Linux Programming - Assignment 1

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Q1. What is Linux Operating System (OS)? List three pros and cons.

Linux is an open-source, Unix-like operating system built around the Linux kernel. The kernel manages hardware resources and acts as a bridge between hardware and applications.

Pros:
1. Free & open-source – you can access and modify the code.
2. Stable and secure – widely used in servers and mission-critical systems.
3. Flexible – many distributions and customizable.

Cons:
1. Hardware driver issues – some devices have limited support.
2. Steeper learning curve – harder for beginners.
3. Limited software availability – fewer mainstream desktop apps compared to Windows.

Q2. Differentiate between Linux, macOS, Android, and Windows OS with six unique features each.

Linux:
1. Open-source kernel with many distributions.
2. Highly customizable for different uses.
3. Uses package managers for software.
4. Common in servers and embedded systems.
5. Strong command-line tools.
6. Free licensing.

macOS:
1. Proprietary Apple OS.
2. Polished GUI and integration with Apple ecosystem.
3. Unix-based.
4. Strong focus on designers/developers.
5. Limited to Apple hardware.
6. Paid license and controlled updates.

Android:
1. Mobile OS built on Linux kernel.
2. App-based ecosystem.
3. OEMs customize it.
4. Supports sensors like GPS and camera.
5. Runs on phones, TVs, wearables.
6. Sandboxed app security model.

Windows:
1. Largest desktop software support.
2. Proprietary by Microsoft.
3. Strong backward compatibility.
4. GUI-first OS.
5. Enterprise management tools.
6. Licensed and frequently updated.

Q3. Why is Linux preferred for Mainframe servers and legacy applications?

1. Portability across architectures, including mainframes.
2. High stability and uptime for heavy workloads.
3. Strong community and frequent security patches.

Q4. Explain the structure of the Linux File System with a diagram/tree.

Linux follows a single-root hierarchy starting from '/'.

Structure:

```
/ - root directory
├── /bin - essential commands
├── /boot - boot files
├── /dev - device files
├── /etc - system configs
├── /home - user directories
├── /lib - libraries
├── /media - removable media
├── /mnt - temporary mounts
├── /opt - optional packages
├── /proc - process info
├── /root - root user home
├── /sbin - system binaries
├── /srv - service data
├── /tmp - temporary files
├── /usr - user programs
└── /var - logs and variable data
```

Q5. If Linux is open-source, how do companies like Red Hat make money?

Red Hat earns through:

1. Subscriptions for tested and supported enterprise software.
2. Consulting, deployment, and training services.
3. Value-added products like OpenShift, Ansible, etc.

Customers pay for security, reliability, and long-term support.

Q6. Command to display today's date and time.

Command: date

Example: date "+%Y-%m-%d %H:%M:%S"

Q7. Which command checks system uptime?

Command: uptime

Q8. Difference between ‘shutdown -h now‘ and ‘halt‘.

‘shutdown -h now‘: Performs graceful shutdown, stops services, unmounts filesystems.
‘halt‘: Stops the CPU, may not perform full shutdown sequence.
Shutdown is safer.

Q9. Compare ‘init 0‘ and ‘shutdown -h‘. Which is safer?

‘init 0‘: Switches to runlevel 0 (halts system).
‘shutdown -h‘: Notifies users, cleans up, then halts.
Shutdown -h is safer as it follows proper shutdown steps.

Q10. Problems if server is powered off without proper shutdown.

1. Filesystem corruption.
2. Data loss.
3. Application inconsistency.
4. Hardware stress.
5. Longer recovery time.

Brainstorming a) Can we build our own OS from Linux kernel?

Yes, by combining the Linux kernel with userland tools and package managers.

Brainstorming b) Challenges in building your own OS.

1. Hardware drivers and support.
2. Packaging and software management.
3. Security updates.
4. Testing and quality assurance.
5. Community and ecosystem support.
6. Legal and licensing issues.

Brainstorming c) Engineers in India working in Linux/OS field.

1. C-DAC team (developers of BOSS Linux).
2. Gautham Shenoy R – Linux kernel contributor.
3. Ananth N Mavinakayanahalli – Linux contributor.
4. Vaishali Thakkar – open-source contributor.