

ECE5725: Homework 1

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Question 1: Academic Integrity

You correctly answered 9 out of 12 questions. What would you like to do now?

Email my score to: hc2325@cornell.edu

Let me do the exercises again.

Let me exit the tutorial.

[Next >](#)

Figure 1: Question 1 Screenshot

Question 2: SD Card Setup

This task has been completed according to the Canvas guides.

Question 3: Linux File Permissions

In Linux, file permissions control the actions that users can perform on files and directories. Permissions are assigned to three user classes: the **owner** (u), the **group** (g), and **other** (o). There are three primary permissions:

- **Read (r):** View the contents of a file or list the contents of a directory.
- **Write (w):** Modify a file or add/remove files in a directory.
- **Execute (x):** Run a file as a program or enter (cd into) a directory.

These are often represented by an octal (numeric) code, where each digit corresponds to the owner, group, and others, respectively. The digit is the sum of the values for its permissions: read=4, write=2, and execute=1.

Permission 777

Permission 777 grants full rights to everyone.

- **Owner:** $7 = 4 + 2 + 1 \rightarrow (rwx)$
- **Group:** $7 = 4 + 2 + 1 \rightarrow (rwx)$
- **Others:** $7 = 4 + 2 + 1 \rightarrow (rwx)$

Danger: This permission is dangerous because it allows any user on the system to read, modify, delete, or execute the file/directory. This can lead to accidental or malicious modification of important data or the introduction of harmful scripts onto the system.

Permission 644

Permission 644 is a common default for files. It allows the owner to edit the file, while others can only read it.

- **Owner:** $6 = 4 + 2 + 0 \rightarrow (rw-)$
- **Group:** $4 = 4 + 0 + 0 \rightarrow (r--)$
- **Others:** $4 = 4 + 0 + 0 \rightarrow (r--)$

Permission 700

Permission 700 provides private access exclusively to the owner.

- **Owner:** $7 = 4 + 2 + 1 \rightarrow (rwx)$
- **Group:** $0 = 0 + 0 + 0 \rightarrow (---)$
- **Others:** $0 = 0 + 0 + 0 \rightarrow (---)$

Question 4: Server Login and Directory Permissions

The screenshot is Figure 2.

Question 5: File Creation and Permissions

The screenshot is Figure 3.

Question 6: The df Command

The `df` (disk free) command displays the amount of available disk space for the system's file systems. The `-h` flag makes the output human-readable by showing sizes in units like Gigabytes (G) and Megabytes (M).

```

Last login: Mon Sep  8 13:37:05 on ttys000
|xixi_bro@dhcp-v12041-45269 ~ % ssh hc2325@132.236.79.6
|hc2325@132.236.79.6's password:
Linux ece5725-f25 6.1.21-v8+ #1642 SMP PREEMPT Mon Apr  3 17:24:16 BST 2023 aarch64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Sep  8 13:41:40 2025 from 10.48.177.213

Wi-Fi is currently blocked by rfkill.
Use raspi-config to set the country before use.

hc2325@ece5725-f25:~ $ whoami
|hc2325
|hc2325@ece5725-f25:~ $ pwd
|/home/hc2325
|hc2325@ece5725-f25:~ $ date
|Mon 08 Sep 2025 02:30:02 PM EDT
|hc2325@ece5725-f25:~ $ mkdir test
|hc2325@ece5725-f25:~ $ ls -l
|total 4
|drwxr-xr-x 2 hc2325 students 4096 Sep  8 14:30 test
|hc2325@ece5725-f25:~ $ chmod 755 /home/hc2325
|hc2325@ece5725-f25:~ $ ls -ld /home/hc2325
|drwxr-xr-x 4 hc2325 students 4096 Sep  8 14:30 /home/hc2325
|hc2325@ece5725-f25:~ $ passwd
|Changing password for hc2325.
|Current password:
|passwd: Authentication token manipulation error
|passwd: password unchanged
|hc2325@ece5725-f25:~ $ passwd
|Changing password for hc2325.
|Current password:
|New password:
|Retype new password:
|passwd: password updated successfully
hc2325@ece5725-f25:~ $ 

```

Figure 2: Question 4 Screenshot

```

[hc2325@ece5725-f25:~ $ ls
|test
[hc2325@ece5725-f25:~ $ cd test
[hc2325@ece5725-f25:~/test $ echo "hc2325, Hongxi Chen" > HW1.txt
[hc2325@ece5725-f25:~/test $ ls
|HW1.txt
[hc2325@ece5725-f25:~/test $ chmod 600 HW1.txt
[hc2325@ece5725-f25:~/test $ ls -l
|total 4
|-rw----- 1 hc2325 students 20 Sep  8 14:38 HW1.txt
[hc2325@ece5725-f25:~/test $ cat HW1.txt
|hc2325, Hongxi Chen
hc2325@ece5725-f25:~/test $ 

```

Figure 3: Question 5 Screenshot

Analysis of the /home entry

The screenshot(Figure 4) shows the output of the `df -h` command. The line for the `/home` directory is:

```
/dev/sda1    916G    3.7G    866G    1% /home
```

This output shows that the `/home` partition has a total **size** of 916G, of which 3.7G is **used** and 866G is **available**.

What is **unique** about this server's setup is that the user home directories (`/home`) are located on a separate physical partition (`/dev/sda1`) from the operating system's root filesystem (`/dev/root`). This is a standard practice for managing multi-user systems

because it isolates user data from system files. If the user partition fills up, it will not crash the operating system, making the server more stable.

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/root	15G	11G	3.0G	78%	/
devtmpfs	667M	0	667M	0%	/dev
tmpfs	925M	8.0K	925M	1%	/dev/shm
tmpfs	370M	1.6M	369M	1%	/run
tmpfs	5.0M	4.0K	5.0M	1%	/run/lock
/dev/sda1	916G	3.7G	866G	1%	/home
/dev/mmcblk0p1	255M	33M	223M	13%	/boot
tmpfs	185M	24K	185M	1%	/run/user/1000
tmpfs	185M	20K	185M	1%	/run/user/1033
tmpfs	185M	24K	185M	1%	/run/user/1052
tmpfs	185M	24K	185M	1%	/run/user/1040
tmpfs	185M	24K	185M	1%	/run/user/1064
tmpfs	185M	24K	185M	1%	/run/user/1027
tmpfs	185M	24K	185M	1%	/run/user/1048
tmpfs	185M	24K	185M	1%	/run/user/1026
tmpfs	185M	24K	185M	1%	/run/user/1008
tmpfs	185M	24K	185M	1%	/run/user/1023
tmpfs	185M	24K	185M	1%	/run/user/1024
tmpfs	185M	24K	185M	1%	/run/user/1022

Figure 4: Question 6 Screenshot.

Question 7: The ps Command

The `ps` command reports a snapshot of the current processes. I used the following commands.

1. `ps aux`: Show all processes for all users.
2. `ps aux | wc -l`: Pipe the output to `wc -l` to count the total lines (processes).
3. `ps aux | grep hc2325`: Pipe the output to `grep` to search for lines containing `hc2325`.

The screenshot is Figure 5.

Question 8: Raspberry Pi vs. Laptop

Component Correspondence

- **Laptop Disk (SSD/HDD)**: Corresponds to the **MicroSD Card** on the Raspberry Pi, which holds the operating system and user data.
- **Laptop Memory (RAM)**: Corresponds to the onboard **LPDDR SDRAM** which is integrated directly into the Pis main chip.

```
[hc2325@ece5725-f25:/home $ ps aux | wc -l
269
[hc2325@ece5725-f25:/home $ ps aux | grep hc2325
root      388576  0.0  0.4 16066  7820 ?        Ss   14:28  0:00 sshd: hc2325 [priv]
hc2325    388603  0.0  0.4 16288  8360 ?        Ss   14:28  0:00 /lib/systemd/systemd --user
hc2325    388604  0.0  0.2 169044  4676 ?        S    14:28  0:00 (sd-pam)
hc2325    388618  0.0  0.2 91148  4960 ?        Ssl  14:28  0:00 /usr/bin/pipewire
hc2325    388619  0.0  0.4 161916  8288 ?        Ssl  14:28  0:00 /usr/bin/pulseaudio --daemonize=n
o --log-target=journal
hc2325    388621  0.0  0.1 7688  3316 ?        Ss   14:28  0:00 /usr/bin/dbus-daemon --session --
address=/systemd: --nofork --nopidfile --systemd-activation --syslog-only
hc2325    388622  0.0  0.3 85176  5844 ?        Sl   14:28  0:00 /usr/bin/pipewire-media-session
hc2325    388628  0.0  0.2 16060  4716 ?        S    14:28  0:00 sshd: hc2325@pts/12
hc2325    388629  0.0  0.2 7964  4500 pts/12   Ss   14:28  0:00 -bash
hc2325    397025  0.0  0.1 9452  2788 pts/12   R+  14:52  0:00 ps aux
hc2325    397026  0.0  0.0 6040  688 pts/12   S+  14:52  0:00 grep --color=auto hc2325
```

Figure 5: Question 7 Screenshot.

- **Laptop Processor (CPU):** Corresponds to the **ARM-based System on a Chip (SoC)**, which integrates the CPU, GPU, and other components into a single package.

Advantages of Raspberry Pi over a Laptop

- **Cost:** Significantly cheaper than any laptop.
- **Size and Portability:** Extremely small and lightweight, making it ideal for embedded and space-constrained projects.
- **Power Consumption:** Uses very little power, allowing it to run off a phone charger or battery pack for extended periods.
- **GPIO Pins:** The GPIO pins allow it to directly interface with sensors, motors, and other electronic components, which is not possible on a standard laptop.

Disadvantages of Raspberry Pi versus a Laptop

- **Performance:** The processing power and memory are much lower than a modern laptop, making it unsuitable for computationally intensive tasks.
- **Storage:** MicroSD cards are slower and have lower capacity and a shorter lifespan than laptop SSDs or HDDs.
- **Compatibility:** The ARM architecture means it cannot run software compiled for standard x86 processors (though this is becoming less of an issue).
- **Integrated Peripherals:** It lacks a built-in screen, keyboard, and battery, which must all be supplied externally.

Question 9: top vs. htop

top (table of processes) is the traditional command-line utility for displaying a real-time view of running system processes. It is pre-installed on nearly all Unix-like systems. It is functional but basic in its presentation and interaction. **htop** is an enhanced, interactive process viewer. It is considered a more user-friendly and powerful alternative to top.

htop is generally preferable for several reasons:

- **User Interface:** htop presents data in a colorful, clearer layout.
- **Interactivity:** htop allows you to directly interact with processes using function keys or a mouse, such as killing, renicing (changing priority), or filtering processes without typing commands.
- **System Information:** htop provides a more comprehensive, graphical view of system resources like CPU, memory, and swap usage at the top of the screen.

Question 10: Debian Release Characters

Stable Releases (Beginning with 1.1):

- 1.1: **Buzz** (Buzz Lightyear)
- 1.2: **Rex** (Rex the Dinosaur)
- 1.3: **Bo** (Bo Peep)
- 2.0: **Hamm** (Hamm the Piggy Bank)
- 2.1: **Slink** (Slinky Dog)
- 2.2: **Potato** (Mr. Potato Head)
- 3.0: **Woody** (Sheriff Woody)
- 3.1: **Sarge** (Sergeant of the Green Army Men)
- 4.0: **Etch** (Etch A Sketch)
- 5.0: **Lenny** (Lenny the Binoculars)
- 6.0: **Squeeze** (Squeeze Toy Aliens)
- 7.0: **Wheezy** (Wheezy the Penguin) - *RPi Foundation based here*
- 8.0: **Jessie** (Jessie the Cowgirl) - *RPi Foundation based here*
- 9: **Stretch** (Stretch the Octopus) - *RPi Foundation based here.*
- 10: **Buster** (Buster the Dog) - *RPi Foundation based here.*
- 11: **Bullseye** (Bullseye the Horse) - *RPi Foundation based here.*
- 12: **Bookworm** (Bookworm) - *Current RPi OS basis.*

Future and Codename-Only Releases:

- 13: **Trixie** (Trixie the Dinosaur)

- 14: Forky (Forky)

Special Releases:

- Sid (Sid Phillips)

