

Operating Systems – COC 3071L

SE 5th A – Fall 2025

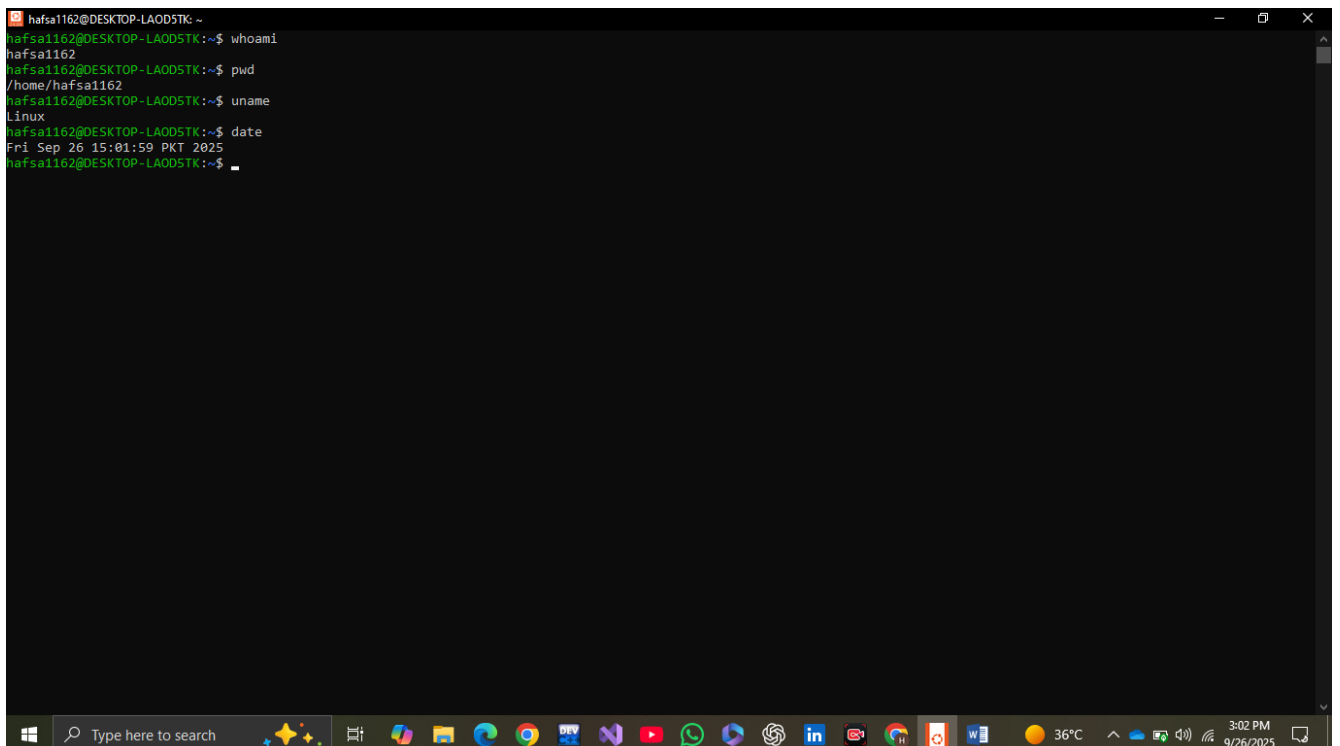
Lab 2: Linux Basics and Introduction

Part 1: Linux Environment Orientation

1.1 Understanding the Linux Environment

- ♦ **Concepts to Cover:**
 - What is Linux? Brief history and distributions
 - Linux vs Windows: Key differences
 - Understanding the shell (bash)
 - WSL2 as a Linux environment
- ♦ **Hands-on Activity:**

```
# Students open WSL2 terminal and explore
whoami          # Check current user
pwd             # Print working directory
uname -a        # System information
date            # Current date and time
```



```
hafsa1162@DESKTOP-LA0D5TK: ~
hafsa1162@DESKTOP-LA0D5TK:~$ whoami
hafsa1162
hafsa1162@DESKTOP-LA0D5TK:~$ pwd
/home/hafsa1162
hafsa1162@DESKTOP-LA0D5TK:~$ uname
Linux
hafsa1162@DESKTOP-LA0D5TK:~$ date
Fri Sep 26 15:01:59 PKT 2025
hafsa1162@DESKTOP-LA0D5TK:~$
```

1.2 Getting Help in Linux

- ◆ **Commands to demonstrate:**

man ls	# Manual pages
ls --help	# Built-in help
which ls	# Location of commands
type ls	# Command type information

```
hafs1162@DESKTOP-LAOD5TK: ~
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
      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 change 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]
      color the output WHEN; more info below

  -d, --directory
      list directories themselves, not their contents

  -D, --dired

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

```
hafsa1162@DESKTOP-LAOD5TK: ~  
hafsa1162@DESKTOP-LAOD5TK:~$ man ls  
hafsa1162@DESKTOP-LAOD5TK:~$  
hafsa1162@DESKTOP-LAOD5TK:~$ ls --help  
Usage: ls [OPTION]... [FILE]...  
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 ..  
-l, --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  
                        change 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]          color the output WHEN; more info below  
-d, --directory         list directories themselves, not their contents  
-D, --dired             generate output designed for Emacs' dired mode  
-f                       list all entries in directory order  
-F, --classify[=WHEN]  append indicator (one of */->@|) to entries WHEN  
                        likewise, except do not append '**'  
--file-type             across -x, commas -m, horizontal -x, long -l,  
--format=WORD           single-column -l, verbose -l, vertical -C  
  
--full-time             like -l --time-style=full-iso  
-g                       like -l, but do not list owner  
--group-directories-first  
                        group directories before files;  
                        can be augmented with a --sort option, but any  
                        use of --sort-none (-U) disables grouping  
  
-G, --no-group          in a long listing, don't print group names  
-h, --human-readable    with -l and -s, print sizes like 1K 234M 2G etc.  
--si                   likewise, but use powers of 1000 not 1024  
-H, --dereference-command-line  
                        follow symbolic links listed on the command line  
--dereference-command-line-symlink-to-dir
```

```
hafsa1162@DESKTOP-LAOD5TK: ~  
hafsa1162@DESKTOP-LAOD5TK:~$ which ls  
/usr/bin/ls  
hafsa1162@DESKTOP-LAOD5TK:~$ type ls  
ls is aliased to `ls --color=auto`  
hafsa1162@DESKTOP-LAOD5TK:~$
```

Part 2: File System Navigation

2.1 Understanding Linux Directory Structure

- ◆ Concepts to Cover:
 - Root directory (/)
 - Important directories: /home, /usr, /etc, /var, /tmp

- Absolute vs relative paths
- Hidden files and directories

♦ **Demonstration:**

```
ls /           # Root directory contents
ls -la        # Long listing with hidden files
cd /home      # Change directory
cd ~          # Home directory shortcut
cd -          # Previous directory
```

```
hafsai1162@DESKTOP-LA0D5TK: ~
hafsai1162@DESKTOP-LA0D5TK:~$ ls
recycle8in  wsl_lab1
hafsai1162@DESKTOP-LA0D5TK:~$ ls -la
total 20
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:05 .
drwxr-xr-x 1 root      root      512 Sep 24 11:47 ..
-rw-r--r-- 1 hafsai1162 hafsai1162 4131 Sep 26 14:43 .bash_history
-rw-r--r-- 1 hafsai1162 hafsai1162 220 Sep 24 11:47 .bash_logout
-rw-r--r-- 1 hafsai1162 hafsai1162 3771 Sep 24 11:47 .bashrc
-rw-r--r-- 1 hafsai1162 hafsai1162 55 Sep 25 16:25 .gitconfig
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 24 11:47 .landscape
-rw-r--r-- 1 hafsai1162 hafsai1162 20 Sep 26 15:05 .lessht
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 14:17 .motd_shown
-rw-r--r-- 1 hafsai1162 hafsai1162 807 Sep 24 11:47 .profile
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 24 15:08 .ssh
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 24 11:48 .sudo_as_admin_successful
-rw-r--r-- 1 hafsai1162 hafsai1162 790 Sep 26 14:45 .viminfo
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycle8in
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1
hafsai1162@DESKTOP-LA0D5TK:~$
```

```
hafsai1162@DESKTOP-LA0D5TK:/home
hafsai1162@DESKTOP-LA0D5TK:~$ cd /home
hafsai1162@DESKTOP-LA0D5TK:/home$ cd ~
hafsai1162@DESKTOP-LA0D5TK:~$ cd -
/home
hafsai1162@DESKTOP-LA0D5TK:/home$
```

2.2 Basic Navigation Commands (15 minutes)

Commands to practice:

```
pwd          # Present working directory
ls           # List directory contents
ls -l        # Long format
ls -la       # Include hidden files
ls -lh       # Human readable sizes
cd           # Change directory
cd ..        # Parent directory
cd ~         # Home directory
cd /         # Root directory
```

```
hafsai1162@DESKTOP-LA0D5TK:/
hafsai1162@DESKTOP-LA0D5TK:/ $ pwd
/
hafsai1162@DESKTOP-LA0D5TK:/ $ ls
bin          boot  etc  init  lib.usr-is-merged  media  opt  root  sbin          snap  sys  usr
bin.usr-is-merged  dev  home  lib  lib64          mnt  proc  run  sbin.usr-is-merged  srv  tmp  var
hafsai1162@DESKTOP-LA0D5TK:/ $ ls -l
total 2672
lrwxrwxrwx 1 root root      7 Apr 22  2024 bin -> usr/bin
drwxr-xr-x 1 root root    512 Feb 26  2024 bin.usr-is-merged
drwxr-xr-x 1 root root    512 Apr 22  2024 boot
drwxr-xr-x 1 root root    512 Sep 26 14:28 dev
drwxr-xr-x 1 root root    512 Sep 26 14:17 etc
drwxr-xr-x 1 root root    512 Sep 24 11:47 home
-rwxr-xr-x 1 root root 2735264 Aug  6 19:54 init
lrwxrwxrwx 1 root root      7 Apr 22  2024 lib -> usr/lib
drwxr-xr-x 1 root root    512 Apr  8  2024 lib.usr-is-merged
lrwxrwxrwx 1 root root      9 Apr 22  2024 lib64 -> usr/lib64
drwxr-xr-x 1 root root    512 Jan  7  2025 media
drwxr-xr-x 1 root root    512 Sep 24 11:46 mnt
drwxr-xr-x 1 root root    512 Jan  7  2025 opt
dr-xr-xr-x 10 root root      0 Sep 26 14:17 proc
drwx----- 1 root root    512 Jan  7  2025 root
drwxr-xr-x 1 root root    512 Sep 26 14:17 run
lrwxrwxrwx 1 root root      8 Apr 22  2024 sbin -> usr/sbin
drwxr-xr-x 1 root root    512 Mar 31  2024 sbin.usr-is-merged
drwxr-xr-x 1 root root    512 Oct 11  2024 snap
drwxr-xr-x 1 root root    512 Jan  7  2025 srv
dr-xr-xr-x 12 root root      0 Sep 26 14:17 sys
drwxrwxrwt 1 root root    512 Sep 25 22:31 tmp
drwxr-xr-x 1 root root    512 Jan  7  2025 usr
drwxr-xr-x 1 root root    512 Jan  8  2024 var
hafsai1162@DESKTOP-LA0D5TK:/ $ ls -la
total 2672
drwxr-xr-x 1 root root    512 Sep 24 11:46 .
drwxr-xr-x 1 root root    512 Sep 24 11:46 ..
lrwxrwxrwx 1 root root      7 Apr 22  2024 bin -> usr/bin
drwxr-xr-x 1 root root    512 Feb 26  2024 bin.usr-is-merged
drwxr-xr-x 1 root root    512 Apr 22  2024 boot
drwxr-xr-x 1 root root    512 Sep 26 14:28 dev
drwxr-xr-x 1 root root    512 Sep 26 14:17 etc
drwxr-xr-x 1 root root    512 Sep 24 11:47 home
-rwxr-xr-x 1 root root 2735264 Aug  6 19:54 init
lrwxrwxrwx 1 root root      7 Apr 22  2024 lib -> usr/lib
drwxr-xr-x 1 root root    512 Apr  8  2024 lib.usr-is-merged
```

```
hafsai1162@DESKTOP-LA0D5TK: /
drwxr-xr-x 1 root root 512 Jan 7 2025 media
drwxr-xr-x 1 root root 512 Sep 24 11:46 mnt
drwxr-xr-x 1 root root 512 Jan 7 2025 opt
dr-xr-xr-x 10 root root 0 Sep 26 14:17 proc
drwx----- 1 root root 512 Jan 7 2025 root
drwxr-xr-x 1 root root 512 Sep 26 14:17 run
lrwxrwxrwx 1 root root 8 Apr 22 2024 sbin -> usr/sbin
drwxr-xr-x 1 root root 512 Mar 31 2024 sbin.usr-is-merged
drwxr-xr-x 1 root root 512 Oct 11 2024 snap
drwxr-xr-x 1 root root 512 Jan 7 2025 srv
dr-xr-xr-x 12 root root 0 Sep 26 14:17 sys
drwxrwxrwt 1 root root 512 Sep 25 22:31 tmp
drwxr-xr-x 1 root root 512 Jan 7 2025 usr
drwxr-xr-x 1 root root 512 Jan 7 2025 var
hafsai1162@DESKTOP-LA0D5TK:/$ ls -lh
total 2.7M
lrwxrwxrwx 1 root root 7 Apr 22 2024 bin -> usr/bin
drwxr-xr-x 1 root root 512 Feb 26 2024 bin.usr-is-merged
drwxr-xr-x 1 root root 512 Apr 22 2024 boot
drwxr-xr-x 1 root root 512 Sep 26 14:28 dev
drwxr-xr-x 1 root root 512 Sep 26 14:17 etc
drwxr-xr-x 1 root root 512 Sep 24 11:47 home
-rwxr-xr-x 1 root root 2.7M Aug 6 19:54 init
lrwxrwxrwx 1 root root 7 Apr 22 2024 lib -> usr/lib
drwxr-xr-x 1 root root 512 Apr 8 2024 lib.usr-is-merged
lrwxrwxrwx 1 root root 9 Apr 22 2024 lib64 -> usr/lib64
drwxr-xr-x 1 root root 512 Jan 7 2025 media
drwxr-xr-x 1 root root 512 Sep 24 11:46 mnt
drwxr-xr-x 1 root root 512 Jan 7 2025 opt
dr-xr-xr-x 10 root root 0 Sep 26 14:17 proc
drwx----- 1 root root 512 Jan 7 2025 root
drwxr-xr-x 1 root root 512 Sep 26 14:17 run
lrwxrwxrwx 1 root root 8 Apr 22 2024 sbin -> usr/sbin
drwxr-xr-x 1 root root 512 Mar 31 2024 sbin.usr-is-merged
drwxr-xr-x 1 root root 512 Oct 11 2024 snap
drwxr-xr-x 1 root root 512 Jan 7 2025 srv
dr-xr-xr-x 12 root root 0 Sep 26 14:17 sys
drwxrwxrwt 1 root root 512 Sep 25 22:31 tmp
drwxr-xr-x 1 root root 512 Jan 7 2025 usr
drwxr-xr-x 1 root root 512 Jan 7 2025 var
hafsai1162@DESKTOP-LA0D5TK:/$
```

```
hafsai1162@DESKTOP-LA0D5TK: /
hafsai1162@DESKTOP-LA0D5TK:/$ cd
hafsai1162@DESKTOP-LA0D5TK:~$ cd ..
hafsai1162@DESKTOP-LA0D5TK:/home$ cd ~
hafsai1162@DESKTOP-LA0D5TK:~$ cd /
hafsai1162@DESKTOP-LA0D5TK:/$
```

Part 3: File and Directory Operations

**3.1 Creating and Managing Files/Directories

- ◆ Commands to demonstrate:

```
mkdir mylab2           # Create directory
mkdir -p test/sub/dir  # Create nested directories
touch file1.txt        # Create empty file
touch file2.txt file3.txt # Multiple files

# Text editors introduction
nano hello.txt         # Simple text editor
# OR
echo "Hello Linux!" > hello.txt # Redirect output to file
```

- ♦ **File viewing commands:**

```
cat hello.txt          # Display file contents
less hello.txt         # Page through file
head hello.txt         # First 10 lines
```

tail hello.txt
wc hello.txt

Last 10 lines
Word count

```
hafsa1162@DESKTOP-LA0D5TK: ~  
hafsa1162@DESKTOP-LA0D5TK:/$ cd ~  
hafsa1162@DESKTOP-LA0D5TK:~$ mkdir Mylab2  
hafsa1162@DESKTOP-LA0D5TK:~$ mkdir -p test/sub/dir  
hafsa1162@DESKTOP-LA0D5TK:~$ touch file1.txt  
hafsa1162@DESKTOP-LA0D5TK:~$ touch file2.txt file3.txt  
hafsa1162@DESKTOP-LA0D5TK:~$ echo "Hello Linux" >hello.txt  
hafsa1162@DESKTOP-LA0D5TK:~$ cat hello.txt  
Hello Linux  
hafsa1162@DESKTOP-LA0D5TK:~$
```

```
hafsa1162@DESKTOP-LA0D5TK: ~  
Hello Linux  
hello.txt (END)
```



```
hafsai1162@DESKTOP-LA0D5TK: ~
hafsai1162@DESKTOP-LA0D5TK:/$ cd ~
hafsai1162@DESKTOP-LA0D5TK:~$ mkdir Mylab2
hafsai1162@DESKTOP-LA0D5TK:~$ mkdir -p test/sub/dir
hafsai1162@DESKTOP-LA0D5TK:~$ touch file1.txt
hafsai1162@DESKTOP-LA0D5TK:~$ touch file2.txt file3.txt
hafsai1162@DESKTOP-LA0D5TK:~$ echo "Hello Linux" >hello.txt
hafsai1162@DESKTOP-LA0D5TK:~$ cat hello.txt
Hello Linux
hafsai1162@DESKTOP-LA0D5TK:~$ less hello.txt
hafsai1162@DESKTOP-LA0D5TK:~$ head hello.txt
Hello Linux
hafsai1162@DESKTOP-LA0D5TK:~$
```

```
hafsai1162@DESKTOP-LA0D5TK: ~
hafsai1162@DESKTOP-LA0D5TK:/$ cd ~
hafsai1162@DESKTOP-LA0D5TK:~$ mkdir Mylab2
hafsai1162@DESKTOP-LA0D5TK:~$ mkdir -p test/sub/dir
hafsai1162@DESKTOP-LA0D5TK:~$ touch file1.txt
hafsai1162@DESKTOP-LA0D5TK:~$ touch file2.txt file3.txt
hafsai1162@DESKTOP-LA0D5TK:~$ echo "Hello Linux" >hello.txt
hafsai1162@DESKTOP-LA0D5TK:~$ cat hello.txt
Hello Linux
hafsai1162@DESKTOP-LA0D5TK:~$ less hello.txt
hafsai1162@DESKTOP-LA0D5TK:~$ head hello.txt
Hello Linux
hafsai1162@DESKTOP-LA0D5TK:~$ tail hello.txt
Hello Linux
hafsai1162@DESKTOP-LA0D5TK:~$ wc hello.txt
 1  2 12 hello.txt
hafsai1162@DESKTOP-LA0D5TK:~$
```

3.2 Copying, Moving, and Deleting

- ◆ **Commands to practice:**

cp hello.txt backup.txt	# Copy file
cp -r mylab2 mylab2_backup	# Copy directory recursively
mv backup.txt renamed.txt	# Move/rename file
rm renamed.txt	# Remove file
rm -r mylab2_backup	# Remove directory
rmdir empty_directory	# Remove empty directory

```
hafsa1162@DESKTOP-LA0D5TK: ~  
hafsa1162@DESKTOP-LA0D5TK:~$ cp hello.txt backup.txt  
hafsa1162@DESKTOP-LA0D5TK:~$ cp -r Mylab2 Mylab2_backup  
hafsa1162@DESKTOP-LA0D5TK:~$ mv backup.txt renamed.txt  
hafsa1162@DESKTOP-LA0D5TK:~$ rm renamed.txt  
hafsa1162@DESKTOP-LA0D5TK:~$ rm -r Mylab2_backup  
hafsa1162@DESKTOP-LA0D5TK:~$ rmdir empty directory  
rmdir: failed to remove 'empty': No such file or directory  
rmdir: failed to remove 'directory': No such file or directory  
hafsa1162@DESKTOP-LA0D5TK:~$
```

Hands-on Exercise: Students create a directory structure, add files, and practice file operations.

Part 4: File Permissions and Ownership

4.1 Understanding File Permissions

- ◆ **Concepts to Cover:**
 - Permission types: read (r), write (w), execute (x)
 - Permission groups: user (u), group (g), others (o)
 - Numeric notation: 755, 644, etc.
- ◆ **Commands to demonstrate:**

```
ls -l           # View permissions  
chmod 755 file.txt # Change permissions (numeric)  
chmod u+x file.txt # Add execute permission for user  
chmod g-w file.txt # Remove write permission for group  
chown user:group file.txt # Change ownership (if applicable)
```

```
hafsai1162@DESKTOP-LA0D5TK: ~  
hafsai1162@DESKTOP-LA0D5TK:~$ ls -l  
total 0  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:18 Mylab2  
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 16:04 combined.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 28 Sep 26 16:04 file.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt  
-rwxr--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:33 mylab2  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycleBin  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:47 repos  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:19 test  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1  
hafsai1162@DESKTOP-LA0D5TK:~$
```

```
hafsai1162@DESKTOP-LA0D5TK: ~  
hafsai1162@DESKTOP-LA0D5TK:~$ sudo chmod 755 file.txt  
[sudo] password for hafsai1162:  
hafsai1162@DESKTOP-LA0D5TK:~$ ls -l  
total 0  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:18 Mylab2  
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 16:04 combined.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 28 Sep 26 16:04 file.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt  
-rwxr--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:33 mylab2  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycleBin  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:47 repos  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:19 test  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1  
hafsai1162@DESKTOP-LA0D5TK:~$ sudo chmod u+x file.txt  
hafsai1162@DESKTOP-LA0D5TK:~$ ls -l  
total 0  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:18 Mylab2  
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 16:04 combined.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 28 Sep 26 16:04 file.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt  
-rwxr--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:33 mylab2  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycleBin  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:47 repos  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:19 test  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1  
hafsai1162@DESKTOP-LA0D5TK:~$
```

```
hafsai1162@DESKTOP-LAOD5TK: ~  
hafsai1162@DESKTOP-LAOD5TK:~$ sudo chmod g-w file.txt  
hafsai1162@DESKTOP-LAOD5TK:~$ ls -l  
total 0  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:18 Mylab2  
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 16:04 combined.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 28 Sep 26 16:04 file.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:33 mylab2  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycleBin  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:47 repos  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:19 test  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1  
hafsai1162@DESKTOP-LAOD5TK:~$ sudo chown hafsai1162:hafsai1162 file.txt  
hafsai1162@DESKTOP-LAOD5TK:~$ ls -l  
total 0  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:18 Mylab2  
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 16:04 combined.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 28 Sep 26 16:04 file.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt  
-rwxr-xr-x 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt  
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:33 mylab2  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycleBin  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:47 repos  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:19 test  
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1  
hafsai1162@DESKTOP-LAOD5TK:~$
```

Part 5: Text Processing and Utilities

5.1 Essential Text Commands

- Commands to demonstrate:

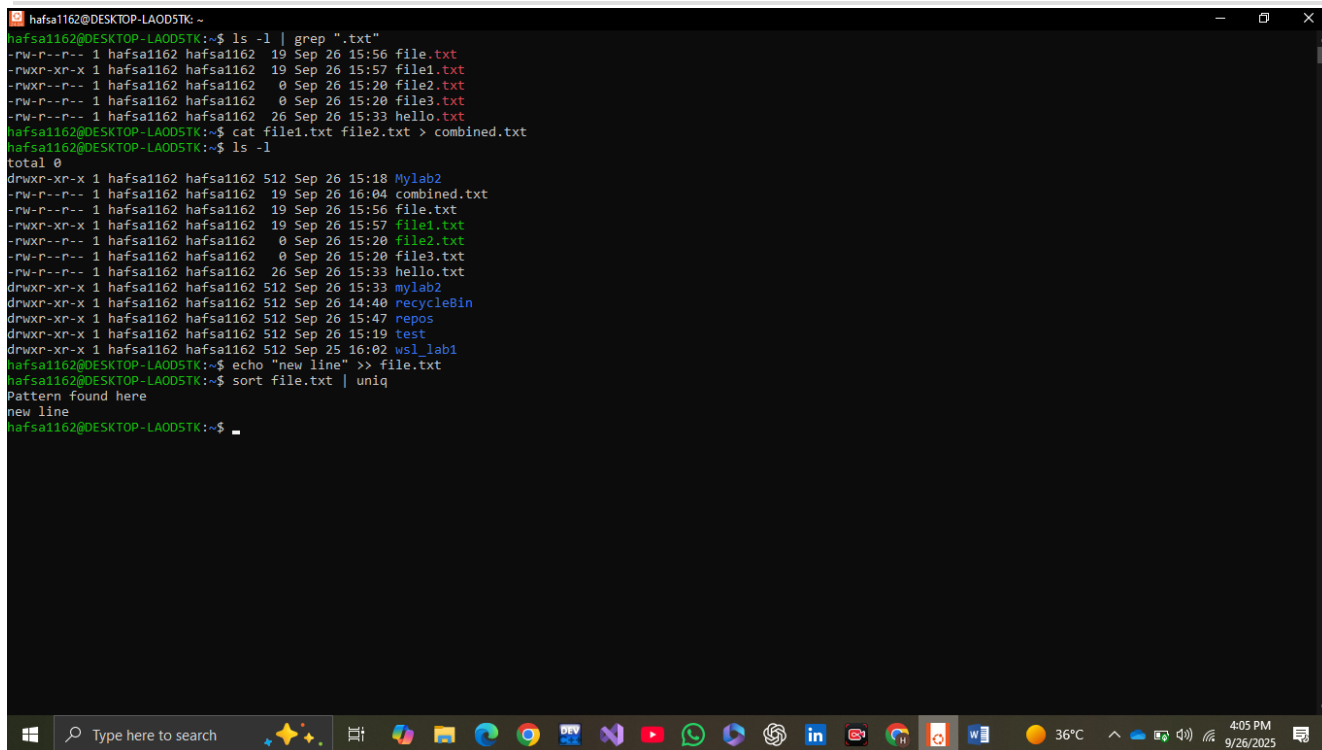
```
grep "pattern" file.txt      # Search for patterns  
grep -i "pattern" file.txt   # Case-insensitive search  
grep -n "pattern" file.txt   # Show line numbers
```

```
hafsai1162@DESKTOP-LAOD5TK: ~  
hafsai1162@DESKTOP-LAOD5TK:~$ ls  
Mylab2 file1.txt file2.txt file3.txt hello.txt mylab2 recycleBin repos test wsl_lab1  
hafsai1162@DESKTOP-LAOD5TK:~$ echo "Pattern found here" >> file.txt  
hafsai1162@DESKTOP-LAOD5TK:~$ grep "pattern" file1.txt  
hafsai1162@DESKTOP-LAOD5TK:~$ echo "pattern found here" >> file1.txt  
hafsai1162@DESKTOP-LAOD5TK:~$ grep "pattern" file1.txt  
pattern found here  
hafsai1162@DESKTOP-LAOD5TK:~$ grep -i "pattern" file1.txt  
pattern found here  
hafsai1162@DESKTOP-LAOD5TK:~$ grep -n "pattern" file1.txt  
1:pattern found here  
hafsai1162@DESKTOP-LAOD5TK:~$
```

5.2 Pipes and Redirection

- Concepts and commands:

```
ls -l | grep ".txt"          # Pipe output
cat file1.txt file2.txt > combined.txt # Redirect output
echo "new line" >> file.txt # Append to file
sort file.txt | uniq         # Chain commands
```

A terminal window titled 'hafsai1162@DESKTOP-LA0D5TK' showing a series of commands and their outputs. The user first runs 'ls -l | grep ".txt"', which lists several files including file1.txt, file2.txt, file3.txt, and hello.txt. Next, they run 'cat file1.txt file2.txt > combined.txt', which concatenates the contents of file1.txt and file2.txt into a new file named combined.txt. Finally, they run 'echo "new line" >> file.txt', which appends the text 'new line' to the end of file.txt. The terminal output shows the results of these commands, including file permissions, sizes, and timestamps. The Windows taskbar is visible at the bottom of the window, showing the time as 4:05 PM on 9/26/2023 and a temperature of 36°C.

```
hafsai1162@DESKTOP-LA0D5TK:~$ ls -l | grep ".txt"
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 15:56 file1.txt
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt
-rwxr-xr-x 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt
hafsai1162@DESKTOP-LA0D5TK:~$ cat file1.txt file2.txt > combined.txt
hafsai1162@DESKTOP-LA0D5TK:~$ ls -l
total 0
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:18 Mylab2
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 16:04 combined.txt
-rw-r--r-- 1 hafsai1162 hafsai1162 19 Sep 26 15:56 file.txt
-rwxr-xr-x 1 hafsai1162 hafsai1162 19 Sep 26 15:57 file1.txt
-rwxr-xr-x 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file2.txt
-rw-r--r-- 1 hafsai1162 hafsai1162 0 Sep 26 15:20 file3.txt
-rw-r--r-- 1 hafsai1162 hafsai1162 26 Sep 26 15:33 hello.txt
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:33 mylab2
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 14:40 recycleBin
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:47 repos
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 26 15:19 test
drwxr-xr-x 1 hafsai1162 hafsai1162 512 Sep 25 16:02 wsl_lab1
hafsai1162@DESKTOP-LA0D5TK:~$ echo "new line" >> file.txt
hafsai1162@DESKTOP-LA0D5TK:~$ sort file.txt | uniq
Pattern found here
new line
hafsai1162@DESKTOP-LA0D5TK:~$
```

Part 6: Introduction to Processes

6.1 Understanding Processes

- Concepts to Cover:

- What is a process?
- Process ID (PID)
- Parent-child relationships
- Process states

◆ Commands to demonstrate:

ps	# Show current processes
ps aux	# Detailed process list
ps -ef	# Full format listing
pstree	# Process tree
top	# Real-time process viewer
htop	# Enhanced process viewer (if available)
kill PID	# Terminate process by PID
killall process_name	# Kill processes by name
pkill pattern	# Kill processes matching pattern

```
hafsai1162@DESKTOP-LAOD5TK: ~  
hafsai1162@DESKTOP-LAOD5TK:~$ ps  
PID TTY          TIME CMD  
137 tty1        00:00:01 bash  
320 tty1        00:00:00 ps  
hafsai1162@DESKTOP-LAOD5TK:~$ ps aux  
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND  
root         1  0.0  0.0  11128 1108 ?        Ssl   14:17   0:00 /init  
root         6  0.0  0.0  11112  616 ?        Sl    14:17   0:00 plan9 --control-socket 6 --log-level 4 --server-fd 7 --pipe-fd 9 --socket-path /mnt/c/Users/Hafsa/AppDa  
hafsai11+  136  0.0  0.0  11128  572 tty1     Ss    14:44   0:00 /init  
hafsai11+  137  0.0  0.0  14108 3868 tty1     S     14:44   0:01 -bash  
hafsai11+  321  0.0  0.0  16312 2760 tty1     R     16:05   0:00 ps aux  
hafsai1162@DESKTOP-LAOD5TK:~$ ps -ef  
UID        PID  PPID  C  STIME TTY          TIME CMD  
root         1    0  0 14:17 ?            00:00:00 /init  
root         6    1  0 14:17 ?            00:00:00 plan9 --control-socket 6 --log-level 4 --server-fd 7 --pipe-fd 9 --socket-path /mnt/c/Users/Hafsa/AppData/Local/Packages  
root       136    1  0 14:44 tty1          00:00:00 /init  
hafsai11+  137   136  0 14:44 tty1          00:00:01 -bash  
hafsai11+  322   137  3 16:06 tty1          00:00:00 ps -ef  
hafsai1162@DESKTOP-LAOD5TK:~$ pstree  
init(Ubuntu-24.)--SessionLeader--bash--pstree  
└─init--(init)  
   └─(init(Ubuntu-24.))  
hafsai1162@DESKTOP-LAOD5TK:~$ top  
top - 16:06:28 up 1:48, 0 user, load average: 0.52, 0.58, 0.59  
Tasks: 5 total, 1 running, 4 sleeping, 0 stopped, 0 zombie  
%Cpu(s): 8.1 us, 16.7 sy, 0.0 ni, 72.0 id, 0.0 wa, 3.2 hi, 0.0 si, 0.0 st  
MiB Mem : 8068.6 total, 3304.5 free, 4764.1 used, 224.0 buff/cache  
MiB Swap: 15185.9 total, 14681.9 free, 504.0 used, 3304.5 avail Mem  


| PID | USER      | PR | NI | VIRT  | RES  | SHR  | S | %CPU | %MEM | TIME+   | COMMAND         |
|-----|-----------|----|----|-------|------|------|---|------|------|---------|-----------------|
| 1   | root      | 20 | 0  | 11128 | 1108 | 1048 | S | 0.0  | 0.0  | 0:00.21 | init(Ubuntu-24. |
| 6   | root      | 20 | 0  | 11112 | 616  | 492  | S | 0.0  | 0.0  | 0:00.00 | init            |
| 136 | root      | 20 | 0  | 11128 | 572  | 520  | S | 0.0  | 0.0  | 0:00.03 | SessionLeader   |
| 137 | hafsai11+ | 20 | 0  | 14108 | 3868 | 3780 | S | 0.0  | 0.0  | 0:01.22 | bash            |
| 324 | hafsai11+ | 20 | 0  | 17340 | 3864 | 1636 | R | 0.0  | 0.0  | 0:00.03 | top             |


```