**Linux Programming: Assignment-4**

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**Q1) A system has a file /etc/passwd. How would grep + tee be used to extract usernames and save them to a file while also displaying them on screen?**

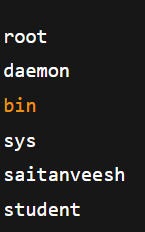
1. The file /etc/passwd contains details of all user accounts. The first field before : is the **username**.
2. To extract usernames:

cut -d: -f1 /etc/passwd | grep "" | tee usernames.txt

**Explanation:**

1. cut -d: -f1 → splits each line by : and takes the first field (the username).
2. grep "" → simply passes the output (can be used to filter specific names if needed).
3. tee usernames.txt → displays the usernames on screen and also saves them into usernames.txt.

**Sample Output:**



**Q2) A binary isn’t found in $PATH. How would commands (which, find, locate) be used to troubleshoot and fix the issue?**

1. **Check with which:**
2. which binary\_name

If nothing is returned, the binary is not in $PATH.

1. **Search with find:**
2. find / -name binary\_name 2>/dev/null

This searches the entire filesystem.

1. **Search with locate:**
2. locate binary\_name

Faster, but relies on

Once found, add its directory to $PATH:

export PATH=$PATH:/path/to/binary

To make it permanent, add that line in ~/.bashrc or ~/.profile.

**Q3) 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.**

find /var/log -name "\*.log" -mtime -1 | tee log\_report.txt

Explanation:

1. find /var/log → start searching in /var/log.
2. -name "\*.log" → only .log files.
3. -mtime -1 → modified within the last 1 day (24 hours).
4. tee log\_report.txt → display results on screen and save into log\_report.txt.

**Q4) What is the difference between shutdown -r now and reboot?**

* shutdown -r now
  1. Initiates a proper shutdown sequence and then restarts the system.
  2. Notifies users, stops processes safely, unmounts filesystems, then reboots.
* reboot
  1. Directly reboots the system.
  2. On modern systems (systemd), it also performs a safe shutdown internally, but traditionally it was a faster, less controlled restart.

**Safer option:** shutdown -r now because it ensures an orderly restart.

**Q5) How can the tee command be used to debug a script that generates both standard output and error messages?**

When running scripts, sometimes both **stdout** and **stderr** are needed for debugging.  
Example:

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

Explanation:

1. 2>&1 → redirects error stream (stderr) into output stream (stdout).
2. tee debug.log → shows everything live on screen and also saves into debug.log.

This way, both normal messages and error messages are captured for later analysis.

**Q6) Explain any three real-world applications of Linux in industries.**

1. **Web Servers:**
   1. Most web servers (Apache, Nginx) run on Linux.
   2. Example: Google, Facebook, and most of the internet backbone.
2. **Cloud & Virtualization:**
   1. AWS, Azure, and GCP use Linux as their foundation.
   2. OpenStack, Docker, Kubernetes also depend heavily on Linux.
3. **Embedded Systems:**
   1. Linux is used in routers, IoT devices, smart TVs, automotive infotainment (Android Auto).
   2. Reliable, cost-effective, open-source choice.

**Q7) Differentiate application, system, and utility software in the context of Linux.**

* **Application Software**
  1. Programs for end-users.
  2. Examples: LibreOffice, Firefox, GIMP.
* **System Software**
  1. OS components that manage hardware and core functions.
  2. Linux kernel, device drivers.
* **Utility Software**
  1. Small programs that help maintain and optimize the system.
  2. Examples: ls, top, df, grep.

**Q8) What are the key differences between open-source and proprietary operating systems?**

| **Aspect** | **Open-Source OS (Linux)** | **Proprietary OS (Windows/macOS)** |
| --- | --- | --- |
| **Source Code** | Publicly available, can be modified | Closed, only vendor controls it |
| **Cost** | Free or very low | Paid license or bundled cost |
| **Flexibility** | Highly customizable | Limited customization |
| **Security** | Audited by community, fast patches | Vendor dependent for fixes |
| **Support** | Community + paid enterprise support | Vendor official support |
| **Examples** | Linux, BSD | Windows, macOS |

**Q9) Write the command to display the system’s kernel version.**

uname -r

Example Output:

6.8.0-45-generic

Alternatively:

uname -a

Shows kernel version plus architecture, hostname, and build details.

**Q10) What is the difference between head and tail commands in text processing?**

* **head command**
  1. Displays the **first lines** of a file (default: first 10 lines).
  2. Example:
  3. head logfile.txt
* **tail command**
  1. Displays the **last lines** of a file (default: last 10 lines).
  2. Example:
  3. tail logfile.txt

**Options:**

1. head -n 20 logfile.txt → first 20 lines.
2. tail -n 20 logfile.txt → last 20 lines.
3. tail -f logfile.txt → live monitoring (useful for logs).