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3C – 18

1. What is Linux Operating System (OS)? List three pros and cons of it. (CO1)

Linux is an open-source operating system. It is a kernel and a user-space tools ecosystem. The kernel manages hardware, processes, memory and drivers, and the distributions package the kernel, system tools and applications which then form an OS which can be used and distributed.

Pros of Linux OS:

- Open-source: the source code is open and available to modify.
- Stable and server-efficient.
- Wide hardware and tools support.

Cons of Linux OS:

- Not very easy to learn for beginners due to the CLI and permissions model.
- Linux has many distros/versions and different installation methods which can confuse a user.
- Users may face difficulty while sharing files when trying to work in a cross-platform environment.

2. Differentiate between Linux, Mac, Android, and Windows OS with at least six unique features. (CO1)

Linux	Mac	Android	Windows
Open-source kernel	XNU hybrid kernel	Built on top of Linux kernel	NT kernel
Runs on almost all hardware	Exclusive to Apple integration	Designed mainly for mobile devices, smart TVs and wearables.	Dominant on desktops and also used in some enterprise servers
Uses package managers like apt, yum, pacman, snap.	Packages are distributed as .app or via the App Store.	Packages are distributed as .apk or via Google Play and sideloading.	Packages are distributed as .exe or .msi and also through the Microsoft Store.
Extremely customisable.	Uses HFS+/APFS as default file system.	Drivers usually tied to device SoC vendors, leading to fragmentation.	Broadest hardware/driver support due to vendor partnerships.
Strong community support.	Emphasis on design/UI consistency.	Highly customized by manufacturers.	Strong backward compatibility for legacy software.

Frequent updates and fast patch cycles.	Security through Gatekeeper and notarization.	Security handled via Google Play Protect.	Centralized **Windows Update** system for patches and fixes.

3. Why is Linux preferred for Mainframe Servers for legacy application? Give three out-of-the-box technical reasons. (CO1)

1. Linux on mainframes is tuned for massive input/output, so it handles heavy legacy workloads smoothly.
2. Built-in virtualization lets hundreds of Linux systems run safely on one mainframe, keeping old apps consolidated.
3. Legacy UNIX and C programs can run with little change, and vendors like Red Hat and SUSE give long-term support.

4. Explain the structure of the Linux File System with proper diagram. Note: you can use the tree command to find it out. (CO2)

```
/
├── bin
├── boot
├── dev
├── etc
├── home
│   └── haz
├── lib
├── lib64
├── media
├── mnt
├── opt
├── proc
├── root
├── run
├── sbin
├── srv
├── sys
├── tmp
├── usr
│   ├── bin
│   ├── lib
│   ├── share
│   └── local
└── var
    ├── cache
    ├── log
```

└─ spool

5. If Linux OS is open-source, how do companies like Red Hat still making money from it? Do a market study and answer properly. (CO2)
Even though Linux itself is free and open source, companies like Red Hat make money by packaging it in a reliable, enterprise-ready form. What customers really pay for are the tested builds, regular security fixes and guaranteed long-term support that Red Hat provides through subscriptions. On top of that, Red Hat spends a lot of effort making sure its systems run smoothly on different kinds of hardware and cloud platforms and this level of certification saves businesses time and risk. The company also earns by offering training, consulting and managed services for organizations that need expert help. Finally, products like OpenShift, which build on Linux and add tools for containers and orchestration, bring in additional revenue because they solve practical problems at scale.

6. Write the command to display today's date and time (i.e., current System time). (CO1)
date

7. Which command is used to check how long the system has been running? (CO1)
uptime (shows how long the system has been up)
who -b (shows last system boot time)
cat /proc/uptime (seconds since boot)

8. What is the difference between shutdown -h now and halt? (CO1)
shutdown -h now requests an orderly shutdown and notifies logged in users, stops services, unmounts filesystems and then powers off the machine.
halt historically stops the kernel and may or may not power off the machine or fully unmount filesystems depending on the init systems and options.

9. Compare init 0 and shutdown -h. Which is safer? Why? (CO1)
init 0 tells SysV init to switch to runlevel 0 (halt). It is older-style and causes the system to transition immediately to the halt runlevel; its behavior depends on legacy init scripts.
shutdown -h is the controlled method: it schedules immediate shutdown (-h now) and by convention notifies users, runs shutdown hooks (runs scripts to stop services) and unmounts filesystems.

10. A system administrator accidentally powers off a Server machine without shutting it down properly. What problems can occur to the said Server? (CO2)
The problems that could occur to the server are:

- Files can get corrupted if the system was writing when power was cut.

- Databases may lose recent changes or fail to start cleanly.
- Services can leave behind broken states or temporary files.
- Hardware like hard drives may get stressed by sudden power loss.
- Backups or running tasks may be incomplete.
- The server might take longer to boot because it has to repair errors.