**Linux Programming Assignment 1**

1. **What is Linux Operating System OS? List three pros and cons of it.**
   1. Linux is an open source operating system kernel started by Linus Torvalds in 1991 that powers complete OS distributions like RHEL Ubuntu Debian Android and many others across servers desktops phones and embedded devices.
   2. Pros include strong security and stability due to a large community and long term support releases broad hardware and cloud portability and deep customization because the code and tooling are open.
   3. Cons include a learning curve if coming from Windows or Mac occasional driver or proprietary software issues and gaming or niche app gaps compared to commercial ecosystems though this has improved over time.
2. **Differentiate between Linux, Mac, Android, and Windows OS with at least six unique features.**
   1. Linux is open source with many distros uses the Linux kernel typical package managers like apt dnf or Pacman and is popular for servers devops and cybersecurity work.
   2. macOS uses Apple’s Darwin base with the XNU kernel integrates tightly with Apple hardware and services and focuses on a polished GUI and curated ecosystem through App Store and signed software distribution.
   3. Android is a mobile OS built on the Linux kernel with the ART runtime and a Google led ecosystem optimized for phones and tablets with app distribution through Play and OEM. stores.
   4. Windows uses the NT kernel is proprietary integrates deeply with Microsoft services and Active Directory has broad commercial software and gaming support and uses executable installers and the Microsoft Store instead of native Linux style package managers.
   5. Security models differ as Linux and Android emphasize permissions capabilities SELinux or similar MAC frameworks while macOS uses Gatekeeper SIP and notarization and Windows emphasizes Defender SmartScreen and enterprise controls like Group Policy and AD.  
      Update strategies differ as Linux distros push repo based or image based updates macOS does periodic system updates tied to hardware and Windows uses Windows Update with well-defined enterprise channels.
3. **Why is Linux preferred for Mainframe Servers for legacy application? Give three out-of-the-box technical reasons.**
   1. Linux on IBM Z or LinuxONE gives extreme vertical scalability high I O throughput and near continuous availability which is ideal for core banking payment rails and large transactional systems.
   2. It brings modern Linux tooling containers and automation onto mainframes while keeping hardware features like pervasive encryption secure boot and hardware cryptography that harden legacy workloads without major app rewrites.
   3. Enterprises get lower complexity with partitioning and consolidation plus mature disaster recovery RPO and RTO characteristics on LinuxONE that simplify running legacy stacks at scale.
4. **Explain the structure of the Linux File System with proper diagram. Note you can use the tree command to find it out.**

A diagram of a computer system

AI-generated content may be incorrect.

* 1. At the top is the root directory represented by a single slash which contains key directories like bin for essential user binaries sbin for system binaries etc for system configs var for logs and variable data home for users usr for shared read only software and docs and tmp for temporary files.
  2. Special virtual filesystems like proc and sys expose kernel and device info while dev holds device nodes and mnt or media are used for mounting external filesystems which together align with the Filesystem Hierarchy Standard used by mainstream distros.
  3. Running the tree command from the root with appropriate permissions shows this hierarchy but on real systems tree is often run per directory like tree etc or tree usr for clarity and speed.

1. **If Linux OS is open source how do companies like Red Hat still making money from it Do a market study and answer properly.**
   1. Red Hat monetizes through subscriptions that bundle certified tested builds support SLAs security patches lifecycle guarantees and management tooling rather than selling the code itself which remains open.
   2. Revenue also comes from platforms and services like OpenShift automation training and certifications plus partnerships and hardware certifications that enterprises value for compliance and reliability.
   3. This model aligns enterprise needs with open source by funding sustained engineering and security backports while customers pay for trust stability and support across data centre and cloud.

A diagram of a computer program

AI-generated content may be incorrect.

1. **Write the command to display today’s date and time i.e. current System time.**
   1. Use the **date** command for a quick one liner and on **systemd systems timedatectl** status shows detailed time settings including NTP sync.
2. **Which command is used to check how long the system has been running?**
   1. Use the **uptime** command which prints current time up time users logged in and load averages in one line.
3. **What is the difference between shutdown h now and halt?**
   1. Shutdown h now tells the init system to bring the machine down cleanly then halt which stops the system after notifying users and terminating services in order while halt directly stops the system and in some setups may not power off or send the same coordinated signals.  
      On modern systemd based distros these map to systemctl poweroff or systemctl halt but using shutdown or systemctl poweroff is generally preferred for a graceful stop of services.
4. **Compare init 0 and shutdown h Which is safer? Why?** 
   1. init 0 or on systemd systems telinit 0 switches to the halt or poweroff target but does not provide the same user notification and controlled scheduling that shutdown offers which can increase risk to running services.
   2. shutdown h is safer because it coordinates a clean shutdown broadcasts warnings and sequences service stop operations reducing chances of data loss or corruption in live workloads.
5. **A system administrator accidentally powers off a Server machine without shutting it down properly What problems can occur to the said Server?**
   1. Unclean power off can cause filesystem issues where the journal must be replayed and in unlucky cases metadata or recent writes may be lost especially on poorly configured barriers or caches.
   2. Databases and message queues can require recovery or reindexing and RAID or storage stacks may resync while application state not flushed to disk can be corrupted or lost.  
      Repeated sudden power losses can also damage disks increase SMART errors and escalate mean time to failure in storage hardware over time.

***Brainstorming:*** As the Linux Kernel is open source can we build our own operating system b In order to do that what are the stoppers hurdles and challenges c Is anyone in India working on this field Find at least three to four engineers. Yes it is totally possible to build a custom OS or a distro on top of the Linux kernel and the broader ecosystem which is how many distros and embedded systems are made today. Real world blockers include bootstrapping a toolchain and build system choosing an init system and package manager device driver coverage secure boot and update pipelines long term maintenance of CVEs and backports and the heavy CI and release engineering work enterprises expect. There are active engineers in India contributing to Linux such as [Amit Shah](https://www.linkedin.com/in/am1tshah/?originalSubdomain=de) who has maintained virtio subsystems linked to virtualization [Aneesh Kumar K V](https://www.linkedin.com/in/kvaneesh/) who has worked on memory management and ext4 features and [Nitin Gupta](https://www.linkedin.com/in/nitingupta910/) who maintains zram and zsmalloc among other memory management components.

**Amit Shah (**[**LinkedIn**](https://www.linkedin.com/in/am1tshah/?originalSubdomain=de)**)**

* The FOSDEM 2016 speaker page states he maintains kernel and QEMU subsystems, notably virtio serial and virtio rng.
* Fedora’s VirtioSerial feature page lists Owner Name Amit Shah for the virtio serial implementation and testing in Fedora.
* Patchwork discussion threads for virtio serial include messages and contributions from Amit Shah on the Linux kernel mailing lists.
* Fedora’s VirtioSerial Test Day instructions reference running Amit’s test suite for virtio serial validation.

**Aneesh Kumar K V (**[**LinkedIn**](https://www.linkedin.com/in/kvaneesh/)**)**

* LWN explains that the Linux kernel gained a formal concept of memory tiers in 6.1 via a series from Aneesh Kumar K V, confirming his MM subsystem work upstream.
* linux conf au speaker profile notes Aneesh as an active contributor in memory management and KVM, aligning with his MM work upstream.
* Aneesh’s professional profile details contributions to memory management and ext4 features like multiblock allocator and delayed allocation, providing further attribution of his filesystem work.

**Nitin Gupta (**[**LinkedIn**](https://www.linkedin.com/in/nitingupta910/)**)**

* Linux Plumbers Conference bio states he is the maintainer of zram and zsmalloc in the Linux kernel, confirming his role in these memory management components.
* LKML MAINTAINERS update thread shows zram maintainers list including Nitin Gupta, providing canonical evidence of his maintainer status.
* The kernel’s zram documentation includes Nitin Gupta’s name and email on the doc page, tying him directly to the subsystem’s documentation and authorship