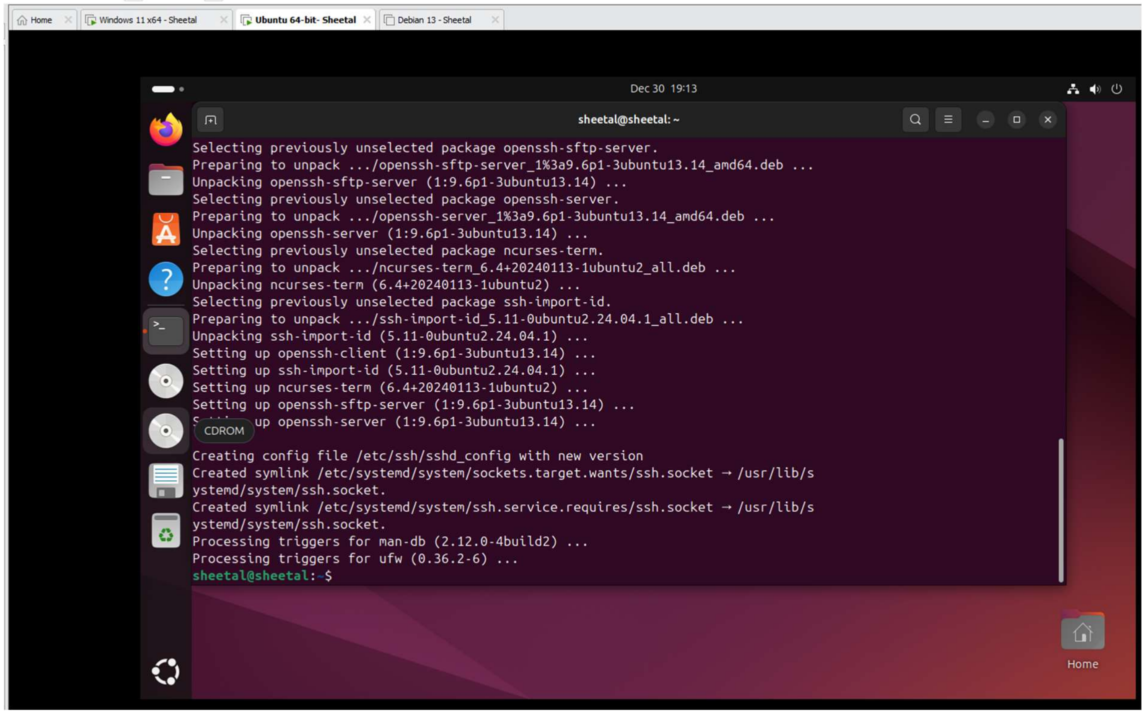
Template Week 6 – Networking

Student number: 575798

Assignment 6.1: Working from home

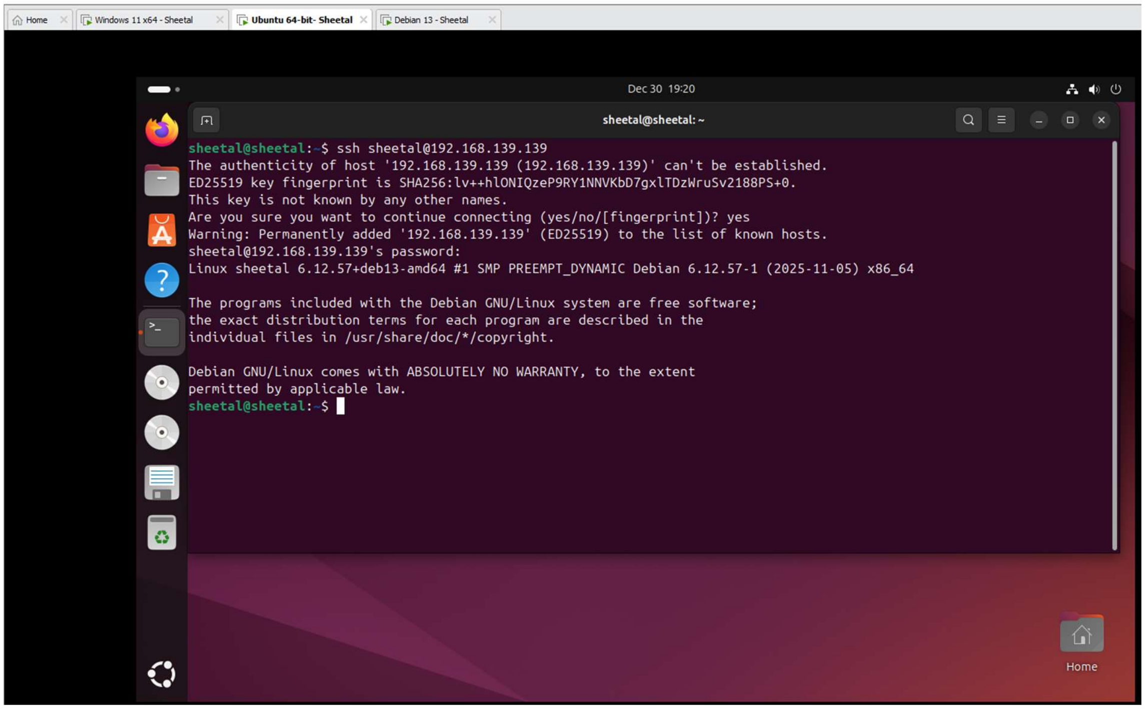
Screenshot installation openssh-server:



```
Selecting previously unselected package openssh-sftp-server.
Preparing to unpack .../openssh-sftp-server_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...
Selecting previously unselected package openssh-server.
Preparing to unpack .../openssh-server_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-server (1:9.6p1-3ubuntu13.14) ...
Selecting previously unselected package ncurses-term.
Preparing to unpack .../ncurses-term_6.4+20240113-1ubuntu2_all.deb ...
Unpacking ncurses-term (6.4+20240113-1ubuntu2) ...
Selecting previously unselected package ssh-import-id.
Preparing to unpack .../ssh-import-id_5.11-0ubuntu2.24.04.1_all.deb ...
Unpacking ssh-import-id (5.11-0ubuntu2.24.04.1) ...
Setting up openssh-client (1:9.6p1-3ubuntu13.14) ...
Setting up ssh-import-id (5.11-0ubuntu2.24.04.1) ...
Setting up ncurses-term (6.4+20240113-1ubuntu2) ...
Setting up openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...
Setting up openssh-server (1:9.6p1-3ubuntu13.14) ...

Creating config file /etc/ssh/sshd_config with new version
Created symlink /etc/systemd/system/sockets.target.wants/ssh.socket → /usr/lib/s
ystemd/system/ssh.socket.
Created symlink /etc/systemd/system/ssh.service.requires/ssh.socket → /usr/lib/s
ystemd/system/ssh.socket.
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for ufw (0.36.2-6) ...
sheetal@sheetal:~$
```

Screenshot successful SSH command execution:

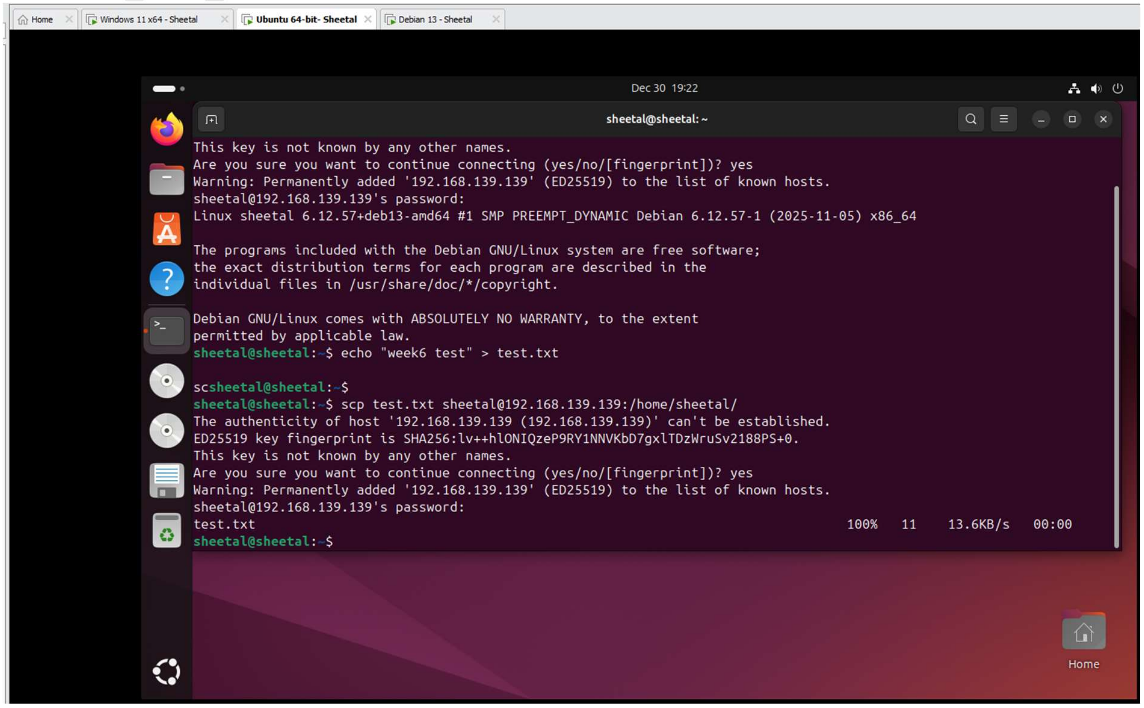


```
sheetal@sheetal:~$ ssh sheetal@192.168.139.139
The authenticity of host '192.168.139.139 (192.168.139.139)' can't be established.
ED25519 key fingerprint is SHA256:lv++hlONIQzeP9RY1NNVKbD7gxlTDzWruSv2188PS+0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.139' (ED25519) to the list of known hosts.
sheetal@192.168.139.139's password:
Linux sheetal 6.12.57+deb13-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.12.57-1 (2025-11-05) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
sheetal@sheetal:~$ 
```

Screenshot successful execution SCP command:



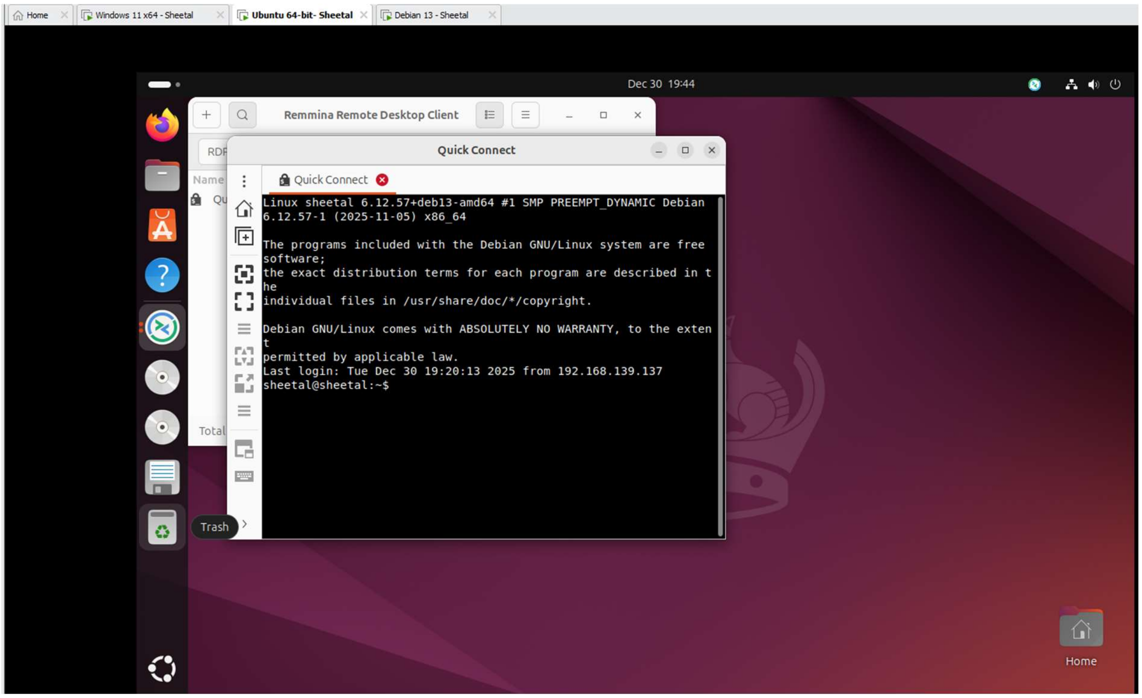
```
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.139' (ED25519) to the list of known hosts.
sheetal@192.168.139.139's password:
Linux sheetal 6.12.57+deb13-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.12.57-1 (2025-11-05) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
sheetal@sheetal:~$ echo "week6 test" > test.txt

scsheetal@sheetal:~$
sheetal@sheetal:~$ scp test.txt sheetal@192.168.139.139:/home/sheetal/
The authenticity of host '192.168.139.139 (192.168.139.139)' can't be established.
ED25519 key fingerprint is SHA256:lv++hlONIQzeP9RY1NNVKbD7gxlTDzWruSv2188PS+0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.139' (ED25519) to the list of known hosts.
sheetal@192.168.139.139's password:
test.txt                                                   100%   11    13.6KB/s   00:00
sheetal@sheetal:~$
```

Screenshot remmina:



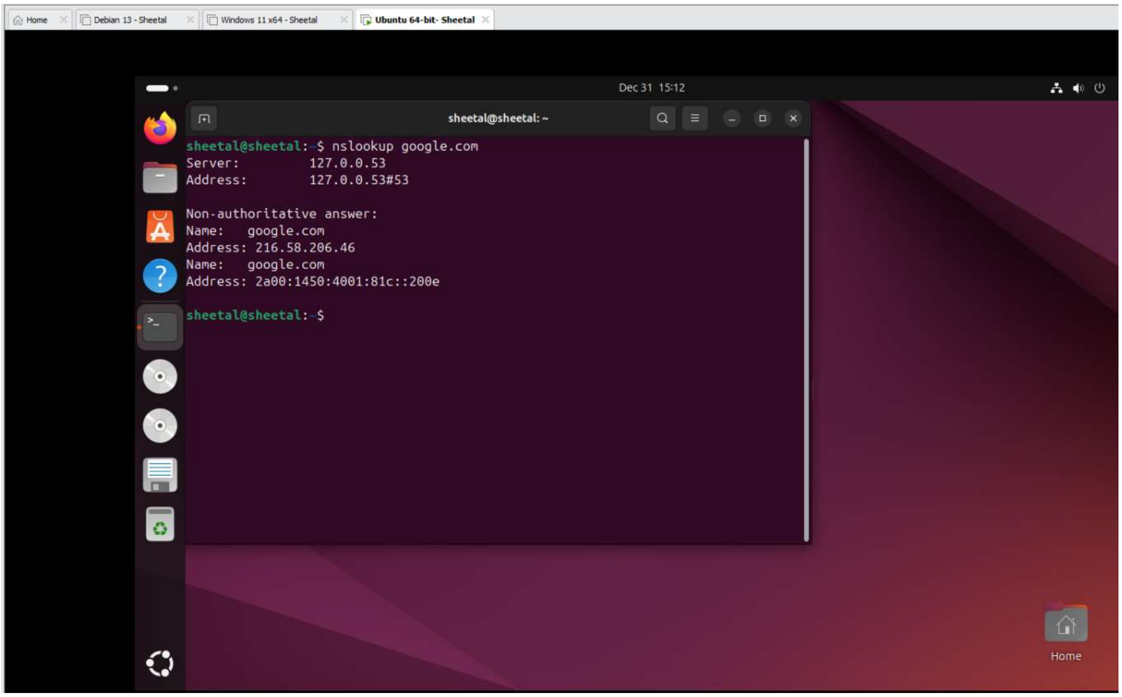
```
Linux sheetal 6.12.57+deb13-amd64 #1 SMP PREEMPT_DYNAMIC Debian
6.12.57-1 (2025-11-05) x86_64

The programs included with the Debian GNU/Linux system are free
software;
the exact distribution terms for each program are described in t
he
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the exten
t
permitted by applicable law.
Last login: Tue Dec 30 19:20:13 2025 from 192.168.139.137
sheetal@sheetal:~$
```

Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:

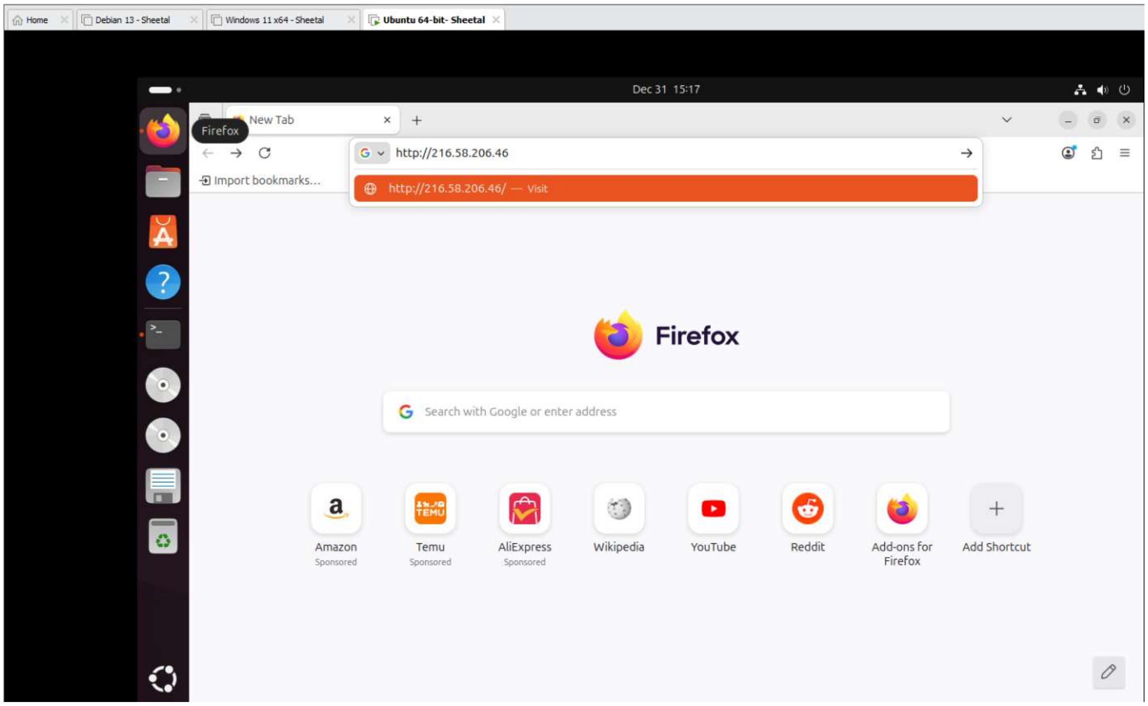


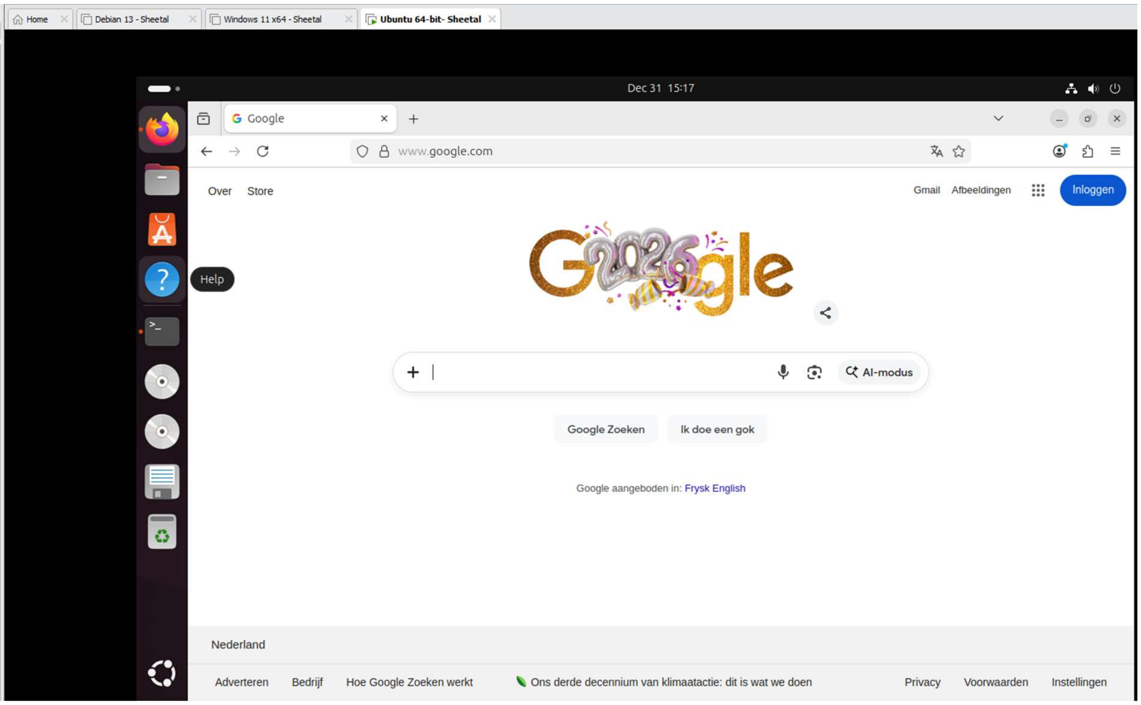
```
sheetal@sheetal:~$ nslookup google.com
Server:         127.0.0.53
Address:        127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 216.58.206.46
Name:   google.com
Address: 2a00:1450:4001:81c::200e

sheetal@sheetal:~$
```

Screenshot website visit via IP address:





Assignment 6.3: subnetting

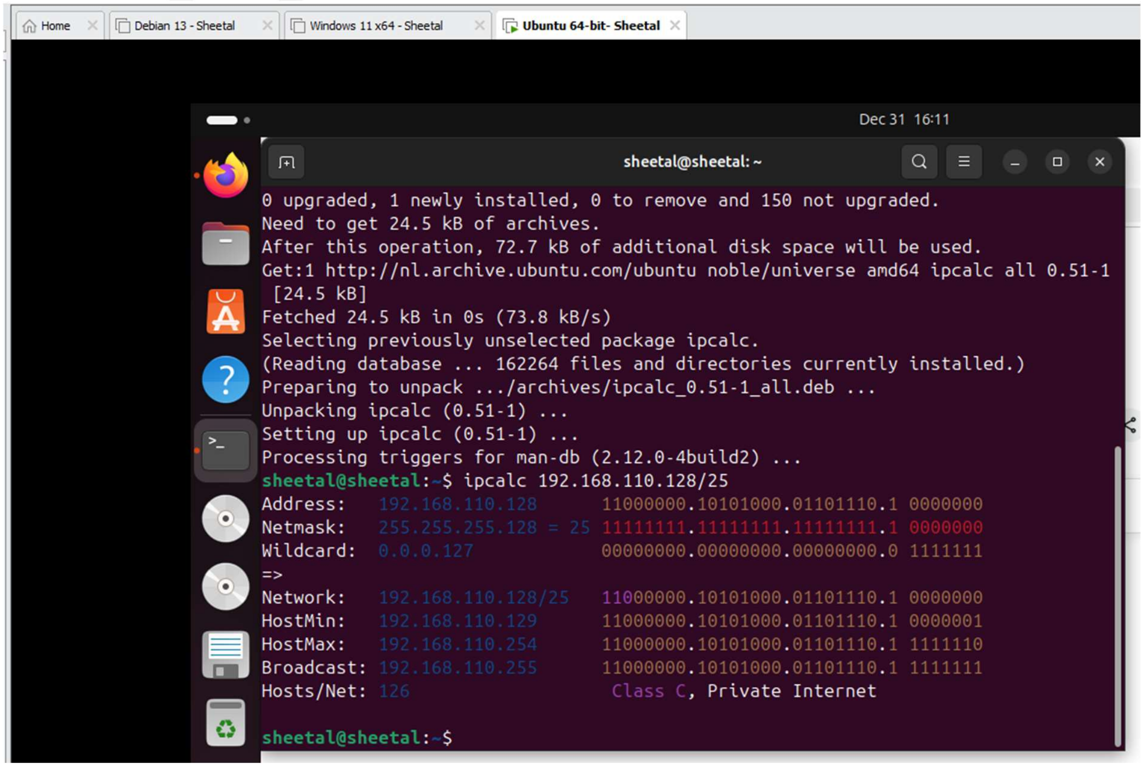
How many IP addresses are in this network configuration 192.168.110.128/25?

Since there is 25 network bits and an IPv4 address always has 32 bits. To find the host bits we do 32-25 = 7. Therefore 2^7 = 128.

What is the usable IP range to hand out to the connected computers?

The usable range is 192.168.110.129 – 192.168.110.254.

Check your two previous answers with this Linux command: `ipcalc 192.168.110.128/25`



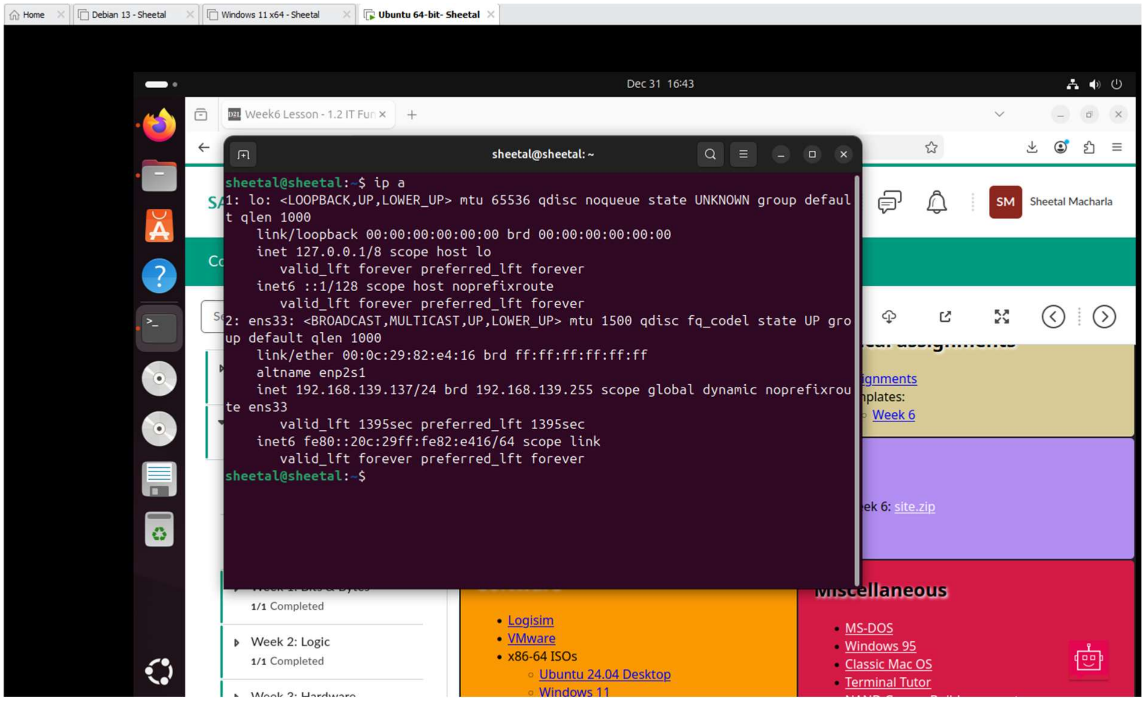
```
0 upgraded, 1 newly installed, 0 to remove and 150 not upgraded.
Need to get 24.5 kB of archives.
After this operation, 72.7 kB of additional disk space will be used.
Get:1 http://nl.archive.ubuntu.com/ubuntu noble/universe amd64 ipcalc all 0.51-1
 [24.5 kB]
Fetched 24.5 kB in 0s (73.8 kB/s)
Selecting previously unselected package ipcalc.
(Reading database ... 162264 files and directories currently installed.)
Preparing to unpack .../archives/ipcalc_0.51-1_all.deb ...
Unpacking ipcalc (0.51-1) ...
Setting up ipcalc (0.51-1) ...
Processing triggers for man-db (2.12.0-4build2) ...
sheetal@sheetal:~$ ipcalc 192.168.110.128/25
Address:   192.168.110.128      11000000.10101000.01101110.1 0000000
Netmask:   255.255.255.128 = 25 11111111.11111111.11111111.1 0000000
Wildcard:  0.0.0.127            00000000.00000000.00000000.0 1111111
=>
Network:   192.168.110.128/25   11000000.10101000.01101110.1 0000000
HostMin:   192.168.110.129      11000000.10101000.01101110.1 0000001
HostMax:   192.168.110.254      11000000.10101000.01101110.1 1111110
Broadcast: 192.168.110.255      11000000.10101000.01101110.1 1111111
Hosts/Net: 126                   Class C, Private Internet

sheetal@sheetal:~$
```

Explain the above calculation in your own words.

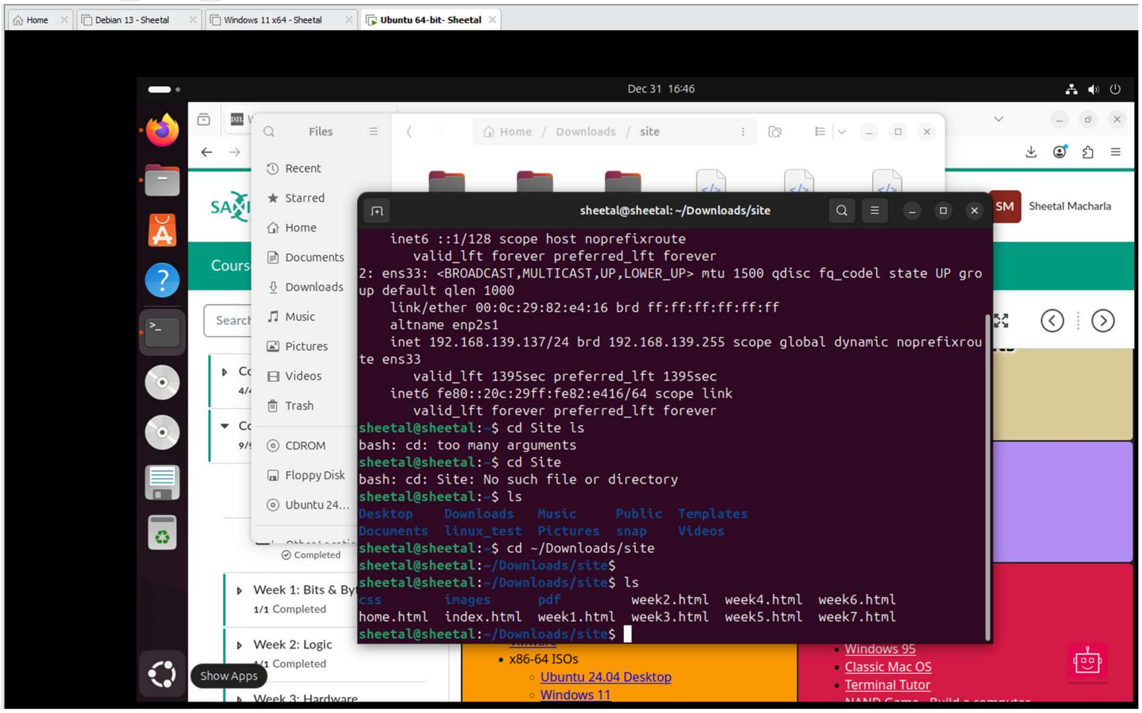
Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:



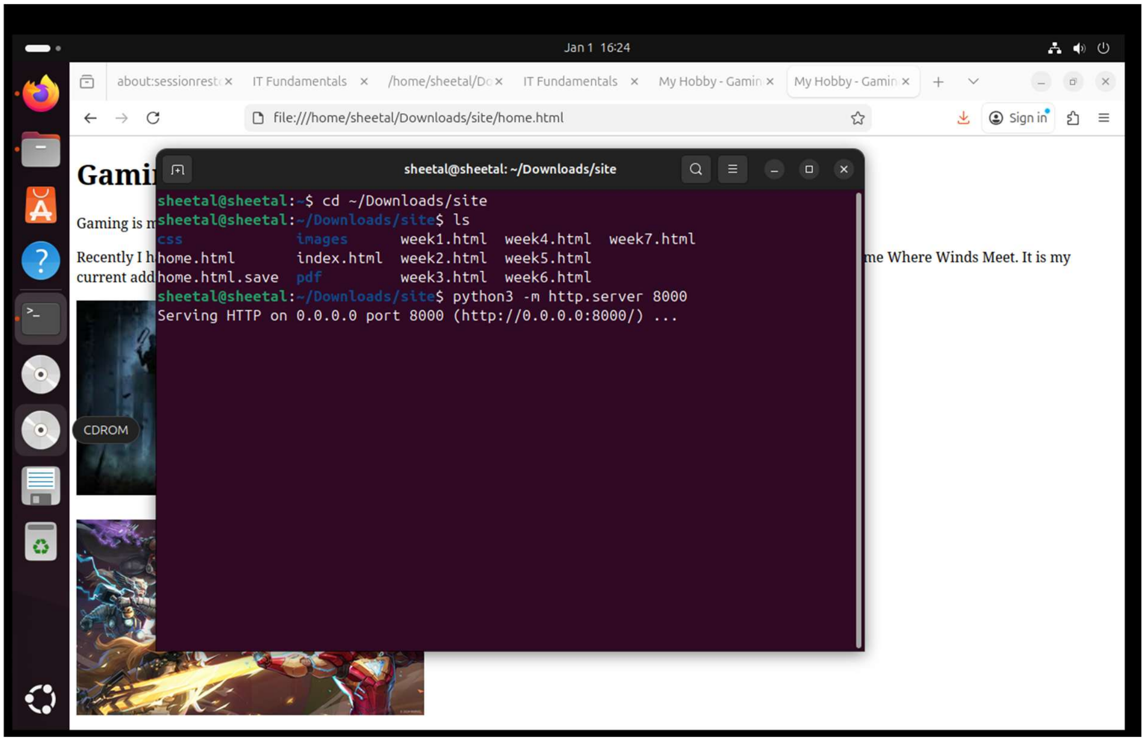
```
sheetal@sheetal:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
       valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gro
up default qlen 1000
    link/ether 00:0c:29:82:e4:16 brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.137/24 brd 192.168.139.255 scope global dynamic noprefixrou
te ens33
       valid_lft 1395sec preferred_lft 1395sec
    inet6 fe80::20c:29ff:fe82:e416/64 scope link
       valid_lft forever preferred_lft forever
sheetal@sheetal:~$
```

Screenshot of Site directory contents:



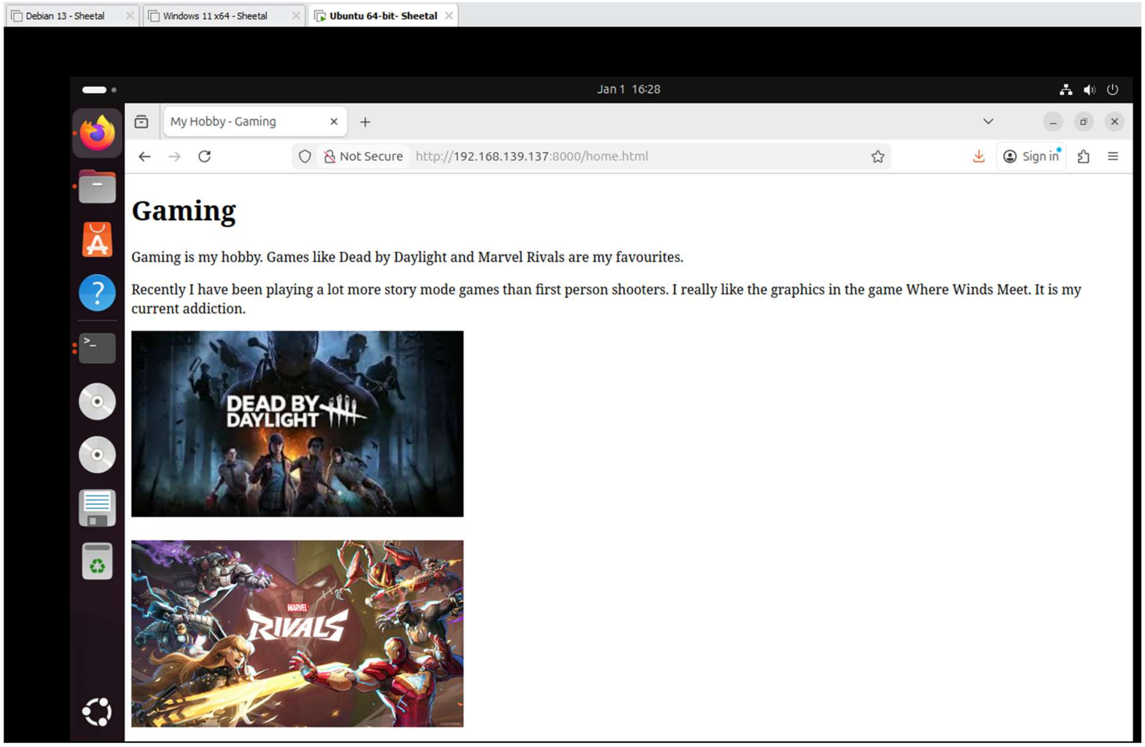
```
    inet6 ::1/128 scope host noprefixroute
       valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP gro
up default qlen 1000
    link/ether 00:0c:29:82:e4:16 brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.137/24 brd 192.168.139.255 scope global dynamic noprefixrou
te ens33
       valid_lft 1395sec preferred_lft 1395sec
    inet6 fe80::20c:29ff:fe82:e416/64 scope link
       valid_lft forever preferred_lft forever
sheetal@sheetal:~$ cd Site ls
bash: cd: too many arguments
sheetal@sheetal:~$ cd Site
bash: cd: Site: No such file or directory
sheetal@sheetal:~$ ls
Desktop    Downloads   Music     Public  Templates
Documents  linux_test  Pictures  snap    Videos
sheetal@sheetal:~$ cd ~/Downloads/site
sheetal@sheetal:~/Downloads/site$
sheetal@sheetal:~/Downloads/site$ ls
css        images      pdf         week2.html  week4.html  week6.html
home.html  index.html  week1.html  week3.html  week5.html  week7.html
sheetal@sheetal:~/Downloads/site$
```

Screenshot python3 webserver command:



```
sheetal@sheetal:~$ cd ~/Downloads/site
sheetal@sheetal:~/Downloads/site$ ls
css             images      week1.html  week4.html  week7.html
home.html       index.html  week2.html  week5.html
home.html.save  pdf         week3.html  week6.html
sheetal@sheetal:~/Downloads/site$ python3 -m http.server 8000
Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000/) ...
```

Screenshot web browser visits your site:



Gaming

Gaming is my hobby. Games like Dead by Daylight and Marvel Rivals are my favourites.

Recently I have been playing a lot more story mode games than first person shooters. I really like the graphics in the game Where Winds Meet. It is my current addiction.

Assignment 6.5: Network segment

Remember that bitwise java application you've made in week 2? Expand that application so that you can also calculate a network segment as explained in the PowerPoint slides of week 6. Use the bitwise & AND operator. You need to be able to input two Strings. An IP address and a subnet.

IP: 192.168.1.100 and subnet: 255.255.255.224 for /27

```
Example: 192.168.1.100/27
Calculate the network segment
IP Address:   11000000.10101000.00000001.01100100
Subnet Mask:  11111111.11111111.11111111.11100000
-------------------------------------------------
Network Addr: 11000000.10101000.00000001.01100000

This gives 192.168.1.96 in decimal as the network address.
For a /27 subnet, each segment (or subnet) has 32 IP addresses ($2^5$).
The range of this network segment is from 192.168.1.96 to 192.168.1.127.
```

Paste source code here, with a screenshot of a working application.

```
import java.util.Scanner;

public class NetworkResults {

  public static void main(String[] args) {
    Scanner sc = new Scanner(System.in);

    System.out.print("Please enter an IP address (e.g 192.168.1.100): ");
    String ipText = sc.nextLine();

    System.out.print("Please enter a Subnet mask (e.g 255.255.255.224): ");
    String subMaskText = sc.nextLine();

    int ipAdd = ipv4ToInt(ipText);
    int mask  = ipv4ToInt(subMaskText);

    int network   = ipAdd & mask;
    int broadcast = network | ~mask;

    String networkStr   = intToIpv4(network);
    String broadcastStr = intToIpv4(broadcast);

    int prefix        = Integer.bitCount(mask);
    int hostBits      = 32 - prefix;
    int totalAddresses = 1 << hostBits;

    String firstUsable;
    String lastUsable;

    if (hostBits >= 2) {
       firstUsable = intToIpv4(network + 1);
       lastUsable  = intToIpv4(broadcast - 1);
    } else {
       firstUsable = "N/A";
       lastUsable  = "N/A";
    }

    System.out.println("---Network---Information---");
    System.out.println("IP Address: " + ipText);
    System.out.println("Subnet Mask: " + subMaskText + " (/" + prefix + ")");
    System.out.println("Network Address: " + networkStr);
    System.out.println("Total IPs: " + totalAddresses);

    if (hostBits >= 2) {
       System.out.println("Usable Range: " + firstUsable + " - " + lastUsable);
```

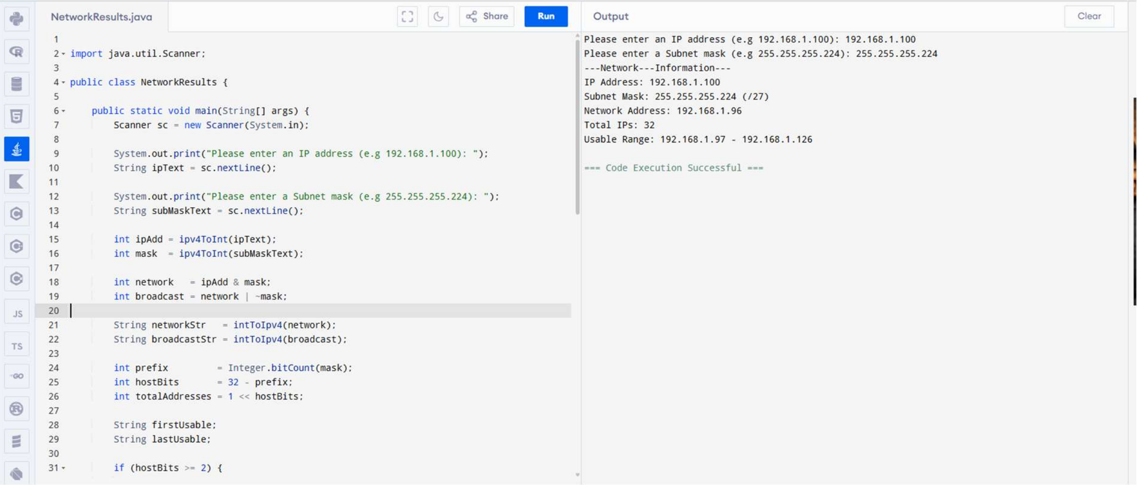
```
        } else {
            System.out.println("Usable Range: N/A (no usable hosts in this subnet)");
        }

        sc.close();
    }

    private static int ipv4ToInt(String ip) {
        String[] parts = ip.split("\\.");
        if (parts.length != 4) {
            throw new IllegalArgumentException("Invalid IPv4: " + ip);
        }

        int result = 0;
        for (String p : parts) {
            int val = Integer.parseInt(p);
            if (val < 0 || val > 255) {
                throw new IllegalArgumentException("Invalid IPv4: " + ip);
            }
            result = (result << 8) | val;
        }
        return result;
    }

    private static String intToIpv4(int value) {
        return ((value >>> 24) & 0xFF) + "." +
               ((value >>> 16) & 0xFF) + "." +
               ((value >>>  8) & 0xFF) + "." +
               ( value         & 0xFF);
    }
}
```



```java

import java.util.Scanner;

public class NetworkResults {

    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Please enter an IP address (e.g 192.168.1.100): ");
        String ipText = sc.nextLine();

        System.out.print("Please enter a Subnet mask (e.g 255.255.255.224): ");
        String subMaskText = sc.nextLine();

        int ipAdd = ipv4ToInt(ipText);
        int mask  = ipv4ToInt(subMaskText);

        int network   = ipAdd & mask;
        int broadcast = network | ~mask;

        String networkStr   = intToIpv4(network);
        String broadcastStr = intToIpv4(broadcast);

        int prefix         = Integer.bitCount(mask);
        int hostBits       = 32 - prefix;
        int totalAddresses = 1 << hostBits;

        String firstUsable;
        String lastUsable;

        if (hostBits >= 2) {
```

```
Please enter an IP address (e.g 192.168.1.100): 192.168.1.100
Please enter a Subnet mask (e.g 255.255.255.224): 255.255.255.224
---Network---Information---
IP Address: 192.168.1.100
Subnet Mask: 255.255.255.224 (/27)
Network Address: 192.168.1.96
Total IPs: 32
Usable Range: 192.168.1.97 - 192.168.1.126

=== Code Execution Successful ===
```

Ready? Save this file and export it as a pdf file with the name: **week6.pdf**