LINUX PROGRAMMING

ASSIGNMENT-4

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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?

A.

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

- grep -E '^[^:]+' /etc/passwd --- selects all lines. In most cases you can forgo the grep command and just use cut -d: -f1.
- cut -d: -f1 --- grabs the first field (the username) from each line.
- tee usernames.txt --- sends the output to usernames.txt and shows it on the screen.

```
vboxuser@abyukth:~/student/project$ grep -E '^[^:]+' /etc/passwd | cut -d: -f1
tee usernames.txt
root
daemon
bin
sys
sync
games
man
lp
mail
news
uucp
proxy
www-data
backup
list
irc
_apt
nobody
systemd-network
systemd-timesync
```

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

A.

1. Check with which:
2. which binary_name

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

3. Search with find:
4. Find / -name binary_name 2>/dev/null

This searches the entire filesystem.

5. Search with locate:
6. locate binary_name

Faster, but relies on

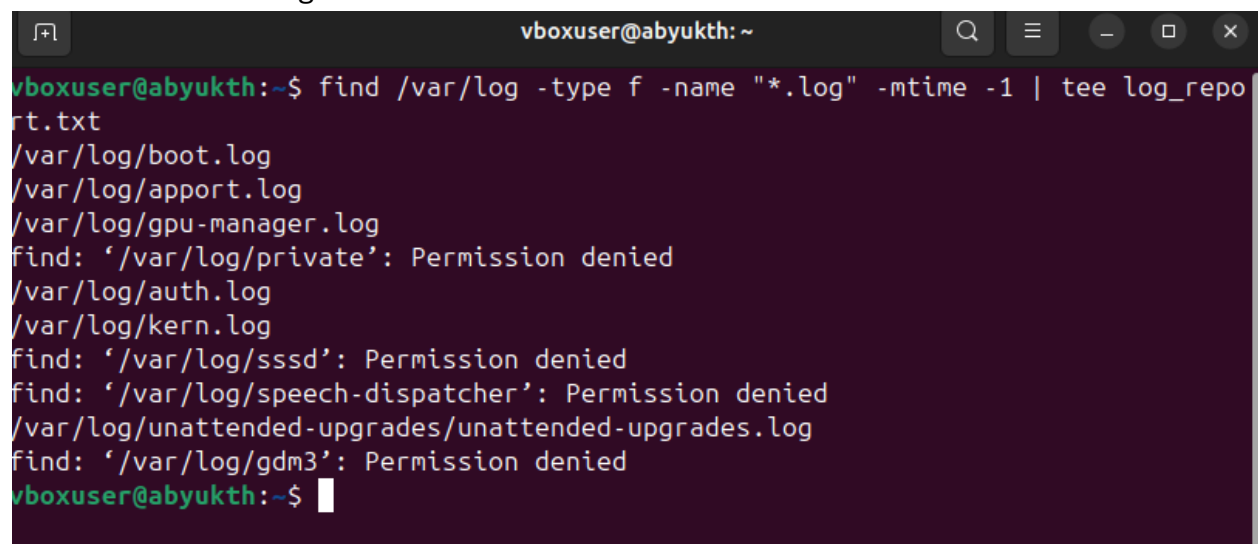Once found, add its directory to $PATH:

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

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.?

A.

Command pipeline that finds all:

- find /var/log -type f -name "*.log" -mtime -1 | tee log_report.txt

Let's Breakdown the given command

```
vboxuser@abyukth:~$ find /var/log -type f -name "*.log" -mtime -1 | tee log_repo
rt.txt
/var/log/boot.log
/var/log/apport.log
/var/log/gpu-manager.log
find: '/var/log/private': Permission denied
/var/log/auth.log
/var/log/kern.log
find: '/var/log/sssd': Permission denied
find: '/var/log/speech-dispatcher': Permission denied
/var/log/unattended-upgrades/unattended-upgrades.log
find: '/var/log/gdm3': Permission denied
vboxuser@abyukth:~$
```

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

A.

"shutdown -r now":

- The shutdown --- command is a more graceful and controlled operation.
- -r --- which instructs the system to restart once the shutdown is complete.
- now --- states the time to execute the shutdown (immediately in this case).

What it does:

- Notifies all logged-in users of the shutdown.
- Cleansly stops all services.
- Unmounts filesystems.
- Reboots the system.

Syntex: sudo shutdown –r now.

"reboot":

- "reboot"--- is a command that literally tells the kernel to restart.
- Not as verbose may not notify every user based on system settings.
- Modern systems (systemd-based) usually call systemctl reboot under the hood.

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

A.

When running scripts, sometimes both stdout and stderr are needed for debugging.
Example: (./myscript.sh 2>&1 | tee debug.log)

- ./yourscript.sh --- runs your script.
- 2>&1 ---- redirects stderr (2) to stdout (1), so both output streams go together.
- | tee debug.log ----- writes all output to debug.log and displays it on the terminal.

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

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

A.

Web Hosting and Cloud Servers:

- Industry: IT, Cloud Computing.
- Application: Linux is the operating system behind web servers (Apache nginx) and cloud infrastructure providers (AWS, Google Cloud, Azure VMs).
- Reason:
  - Reliable and secure for 24/7 uptime.
  - Open source -- Cost-effective.
  - Customizable to specific server demands (no vendor lock).
  - Example: Most web hosting services utilize Linux-based servers to host applications and websites.

Supercomputing and Research:

- Field: Scientific Research, AI, Aerospace
- Usage: Linux is ubiquitous in high-performance computing (HPC) clusters and research lab environments.
- Reason:
  - Encourages parallel processing and distributed computing.
  - Highly configurable for large workloads and massive computational problems.
- Example:
  - A majority of Top500 supercomputers run Linux.
  - NASA and CERN utilize Linux for simulations, data analysis, and scientific computing.

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

A.

- **Application Software**
  - Programs designed to perform specific user tasks.
  - Directly used by end-users.
  - Depends on system software to run.
- **System Software**
  - Software that manages and controls hardware and provides a platform for applications.
  - Mainly interacts with hardware and applications; users use indirectly.
  - Can operate independently to manage hardware.

- **Utility Software**
  - Programs that perform maintenance, optimization, or management tasks on the system.
  - Can be used by both system admins and end-users for maintenance tasks.
  - Depends on system software to access hardware/resources.

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

A.

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

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

A.

"uname -r" is the command to dispaly the system's kernel version.

```
vboxuser@abyukth:~$ uname -r
6.11.0-24-generic
vboxuser@abyukth:~$
```

Onther way:

"uname -a" Shows kernel version plus architecture, hostname, and build details.

```
vboxuser@abyukth:~$ uname -a
Linux abyukth 6.11.0-24-generic #24~24.04.1-Ubuntu SMP PREEMPT_DYNAMIC Tue Mar 2
5 20:14:34 UTC 2 x86_64 x86_64 x86_64 GNU/Linux
vboxuser@abyukth:~$
```

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

A.

head command:
- Displays the first lines of a file (default: first 10 lines).
- Example:
- head logfile.txt

tail command:
- Displays the last lines of a file (default: last 10 lines).
- Example:
- tail logfile.txt