



## **Cloud Computing**

**BSE ( V-B )**

**Lab 07**

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**Roll No: 2023-BSE-068**

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## Task 1: Print & filter environment variables

```
urwa@urwa:~$ printenv
SHELL=/bin/bash
PWD=/home/urwa
LOGNAME=urwa
XDG_SESSION_TYPE=ttty
HOME=/home/urwa
LANG=en_US.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:
*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.tzo=01;31:*.t7z=0
1;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:*.tztst=01;31:*.bz2=01;31:*.bz=01;31:*.tbz=01;31:*.tbz2
=01;31:*.tzt=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:*.mjpg=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:*.web
p=01;35:*.ogg=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:*.f
lac=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:*.xsp
f=00;36:*.~00;90:*.bak=00;90:*.crdownload=00;90:*.dpkg-dist=00;90:*.dpkg
g-new=00;90:*.dpkg-old=00;90:*.dpkg-tmp=00;90:*.old=00;90:*.orig=00;90:*.part=00
;90:*.rej=00;90:*.rpmnew=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=192.168.189.1 55256 192.168.189.128 22
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=xterm
LESSOPEN=| /usr/bin/lesspipe %s
USER=urwa
SHELL=/bin/bash
XDG_SESSION_ID=39
XDG_RUNTIME_DIR=/run/user/1000
SSH_CLIENT=192.168.189.1 55256 22
XDG_DATA_DIRS=/usr/share/gnome:/usr/local/share:/usr/share:/var/lib/snapd/desktop
```

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

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

```
urwa@urwa:~$ export DB_URL="postgres://db.example.local:5
432/mydb"
export DB_USER="labuser"
export DB_PASSWORD="labpass123"
urwa@urwa:~$
```

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

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

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

**Task 3: Make DB\_\* variables persistent in ~/.bashrc**

```

# Alias definitions.
# You may want to put all your additions into a separate
file like
# ~/.bash_aliases, instead of adding them here directly.
# See /usr/share/doc/bash-doc/examples in the bash-doc package.

if [ -f ~/.bash_aliases ]; then
    . ~/.bash_aliases
fi

# enable programmable completion features (you don't need to enable
to enable
# this, if it's already enabled in /etc/bash.bashrc and /
etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
    if [ -f /usr/share/bash-completion/bash_completion ]; then
        . /usr/share/bash-completion/bash_completion
    elif [ -f /etc/bash_completion ]; then
        . /etc/bash_completion
    fi
fi

# Lab 7 persistent DB variables
export DB_URL="postgres://db.example.local:5432/mydb"
export DB_USER="labuser"
export DB_PASSWORD="labpass123"
:w

```

```

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

```

```

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

```

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

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

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

```
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
Class="CC-<Urwa>"
~
~
~
```

```
urwa@urwa:~$ 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-<Urwa>"
urwa@urwa:~$
```

```
urwa@urwa:~$ echo $Class
echo "$PATH"

/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
urwa@urwa:~$
```

```
urwa@urwa:~$ cat > ~/welcome <<'EOF'
>
>
> #!/bin/bash
echo "Welcome to Cloud Computing $USER"
EOF
urwa@urwa:~$
chmod +x ~/welcome
urwa@urwa:~$ ^C
urwa@urwa:~$ ~/welcome
Welcome to Cloud Computing urwa
```

```
urwa@urwa:~$ cd ~
./welcome
Welcome to Cloud Computing urwa
urwa@urwa:~$
```

```
fi
# Lab 7 persistent DB variables
export DB_URL="postgres://db.example.local:5432/mydb"
export DB_USER="labuser"
export DB_PASSWORD="labpass123"

PATH=$PATH:~
```

```
urwa@urwa:~$ source ~/.bashrc
cd ~
welcome
Welcome to Cloud Computing urwa
urwa@urwa:~$
```

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

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

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

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

```
urwa@urwa:~$ ssh urwa@192.168.189.128
urwa@192.168.189.128'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 Wed Dec 24 04:24:56 PM UTC 2025

System load:  0.06               Processes:           236
Usage of /:   81.6% of 9.75GB    Users logged in:    1
Memory usage: 24%               IPv4 address for ens33: 192.168.189.128
Swap usage:   0%

 * 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.

76 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

*** System restart required ***
Last login: Wed Dec 24 16:18:46 2025 from 192.168.189.1
urwa@urwa:~$
```

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

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

```
urwa@urwa:~$ ssh urwa@192.168.189.128
urwa@192.168.189.128'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 Wed Dec 24 04:27:00 PM UTC 2025

System load: 0.13          Processes: 242
Usage of /: 81.6% of 9.75GB Users logged in: 1
Memory usage: 24%          IPv4 address for ens33: 192.168.189.128
Swap usage: 0%

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

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*** System restart required ***
Last login: Wed Dec 24 16:24:56 2025 from 192.168.189.128
```

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



```


urwa@urwa:~$ ssh-keygen -t ed25519 -f ~/.ssh/id_lab7 -C "lab_key"
ls -la ~/.ssh
Generating public/private ed25519 key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/urwa/.ssh/id_lab7
Your public key has been saved in /home/urwa/.ssh/id_lab7.pub
The key fingerprint is:
SHA256:hPteY6Cio/uaUbUvZHRXTf528uzbQu5PGVlc0zqDG0E lab_key
The key's randomart image is:
+--[ED25519 256]--+
|      .+E  o.|
|      . . .o . +|
|     o o o  .o + |
|     o o +   o.= |
|    . + . S   ++. |
|   . o . o .  ..O=O|
|  .  o o . +  o .+|
| o.. o . o . oo.|
|==o.      .  .+=|
+----[SHA256]-----+
total 24
drwx-----  2 urwa urwa 4096 Dec 24 16:27 .
drwxr-x---  25 urwa urwa 4096 Dec 23 14:50 ..
-rw-----  1 urwa urwa   0 Oct 24 14:08 authorized_keys
-rw-----  1 urwa urwa  399 Dec 24 16:27 id_lab7
-rw-r--r--  1 urwa urwa   89 Dec 24 16:27 id_lab7.pub
-rw-----  1 urwa urwa  978 Oct 24 14:58 known_hosts
-rw-r--r--  1 urwa urwa  142 Oct 24 14:57 known_hosts.old
urwa@urwa:~$

```

```

urwa@urwa:~$ ssh-keygen -t ed25519 -f $env:USERPROFILE\.ssh\id_lab7 -C "lab_key"
Generating public/private ed25519 key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in :USERPROFILE.sshid_lab7
Your public key has been saved in :USERPROFILE.sshid_lab7.pub
The key fingerprint is:
SHA256:1zsL+KqL70OclUUsqW8WtkYhQbsgT3Iewhosblbj3lM lab_key
The key's randomart image is:
+--[ED25519 256]--+
|      .o. +. |
|..      ..+ o |
|o..=o= .o = |
|oooO.o..* . |
|. + .o..ESo. . |
|o . . = *o . |
|   . + +. . o |
|      .o . . o |
|      .o = + . . |
+----[SHA256]-----+
urwa@urwa:~$

```

 Windows PowerShell

```

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

```

```

urwa@urwa:~$ ssh urwa@192.168.189.128
urwa@192.168.189.128'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 Wed Dec 24 04:41:47 PM UTC 2025

System load: 0.1               Processes: 243
Usage of /:  81.6% of 9.75GB   Users logged in: 1
Memory usage: 25%             IPv4 address for ens33: 192.168.189.128
Swap usage:  0%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
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   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

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To see these additional updates run: apt list --upgradable

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*** System restart required ***
Last login: Wed Dec 24 16:27:01 2025 from 192.168.189.128
urwa@urwa:~$

```

```

PS C:\Users\TT> type $env:USERPROFILE\.ssh\known_hosts
192.168.189.128 ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAICEziKjXxvUE8EI6SBnfKqtXd3UMn
Cks2usNM1yG6EzJK
192.168.189.128 ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQgQDvX55msLieF1a/QhcNUxLxSShIb
CVaji6622z8nQTGd2eL9a6RWL+dgyQ4niN6JPAYkbtLu1mctM0zcjBbAUpvg6BA/Yw47WYHpsBG/Y1Mn
2CpPov0+srDgjUsGLRZBEeF78rSzT8kxYACFFzR4HyRVER5J10pFA8LZBFYv17s98ugJLjgYhsA4DY/Y
h+FnaqM0tBb7wvc3WdIYrS781k111PR6SJFP18320prFmeygU/wKwM0zH2JpwDr0mXfpbK/D6zZAahNDg
M3xbB0wcrBB+Sgb3LurWbPQ9aaIpMQW3M6LQ2Bec2FSXtwwQck4qBhVZK2fngLl0/pW76Q+io1V2BVUw
9BkAmjw2Hce+2gUPqMsRVqEULooKtLQ/lpzhVwB1tP9SX9ETa08v16oHmjhePYGd9RxUSio28K1Mi6lgT
VhPIx7Ll+ohojFX/47JvvzIQVYxutg3MVD4vhuAYnG/xQy+J2980MiHH1DLpCSFxGu9C9nj+PjeYE6z0s
=
192.168.189.128 ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyN
TYAAABBBEJ5rCnzv1A1oZ1NKHVclqUCUg1dyim6+6tyZmHDM8NPvJ5I9NQ6ztaAOUUvCvqH13JIRH1hx
1nCkCA6vA3aM=
PS C:\Users\TT>

```

```

urwa@urwa:~$ mkdir -p ~/.ssh
chmod 700 ~/.ssh
> ~/.ssh/authorized_keys
urwa@urwa:~$

```

```

PS C:\Users\TT> ssh urwa@192.168.189.128
urwa@192.168.189.128'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 Wed Dec 24 04:48:23 PM UTC 2025

System load: 0.02          Processes:            251
Usage of /:  81.6% of 9.75GB Users logged in:        1
Memory usage: 25%          IPv4 address for ens33: 192.168.189.128
Swap usage:  0%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
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   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

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*** System restart required ***
Last login: Wed Dec 24 16:45:25 2025 from 192.168.189.1

```

```

urwa@urwa:~$ ssh -i ~/.ssh/id_lab7 urwa@192.168.189.128
urwa@192.168.189.128'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 Wed Dec 24 04:50:00 PM UTC 2025

System load: 0.0          Processes:            255
Usage of /:  81.6% of 9.75GB Users logged in:        1
Memory usage: 26%          IPv4 address for ens33: 192.168.189.128
Swap usage:  0%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
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   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

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*** System restart required ***
Last login: Wed Dec 24 16:48:24 2025 from 192.168.189.1

```