Operating Systems – COC 3071L
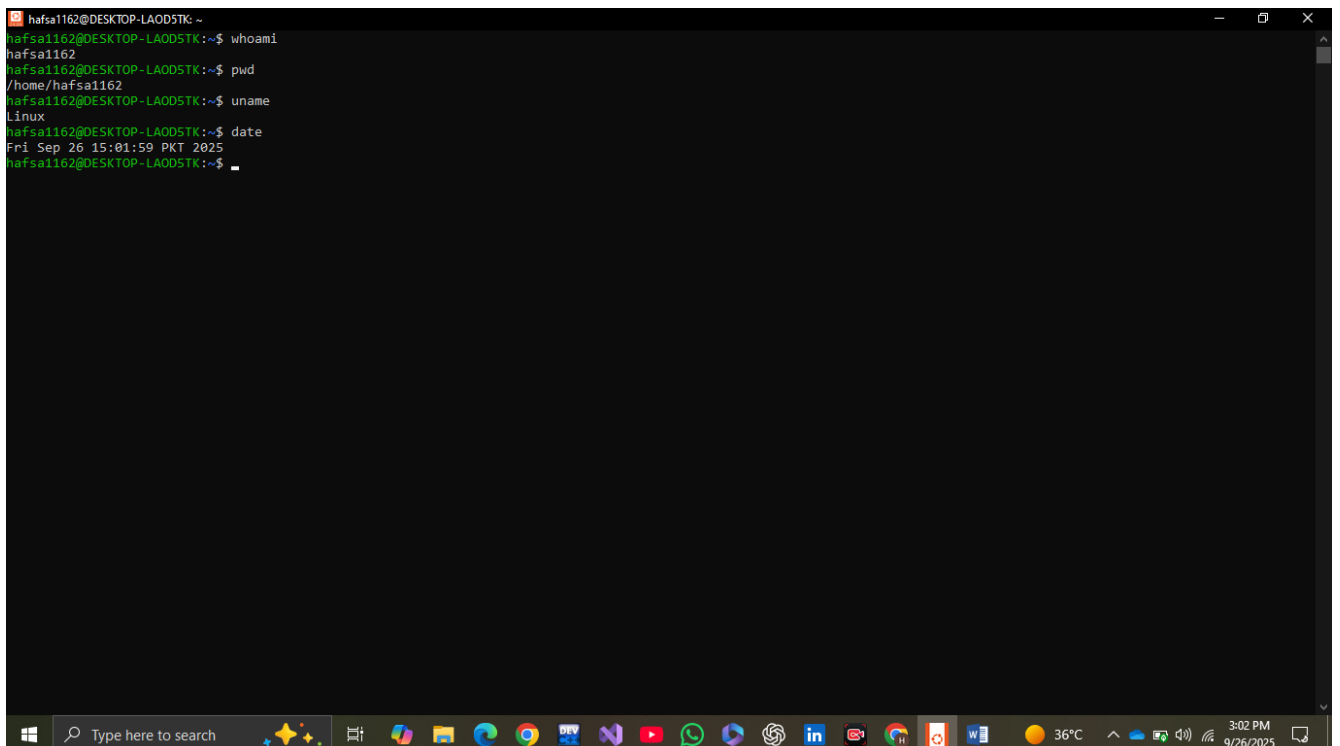
SE 5th A – Fall 2025

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
```


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
```

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)

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
```


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
```

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          # Last 10 lines
wc hello.txt             # Word count
```



```
hafsa1162@DESKTOP-LAOD5TK: ~
hafsa1162@DESKTOP-LAOD5TK:/$ cd ~
hafsa1162@DESKTOP-LAOD5TK:~$ mkdir Mylab2
hafsa1162@DESKTOP-LAOD5TK:~$ mkdir -p test/sub/dir
hafsa1162@DESKTOP-LAOD5TK:~$ touch file1.txt
hafsa1162@DESKTOP-LAOD5TK:~$ touch file2.txt file3.txt
hafsa1162@DESKTOP-LAOD5TK:~$ echo "Hello Linux" >hello.txt
hafsa1162@DESKTOP-LAOD5TK:~$ cat hello.txt
Hello Linux
hafsa1162@DESKTOP-LAOD5TK:~$
```



```
hafsa1162@DESKTOP-LAOD5TK: ~
Hello Linux
hello.txt (END)
```

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-LAOD5TK:~
hafsa1162@DESKTOP-LAOD5TK:~$ cp hello.txt backup.txt
hafsa1162@DESKTOP-LAOD5TK:~$ cp -r Mylab2 Mylab2_backup
hafsa1162@DESKTOP-LAOD5TK:~$ mv backup.txt renamed.txt
hafsa1162@DESKTOP-LAOD5TK:~$ rm renamed.txt
hafsa1162@DESKTOP-LAOD5TK:~$ rm -r Mylab2_backup
hafsa1162@DESKTOP-LAOD5TK:~$ 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-LAOD5TK:~$
```

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)
```

```
hafsa1162@DESKTOP-LAOD5TK:~$ ls -l
total 0
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:18 Mylab2
-rw-r--r-- 1 hafsa1162 hafsa1162  19 Sep 26 16:04 combined.txt
-rw-r--r-- 1 hafsa1162 hafsa1162  28 Sep 26 16:04 file.txt
-rwxr-xr-x 1 hafsa1162 hafsa1162  19 Sep 26 15:57 file1.txt
-rwxr--r-- 1 hafsa1162 hafsa1162   0 Sep 26 15:20 file2.txt
-rw-r--r-- 1 hafsa1162 hafsa1162   0 Sep 26 15:20 file3.txt
-rw-r--r-- 1 hafsa1162 hafsa1162  26 Sep 26 15:33 hello.txt
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:33 mylab2
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 14:40 recycleBin
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:47 repos
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:19 test
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 25 16:02 wsl_lab1
hafsa1162@DESKTOP-LAOD5TK:~$
```



```
hafsa1162@DESKTOP-LAOD5TK:~$ sudo chmod 755 file.txt
[sudo] password for hafsa1162:
hafsa1162@DESKTOP-LAOD5TK:~$ ls -l
total 0
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:18 Mylab2
-rw-r--r-- 1 hafsa1162 hafsa1162  19 Sep 26 16:04 combined.txt
-rwxr-xr-x 1 hafsa1162 hafsa1162  28 Sep 26 16:04 file.txt
-rwxr-xr-x 1 hafsa1162 hafsa1162  19 Sep 26 15:57 file1.txt
-rwxr--r-- 1 hafsa1162 hafsa1162   0 Sep 26 15:20 file2.txt
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drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:19 test
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 25 16:02 wsl_lab1
hafsa1162@DESKTOP-LAOD5TK:~$ sudo chmod u+x file.txt
hafsa1162@DESKTOP-LAOD5TK:~$ ls -l
total 0
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:18 Mylab2
-rw-r--r-- 1 hafsa1162 hafsa1162  19 Sep 26 16:04 combined.txt
-rwxr-xr-x 1 hafsa1162 hafsa1162  28 Sep 26 16:04 file.txt
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drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 26 15:19 test
drwxr-xr-x 1 hafsa1162 hafsa1162 512 Sep 25 16:02 wsl_lab1
hafsa1162@DESKTOP-LAOD5TK:~$
```

Part 5: Text Processing and Utilities

5.1 Essential Text Commands

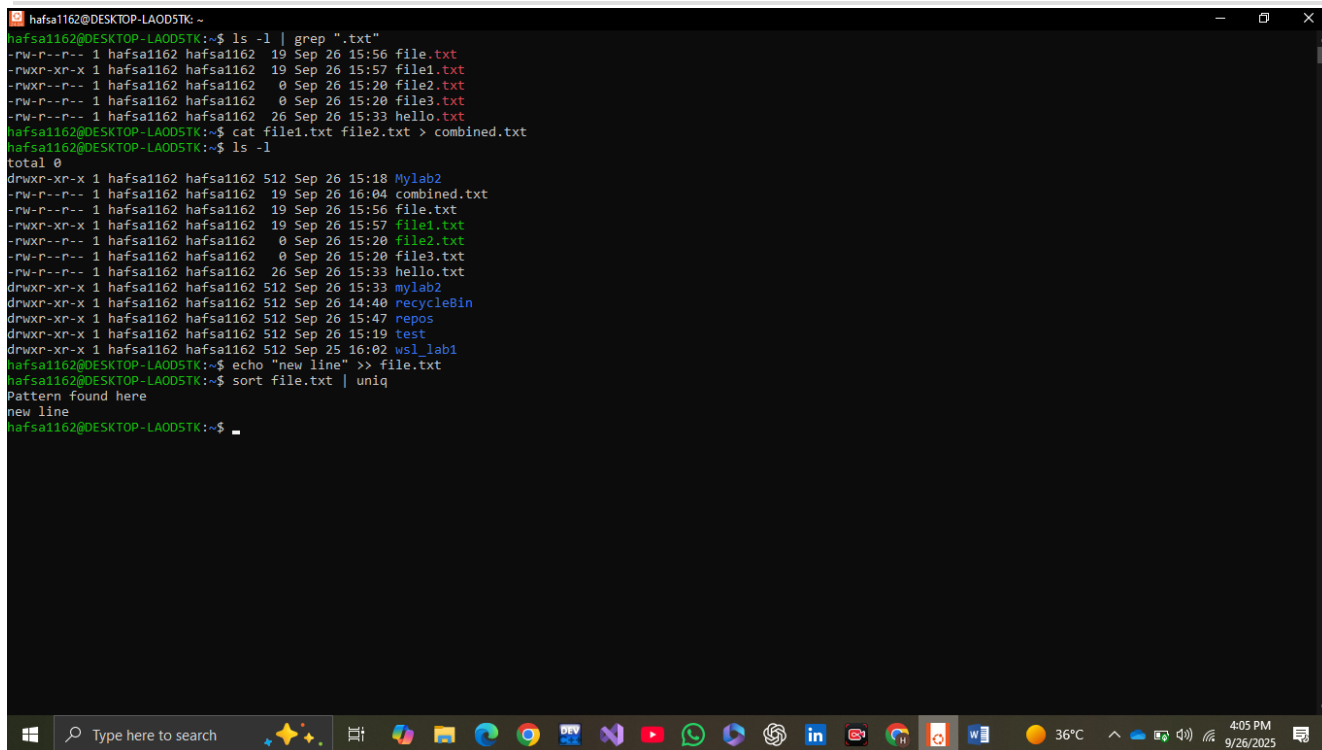- **Commands to demonstrate:**

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

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
```


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
```