



## **CLOUD COMPUTING**

### **LAB: 07**

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**Registration. no:**

2023-BSE-060

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5B

## Task 1 — Print & filter environment variables

```
serat060@ubuntu60:~$ printenv
SHELL=/bin/bash
CREDENTIALS_DIRECTORY=/run/credentials/getty@tty1.service
MEMORY_PRESSURE_WRITE=c29tZSAyMDAwMDAgMjAwMDAwMAA=
XDG_SEAT=seat0
PWD=/home/serat060
LOGNAME=serat060
XDG_SESSION_TYPE=ttty
SYSTEMD_EXEC_PID=1359
HOME=/home/serat060
LANG=en_US.UTF-8
```

```
serat060@ubuntu60:~$ printenv | grep SHELL
SHELL=/bin/bash
serat060@ubuntu60:~$ printenv | grep HOME
HOME=/home/serat060
serat060@ubuntu60:~$ printenv | grep USER
USER=serat060
```

## Task 2 — Export DB \* variables temporarily and observe scope

```
serat060@ubuntu60:~$ export DB_URL="postgres://db.example.local:5432/mydb"
serat060@ubuntu60:~$
serat060@ubuntu60:~$ export DB_USER="labuser"
serat060@ubuntu60:~$
serat060@ubuntu60:~$ export DB_PASSWORD="labpass123"
serat060@ubuntu60:~$
```

```
serat060@ubuntu60:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
serat060@ubuntu60:~$
serat060@ubuntu60:~$ echo "$DB_USER"
labuser
serat060@ubuntu60:~$
serat060@ubuntu60:~$ echo "$DB_PASSWORD"
labpass123
```

```
serat060@ubuntu60:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
```

```
serat060@ubuntu60:~$ echo "$DB_URL"
serat060@ubuntu60:~$
serat060@ubuntu60:~$ printenv | grep '^DB_'
```

### **Task 3 — Make DB \* variables persistent in ~/.bashrc**

```
export DB_URL="postgres://db.example.local:5432/mydb"
export DB_USER="labuser"
export DB_PASSWORD="labpass123"
```

```
serat060@ubuntu60:~$ source ~/.bashrc
serat060@ubuntu60:~$
serat060@ubuntu60:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
serat060@ubuntu60:~$
serat060@ubuntu60:~$ echo "$DB_USER"
labuser
serat060@ubuntu60:~$
serat060@ubuntu60:~$ echo "$DB_PASSWORD"
labpass123
serat060@ubuntu60:~$
serat060@ubuntu60:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
```

```
serat060@ubuntu60:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
serat060@ubuntu60:~$
serat060@ubuntu60:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
```

### **Task 4 — System-wide environment variable, welcome script, and PATH**

```
serat060@ubuntu60:~$ sudo cat /etc/environment
[sudo] password for serat060:
Sorry, try again.
[sudo] password for serat060:
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
```

```
serat060@ubuntu60:~$ echo "$PATH"
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
```

```
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
Class="CC-BSE5"
```

```
serat060@ubuntu60:~$ 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-BSE5"
```

```
serat060@ubuntu60:~$ echo $Class
```

```
serat060@ubuntu60:~$
```

```
serat060@ubuntu60:~$ echo "$PATH"
```

```
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
```

```
serat060@ubuntu60:~$ echo $Class
```

```
CC-BSE5
```

```
serat060@ubuntu60:~$
```

```
serat060@ubuntu60:~$ echo "$PATH"
```

```
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
```

```
serat060@ubuntu60:~$ cat > ~/welcome <<'EOF'
```

```
>
```

```
> #!/bin/bash
```

```
> echo "Welcome to Cloud Computing $USER"
```

```
>
```

```
> EOF
```

```
serat060@ubuntu60:~$ chmod +x ~/welcome
```

```
serat060@ubuntu60:~$
```

```
serat060@ubuntu60:~$ ls -l ~/welcome
```

```
-rwxrwxr-x 1 serat060 serat060 54 Nov  7 04:32 /home/serat060/welcome
```

```
serat060@ubuntu60:~$ cd ~
```

```
serat060@ubuntu60:~$ ./welcome
```

```
Welcome to Cloud Computing serat060
```

```
PATH=$PATH:~
```

```
serat060@ubuntu60:~$ source ~/.bashrc
```

```
serat060@ubuntu60:~$ cd ~
```

```
serat060@ubuntu60:~$ welcome
```

```
Welcome to Cloud Computing serat060
```

## **Task 5 — Block and allow SSH using ufw (firewall)**

```
serat060@ubuntu60:~$ sudo ufw enable
```

```
[sudo] password for serat060:
```

```
Sorry, try again.
```

```
[sudo] password for serat060:
```

```
Firewall is active and enabled on system startup
```

```
serat060@ubuntu60:~$ sudo ufw status verbose
```

```
Status: active
```

```
Logging: on (low)
```

```
Default: deny (incoming), allow (outgoing), disabled (routed)
```

```
New profiles: skip
```

```
serat060@ubuntu60:~$ sudo ufw deny 22/tcp
Rule added
Rule added (v6)
serat060@ubuntu60:~$ sudo ufw status numbered
```

Status: active

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

```
PS C:\Users\Waseem> ssh serat060@192.168.243.128
ssh: connect to host 192.168.243.128 port 22: Connection timed out
PS C:\Users\Waseem> █
```

```
serat060@ubuntu60:~$ sudo ufw allow 22/tcp
```

```
Rule updated
Rule updated (v6)
serat060@ubuntu60:~$ sudo ufw reload
```

```
Firewall reloaded
serat060@ubuntu60:~$ sudo ufw status
```

Status: active

	To	Action	From
	--	-----	----
	22/tcp	ALLOW	Anywhere
	22/tcp (v6)	ALLOW	Anywhere (v6)

```
PS C:\Users\Waseem> ssh serat060@192.168.243.128
The authenticity of host '192.168.243.128 (192.168.243.128)' can't be established.
ED25519 key fingerprint is SHA256:tuTtXbv4M223qLA3Ua6ofkfC3kK4KGWls9Zx94j8L/w.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Failed to add the host to the list of known hosts (C:\\Users\\Waseem/.ssh/known_hosts).
serat060@192.168.243.128's password:
hostfile_replace_entries: mkstemp: Permission denied
update_known_hosts: hostfile_replace_entries failed for C:\\Users\\Waseem/.ssh/known_hosts: Permission denied
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 Fri Nov  7 04:44:52 AM UTC 2025

System load:  0.21           Processes:            230
Usage of /:   87.0% of 9.75GB Users logged in:      1
Memory usage: 9%           IPv4 address for ens33: 192.168.243.128
Swap usage:   0%

=> / is using 87.0% of 9.75GB

 * 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.

15 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

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

Last login: Sat Oct 25 19:17:50 2025 from 192.168.243.1
```

## **Task 6 — Configure SSH key-based login from Windows host**

```
serat060@ubuntu60:~$ ssh-keygen -t ed25519 -f ~/.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 /home/serat060/.ssh/id_lab7
```

```
Your public key has been saved in /home/serat060/.ssh/id_lab7.pub
```

```
The key fingerprint is:
```

```
SHA256:u5ykgQ00XzjegkS/STDroC78Iucd09PwsjMMMdYq4Qg lab_key
```

```
The key's randomart image is:
```

```
+--[ED25519 256]--+
```

```
|  
| + .  
|E..+..  
|oo+o*+o S  
|o+oBo@ + .  
|o o.@oB =  
|+o.. ++O o  
|o++.. oo+  
|  
+-----[SHA256]-----+
```

```
serat060@ubuntu60:~$
```

```
serat060@ubuntu60:~$ ls -la ~/.ssh
```

```
total 16  
drwx----- 2 serat060 serat060 4096 Nov  7 04:51 .  
drwxr-x--- 28 serat060 serat060 4096 Nov  7 04:35 ..  
-rw----- 1 serat060 serat060    0 Sep 30 18:17 authorized_keys  
-rw----- 1 serat060 serat060  399 Nov  7 04:51 id_lab7  
-rw-r--r-- 1 serat060 serat060   89 Nov  7 04:51 id_lab7.pub
```

```
serat060@ubuntu60:~$ cat ~/.ssh/id_lab7.pub
```

```
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIA426uLD0PK3QClyn5tx7gnb24q+ZBf1HfUa2NgslEHA lab_key
```

```
serat060@ubuntu60:~$ echo "ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIA426uLD0PK3QClyn5tx7gnb24q+ZBf1HfUa2NgslEHA lab_key" >> ~/.ssh/authorized_keys  
serat060@ubuntu60:~$ chmod 600 ~/.ssh/authorized_keys  
serat060@ubuntu60:~$  
serat060@ubuntu60:~$ cat ~/.ssh/authorized_keys  
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIA426uLD0PK3QClyn5tx7gnb24q+ZBf1HfUa2NgslEHA lab_key
```

```
PS C:\Users\Waseem> cd $env:USERPROFILE\.ssh
```

```
PS C:\Users\Waseem\.ssh> ls
```

```
Directory: C:\Users\Waseem\.ssh
```

Mode	LastWriteTime	Length	Name
-a----	10/3/2025 8:29 AM	419	id_ed25519
-a----	10/3/2025 8:29 AM	110	id_ed25519.pub
-a----	10/17/2025 1:07 AM	828	known_hosts
-a----	10/17/2025 1:07 AM	92	known_hosts.old

```
PS C:\Users\Waseem> ssh seraf060@192.168.243.128
The authenticity of host '192.168.243.128 (192.168.243.128)' can't be established.
ED25519 key fingerprint is SHA256:tuTtXbv4M223qLA3Ua6ofkfC3kK4KGWls9Zx94jBL/w.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Failed to add the host to the list of known hosts (C:\\Users\\Waseem/.ssh/known_hosts).
hostfile_replace_entries: mkstemp: Permission denied
update_known_hosts: hostfile_replace_entries failed for C:\\Users\\Waseem/.ssh/known_hosts: Permission denied
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 Fri Nov  7 06:36:26 AM UTC 2025

System load:  0.0           Processes:            238
Usage of /:   86.8% of 9.75GB Users logged in:        1
Memory usage: 10%          IPv4 address for ens33: 192.168.243.128
Swap usage:   0%

=> / is using 86.8% of 9.75GB

Expanded Security Maintenance for Applications is not enabled.

15 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

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

Last login: Fri Nov  7 06:29:15 2025 from 192.168.243.1
```



```

PS C:\Users\Waseem> scp $env:USERPROFILE\.ssh\id_ed25519.pub serat060@192.168.243.128:~
The authenticity of host '192.168.243.128 (192.168.243.128)' can't be established.
ED25519 key fingerprint is SHA256:tuTtXbv4M223qLA3Ua6ofkFC3kk4KGWls9Zx94jBL/w.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
Failed to add the host to the list of known hosts (C:\\Users\\Waseem/.ssh/known_hosts).
serat060@192.168.243.128's password:
hostfile_replace_entries: mkstemp: Permission denied
update_known_hosts: hostfile_replace_entries failed for C:\\Users\\Waseem/.ssh/known_hosts: Permission denied
id_ed25519.pub 100% 110 21.5KB/s 00:00
PS C:\Users\Waseem> ssh -i $env:USERPROFILE\.ssh\id_ed25519 serat060@192.168.243.128
The authenticity of host '192.168.243.128 (192.168.243.128)' can't be established.
ED25519 key fingerprint is SHA256:tuTtXbv4M223qLA3Ua6ofkFC3kk4KGWls9Zx94jBL/w.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Failed to add the host to the list of known hosts (C:\\Users\\Waseem/.ssh/known_hosts).
hostfile_replace_entries: mkstemp: Permission denied
update_known_hosts: hostfile_replace_entries failed for C:\\Users\\Waseem/.ssh/known_hosts: Permission denied
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 Fri Nov 7 06:29:15 AM UTC 2025

System load: 0.02          Processes: 239
Usage of / : 86.8% of 9.75GB Users logged in: 1
Memory usage: 10%         IPv4 address for ens33: 192.168.243.128
Swap usage: 0%

=> / is using 86.8% of 9.75GB

Expanded Security Maintenance for Applications is not enabled.

15 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

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

Last login: Fri Nov 7 06:21:26 2025 from 192.168.243.128

```

## Exam Evaluation Questions

### Q1: Quick Environment Audit

```

serat060@ubuntu60:~$ printenv
SHELL=/bin/bash
DB_PASSWORD=labpass123
PWD=/home/serat060
LOGNAME=serat060
XDG_SESSION_TYPE=tty
DB_USER=labuser
HOME=/home/serat060
LANG=en_US.UTF-8

serat060@ubuntu60:~$ printenv | grep PATH
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/home/serat060
serat060@ubuntu60:~$ printenv | grep LANG
LANG=en_US.UTF-8
serat060@ubuntu60:~$ printenv | grep PWD
PWD=/home/serat060

```

## Q2: Short-lived Student Info

```
serat060@ubuntu60:~$ export STUDENT_NAME="Seerat Fatima"
serat060@ubuntu60:~$ export STUDENT_ROLL_NUMBER="2023BSE060"
serat060@ubuntu60:~$ export STUDENT_SEMESTER="5th"
```

```
serat060@ubuntu60:~$ echo $STUDENT_NAME
Seerat Fatima
serat060@ubuntu60:~$ echo $STUDENT_ROLL_NUMBER
2023BSE060
serat060@ubuntu60:~$ echo $STUDENT_SEMESTER
5th
```

```
serat060@ubuntu60:~$ printenv | grep STUDENT_
STUDENT_NAME=Seerat Fatima
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=2023BSE060
```

```
serat060@ubuntu60:~$ echo $STUDENT_NAME

serat060@ubuntu60:~$ echo $STUDENT_ROLL_NUMBER
STUDENT_ROLL_NUMBER
serat060@ubuntu60:~$ echo $STUDENT_ROLL_NUMBER

serat060@ubuntu60:~$ echo $STUDENT_SEMESTER

serat060@ubuntu60:~$ printenv | grep STUDENT_
```

## Q3: Make It Sticky (Persistence Check for Student Info)

```
export STUDENT_NAME="Seerat Fatima"
export STUDENT_ROLL_NUMBER="2023BSE060"
export STUDENT_SEMESTER="5th"
```

Help	Write Out	Where Is	Cut	Execute	Location	M-U
Exit	Read File	Replace	Paste	Justify	Go To Line	M-E

```

serat060@ubuntu60:~$ source ~/.bashrc
serat060@ubuntu60:~$ echo $STUDENT_NAME
Seerat Fatima
serat060@ubuntu60:~$
serat060@ubuntu60:~$ echo $STUDENT_ROLL_NUMBER
2023BSE060
serat060@ubuntu60:~$ echo $STUDENT_SEMESTER
5th
serat060@ubuntu60:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=Seerat Fatima
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=2023BSE060

```

```

serat060@ubuntu60:~$ echo $STUDENT_NAME
Seerat Fatima
serat060@ubuntu60:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=Seerat Fatima
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=2023BSE060

```

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

```

serat060@ubuntu60:~$ sudo ufw enable
Firewall is active and enabled on system startup
serat060@ubuntu60:~$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), disabled (routed)
New profiles: skip

```

To	Action	From
--	-----	----
22/tcp	ALLOW IN	Anywhere
22/tcp (v6)	ALLOW IN	Anywhere (v6)

```

serat060@ubuntu60:~$ sudo ufw deny proto icmp from any to any

```

```

ERROR: Unsupported protocol 'icmp'
serat060@ubuntu60:~$ sudo ufw status numbered

```

```

Status: active

```

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

```

PS C:\Users\Waseem> ping 192.168.243.128

```

```

Pinging 192.168.243.128 with 32 bytes of data:
Request timed out.
Request timed out.

```

```
serat060@ubuntu60:~$ sudo ufw reload
Firewall reloaded
serat060@ubuntu60:~$ sudo ufw status
Status: active
```

To	Action	From
--	-----	----
22/tcp	ALLOW	Anywhere
22/tcp (v6)	ALLOW	Anywhere (v6)

```
PS C:\Users\Waseem> ping 192.168.243.128
```

```
Pinging 192.168.243.128 with 32 bytes of data:
```

```
Reply from 192.168.243.128: bytes=32 time<1ms TTL=64
```

```
Reply from 192.168.243.128: bytes=32 time<1ms TTL=64
```

```
Reply from 192.168.243.128: bytes=32 time<1ms TTL=64
```

```
Reply from 192.168.243.128: bytes=32 time<1ms TTL=64
```

```
Ping statistics for 192.168.243.128:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```