LAB 7

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REG NO: 2023-BSE-038
CLASS: BSE-5A
SUBJECT: CC

LAB TITLE: Environment Variables, PATH, UFW, and SSH Key Authentication

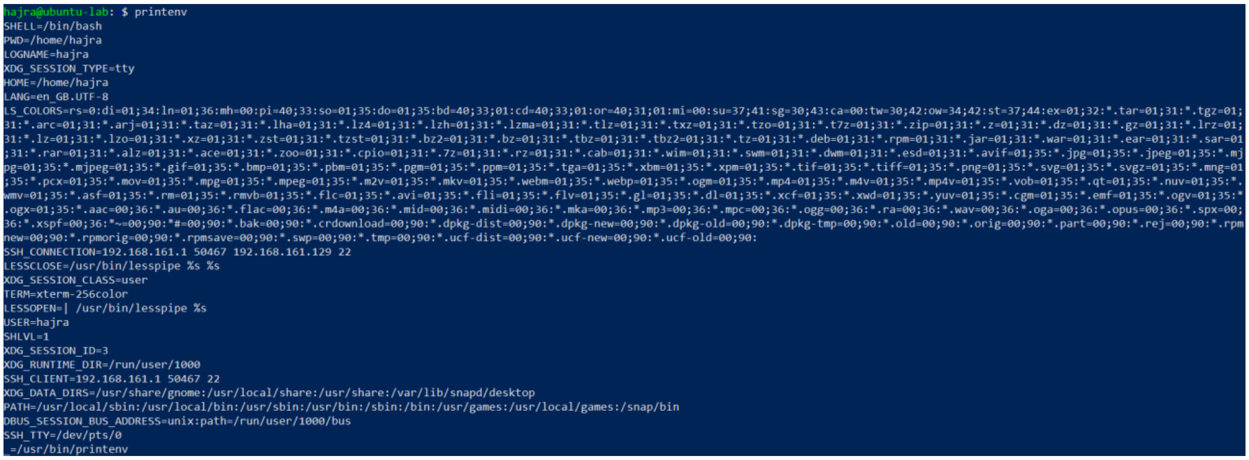
TASK:

Task 1: Print & Filter Environment Variables

Goal:

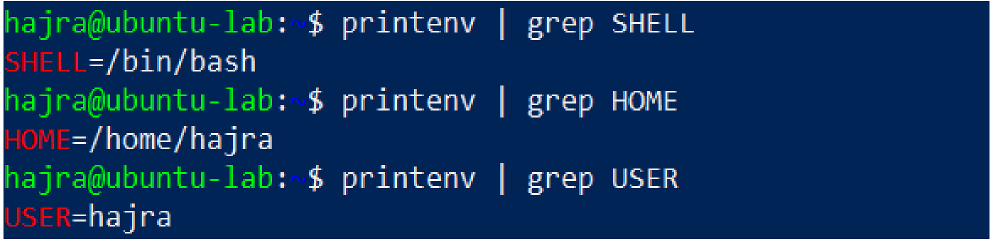
Show environment variables and filter them using grep.

1. **Print all environment variables**



```
hajra@ubuntu-lab:~$ printenv
SHELL=/bin/bash
PWD=/home/hajra
LOGNAME=hajra
XDG_SESSION_TYPE=tty
HOME=/home/hajra
LANG=en_GB.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=00:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;
31:*.arc=01;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;
31:*.lz=01;31:*.lzo=01;31:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01
;31:*.rar=01;31:*.alz=01;31:*.ace=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.avif=01;35:*.jpg=01;35:*.jpeg=01;35:*.mj
pg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01
;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.webp=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.
wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*
.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;
36:*.xspf=00;36:*~=00;90:*#=00;90:*.bak=00;90:*.crdownload=00;90:*.dpkg-dist=00;90:*.dpkg-new=00;90:*.dpkg-old=00;90:*.dpkg-tmp=00;90:*.old=00;90:*.orig=00;90:*.part=00;90:*.rej=00;90:*.rpm
new=00;90:*.rpmorig=00;90:*.rpmsave=00;90:*.swp=00;90:*.tmp=00;90:*.ucf-dist=00;90:*.ucf-new=00;90:*.ucf-old=00;90:
SSH_CONNECTION=192.168.161.1 50467 192.168.161.129 22
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=hajra
SHLVL=1
XDG_SESSION_ID=3
XDG_RUNTIME_DIR=/run/user/1000
SSH_CLIENT=192.168.161.1 50467 22
XDG_DATA_DIRS=/usr/share/gnome:/usr/local/share:/usr/share:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus
SSH_TTY=/dev/pts/0
_=/usr/bin/printenv
```

2. **Filter for SHELL, HOME, USER**



```
hajra@ubuntu-lab:~$ printenv | grep SHELL
SHELL=/bin/bash
hajra@ubuntu-lab:~$ printenv | grep HOME
HOME=/home/hajra
hajra@ubuntu-lab:~$ printenv | grep USER
USER=hajra
```

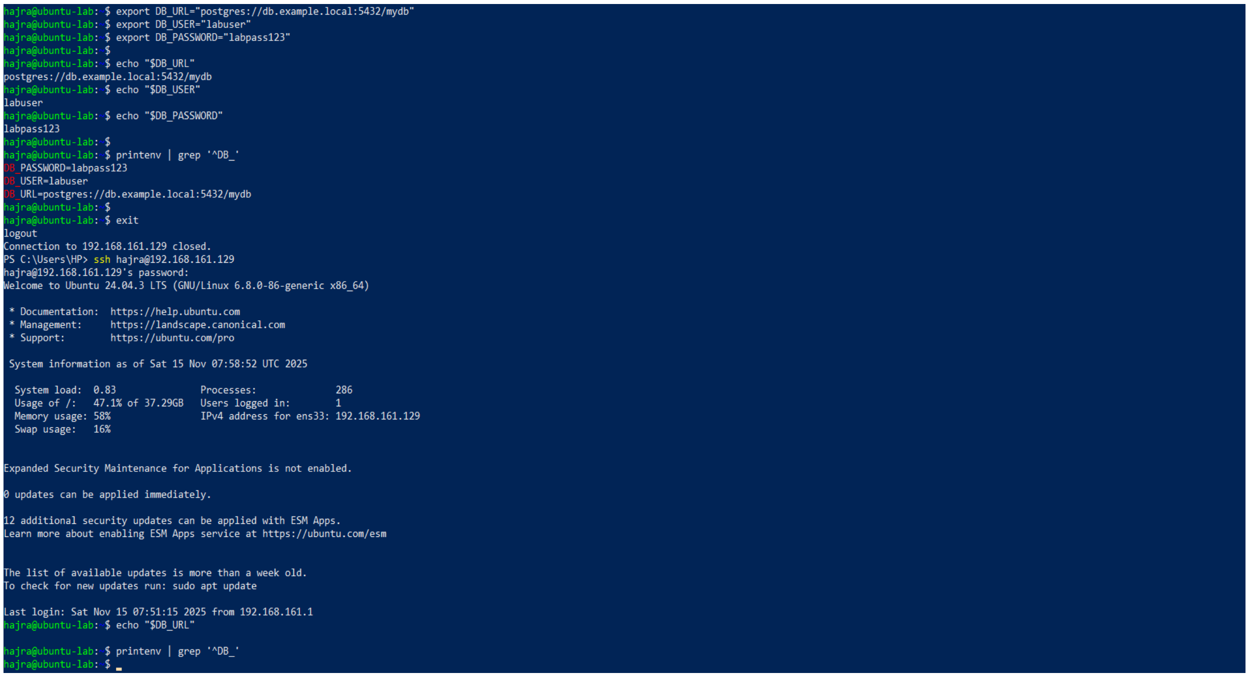
Task 2: Export DB_ Variables Temporarily and Observe Scope

Goal:

Create environment variables with export in the current shell, verify them, then close the shell and confirm the variables disappear.

1. **Define all DB_ variables**
2. **Echo the three variables**
3. **Show all DB_ variables using grep**
4. **Close and reopen the shell — verify variables are gone**

Screenshort:



```
hajra@ubuntu-lab:~$ export DB_URL="postgres://db.example.local:5432/mydb"
hajra@ubuntu-lab:~$ export DB_USER="labuser"
hajra@ubuntu-lab:~$ export DB_PASSWORD="labpass123"
hajra@ubuntu-lab:~$
hajra@ubuntu-lab:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
hajra@ubuntu-lab:~$ echo "$DB_USER"
labuser
hajra@ubuntu-lab:~$ echo "$DB_PASSWORD"
labpass123
hajra@ubuntu-lab:~$
hajra@ubuntu-lab:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
hajra@ubuntu-lab:~$
hajra@ubuntu-lab:~$ exit
logout
Connection to 192.168.161.129 closed.
PS C:\Users\HP> ssh hajra@192.168.161.129
hajra@192.168.161.129's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.8.0-86-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sat 15 Nov 07:58:52 UTC 2025

  System load:  0.83               Processes:             286
  Usage of /:   47.1% of 37.29GB   Users logged in:       1
  Memory usage: 58%                IPv4 address for ens33: 192.168.161.129
  Swap usage:   16%


Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

12 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm


The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Nov 15 07:51:15 2025 from 192.168.161.1
hajra@ubuntu-lab:~$ echo "$DB_URL"

hajra@ubuntu-lab:~$ printenv | grep '^DB_'
hajra@ubuntu-lab:~$ _
```

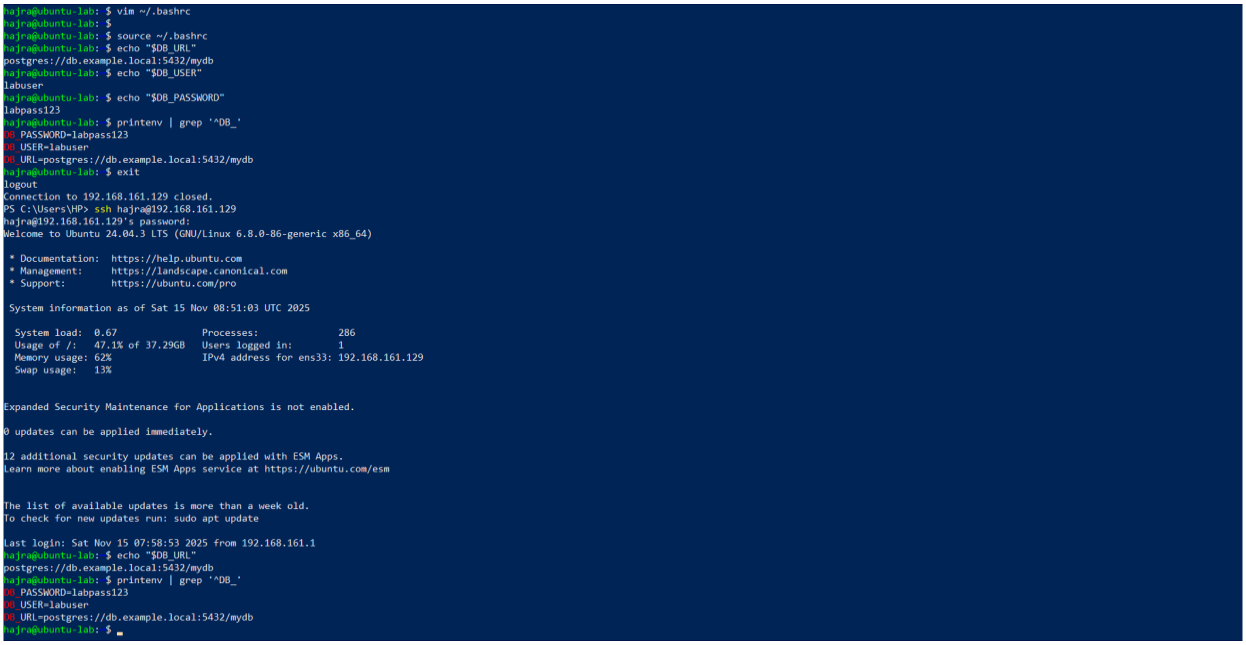
Task 3: Make DB_ Variables Persistent in ~/.bashrc*

Goal:

Add DB_* variables to ~/.bashrc, reload the file, and verify persistence.

1. ***Add the DB_ variables inside ~/.bashrc****
2. ***Source ~/.bashrc and verify***
3. ***Close and reopen the terminal — verify persistence***

Screenshort:



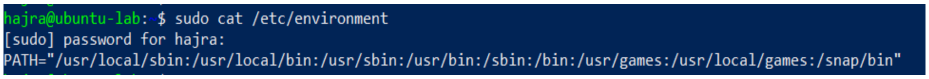
```
hajra@ubuntu-lab:~$ vim ~/.bashrc
hajra@ubuntu-lab:~$
hajra@ubuntu-lab:~$ source ~/.bashrc
hajra@ubuntu-lab:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
hajra@ubuntu-lab:~$ echo "$DB_USER"
labuser
hajra@ubuntu-lab:~$ echo "$DB_PASSWORD"
labpass123
hajra@ubuntu-lab:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
hajra@ubuntu-lab:~$ exit
logout
Connection to 192.168.161.129 closed.
PS C:\Users\HP> ssh hajra@192.168.161.129
hajra@192.168.161.129's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.8.0-86-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sat 15 Nov 08:51:03 UTC 2025

  System load:  0.67               Processes:             286
  Usage of /:   47.1% of 37.29GB   Users logged in:       1
  Memory usage: 62%                IPv4 address for ens33: 192.168.161.129
  Swap usage:   13%


Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

12 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm


The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Nov 15 07:58:53 2025 from 192.168.161.1
hajra@ubuntu-lab:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
hajra@ubuntu-lab:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
hajra@ubuntu-lab:~$ _
```

Task 4: System-wide Environment Variable, Welcome Script, and PATH

Goal:

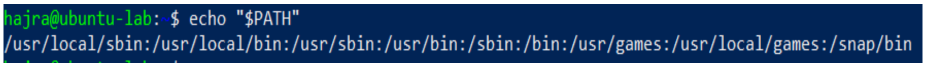
Add a system-wide Class variable to /etc/environment, view PATH, create a welcome script, make it executable, and add a PATH entry to ~/.bashrc so the script can run without ./.

1. **View /etc/environment**



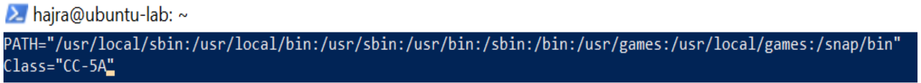
```
hajra@ubuntu-lab:~$ sudo cat /etc/environment
[sudo] password for hajra:
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
```

2. **Show current PATH**



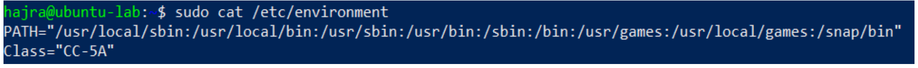
```
hajra@ubuntu-lab:~$ echo "$PATH"
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
```

3. **Edit /etc/environment to add Class variable**



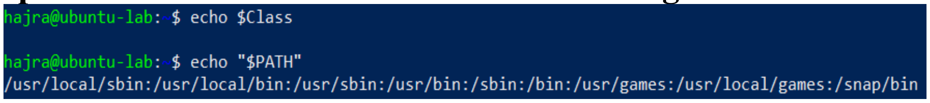
hajra@ubuntu-lab: ~

```
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
Class="CC-5A"
```



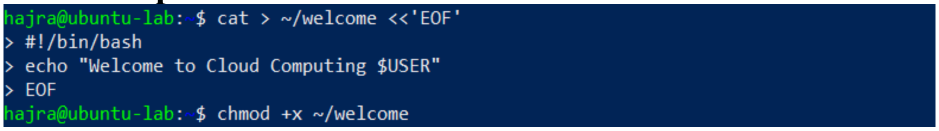
```
hajra@ubuntu-lab:~$ sudo cat /etc/environment
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
Class="CC-5A"
```

4. **Re-login / open new shell — show Class and PATH together**



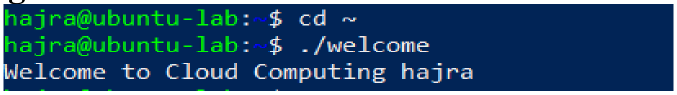
```
hajra@ubuntu-lab:~$ echo $Class

hajra@ubuntu-lab:~$ echo "$PATH"
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
```

5. **Create welcome script and make it executable**



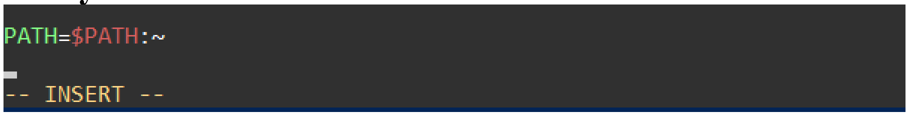
```
hajra@ubuntu-lab:~$ cat > ~/welcome <<'EOF'
> #!/bin/bash
> echo "Welcome to Cloud Computing $USER"
> EOF
hajra@ubuntu-lab:~$ chmod +x ~/welcome
```

6. **Run the script using ./welcome**



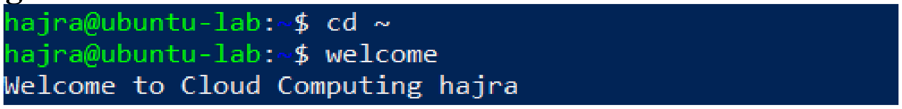
```
hajra@ubuntu-lab:~$ cd ~
hajra@ubuntu-lab:~$ ./welcome
Welcome to Cloud Computing hajra
```

7. **Add PATH entry to ~/.bashrc**



```
PATH=$PATH:~

-- INSERT --
```

8. **Apply changes and run welcome without ./**



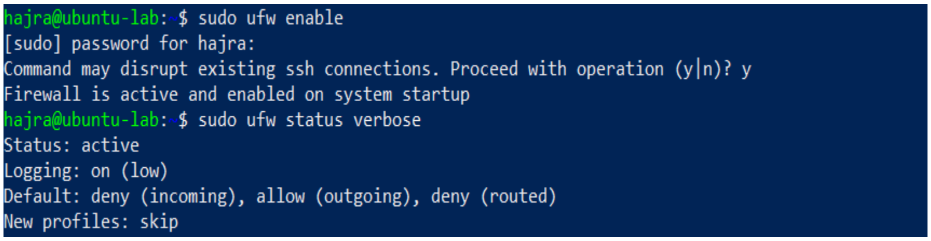
```
hajra@ubuntu-lab:~$ cd ~
hajra@ubuntu-lab:~$ welcome
Welcome to Cloud Computing hajra
```

Task 5 — Block and Allow SSH Using UFW (Firewall)

Goal:

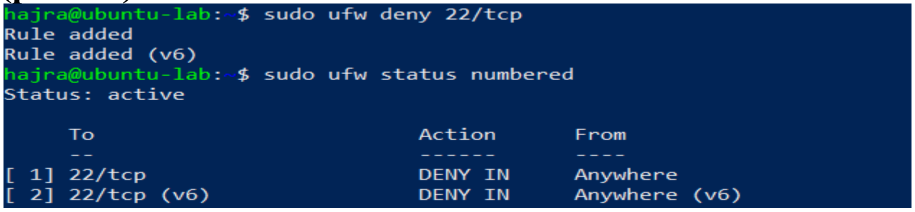
Use `ufw` to deny and allow SSH access, then verify the connectivity changes from the Windows host.

1. **Enable UFW and show its status**



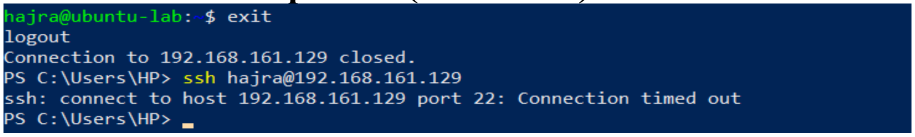
```
hajra@ubuntu-lab:~$ sudo ufw enable
[sudo] password for hajra:
Command may disrupt existing ssh connections. Proceed with operation (y|n)? y
Firewall is active and enabled on system startup
hajra@ubuntu-lab:~$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), deny (routed)
New profiles: skip
```

2. Deny SSH (port 22) and show numbered status



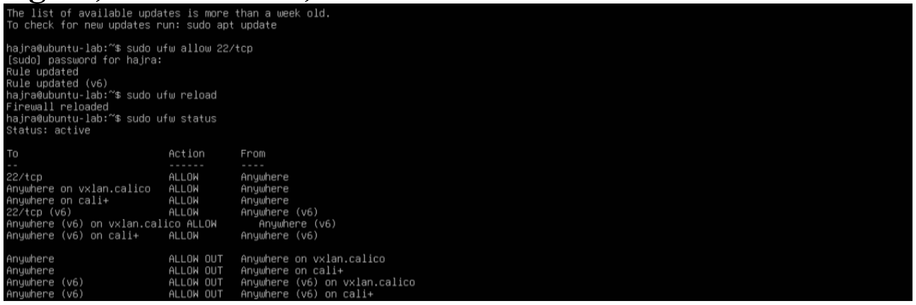
```
hajra@ubuntu-lab:~$ sudo ufw deny 22/tcp
Rule added
Rule added (v6)
hajra@ubuntu-lab:~$ sudo ufw status numbered
Status: active

     To                         Action      From
     --                         ------      ----
[ 1] 22/tcp                     DENY IN     Anywhere
[ 2] 22/tcp (v6)                DENY IN     Anywhere (v6)
```

3. From Windows host — attempt SSH (should fail)



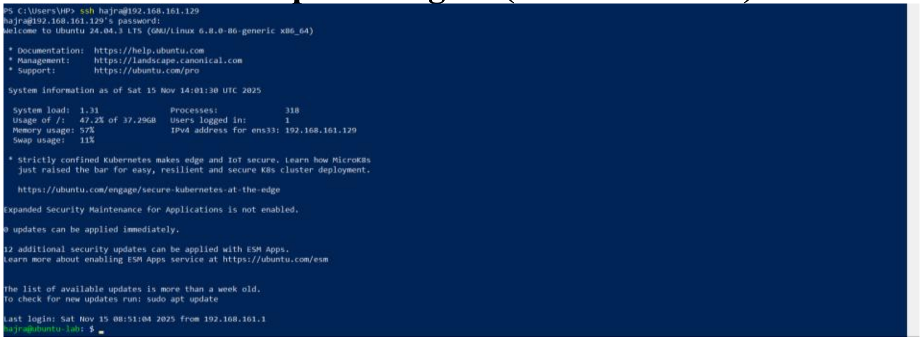
```
hajra@ubuntu-lab:~$ exit
logout
Connection to 192.168.161.129 closed.
PS C:\Users\HP> ssh hajra@192.168.161.129
ssh: connect to host 192.168.161.129 port 22: Connection timed out
PS C:\Users\HP> _
```

4. Allow SSH again, reload UFW, and show status



```
The list of available updates is more than a week old.
To check for new updates run: sudo apt update

hajra@ubuntu-lab:~$ sudo ufw allow 22/tcp
[sudo] password for hajra:
Rule updated
Rule updated (v6)
hajra@ubuntu-lab:~$ sudo ufw reload
Firewall reloaded
hajra@ubuntu-lab:~$ sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW       Anywhere
Anywhere on vxlan.calico   ALLOW       Anywhere
Anywhere on cali+          ALLOW       Anywhere
22/tcp (v6)                ALLOW       Anywhere (v6)
Anywhere (v6) on vxlan.calico ALLOW       Anywhere (v6)
Anywhere (v6) on cali+     ALLOW       Anywhere (v6)

Anywhere                   ALLOW OUT   Anywhere on vxlan.calico
Anywhere                   ALLOW OUT   Anywhere on cali+
Anywhere (v6)              ALLOW OUT   Anywhere (v6) on vxlan.calico
Anywhere (v6)              ALLOW OUT   Anywhere (v6) on cali+
```

5. From Windows host — attempt SSH again (should succeed)



```
PS C:\Users\HP> ssh hajra@192.168.161.129
hajra@192.168.161.129's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.8.0-86-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sat 15 Nov 14:01:30 UTC 2025

  System load:  1.31               Processes:             318
  Usage of /:   47.2% of 37.29GB   Users logged in:       1
  Memory usage: 57%                IPv4 address for ens33: 192.168.161.129
  Swap usage:   11%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

12 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm


The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Nov 15 08:51:04 2025 from 192.168.161.1
hajra@ubuntu-lab:~$ _
```

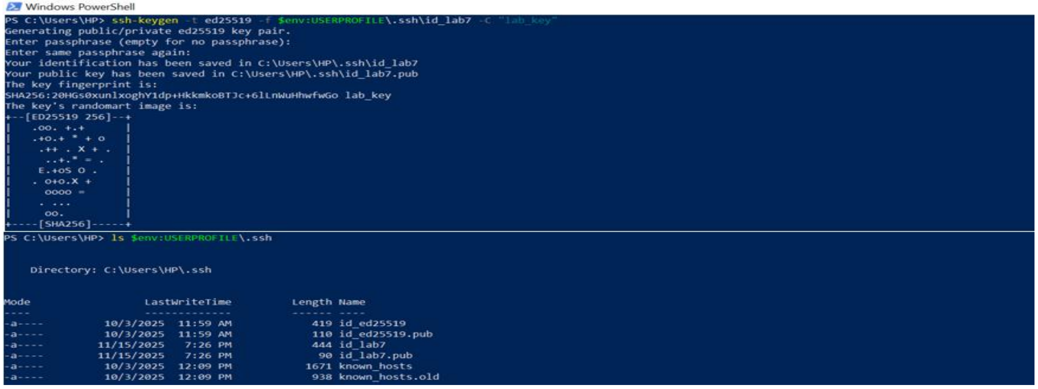
Task 6 — Configure SSH Key-Based Login from Windows Host

Goal:

Copy the Windows client's public key into the Ubuntu server's `~/.ssh/authorized_keys` to enable passwordless SSH.

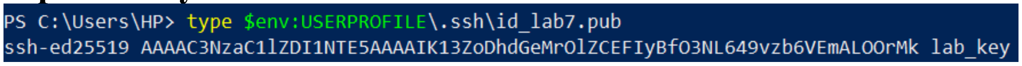
A. Windows Host (Client-Side Steps)

1. Generate SSH key pair and list `.ssh` directory



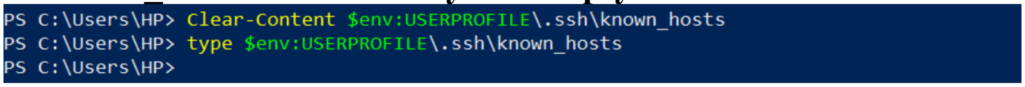
```
PS C:\Users\HP> ssh-keygen -t ed25519 -f $env:USERPROFILE\.ssh\id_lab7 -C "lab_key"
Generating public/private ed25519 key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in C:\Users\HP\.ssh\id_lab7
Your public key has been saved in C:\Users\HP\.ssh\id_lab7.pub
The key fingerprint is:
SHA256:20HGs0xunlxoghY1dp+HkkmkoBTJc+6lLnWuHhwfwGo lab_key
The key's randomart image is:
+--[ED25519 256]--+
|    .oo. +.+     |
|    .+o.+ * + o  |
|     .++ . X + . |
|      ..+.* = .  |
|     E.+oS O .   |
|    . o+o.X +    |
|      oooo =     |
|     . ...       |
|      oo.        |
+----[SHA256]-----+
PS C:\Users\HP> ls $env:USERPROFILE\.ssh


    Directory: C:\Users\HP\.ssh


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
-a----         10/3/2025  11:59 AM            419 id_ed25519
-a----         10/3/2025  11:59 AM            110 id_ed25519.pub
-a----        11/15/2025   7:26 PM            444 id_lab7
-a----        11/15/2025   7:26 PM             90 id_lab7.pub
-a----         10/3/2025  12:09 PM           1671 known_hosts
-a----         10/3/2025  12:09 PM            938 known_hosts.old
```

2. **Show the public key content**



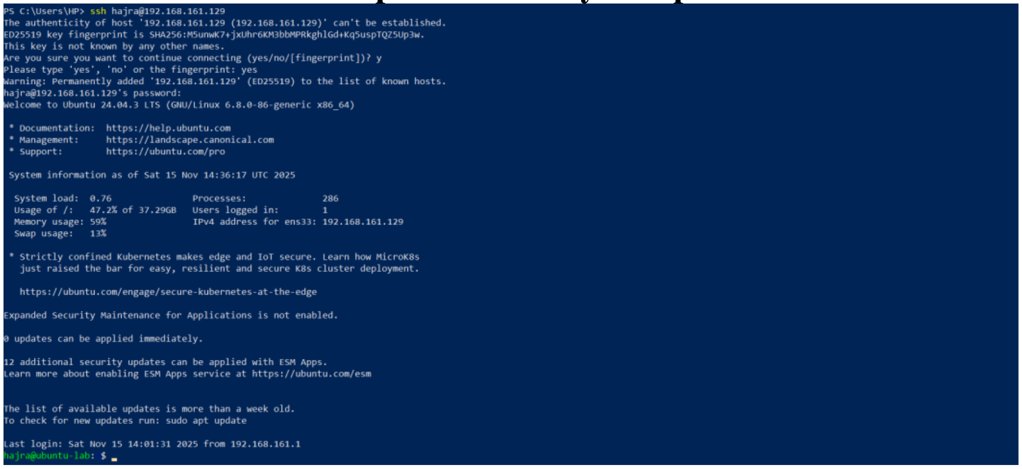
```
PS C:\Users\HP> type $env:USERPROFILE\.ssh\id_lab7.pub
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIK13ZoDhdGeMrOlZCEFIyBfO3NL649vzb6VEmALOOrMk lab_key
```

3. **Clear the known_hosts file and verify it is empty**



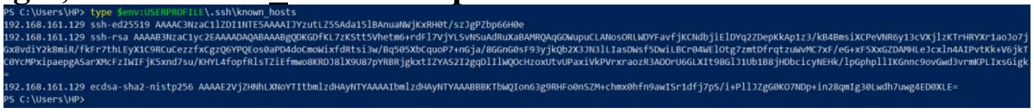
```
PS C:\Users\HP> Clear-Content $env:USERPROFILE\.ssh\known_hosts
PS C:\Users\HP> type $env:USERPROFILE\.ssh\known_hosts
PS C:\Users\HP>
```

4. **Connect to Ubuntu server — capture host-key acceptance**



```
PS C:\Users\HP> ssh hajra@192.168.161.129
The authenticity of host '192.168.161.129 (192.168.161.129)' can't be established.
ED25519 key fingerprint is SHA256:M5unwK7+jxUhr6KM3bbMPRkghlGd+Kq5uspTQZ5Up3w.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? y
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.161.129' (ED25519) to the list of known hosts.
hajra@192.168.161.129's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.8.0-86-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sat 15 Nov 14:36:17 UTC 2025

  System load:  0.76              Processes:             286
  Usage of /:   47.2% of 37.29GB   Users logged in:       1
  Memory usage: 59%               IPv4 address for ens33: 192.168.161.129
  Swap usage:   13%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

12 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm


The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Nov 15 14:01:31 2025 from 192.168.161.1
hajra@ubuntu-lab:~$ _
```

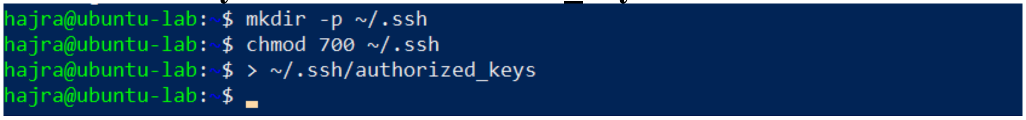
5. **After login, show known_hosts file updated**



```
PS C:\Users\HP> type $env:USERPROFILE\.ssh\known_hosts
192.168.161.129 ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIJYzutLZ5SAda15lBAnuaNWjKxRH0t/szJgPZbp66H0e
192.168.161.129 ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABgQDKGDfKL7zKStt5Vhetm6+rdFl7VjYLSvNSuAdRuXaBAMRQAqGOWupuCLANosORLWDYFavfjKCNdbjiElDYq2ZDepKkAp1z3/kB4BmsiXCPeVNR6y13cVXjlzKTrHRYXr1aoJo7j
Gx8vdiY2kBmiR/fkFr7thLEyX1C9RCuCezzfxCgzQ6YPQEos0aPD4doCmoWixfdRtsi3w/Bq505XbCquoP7+nGja/8GGnG0sF93yjkQb2X3JN3lLIasDWsf5DwiLBCr04WElOtg7zmtDfrqtzuWvMC7xF/eG+xF5XxGZDAMHLeJcxln4AIPvtKk+V6jkT
C0YcMPxipaepgASarXMcFzIWIFjK5xnd7su/KHYL4fopfRlsTZiEfmwo8KRDJ8lX9U87pYRBRjgkxtIZYAS2I2gqDlIlWQOcHzoxUtvUPaxiVkPVrxraozR3AOOrU6GLXIt98GlJ1Ub1B8jHDbcicyNEHk/lpGphllIKGnnc9ovGwd3vrmKPLIxsGigk
=
192.168.161.129 ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBKTbWQIon63g9RHFo0nSZM+chmx0hfn9awISr1dfj7pS/i+PllJZgG0KO7NDp+in28qmIg30Lwdh7uwg4ED0XLE=
PS C:\Users\HP>
```

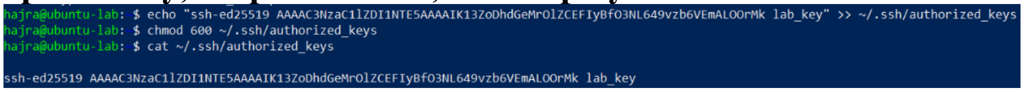
B. Ubuntu Server (Server-Side Steps)

6. **Prepare `.ssh` directory and clear authorized_keys**



```
hajra@ubuntu-lab:~$ mkdir -p ~/.ssh
hajra@ubuntu-lab:~$ chmod 700 ~/.ssh
hajra@ubuntu-lab:~$ > ~/.ssh/authorized_keys
hajra@ubuntu-lab:~$ _
```

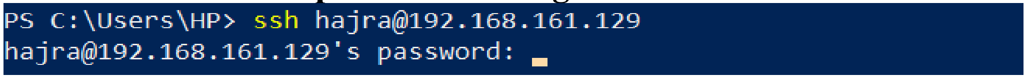
7. **Add the public key, set permissions, and display file**



```
hajra@ubuntu-lab:~$ echo "ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIK13ZoDhdGeMrOlZCEFIyBfO3NL649vzb6VEmALOOrMk lab_key" >> ~/.ssh/authorized_keys
hajra@ubuntu-lab:~$ chmod 600 ~/.ssh/authorized_keys
hajra@ubuntu-lab:~$ cat ~/.ssh/authorized_keys

ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIK13ZoDhdGeMrOlZCEFIyBfO3NL649vzb6VEmALOOrMk lab_key
```

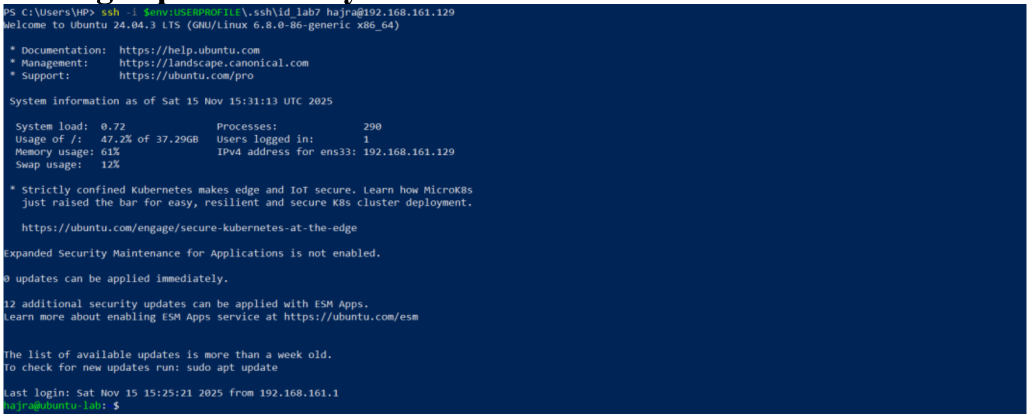
C. Test Passwordless SSH

8. **From Windows — confirm passwordless login**



```
PS C:\Users\HP> ssh hajra@192.168.161.129
hajra@192.168.161.129's password: _
```

9. **Also test using explicit identity file**



```
PS C:\Users\HP> ssh -i $env:USERPROFILE\.ssh\id_lab7 hajra@192.168.161.129
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.8.0-86-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sat 15 Nov 15:31:13 UTC 2025

  System load:  0.72              Processes:             290
  Usage of /:   47.2% of 37.29GB   Users logged in:       1
  Memory usage: 61%               IPv4 address for ens33: 192.168.161.129
  Swap usage:   12%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

12 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm


The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Nov 15 15:25:21 2025 from 192.168.161.1
hajra@ubuntu-lab:~$
```

Exam Evaluation Questions

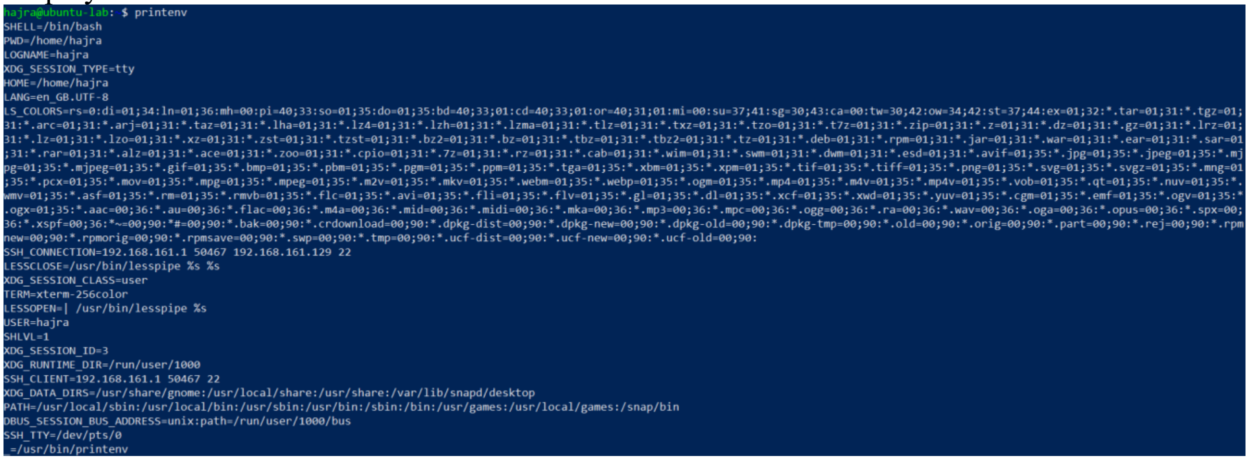
Q1 — Quick Environment Audit

Objective:

Demonstrate you can inspect the current environment and extract a few key variables.

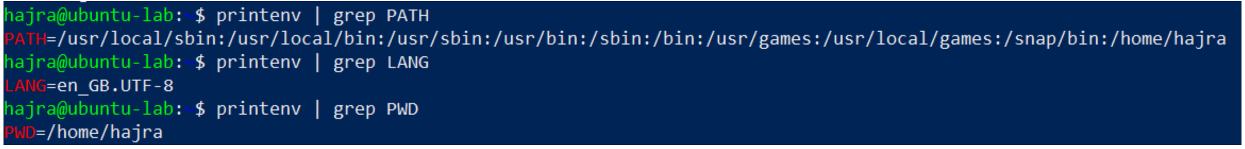
Actions & Evidence:

1. Display all environment variables:



```
hajra@ubuntu-lab:~$ printenv
SHELL=/bin/bash
PWD=/home/hajra
LOGNAME=hajra
XDG_SESSION_TYPE=tty
HOME=/home/hajra
LANG=en_GB.UTF-8
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=00:su=37;41:sg=30;43:ca=00:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;
31:*.arc=01;31:*.arj=01;31:*.taz=01;31:*.lha=01;31:*.lz4=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=01;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;
31:*.lz=01;31:*.lzo=01;31:*.xz=01;31:*.zst=01;31:*.tzst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:*.sar=01
;31:*.rar=01;31:*.alz=01;31:*.ace=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.avif=01;35:*.jpg=01;35:*.jpeg=01;35:*.mj
pg=01;35:*.mjpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01
;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.webp=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.
wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*
.ogx=01;35:*.aac=00;36:*.au=00;36:*.flac=00;36:*.m4a=00;36:*.mid=00;36:*.midi=00;36:*.mka=00;36:*.mp3=00;36:*.mpc=00;36:*.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;
36:*.xspf=00;36:*~=00;90:*#=00;90:*.bak=00;90:*.crdownload=00;90:*.dpkg-dist=00;90:*.dpkg-new=00;90:*.dpkg-old=00;90:*.dpkg-tmp=00;90:*.old=00;90:*.orig=00;90:*.part=00;90:*.rej=00;90:*.rpm
new=00;90:*.rpmorig=00;90:*.rpmsave=00;90:*.swp=00;90:*.tmp=00;90:*.ucf-dist=00;90:*.ucf-new=00;90:*.ucf-old=00;90:
SSH_CONNECTION=192.168.161.1 50467 192.168.161.129 22
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm-256color
LESSOPEN=| /usr/bin/lesspipe %s
USER=hajra
SHLVL=1
XDG_SESSION_ID=3
XDG_RUNTIME_DIR=/run/user/1000
SSH_CLIENT=192.168.161.1 50467 22
XDG_DATA_DIRS=/usr/share/gnome:/usr/local/share:/usr/share:/var/lib/snapd/desktop
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus
SSH_TTY=/dev/pts/0
_=/usr/bin/printenv
```

2. Filter for `PATH`, `LANG`, and `PWD` (run 3 commands, capture together):



```
hajra@ubuntu-lab:~$ printenv | grep PATH
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/home/hajra
hajra@ubuntu-lab:~$ printenv | grep LANG
LANG=en_GB.UTF-8
hajra@ubuntu-lab:~$ printenv | grep PWD
PWD=/home/hajra
```

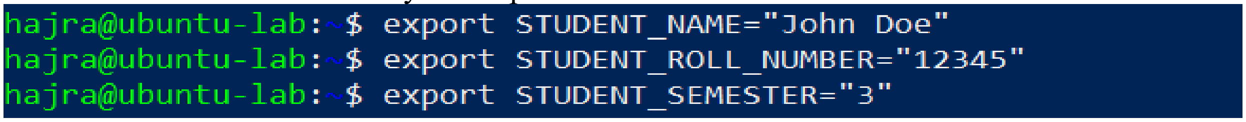
Q2 — Short-Lived Student Info

Objective:

Show how temporary environment variables behave (session-scoped).

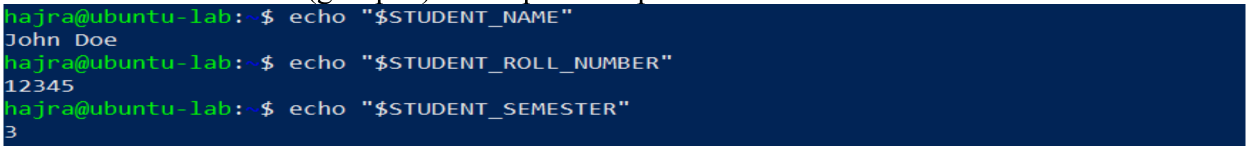
Actions & Evidence:

1. Set three variables consecutively and capture commands + execution:



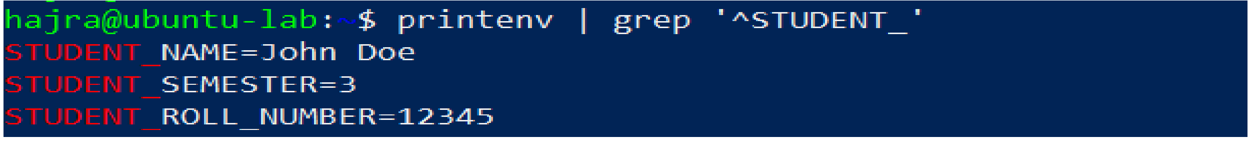
```
hajra@ubuntu-lab:~$ export STUDENT_NAME="John Doe"
hajra@ubuntu-lab:~$ export STUDENT_ROLL_NUMBER="12345"
hajra@ubuntu-lab:~$ export STUDENT_SEMESTER="3"
```

2. Print all three variables (grouped) and capture output:



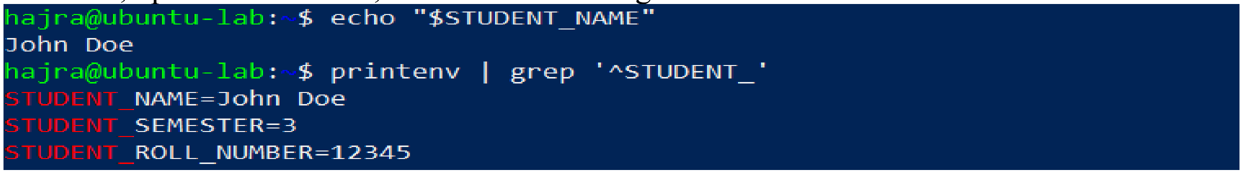
```
hajra@ubuntu-lab:~$ echo "$STUDENT_NAME"
John Doe
hajra@ubuntu-lab:~$ echo "$STUDENT_ROLL_NUMBER"
12345
hajra@ubuntu-lab:~$ echo "$STUDENT_SEMESTER"
3
```

3. Use `printenv | grep` to show any `STUDENT_` variables:



```
hajra@ubuntu-lab:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=John Doe
STUDENT_SEMESTER=3
STUDENT_ROLL_NUMBER=12345
```

4. Exit shell, open new terminal, show variables are gone:



```
hajra@ubuntu-lab:~$ echo "$STUDENT_NAME"
John Doe
hajra@ubuntu-lab:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=John Doe
STUDENT_SEMESTER=3
STUDENT_ROLL_NUMBER=12345
```

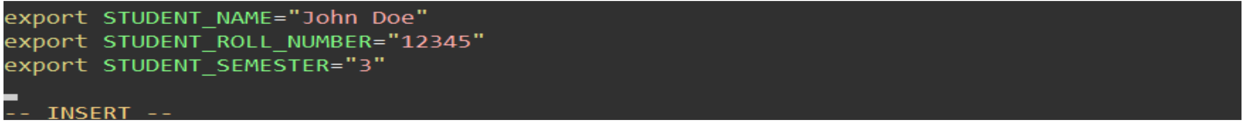
Q3 — Make It Sticky (Persistent Student Info)

Objective:

Demonstrate persistence of environment variables across sessions via `~/.bashrc`.

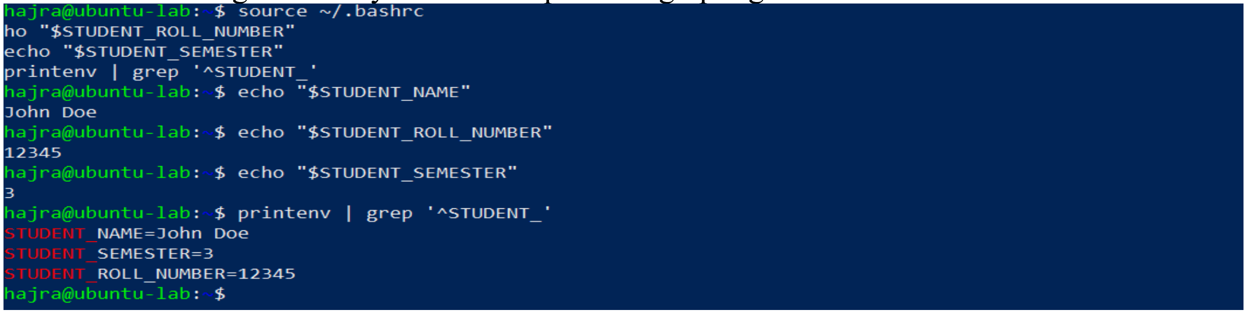
Actions & Evidence:

1. Edit `~/.bashrc` and append the three STUDENT_* exports. Capture **editor screenshot**:



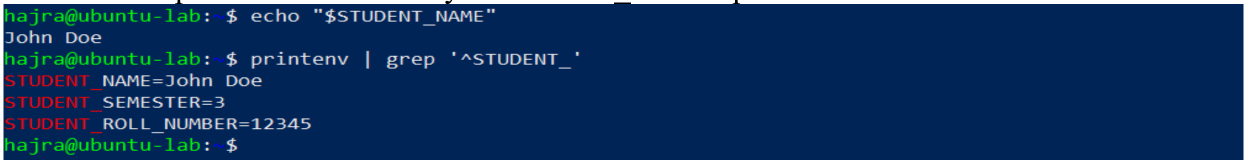
```
export STUDENT_NAME="John Doe"
export STUDENT_ROLL_NUMBER="12345"
export STUDENT_SEMESTER="3"

-- INSERT --
```

2. Reload shell config and verify variables + printenv grep together:



```
hajra@ubuntu-lab:~$ source ~/.bashrc
ho "$STUDENT_ROLL_NUMBER"
echo "$STUDENT_SEMESTER"
printenv | grep '^STUDENT_'
hajra@ubuntu-lab:~$ echo "$STUDENT_NAME"
John Doe
hajra@ubuntu-lab:~$ echo "$STUDENT_ROLL_NUMBER"
12345
hajra@ubuntu-lab:~$ echo "$STUDENT_SEMESTER"
3
hajra@ubuntu-lab:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=John Doe
STUDENT_SEMESTER=3
STUDENT_ROLL_NUMBER=12345
hajra@ubuntu-lab:~$
```

3. Close and reopen terminal — verify STUDENT_NAME persists:



```
hajra@ubuntu-lab:~$ echo "$STUDENT_NAME"
John Doe
hajra@ubuntu-lab:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=John Doe
STUDENT_SEMESTER=3
STUDENT_ROLL_NUMBER=12345
hajra@ubuntu-lab:~$
```

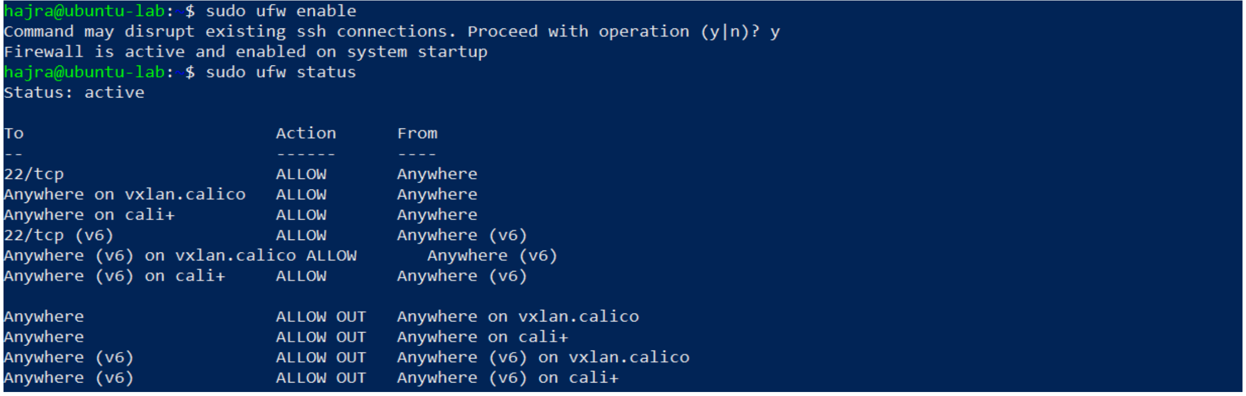
Q4 — Firewall Rules: Block and Restore Ping (ICMP)

Objective:

Block ping (ICMP echo) traffic using `ufw` and then re-allow it; show effect from a client.

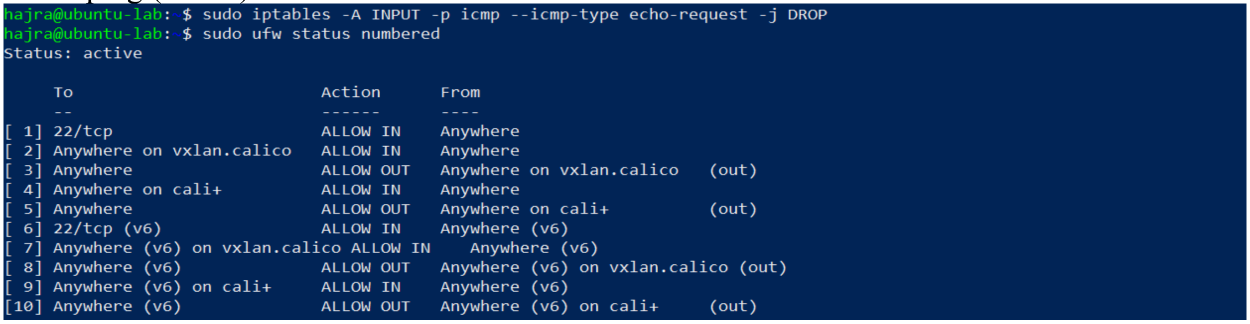
Actions & Evidence:

1. Enable `ufw` and show status (group commands):



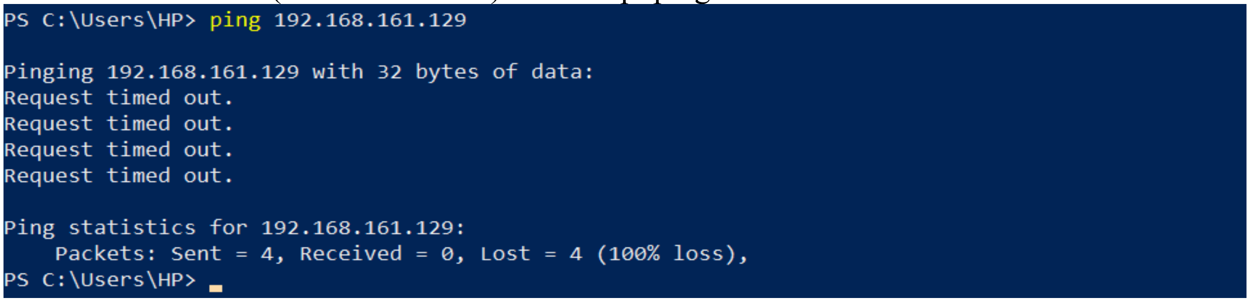
```
hajra@ubuntu-lab:~$ sudo ufw enable
Command may disrupt existing ssh connections. Proceed with operation (y|n)? y
Firewall is active and enabled on system startup
hajra@ubuntu-lab:~$ sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW       Anywhere
Anywhere on vxlan.calico   ALLOW       Anywhere
Anywhere on cali+          ALLOW       Anywhere
22/tcp (v6)                ALLOW       Anywhere (v6)
Anywhere (v6) on vxlan.calico ALLOW       Anywhere (v6)
Anywhere (v6) on cali+     ALLOW       Anywhere (v6)

Anywhere                   ALLOW OUT   Anywhere on vxlan.calico
Anywhere                   ALLOW OUT   Anywhere on cali+
Anywhere (v6)              ALLOW OUT   Anywhere (v6) on vxlan.calico
Anywhere (v6)              ALLOW OUT   Anywhere (v6) on cali+
```

2. Block ping (ICMP) and show numbered status:



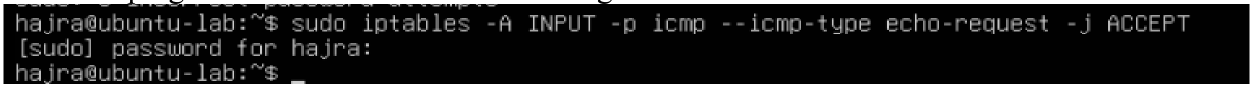
```
hajra@ubuntu-lab:~$ sudo iptables -A INPUT -p icmp --icmp-type echo-request -j DROP
hajra@ubuntu-lab:~$ sudo ufw status numbered
Status: active

     To                         Action      From
     --                         ------      ----
[ 1] 22/tcp                     ALLOW IN    Anywhere
[ 2] Anywhere on vxlan.calico   ALLOW IN    Anywhere
[ 3] Anywhere                   ALLOW OUT   Anywhere on vxlan.calico    (out)
[ 4] Anywhere on cali+          ALLOW IN    Anywhere
[ 5] Anywhere                   ALLOW OUT   Anywhere on cali+           (out)
[ 6] 22/tcp (v6)                ALLOW IN    Anywhere (v6)
[ 7] Anywhere (v6) on vxlan.calico ALLOW IN    Anywhere (v6)
[ 8] Anywhere (v6)              ALLOW OUT   Anywhere (v6) on vxlan.calico (out)
[ 9] Anywhere (v6) on cali+     ALLOW IN    Anywhere (v6)
[10] Anywhere (v6)              ALLOW OUT   Anywhere (v6) on cali+      (out)
```

3. From Windows host (or another client) — attempt ping while blocked:



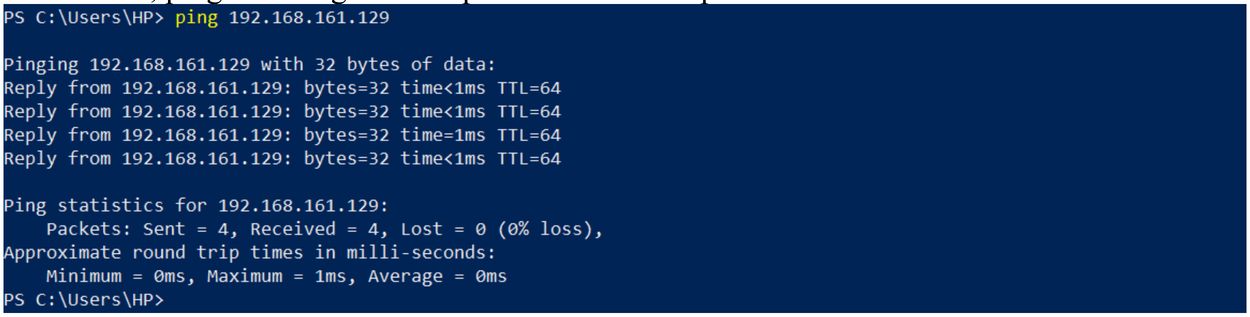
```
PS C:\Users\HP> ping 192.168.161.129

Pinging 192.168.161.129 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.161.129:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PS C:\Users\HP> _
```

4. Re-allow ping and show allow/reload/status together:



```
hajra@ubuntu-lab:~$ sudo iptables -A INPUT -p icmp --icmp-type echo-request -j ACCEPT
[sudo] password for hajra:
hajra@ubuntu-lab:~$ _
```

5. From client, ping server again — capture successful replies:



```
PS C:\Users\HP> ping 192.168.161.129

Pinging 192.168.161.129 with 32 bytes of data:
Reply from 192.168.161.129: bytes=32 time<1ms TTL=64
Reply from 192.168.161.129: bytes=32 time<1ms TTL=64
Reply from 192.168.161.129: bytes=32 time=1ms TTL=64
Reply from 192.168.161.129: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.161.129:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
PS C:\Users\HP>
```