Linux Programming: Assignment-1

1. What is Linux Operating System (OS)? List three pros and cons of it.

Linux OS:

Linux is an open-source, Unix-like operating system kernel that powers a wide range of devices—from personal computers and servers to mobile phones and embedded systems. It is well known for stability, security, and flexibility.

Pros:

1. Open-source and free (no licensing fees).
2. High security and stability compared to proprietary OS.
3. Excellent for developers, servers, and customization.

Cons:

1. Steeper learning curve for beginners.
2. Limited support for some proprietary software/games.
3. Hardware driver compatibility issues in some cases.

2. Differentiate between Linux, Mac, Android, and Windows OS with at least six unique features.

Feature	Linux	MacOS	Android	Windows
Licensing	Open-source (GPL)	Proprietary (Apple only)	Open-source (AOSP) with Google services	Proprietary (Microsoft)
Hardware Support	Runs on almost any hardware	Only on Apple devices	Smartphones & tablets	Wide PC hardware compatibility
Cost	Free	Expensive (comes with Apple hardware)	Free (device cost only)	Paid (OEM license cost included)
Security		Secure but closed system	Secure (sandbox apps) but malware-prone if sideloading	More prone to malware/ viruses
User Base	Developers, servers, power users	Creative professionals	Mobile users worldwide	General users, businesses

Customization	Very secure, multi-user permissions	Minimal customization	Moderate (UI skins by vendors)	Limited customization
App Ecosystem	FOSS repos + some commercial apps	Apple App Store only	Google Play Store + APKs	Microsoft Store + desktop apps

3. Why is Linux preferred for Mainframe Servers for legacy applications? Give three out-of-the-box technical reasons.

1. Stability & Uptime – Linux can run for years without reboot, critical for 24×7 mainframe workloads.
2. Backward Compatibility – Legacy COBOL/C/Assembler applications can run in Linux emulators or containers.
3. Scalability & Performance – Optimized for multi-core, high-memory mainframe environments; supports virtualization (KVM, LPARs).

4. Explain the structure of the Linux File System with proper diagram.

Linux file system follows a hierarchical tree structure with root (/) at the base:

/
- bin (Essential user binaries)
- boot (Boot loader, kernel files)
- dev (Device files)
- etc (System configuration)
- home (User directories)
- lib (Shared libraries)
- media (Removable media mounts)
- mnt (Temporary mount points)
- opt (Optional software)
- root (Root user home directory)
- sbin (System binaries for admin)
- tmp (Temporary files)
- usr (User programs and utilities)
- var (Variable data: logs, spool)

5. If Linux OS is open-source, how do companies like Red Hat still make money from it? Do a market study and answer properly.

Companies like Red Hat, SUSE, Canonical (Ubuntu) monetize Linux via:

1. Enterprise Support & Maintenance – Paid subscriptions for security updates, patches, and enterprise-grade stability.

2. Training & Certification – Red Hat Certified Engineer (RHCE), system admin certifications.
3. Consulting & Custom Solutions – Performance tuning, migration, and architecture design.
4. Value-Added Tools – Kubernetes (OpenShift), cloud management, container orchestration.

Example: Red Hat's revenue (before IBM acquisition) was ~ $3.4 billion/year, primarily from subscriptions and support.

6. Write the command to display today's date and time (i.e., current System time).

date

7. Which command is used to check how long the system has been running?

uptime

8. What is the difference between shutdown -h now and halt?

- shutdown -h now Gracefully stops all services/processes, syncs disks, and then halts system.
- halt Immediately halts CPU without properly shutting down services (less safe).

9. Compare init 0 and shutdown -h. Which is safer? Why?

- init 0 Changes system run level to 0 (halt). Equivalent to shutdown, but not as graceful in stopping services.
- shutdown -h Safest because it notifies logged-in users, stops services properly, syncs disks, and then halts.

Safer: shutdown -h (prevents data loss and corruption).

10. A system administrator accidentally powers off a Server machine without shutting it down properly. What problems can occur?

1. File System Corruption – Unsaved data in cache may be lost.
2. Database Inconsistency – Transactions may remain uncommitted, leading to corruption.
3. Hardware Damage Risk – Sudden power cuts stress HDD/SSD.
4. Service Downtime – Critical apps may not restart properly, affecting users.

LINUX PROGRAMMING: ASSIGNMENT-2

1. What does the command pwd, whoami, and hostname display?

. pwd: Displays the current working directory (Present Working Directory).

. whoami: Displays the username of the current user.

. hostname: Displays the hostname of the system.

2. Write the command to create a directory named “project” inside the /home/student folder and keep three .txt file into it. Give output snapshot.To create a directory named "project" inside /home/student and add three .txt files:

mkdir /home/student/project

touch /home/student/project/file1.txt /home/student/project/file2.txt /home/student/project/file3.txt

Output:

/home/student/project

├── file1.txt

├── file2.txt

└── file3.txt

3. Explain the difference between absolute path and relative path with proper examples

. Absolute path: Specifies the full path from the root directory

(e.g., /home/student/project/file.txt).

. Relative path: Specifies the path relative to the current working directory

(e.g., /project/file.txt if you're in /home/student).

4. What command will give you the already executed command traces in the terminal. Give output snapshot.

history

Output:

1 mkdir /home/student/project

2 touch /home/student/project/file1.txt /home/student/project/file2.txt /home/student/project/file3.txt

3 history

5. Compare the working functionality of find and locate command. Which one is faster and why?

. **find:** Searches for files based on various conditions (e.g., name, size, modification time).

. **locate**: Uses a database to quickly find files by name.

locate is generally faster because it uses a pre-built database, while find searches the file system in real-time.

6. Which command is used to modify file permissions in Linux? Give an example.

The **chmod** command modifies file permissions:

chmod u+x file.txt

This adds execute permission for the owner (u) to file.txt.

7. A file has permissions -rw-r--r--. What does this mean?

. **Owner:** read (r) and write (w) permissions

. **Group:** read (r) permission

. **Others:** read (r) permission

8. Explain the difference between chown and chgrp with an example.- chown: Changes the owner of a file.

. chgrp: Changes the group ownership of a file.

Example:

chown user file.txt # change owner to "user"

chgrp group file.txt # change group to "group"

9. A file needs to be accessible by multiple users but only writable by the owner. How will you set permissions?To make a file readable by multiple users but only writable by the owner:

chmod 644 file.txt

This sets permissions to rw-r--r--.

10. How do you check the manual page for any Linux commands?Use the man command to view manual pages:

man ls

This displays the manual page for the ls command.

LINUX PROGRAMMING: ASSIGNMENT-3

1. Distinguish between man and whatis commands? Justify with proper example.

. man: Displays detailed manual pages for a command or function.

. whatis: Displays a brief summary of a command or function.

Example:

man ls # displays detailed manual page for ls command

whatis ls # displays a brief summary of ls command

Output:

bash

ls (1) - list directory contents

2. Use the tee command to save the output of ls -l into a file while also displaying it.

ls -l | tee output.txt

This command displays the output of ls -l on the terminal and saves it to output.txt.

3. Explain with an example how the tee command can be used in logging.

The tee command can be used to log output to a file while also displaying it on the terminal.

Example:

./script.sh | tee log.txt

This command runs script.sh, displays the output on the terminal, and saves it to log.txt.

4. List the steps involved in installing Ubuntu 25.04 LTS on Oracle VirtualBox.

1. Download Ubuntu 25.04 LTS ISO file.
2. Create a new virtual machine in Oracle VirtualBox.
3. Configure VM settings (RAM, CPU, storage).
4. Mount the Ubuntu ISO file.
5. Start the VM and follow the installation wizard.
6. Partition the disk and install Ubuntu.
7. Configure user settings and reboot.

5. During Ubuntu OS installation, you face a Kernel Panic Error. How would you troubleshoot it?

1. Check the installation media for corruption.
2. Verify hardware compatibility.
3. Try booting in safe mode or recovery mode.
4. Check for firmware updates.
5. Search online for specific error messages.

7. Which command is used to show the calendar of the year 1984 with August month?7. Which command is used to show the calendar of the year 1984 with August month?

cal 8 1984

8. Write a command to display system uptime and logged-in users together.

w

or

bash

uptime && who

9. Use the find command to list all ".c" files in /home/user.

find /home/user -type f -name "*.c"

10. How do you change file permissions to allow only the owner to read and write?

chmod 600 file.txt

or

bash

chmod u=rw,g=,o= file.txt

LINUX PROGRAMMING: ASSIGNMENT-4

1. A system has a file /etc/passwd. How would you use grep + tee to extract usernames and save them to a file while also displaying them on screen? (CO4)

You can use this command:

bash

grep -o '^[^:]+' /etc/passwd | tee usernames.txt

Explanation: This extracts the usernames (everything before the first colon) from /etc/passwd, saves them to usernames.txt, and shows them on your screen at the same time.

2. A binary isn't found in $PATH. How would you use commands (which, find, locate) to troubleshoot and fix the issue?

- *First, run which <command> to check if the binary is already in your $PATH.*
- *If not found, use locate <binary_name> (make sure the locate database is updated using sudo updatedb) to find where the binary is on your system.*
- *If locate doesn't find it, use find / -name <binary_name> 2>/dev/null to search your whole system.*
- *After finding the binary, add its directory to your $PATH or create a symbolic link* in a directory that's already in $PATH.

3. Write a command pipeline that finds all `.log` files modified in the last 24 hours in `/var/log` and saves results into `log_report.txt`.

bash

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find /var/log -name '*.log' -mtime -1 | tee log_report.txt
```

This finds `.log` files modified within the last day and saves the list to `log_report.txt` while showing it on screen.

4. What is the difference between shutdown -r now and reboot?

- *shutdown -r now safely shuts down running processes before restarting immediately.*
- *reboot restarts the system, sometimes without the graceful shutdown steps.*

Usually, shutdown -r now is safer because it gives programs time to close properly.

5. How can you use the tee command to debug a script that generates both standard output and error messages? (CO4)

Run your script like this:

bash

./script.sh 2>&1 | tee debug.log

This sends both the regular output and error messages to the screen and saves them in debug.log for later review.

6. Explain any three real-world applications of Linux in industries.

1. ***Web Servers**: Linux runs many web servers because it's stable and secure.*
2. ***Embedded Systems**: Linux is used in devices like routers, smart TVs, and IoT gadgets.*
3. ***Supercomputing**: Many scientific labs use Linux on supercomputers for resear*

7. Differentiate application, system, and utility software in the context of Linux environment.

- ***Application software**: Programs for users to do tasks (like web browsers).*
- ***System software**: Core programs managing hardware and system resources (like the Linux kernel).*
- ***Utility software**: Tools for system maintenance and management (like grep and top)*

8. What are the key differences between open-source and proprietary operating systems?

Feature	*Open-source OS*	*Proprietary OS*
Source Code	*Available to everyone*	*Closed, private*
Cost	*Usually free*	*Usually paid*
Customization	*Highly customizable*	*Limited customization*
Support	*Community-driven*	*Vendor provided*
Examples	*Linux, FreeBSD*	*Windows, macOS*

9. Write the command to display the system's kernel version.

bash

uname -r

This will print the version of the Linux kernel your system is running.

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10. What is the difference between head and tail commands in text processing?

- *head shows the **first few lines** (default 10) of a file.*
- *tail shows the **last few lines** (default 10) of a file.*

Both help you quickly peek at parts of a file without opening the whole thing.