Name: Maira Malik

Reg.no: 2023-BSE-040

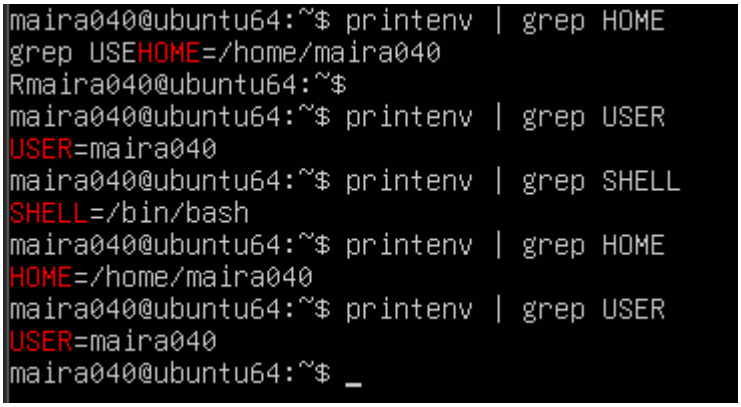
Subject: Cloud Computing

LAB # 6

Task 1 — Print & filter environment variables:

1.

2.



Task 2 — Export DB_* variables temporarily and observe scope

1.
```
maira040@ubuntu64:~$ export DB_URL="postgres://db.example.local:5432/mydb"
maira040@ubuntu64:~$ export DB_USER="labuser"
maira040@ubuntu64:~$ export DB_PASSWORD="labpass123"
```

2.
```
maira040@ubuntu64:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
 "$maira040@ubuntu64:~$
maira040@ubuntu64:~$ echo "$DB_USER"
labuser
$DB_Pmaira040@ubuntu64:~$
maira040@ubuntu64:~$ echo "$DB_PASSWORD"
labpass123
maira040@ubuntu64:~$
```

3.
```
maira040@ubuntu64:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
```

4.
```
maira040@ubuntu64:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
printmaira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
maira040@ubuntu64:~$ _
```

Task 3 — Make DB_* variables persistent in ~/.bashrc:

1.
```
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
export DB_URL="postgres://db.example.local:5432/mydb"

export DB_USER="labuser"

export DB_PASSWORD="labpass123"
:wq_
```

2.

```
maira040@ubuntu64:~$ source ~/.bashrc
maira040@ubuntu64:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
maira040@ubuntu64:~$
maira040@ubuntu64:~$ echo "$DB_USER"
labuser
maira040@ubuntu64:~$
maira040@ubuntu64:~$ echo "$DB_PASSWORD"
labpass123
maira040@ubuntu64:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
maira040@ubuntu64:~$
```

3.

```
maira040@ubuntu64:~$ echo "$DB_URL"
postgres://db.example.local:5432/mydb
maira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv | grep '^DB_'
DB_PASSWORD=labpass123
DB_USER=labuser
DB_URL=postgres://db.example.local:5432/mydb
maira040@ubuntu64:~$
```

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

1.

```
maira040@ubuntu64:~$ sudo cat /etc/environment
[sudo] password for maira040:
PATH="/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin"
```

2.

```
maira040@ubuntu64:~$ echo "$PATH"
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
maira040@ubuntu64:~$
```

3.

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

```
maira040@ubuntu64:~$ 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-5thB"
```

4.

```
Ubuntu 24.04.3 LTS ubuntu64 tty1

ubuntu64 login: maira040
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 Fri Nov  7 03:57:45 AM UTC 2025

  System load:  0.0               Processes:             227
  Usage of /:   94.7% of 9.75GB   Users logged in:       0
  Memory usage: 9%                IPv4 address for ens33: 192.168.238.129
  Swap usage:   0%

  => / is using 94.7% 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.

29 updates can be applied immediately.
22 of these updates are standard security updates.
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


maira040@ubuntu64:~$ echo $Class

eCC-5thB
cmaira040@ubuntu64:~$
maira040@ubuntu64:~$ echo "$PATH"
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
maira040@ubuntu64:~$
```

5.
```
maira040@ubuntu64:~$ cat > ~/welcome <<'EOF'
> #!/bin/bash
>
> echo "Welcome to Cloud Computing $USER"
>
> EOF
maira040@ubuntu64:~$ chmod +x ~/welcome
maira040@ubuntu64:~$
```

6.
```
maira040@ubuntu64:~$ cd ~
maira040@ubuntu64:~$ ./welcome
Welcome to Cloud Computing maira040
maira040@ubuntu64:~$ _
```

7.
```
PATH=$PATH:~
:wq
```

8.
```
maira040@ubuntu64:~$ source ~/.bashrc
maira040@ubuntu64:~$ cd ~
maira040@ubuntu64:~$ welcome
Welcome to Cloud Computing maira040
```

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

1.
```
maira040@ubuntu64:~$ sudo ufw enable
[sudo] password for maira040:
Firewall is active and enabled on system startup
maira040@ubuntu64:~$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), deny (routed)
New profiles: skip
maira040@ubuntu64:~$ _
```

2.
```
maira040@ubuntu64:~$ sudo ufw deny 22/tcp
Rule added
Rule added (v6)
maira040@ubuntu64:~$ sudo ufw status numbered
Status: active

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

maira040@ubuntu64:~$
```

3.

```
C:\Users\BOSS>ssh maira040@192.168.238.129
ssh: connect to host 192.168.238.129 port 22: Connection timed out
```

4.

```
maira040@ubuntu64:~$ sudo ufw allow 22/tcp
Rule updated
Rule updated (v6)
maira040@ubuntu64:~$ sudo ufw reload
Firewall reloaded
maira040@ubuntu64:~$ sudo ufw status
Status: active

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

maira040@ubuntu64:~$ _
```

5.

```
C:\Users\BOSS>ssh maira040@192.168.238.129
maira040@192.168.238.129'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 Fri Nov  7 04:11:01 AM UTC 2025

  System load:  0.0               Processes:             234
  Usage of /:   92.8% of 9.75GB   Users logged in:       1
  Memory usage: 14%               IPv4 address for ens33: 192.168.238.129
  Swap usage:   0%

  => / is using 92.8% of 9.75GB

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

Expanded Security Maintenance for Applications is not enabled.

7 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: Sun Nov  2 06:35:51 2025 from 192.168.238.1
maira040@ubuntu64:~$
```

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

1.

```
maira040@ubuntu64:~$ 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/maira040/.ssh/id_lab7
Your public key has been saved in /home/maira040/.ssh/id_lab7.pub
The key fingerprint is:
SHA256:TG/ezn/dcgSuNSYaa+UybvKWGBi/L/rpB2YSNrl46pc lab_key
The key's randomart image is:
+--[ED25519 256]--+
|                 |
|                 |
|       ..        |
|      *o .    .  |
|     o BS o  . . |
|    . = *o..o = .|
|     o = =.B.= oo|
|    . E =.@oo . =|
|   ....++@+oo..+ |
+----[SHA256]-----+
maira040@ubuntu64:~$ ls -la ~/.ssh
total 16
drwx------  2 maira040 maira040 4096 Nov  7 04:13 .
drwxr-x--- 24 maira040 maira040 4096 Nov  7 04:03 ..
-rw-------  1 maira040 maira040    0 Sep 26 16:32 authorized_keys
-rw-------  1 maira040 maira040  399 Nov  7 04:13 id_lab7
-rw-r--r--  1 maira040 maira040   89 Nov  7 04:13 id_lab7.pub
maira040@ubuntu64:~$ _
```

2.

```
maira040@ubuntu64:~$ cat $HOME/.ssh/id_lab7.pub
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIPteE/7Y4AutqGN+KB82dz7pVrvxMlAfNunde3tDVEFo lab_key
maira040@ubuntu64:~$
```

3.

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

4.

```
maira040@ubuntu64:~$ ssh maira040@192.168.238.129
The authenticity of host '192.168.238.129 (192.168.238.129)' can't be established.
ED25519 key fingerprint is SHA256:FTSGhWw78R3geJpUfJucvPvD5g0LEFqDx1T1q/cUYo4.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.238.129' (ED25519) to the list of known hosts.
maira040@192.168.238.129'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 Fri Nov  7 04:28:28 AM UTC 2025

  System load:  0.0               Processes:             233
  Usage of /:   92.8% of 9.75GB   Users logged in:       1
  Memory usage: 14%               IPv4 address for ens33: 192.168.238.129
  Swap usage:   0%
```

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

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

Expanded Security Maintenance for Applications is not enabled.

7 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: Fri Nov  7 04:17:20 2025 from 192.168.238.1
maira040@ubuntu64:~$
```

5.

```
maira040@ubuntu64:~$ mkdir -p ~/.ssh
maira040@ubuntu64:~$ chmod 700 ~/.ssh
maira040@ubuntu64:~$  > ~/.ssh/authorized_keys
```

6.

```
maira040@ubuntu64:~$ echo "ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIPAteE/7Y4AutqGN+KB82dz7pVrvxM1Af
maira040@ubuntu64:~$
maira040@ubuntu64:~$
maira040@ubuntu64:~$ chmod 600 ~/.ssh/authorized_keys
maira040@ubuntu64:~$ cat ~/.ssh/authorized_keys
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIPAteE/7Y4AutqGN+KB82dz7pVrvxM1AfNunde3tDVEFo lab_key
maira040@ubuntu64:~$ _
```

7.

```
C:\Users\BOSS>ssh maira040@192.168.238.129
The authenticity of host '192.168.238.129 (192.168.238.129)' can't be established.
ED25519 key fingerprint is SHA256:FTSGhWw78R3geJpUfJucvPvD5g0LEFqDx1T1q/cUYo4.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.238.129' (ED25519) to the list of known hosts.
maira040@192.168.238.129'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 Fri Nov  7 04:44:05 AM UTC 2025

  System load:  0.0               Processes:             232
  Usage of /:   92.8% of 9.75GB   Users logged in:       1
  Memory usage: 14%               IPv4 address for ens33: 192.168.238.129
  Swap usage:   0%

  => / is using 92.8% 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.
```

8.

```
maira040@ubuntu64:~$ ssh -i ~/.ssh/id_lab7 maira040@192.168.238.129
maira040@192.168.238.129'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 Fri Nov  7 04:46:35 AM UTC 2025

  System load:  0.0               Processes:             237
  Usage of /:   92.8% of 9.75GB   Users logged in:       1
  Memory usage: 14%               IPv4 address for ens33: 192.168.238.129
  Swap usage:   0%

  => / is using 92.8% 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.
```

EXAM EVALUATION QUESTIONS:

Question 1:

1.

```
maira040@ubuntu64:~$ printenv
SHELL=/bin/bash
DB_PASSWORD=labpass123
CREDENTIALS_DIRECTORY=/run/credentials/getty@tty1.service
MEMORY_PRESSURE_WRITE=c29tZSAyMDAwMDAgMjAwMDAwMAA=
XDG_SEAT=seat0
PWD=/home/maira040
LOGNAME=maira040
XDG_SESSION_TYPE=tty
SYSTEMD_EXEC_PID=2729
DB_USER=labuser
HOME=/home/maira040
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:c
x=01;32:*.tar=01;31:*.tgz=01;31:*.arc=01;31:*.arj=01;31:*.taz=01;31:*.lha=01;31
1;31:*.zip=01;31:*.z=01;31:*.dz=01;31:*.gz=01;31:*.lrz=01;31:*.lz=01;31:*.lzo=0
2=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=01;31:*.war=01;31:*.ear=01;31:
31:*.rz=01;31:*.cab=01;31:*.wim=01;31:*.swm=01;31:*.dwm=01;31:*.esd=01;31:*.avi
35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.ti
:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.webm=01;35:*.we
*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=0
01;35:*.cgm=01;35:*.emf=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=00;36:*.au=00;36:*.
36:*.ogg=00;36:*.ra=00;36:*.wav=00;36:*.oga=00;36:*.opus=00;36:*.spx=00;36:*.xs
g-new=00;90:*.dpkg-old=00;90:*.dpkg-tmp=00;90:*.old=00;90:*.orig=00;90:*.part=0
=00;90:*.ucf-dist=00;90:*.ucf-new=00;90:*.ucf-old=00;90:
MEMORY_PRESSURE_WATCH=/sys/fs/cgroup/system.slice/system-getty.slice/getty@tty1
INVOCATION_ID=8b5197287d12407b854bad504bf6454b
LESSCLOSE=/usr/bin/lesspipe %s %s
XDG_SESSION_CLASS=user
TERM=linux
LESSOPEN=| /usr/bin/lesspipe %s
USER=maira040
SHLVL=1
XDG_VTNR=1
DB_URL=postgres://db.example.local:5432/mydb
XDG_SESSION_ID=7
XDG_RUNTIME_DIR=/run/user/1000
XDG_DATA_DIRS=/usr/share/gnome:/usr/local/share:/usr/share:/var/lib/snapd/deskt
HUSHLOGIN=FALSE
PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/u
DBUS_SESSION_BUS_ADDRESS=unix:path=/run/user/1000/bus
MAIL=/var/mail/maira040
Class=CC-5thB
OLDPWD=/home/maira040
_=/usr/bin/printenv
maira040@ubuntu64:~$ _
```

2.

```
maira040@ubuntu64:~$ printenv PATH

pri/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/sn
nmaira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv LANG

en_US.UTF-8
prmaira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv PWD
/home/maira040
maira040@ubuntu64:~$
```

Question 2:

1.

```
maira040@ubuntu64:~$ export STUDENT_NAME="Maira Malik"
maira040@ubuntu64:~$ export STUDENT_ROLL_NUMBER="040"
maira040@ubuntu64:~$ export STUDENT_SEMESTER="5th"
```

2.

```
maira040@ubuntu64:~$ echo $STUDENT_NAME
Maira Malik
maira040@ubuntu64:~$
maira040@ubuntu64:~$ echo $STUDENT_ROLL_NUMBER
040
maira040@ubuntu64:~$
maira040@ubuntu64:~$ echo $STUDENT_SEMESTER
5th
maira040@ubuntu64:~$ _
```

3.

```
maira040@ubuntu64:~$ printenv | grep STUDENT_
STUDENT_NAME=Maira Malik
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=040
```

4.

```
maira040@ubuntu64:~$ echo $STUDENT_NAME
Maira Malik
maira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv | grep STUDENT_
STUDENT_NAME=Maira Malik
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=040
maira040@ubuntu64:~$
```

Question 3:

1.

```
export STUDENT_NAME="Maira Malik"

export STUDENT_ROLL_NUMBER="040"

export STUDENT_SEMESTER="5th"
:wq
```

2.

```
maira040@ubuntu64:~$ source ~/.bashrc
maira040@ubuntu64:~$ echo $STUDENT_NAME
Maira Malik
maira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv | grep '^STUDENT_'
STUDENT_NAME=Maira Malik
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=040
maira040@ubuntu64:~$
```

3.

```
ubuntu64 login: maira040
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 Fri Nov  7 04:58:27 AM UTC 2025

  System load:  0.0               Processes:             237
  Usage of /:   92.8% of 9.75GB   Users logged in:       1
  Memory usage: 14%               IPv4 address for ens33: 192.168.238.129
  Swap usage:   0%

  => / is using 92.8% 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.

7 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 ***
maira040@ubuntu64:~$ echo $STUDENT_NAME
Maira Malik
maira040@ubuntu64:~$
maira040@ubuntu64:~$ printenv | grep STUDENT_
STUDENT_NAME=Maira Malik
STUDENT_SEMESTER=5th
STUDENT_ROLL_NUMBER=040
maira040@ubuntu64:~$
```

Question 4:

1.

```
maira040@ubuntu64:~$ sudo ufw enable
[sudo] password for maira040:
Firewall is active and enabled on system startup
maira040@ubuntu64:~$ sudo ufw status
Status: active

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

maira040@ubuntu64:~$
```

2.

```
maira040@ubuntu64:~$ sudo ufw deny proto icmp from any to any

sudo ufw status num
sudo ufw status numberedERROR: Unsupported protocol 'icmp'
maira040@ubuntu64:~$
```

3.

```
maira040@ubuntu64:~$ ping 192.168.238.129
PING 192.168.238.129 (192.168.238.129) 56(84) bytes of data.
64 bytes from 192.168.238.129: icmp_seq=1 ttl=64 time=0.102 ms
64 bytes from 192.168.238.129: icmp_seq=2 ttl=64 time=0.119 ms
64 bytes from 192.168.238.129: icmp_seq=3 ttl=64 time=0.109 ms
64 bytes from 192.168.238.129: icmp_seq=4 ttl=64 time=0.109 ms
64 bytes from 192.168.238.129: icmp_seq=5 ttl=64 time=0.036 ms
64 bytes from 192.168.238.129: icmp_seq=6 ttl=64 time=0.128 ms
64 bytes from 192.168.238.129: icmp_seq=7 ttl=64 time=0.098 ms
64 bytes from 192.168.238.129: icmp_seq=8 ttl=64 time=0.050 ms
```