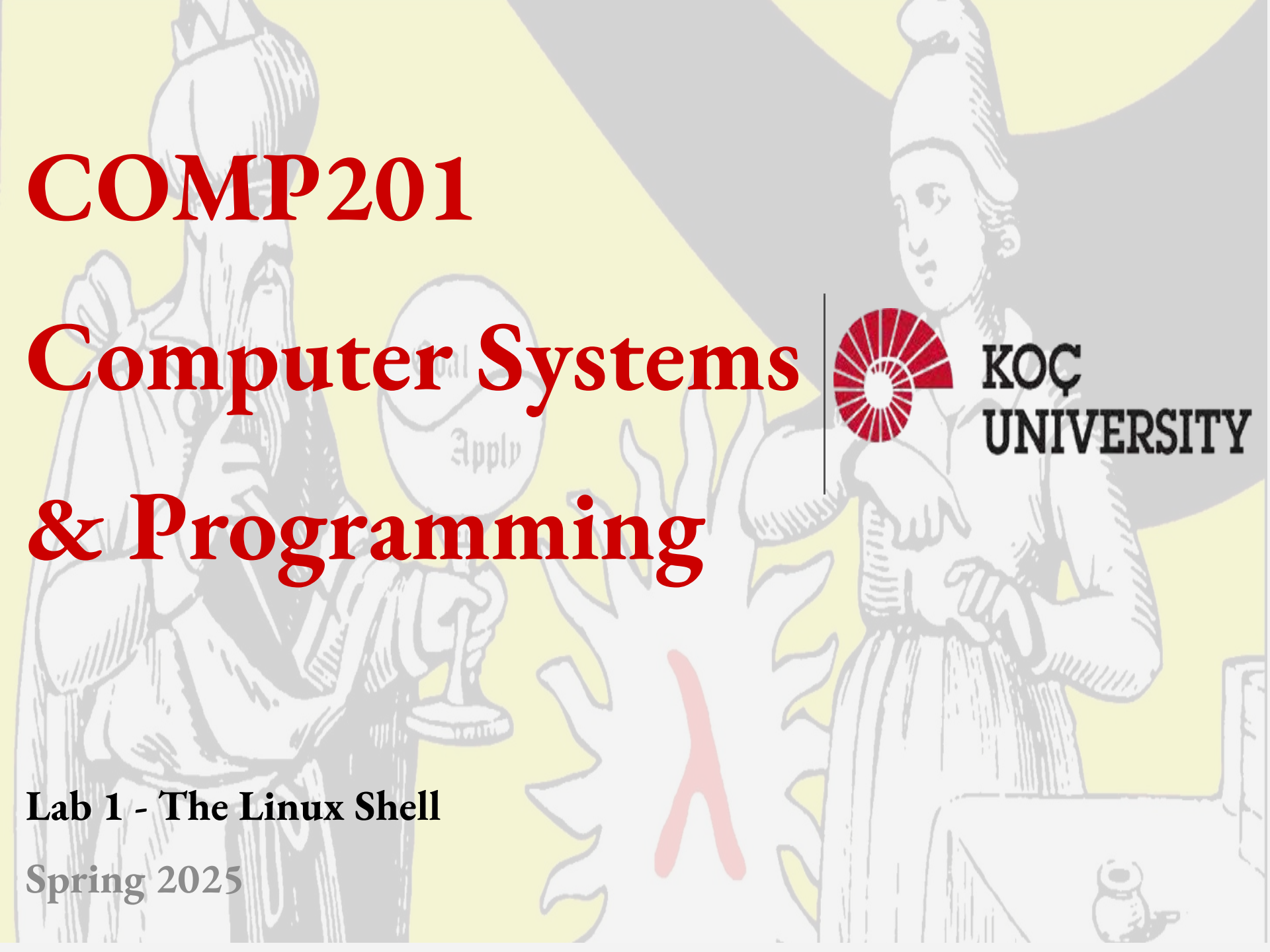


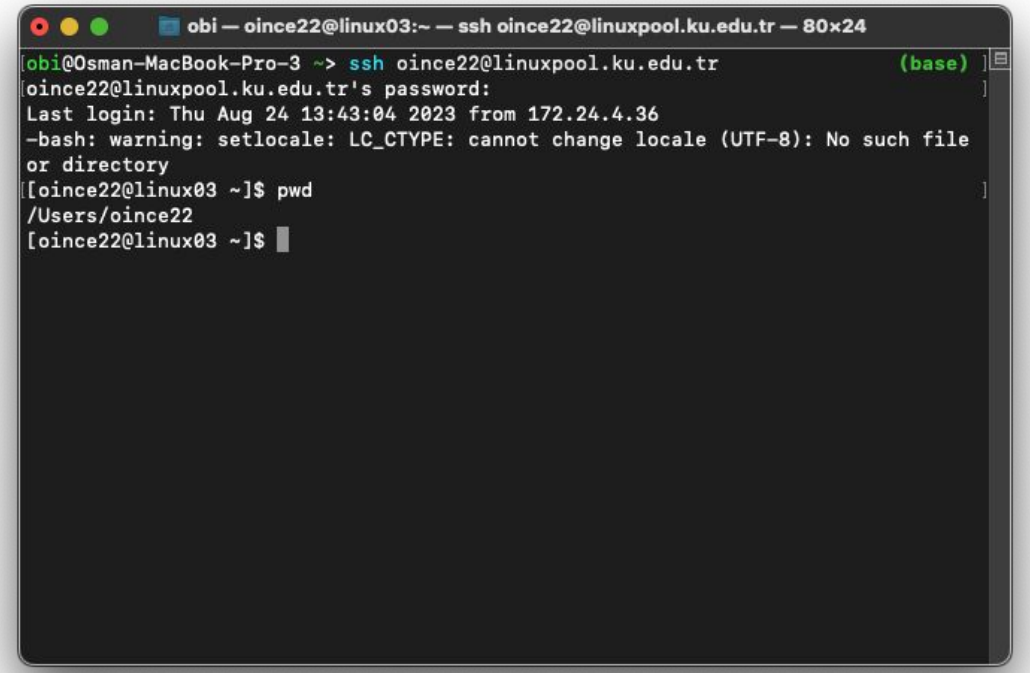
COMP201 Computer Systems & Programming

KOÇ UNIVERSITY

Lab 1 - The Linux Shell

Spring 2025

What is shell?



- **Linux shell** is the interface between you and OS that controls hardware.
- The most commonly used shell is called BASH – Bourne Again Shell
  - The default shell in Linuxpool
- username@hostname:curr_dir$
  - username: oince22
  - hostname: linux03
  - curr_dir: /Users/oince22

How to connect?

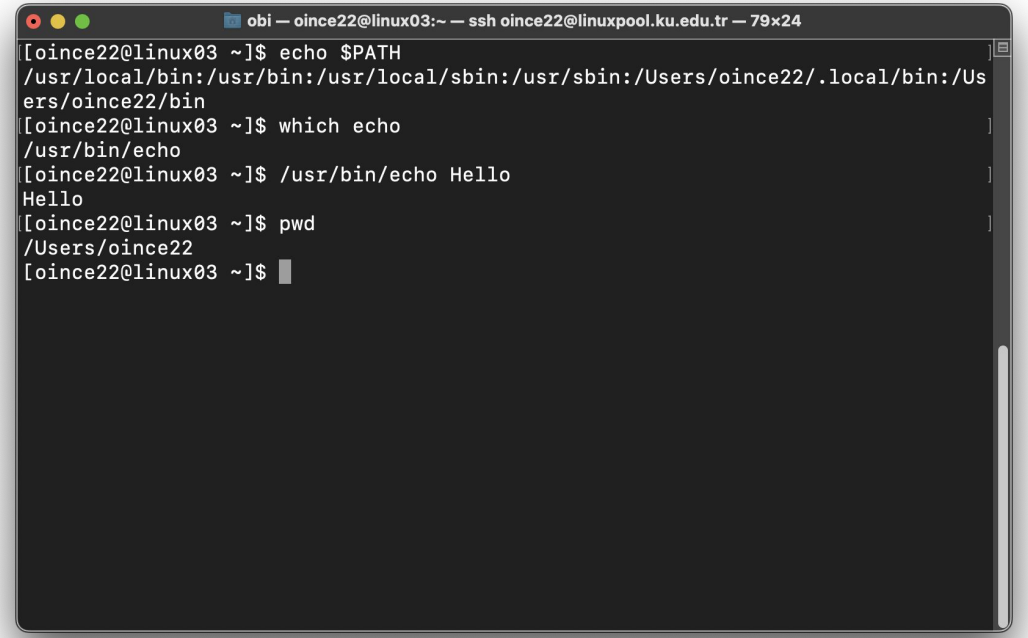
`ssh USERNAME@linuxpool.ku.edu.tr`

1. Type your password when prompted.
2. If you see a warning about SSH host keys, click or enter “yes.”

Executing system programs

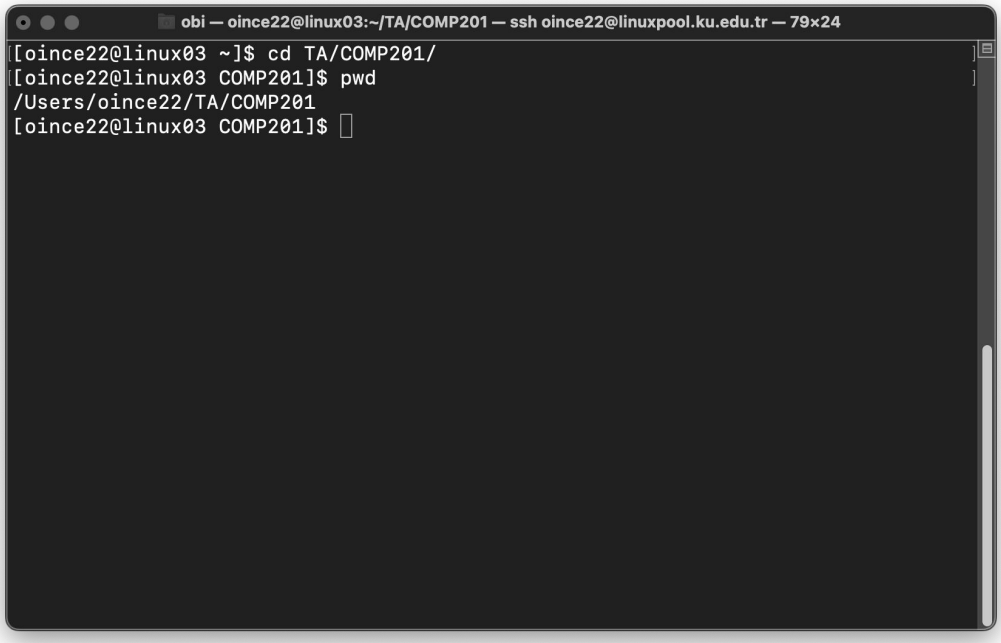
- Execute programs
- `date`
  - This program prints current date and time
- `echo`
  - This program prints the input argument
  - Put quotation marks around the string if the string has more than one word

Path and $PATH



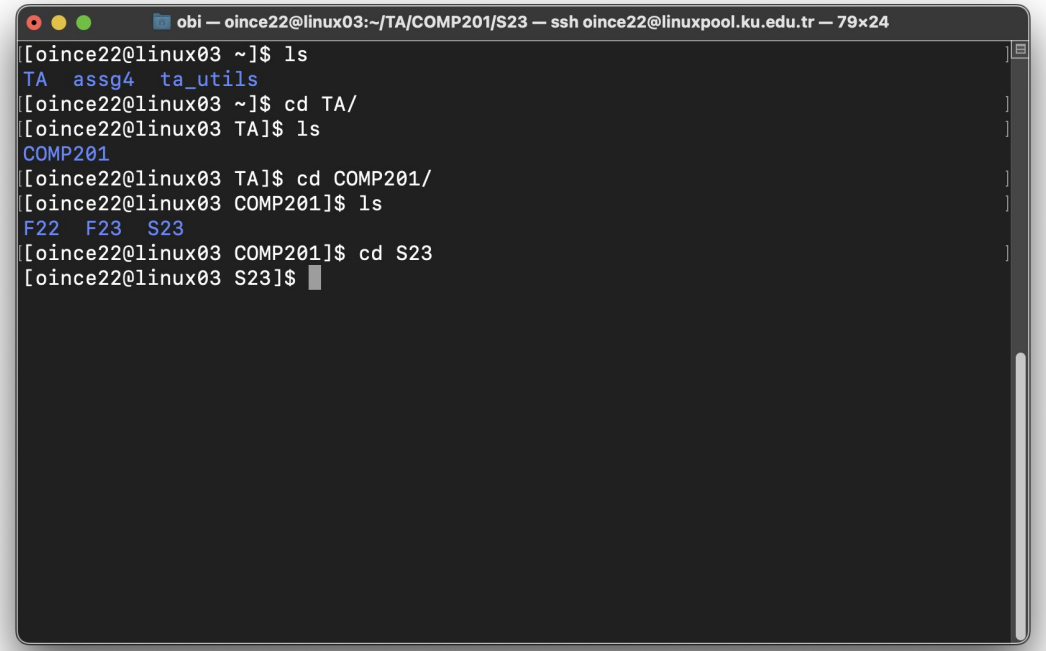
- `$PATH`
  - A variable that contains addresses where system look for programs to execute
- `which`
  - Prints which file is being executed given an input program name
- `pwd`
  - This program prints current working directory
  - Stands for “print working directory”

Path



- cd
  - Changes the working directory
  - `..` is the parent directory
  - `.` is the current directory
  - Tilda (~) is the /Users/<username> directory
    - This is true in Linuxpool
    - May be different in another machine
- Absolute vs relative path
  - Relative: TA/COMP201 from ~ (home)
  - Absolute: /Users/oince22/TA/COMP201

Listing files and directories



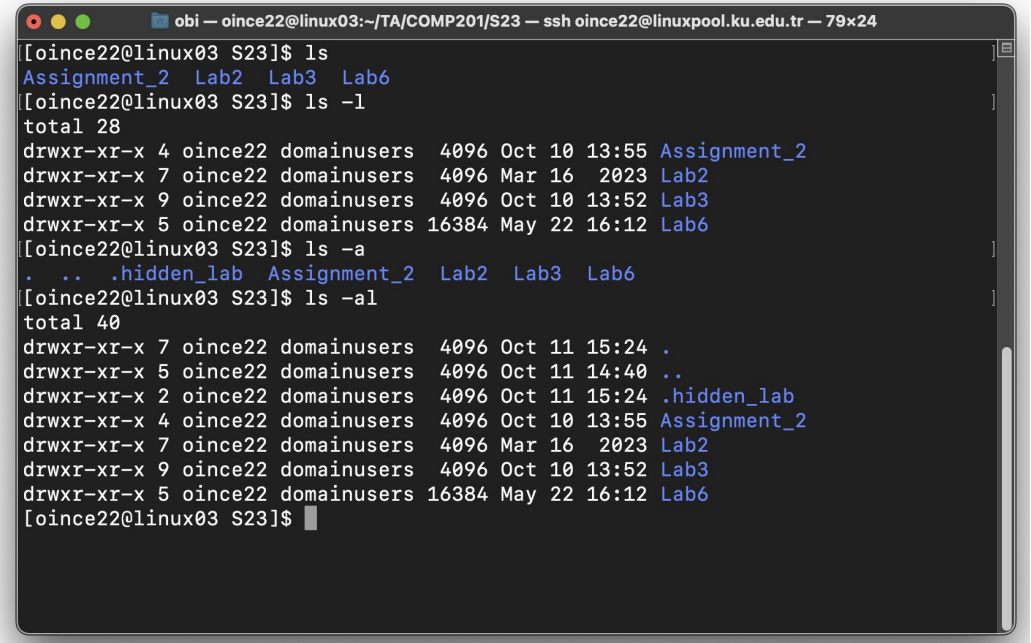
- `ls`
  - Prints files and directories under current working directory

Flags with Commands in Linux

- Many Linux commands have **flags** that can be used to modify their behavior.
- **Flags** are usually preceded by **one** or **two** dashes, followed by a letter or a word.
- **Flags** can be used to:
  - Control the output of a command
  - Specify a file or directory to work with
  - Modify the command's behavior in other ways

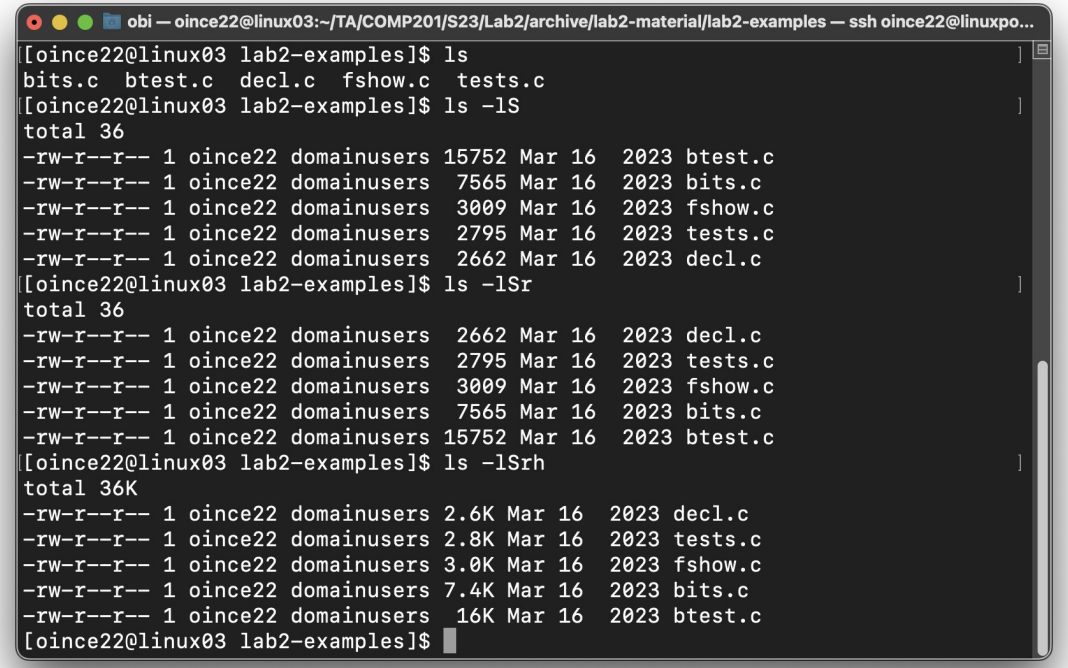
Flags with Commands in Linux

- Let's look at an example: **`ls`** command.
- By default, it lists contents of the current folder.
- But we can use **flags** to modify its behavior.
- For example,
  - **`-l`** flag to list the contents of the directory line-by-line, long-format including additional info about file permissions, owner, and size.
  - **`-a`** flag to display all files, including hidden files (usually not displayed by default).
- To use both flags together, type **`ls -la`**
  - Combine as many as you want!



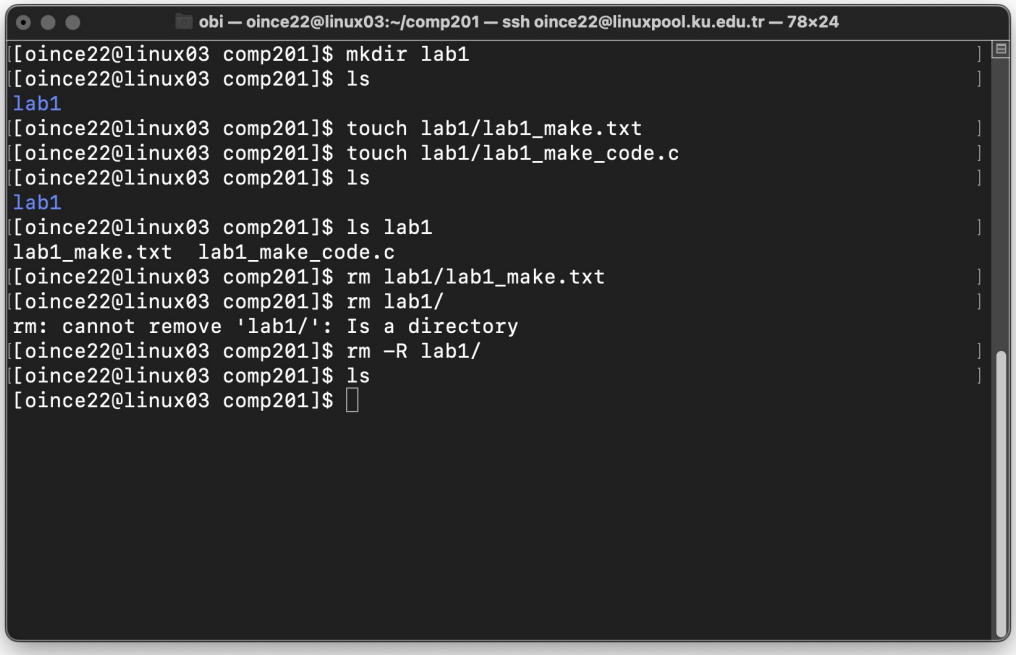
To learn more about the flags available for a `command`, type `man command`
To learn details about the `ls` command and its flags → `man ls`

Listing files and directories



- You can use **`-S`** flag to display files sorted by their sizes, and **`-r`** option for reverse sorting.
- You can use **`-h`** flag to display file sizes in a human-readable format.

Making/Removing folders and files



- `mkdir <folder_name>`
  - Makes a new directory in the given working directory with the given “folder_name”.
- `touch`
  - Creates a file with desired extension and name
- `rm`
  - Removes a file or folder.
  - For removing folders you need to use -R option

Chmod

- Chmod (short for "change mode") is a command in Linux that allows users to change the read, write, and execute permissions of files and directories.
- The syntax for chmod is as follows:
  - `chmod [options] MODE FILENAME`
- The mode is a combination of the letters "r" (read), "w" (write), and "x" (execute).
- Permissions can be granted to three different user groups:
  - The file owner
  - The group owner
  - All users

File Permission in Linux

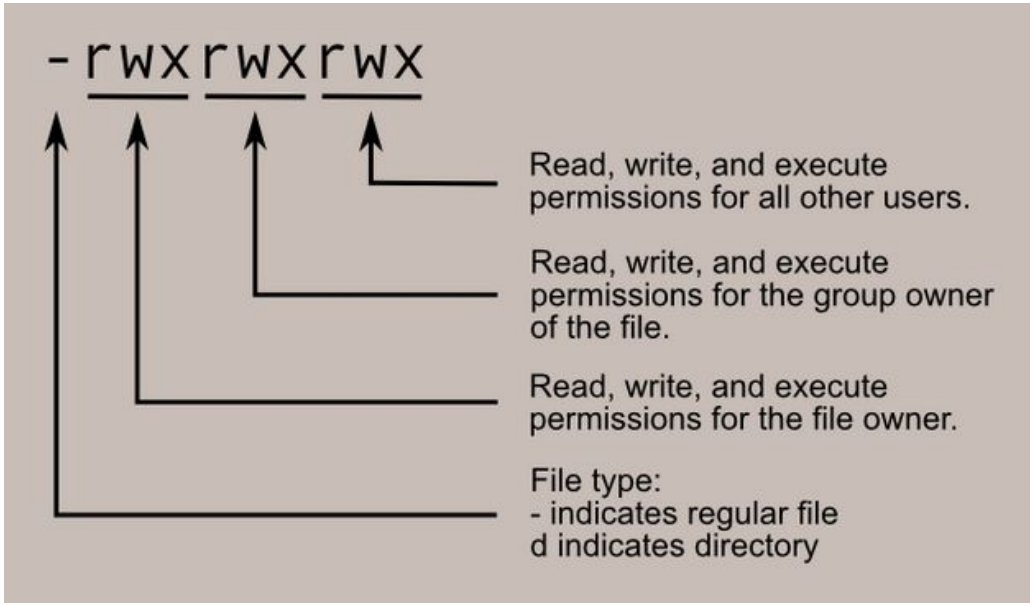


Image source: http://linuxcommand.org/lc3_lts0090.php

File Permission in Linux

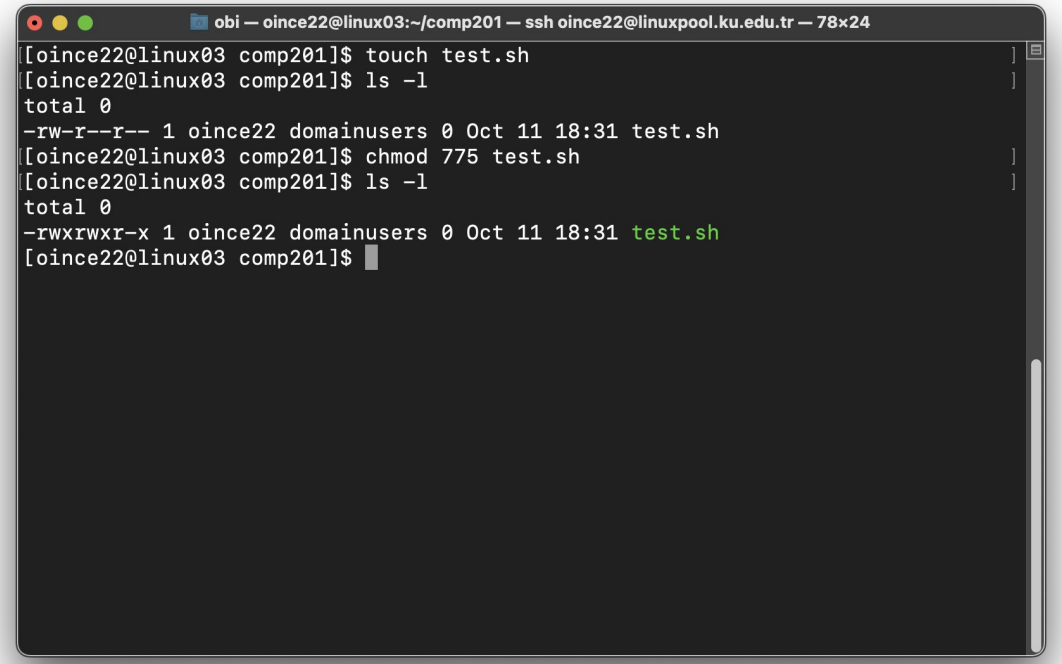
```
rwx rwx rwx = 111 111 111
rw- rw- rw- = 110 110 110
rwx --- --- = 111 000 000

and so on...

rwx = 111 in binary = 7
rw- = 110 in binary = 6
r-x = 101 in binary = 5
r-- = 100 in binary = 4
```

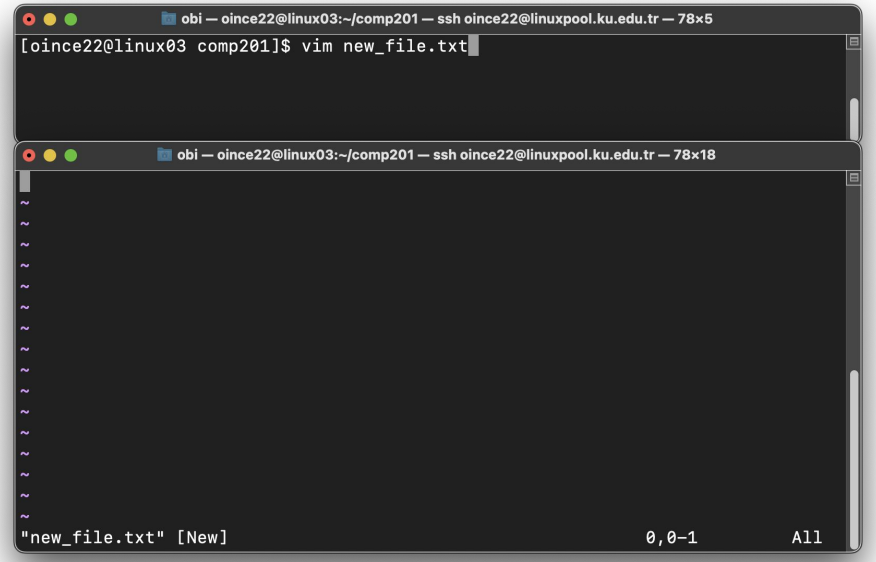
Image source: http://linuxcommand.org/lc3_lts0090.php

File Permission in Linux



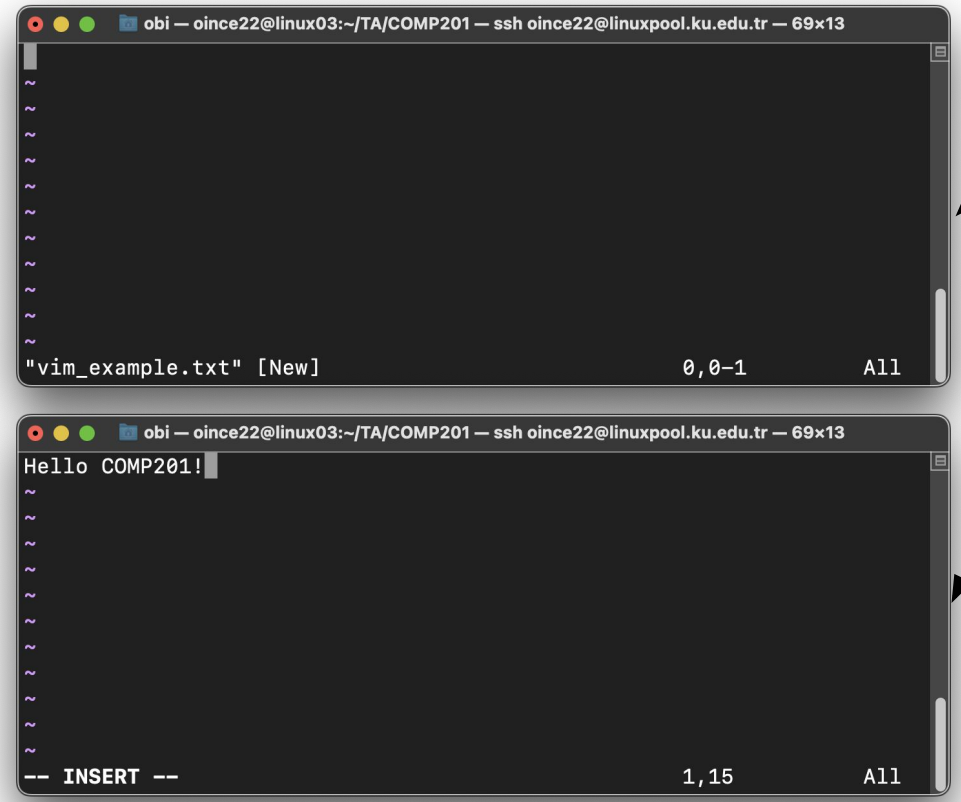
Initially, `test.sh` cannot be executed, to grant -rwx rwx r-x permission to `test.sh` file execute `chmod 775 test.sh` command.

What is Vim?



- **Vim** is the default text editor in the UNIX operating system.
- Using **vim**, we can create a new file, read, and edit an existing file.
- To open **vim**, type `vim` or `vim FNAME`. If the file `FNAME` doesn't exist, it will be created when you save it.

Operation Modes in Vim



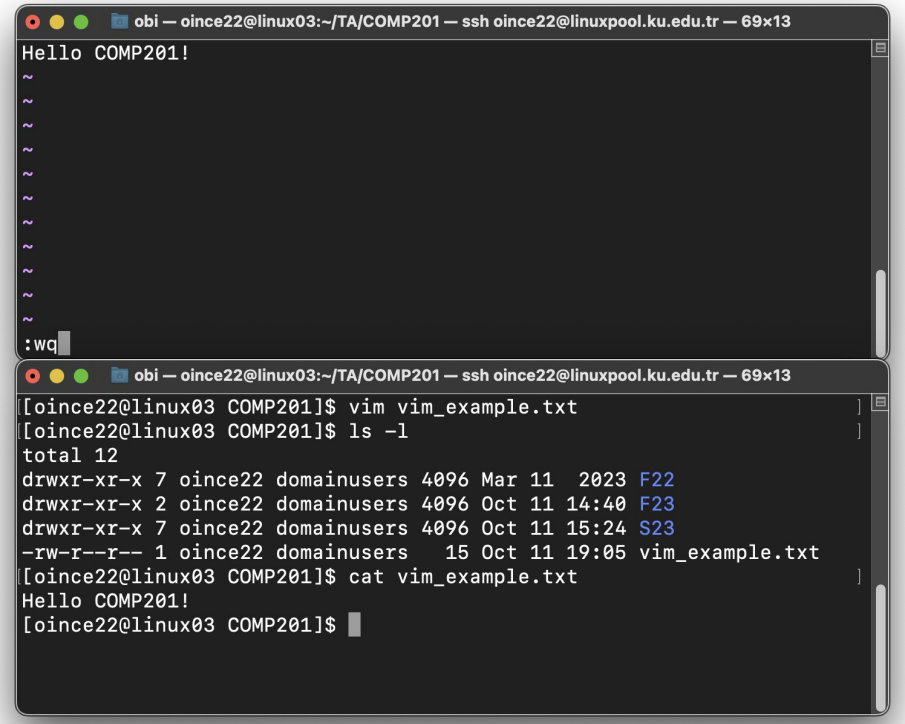
Normal mode

- The default mode in **vim**.
- Every character you type is interpreted as a command.

Insert mode

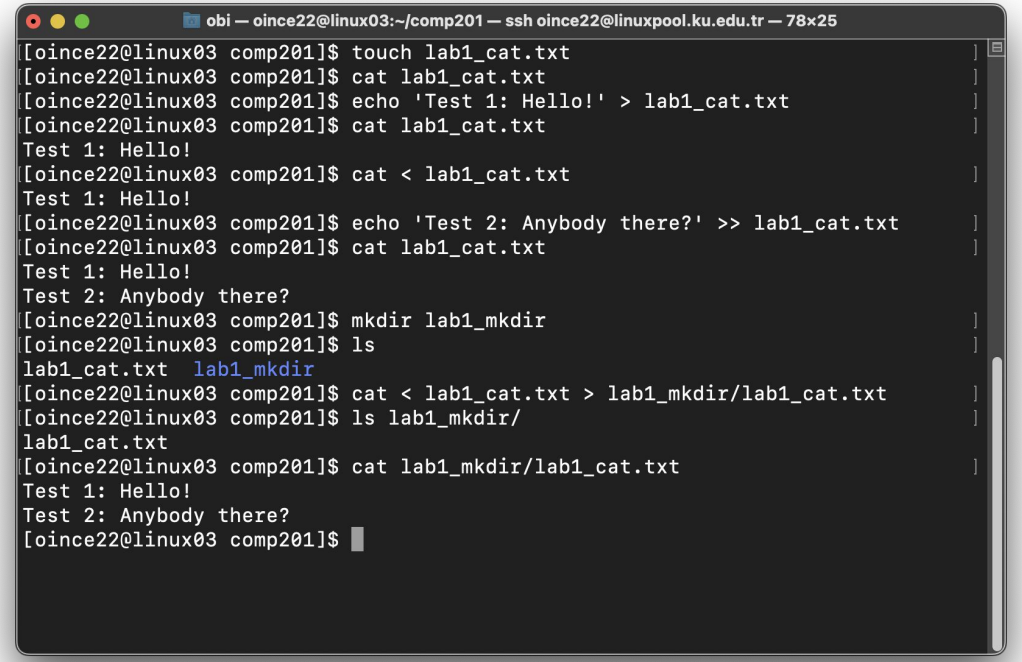
- To switch from normal mode to insert mode, type **i** in the normal mode.
- Every character you type is put to the file.
- To switch back to normal mode, press <Esc>

Operation Modes in Vim



- Exit **with** saving
  - To save and exit a file, go to the Normal mode by pressing <Esc> then type :wq
- Exit **without** saving
  - To exit from a file without saving it, go to the Normal mode by pressing <Esc> then type :q!
- After typing :wq or :q!, press <Enter>

Redirection



- `cat`
  - Print the content of the given file
- `< file` and `> file`
  - You can write the input and output of a program to a file
  - “>> file” appends to end of file

Piping

- Pipe character is `|`
  - Connects output of a program to input of another one
- `grep`
  - Searches for a particular information
  - By default it is case sensitive
- Try `grep --help` and find what does `-i` option do

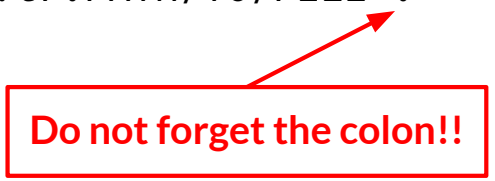
SCP

- SCP is a tool in Linux used to transfer files between hosts over a network.
- The syntax for SCP is as follows:
  - `scp [OPTIONS] SOURCE DESTINATION`
- -r flag is used to copy directories, stands for **recursive**

SCP

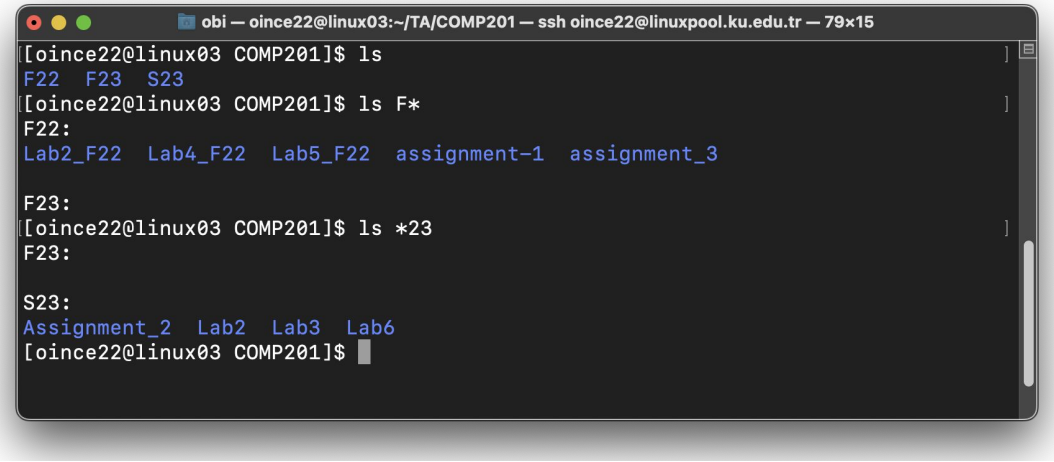
- From local machine to Linuxpool:
  - (on local machine): `scp -r FILENAME USERNAME@linuxpool.ku.edu.tr:`

- From Linuxpool to local machine:
  - (on local machine): `scp -r USERNAME@linuxpool.ku.edu.tr:PATH/TO/FILE .`



Useful Commands

- **`clear`**: Clearing the contents of the terminal screen
- **`history`**: Searching for previously executed commands
- **Tab key**: auto-completion
- *** (asterisk)**: Used as a wildcard to represent any combination of characters in a command or filename



Other Resources

- MIT MS The Shell
- Stanford CS107 Unix videos 1-15, 24, 25
- UNIX Tutorial for Beginners