5. **Mounting:**
    - The process of attaching a file system to the existing directory tree is called **mounting**.
    - A mounted file system becomes accessible under a specific directory.
6. **Types of Files:**
    - **Regular files**: Contain data or program instructions.
    - **Directories**: Contain lists of other files.
    - **Character special files**: Represent devices like keyboards.
    - **Block special files**: Represent devices like hard disks.
    - **Symbolic links**: Shortcut to another file.
    - **FIFOs and sockets**: Used for inter-process communication.
7. **Permissions:**
    - UNIX uses a permission system to control access to files and directories.
    - Permissions include read (r), write (w), and execute (x) for the **owner**, **group**, and **others**.

1.3 Briefly explain the following commands with suitable examples: (i) pwd (ii) ls (iii) date (iv) cat (v) echo (vi) mkdir (vii) cd (viii) cal (ix) tty (x) mv (xi)cp (xii) rmdir (xii)rm (xiv) vi editor (xv) chmod (XVI) grep and cut

(i) `pwd`

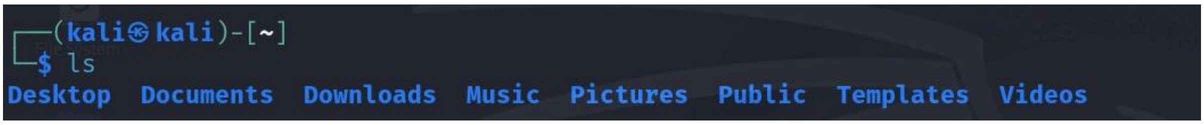
Displays the current working directory.



```
┌──(kali㉿kali)-[~]
└─$ pwd
/home/kali
```

(ii) `ls`

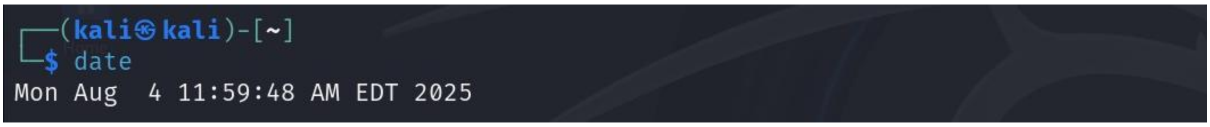
Lists the contents of a directory.



```
┌──(kali㉿kali)-[~]
└─$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
```

(iii) `date`

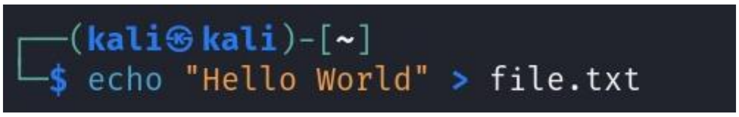
Displays the current system date and time.



```
┌──(kali㉿kali)-[~]
└─$ date
Mon Aug  4 11:59:48 AM EDT 2025
```

(iv) `echo`

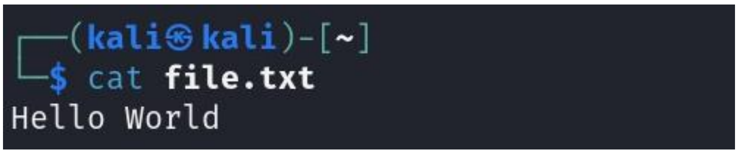
Prints a line of text or variable value.



```
┌──(kali㉿kali)-[~]
└─$ echo "Hello World" > file.txt
```

(v) `cat`

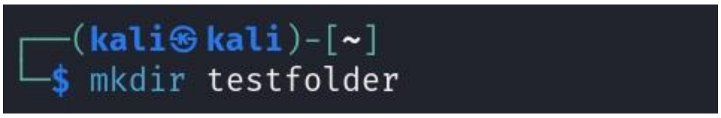
Displays the contents of a file.



```
┌──(kali㉿kali)-[~]
└─$ cat file.txt
Hello World
```

(vi) `mkdir`

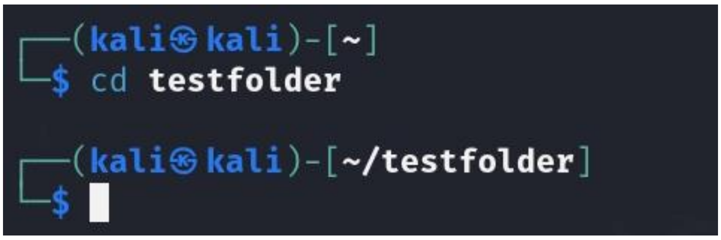
Creates a new directory.



```
┌──(kali㉿kali)-[~]
└─$ mkdir testfolder
```

(vii) `cd`

Changes the current working directory.

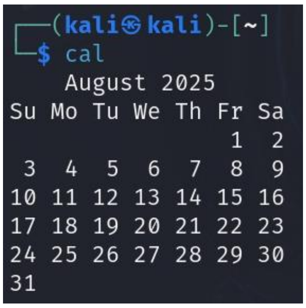


```
┌──(kali㉿kali)-[~]
└─$ cd testfolder

┌──(kali㉿kali)-[~/testfolder]
└─$ 
```

(viii) `cal`

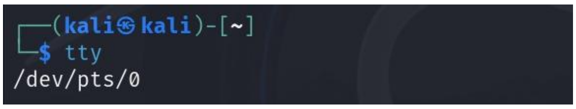
Displays a calendar of the current or given month/year.



```
┌──(kali㉿kali)-[~]
└─$ cal
    August 2025
Su Mo Tu We Th Fr Sa
                1  2
 3  4  5  6  7  8  9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
31
```

(ix) `tty`

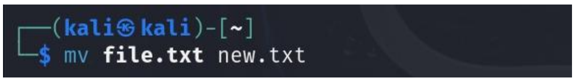
Displays the terminal device name.



```
┌──(kali㉿kali)-[~]
└─$ tty
/dev/pts/0
```

(x) `mv`

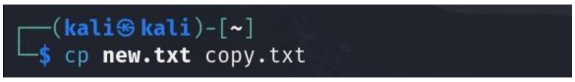
Moves or renames files and directories.



```
┌──(kali㉿kali)-[~]
└─$ mv file.txt new.txt
```

(xi) `cp`

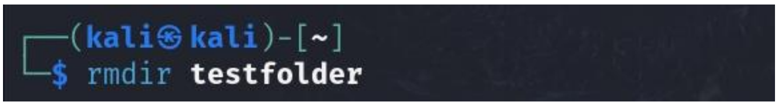
Copies files and directories.



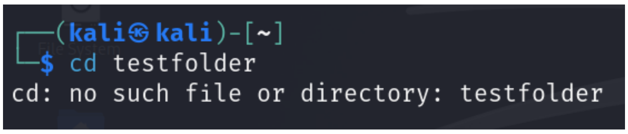
```
┌──(kali㉿kali)-[~]
└─$ cp new.txt copy.txt
```

(xii) `rmdir`

Removes an empty directory.



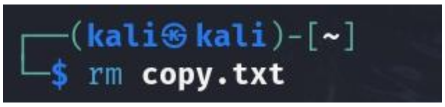
```
┌──(kali㉿kali)-[~]
└─$ rmdir testfolder
```



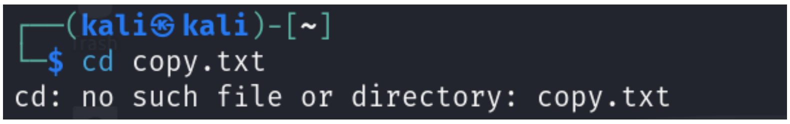
```
┌──(kali㉿kali)-[~]
└─$ cd testfolder
cd: no such file or directory: testfolder
```

(xiii) `rm`

Removes files or directories.



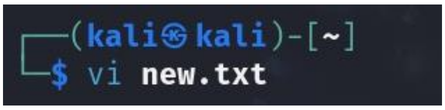
```
┌──(kali㉿kali)-[~]
└─$ rm copy.txt
```



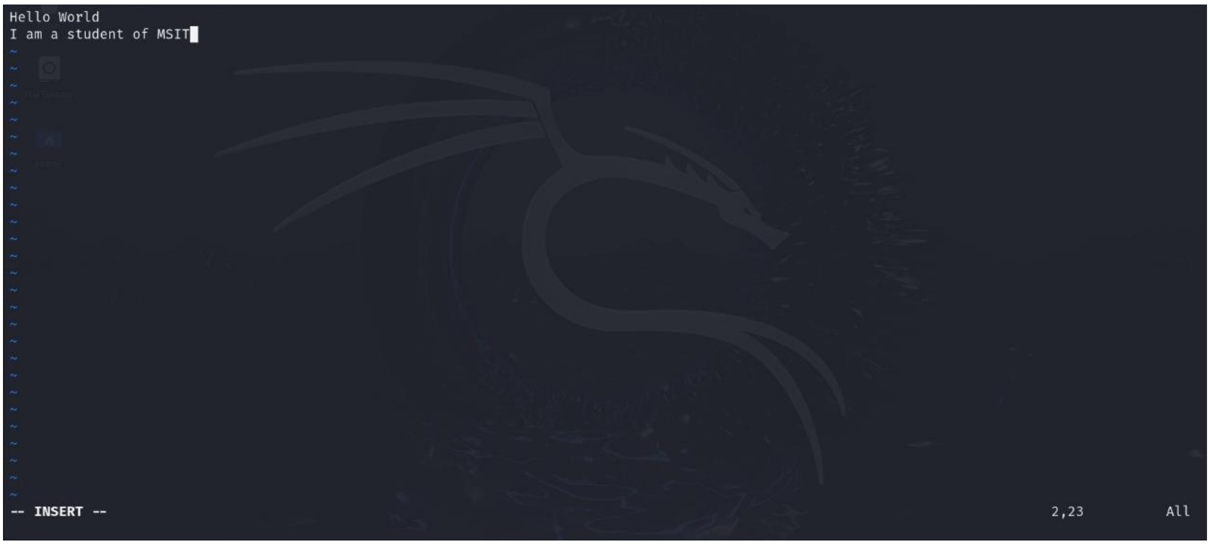
```
┌──(kali㉿kali)-[~]
└─$ cd copy.txt
cd: no such file or directory: copy.txt
```

(xiv) `vi`

Opens the `vi` editor to create or edit files.



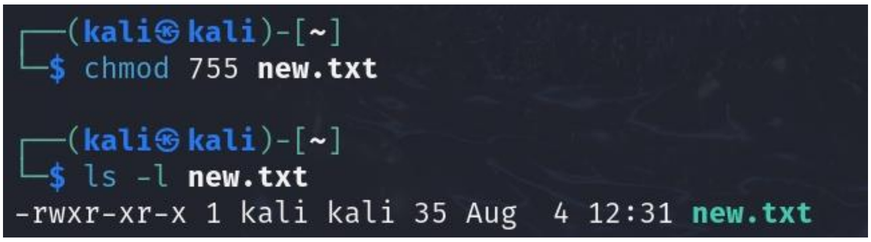
```
┌──(kali㉿kali)-[~]
└─$ vi new.txt
```



```
Hello World
I am a student of MSIT
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
-- INSERT --                                                              2,23          All
```

(xv) `chmod`

Changes the permission of files or directories.

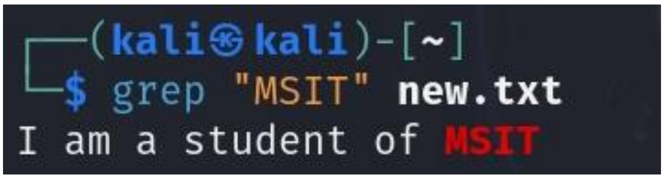


```
┌──(kali㉿kali)-[~]
└─$ chmod 755 new.txt

┌──(kali㉿kali)-[~]
└─$ ls -l new.txt
-rwxr-xr-x 1 kali kali 35 Aug  4 12:31 new.txt
```

(xvi) `grep`

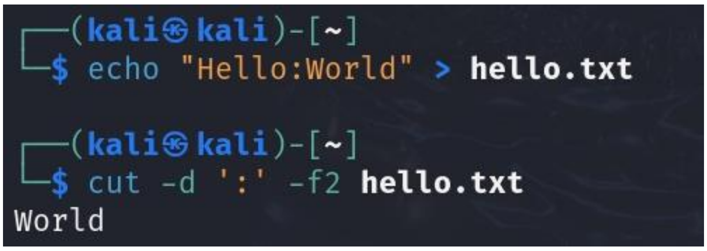
Searches for a pattern in a file.



```
┌──(kali㉿kali)-[~]
└─$ grep "MSIT" new.txt
I am a student of MSIT
```

(xvii) `cut`

Extracts specific fields or columns from a file or input.



```
┌──(kali㉿kali)-[~]
└─$ echo "Hello:World" > hello.txt

┌──(kali㉿kali)-[~]
└─$ cut -d ':' -f2 hello.txt
World
```