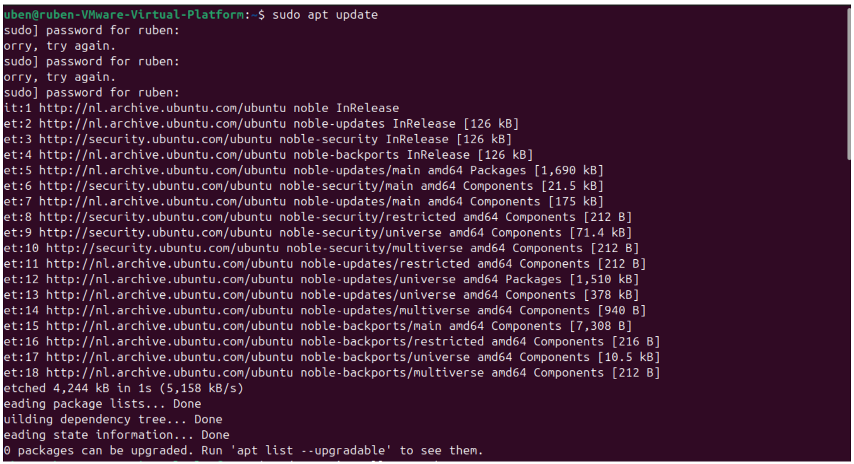
Template Week 6 – Networking

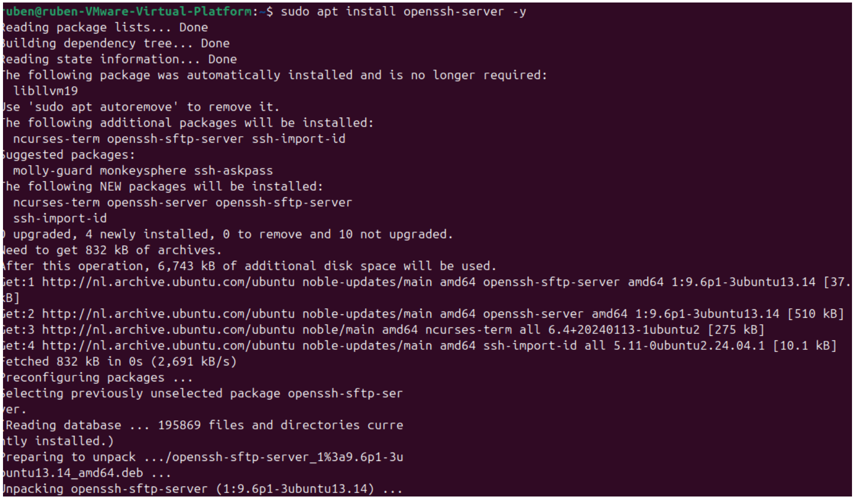
Student number: 589892

Assignment 6.1: Working from home

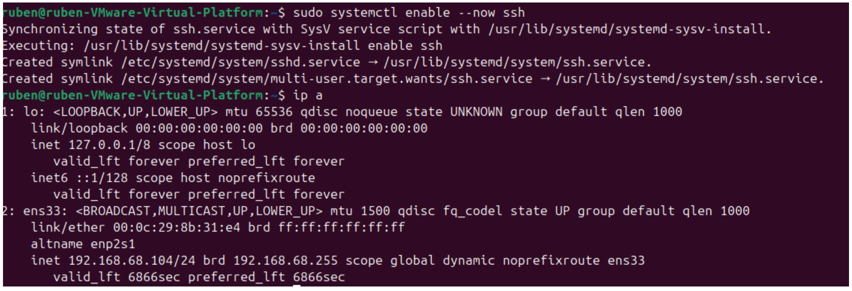
Screenshot installation openssh-server:



```
uben@ruben-VMware-Virtual-Platform:~$ sudo apt update
sudo] password for ruben:
orry, try again.
sudo] password for ruben:
orry, try again.
sudo] password for ruben:
it:1 http://nl.archive.ubuntu.com/ubuntu noble InRelease
et:2 http://nl.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
et:3 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
et:4 http://nl.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
et:5 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,690 kB]
et:6 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
et:7 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
et:8 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
et:9 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [71.4 kB]
et:10 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [212 B]
et:11 http://nl.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
et:12 http://nl.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,510 kB]
et:13 http://nl.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
et:14 http://nl.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
et:15 http://nl.archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7,308 B]
et:16 http://nl.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
et:17 http://nl.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [10.5 kB]
et:18 http://nl.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
etched 4,244 kB in 1s (5,158 kB/s)
eading package lists... Done
uilding dependency tree... Done
eading state information... Done
0 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

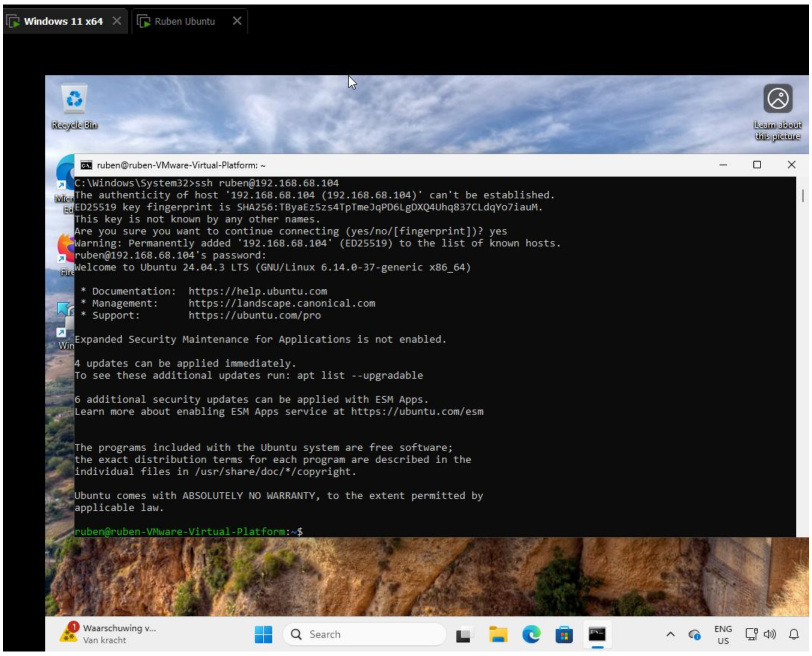


```
ruben@ruben-VMware-Virtual-Platform:~$ sudo apt install openssh-server -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libllvm19
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere ssh-askpass
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server
  ssh-import-id
0 upgraded, 4 newly installed, 0 to remove and 10 not upgraded.
Need to get 832 kB of archives.
After this operation, 6,743 kB of additional disk space will be used.
Get:1 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-sftp-server amd64 1:9.6p1-3ubuntu13.14 [37.
kB]
Get:2 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-server amd64 1:9.6p1-3ubuntu13.14 [510 kB]
Get:3 http://nl.archive.ubuntu.com/ubuntu noble/main amd64 ncurses-term all 6.4+20240113-1ubuntu2 [275 kB]
Get:4 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 ssh-import-id all 5.11-0ubuntu2.24.04.1 [10.1 kB]
Fetched 832 kB in 0s (2,691 kB/s)
Preconfiguring packages ...
Selecting previously unselected package openssh-sftp-ser
ver.
(Reading database ... 195869 files and directories curre
ntly installed.)
Preparing to unpack .../openssh-sftp-server_1%3a9.6p1-3u
buntu13.14_amd64.deb ...
Unpacking openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...
```



```
ruben@ruben-VMware-Virtual-Platform:~$ sudo systemctl enable --now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
Created symlink /etc/systemd/system/sshd.service → /usr/lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /usr/lib/systemd/system/ssh.service.
ruben@ruben-VMware-Virtual-Platform:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default 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 group default qlen 1000
    link/ether 00:0c:29:8b:31:e4 brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.68.104/24 brd 192.168.68.255 scope global dynamic noprefixroute ens33
       valid_lft 6866sec preferred_lft 6866sec
```

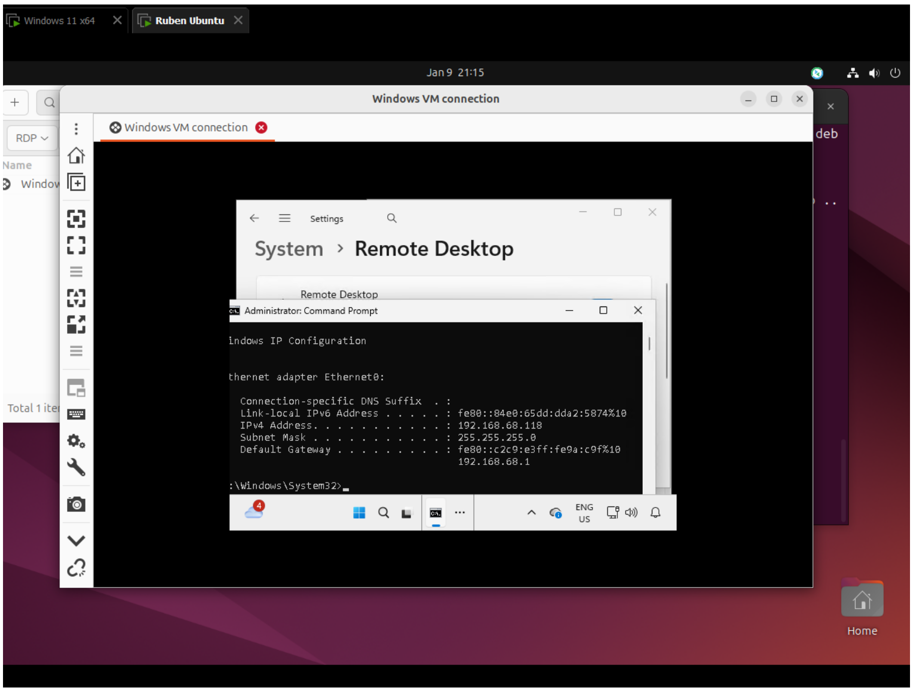
Screenshot successful SSH command execution:



```
C:\Windows\System32>ssh ruben@192.168.68.104
The authenticity of host '192.168.68.104 (192.168.68.104)' can't be established.
ED25519 key fingerprint is SHA256:TByaEz5zs4TpTmeJqPD6LgDXQ4Uhq837CLdqYo7iauM.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.68.104' (ED25519) to the list of known hosts.
ruben@192.168.68.104's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-37-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

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

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


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

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

ruben@ruben-VMware-Virtual-Platform:~$
```

Screenshot successful execution SCP command:

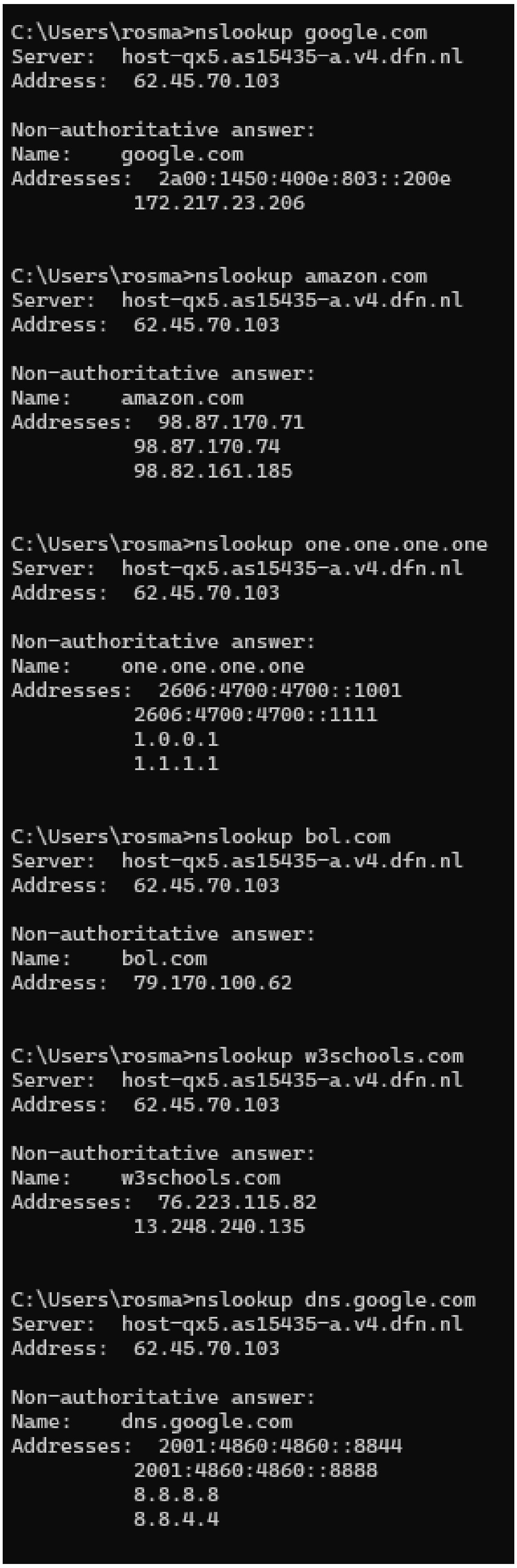
Screenshot remmina:



```
indows IP Configuration


thernet adapter Ethernet0:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::84e0:65dd:dda2:5874%10
   IPv4 Address. . . . . . . . . . . : 192.168.68.118
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::c2c9:e3ff:fe9a:c9f%10
                                       192.168.68.1

:\Windows\System32>_
```

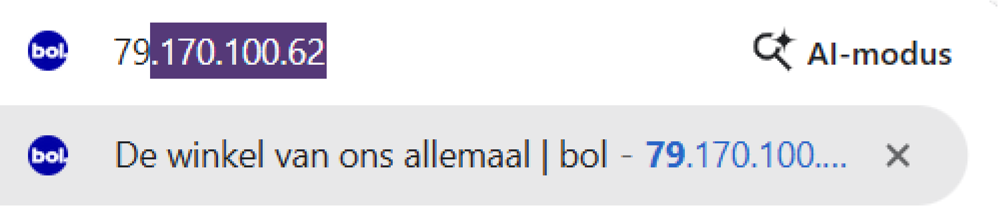
Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:

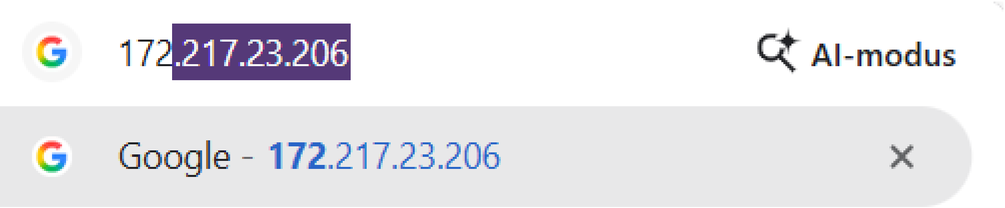


```
C:\Users\rosma>nslookup google.com
Server:  host-qx5.as15435-a.v4.dfn.nl
Address:  62.45.70.103

Non-authoritative answer:
Name:    google.com
Addresses:  2a00:1450:400e:803::200e
          172.217.23.206


C:\Users\rosma>nslookup amazon.com
Server:  host-qx5.as15435-a.v4.dfn.nl
Address:  62.45.70.103

Non-authoritative answer:
Name:    amazon.com
Addresses:  98.87.170.71
          98.87.170.74
          98.82.161.185


C:\Users\rosma>nslookup one.one.one.one
Server:  host-qx5.as15435-a.v4.dfn.nl
Address:  62.45.70.103

Non-authoritative answer:
Name:    one.one.one.one
Addresses:  2606:4700:4700::1001
          2606:4700:4700::1111
          1.0.0.1
          1.1.1.1


C:\Users\rosma>nslookup bol.com
Server:  host-qx5.as15435-a.v4.dfn.nl
Address:  62.45.70.103

Non-authoritative answer:
Name:    bol.com
Address:  79.170.100.62


C:\Users\rosma>nslookup w3schools.com
Server:  host-qx5.as15435-a.v4.dfn.nl
Address:  62.45.70.103

Non-authoritative answer:
Name:    w3schools.com
Addresses:  76.223.115.82
          13.248.240.135


C:\Users\rosma>nslookup dns.google.com
Server:  host-qx5.as15435-a.v4.dfn.nl
Address:  62.45.70.103

Non-authoritative answer:
Name:    dns.google.com
Addresses:  2001:4860:4860::8844
          2001:4860:4860::8888
          8.8.8.8
          8.8.4.4
```

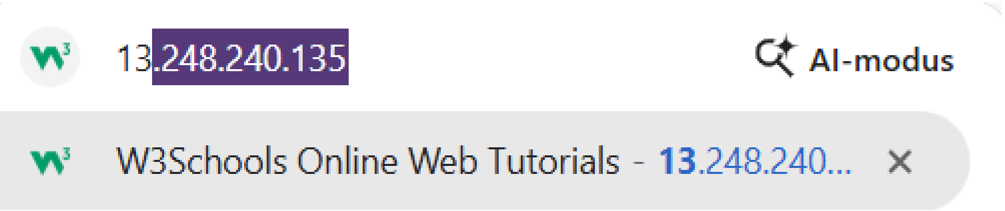
Screenshot website visit via IP address:


79.170.100.62

De winkel van ons allemaal | bol - 79.170.100....


172.217.23.206

Google - 172.217.23.206


13.248.240.135

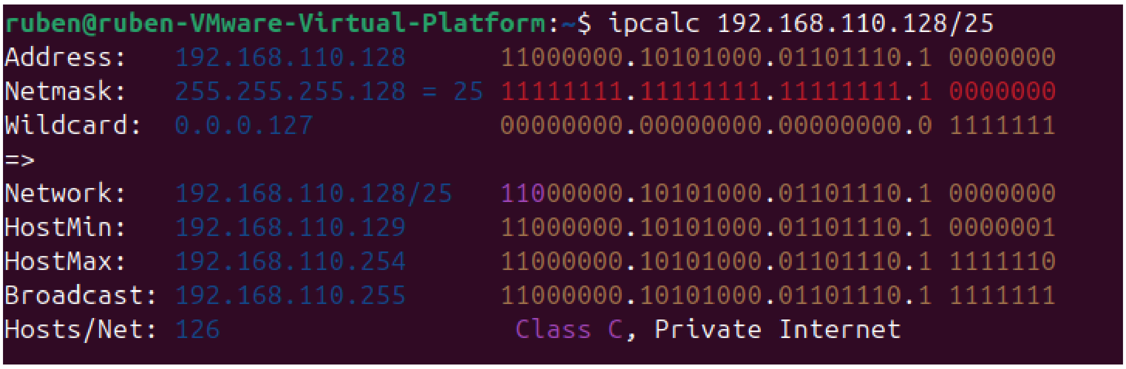
W3Schools Online Web Tutorials - 13.248.240...

Assignment 6.3: subnetting

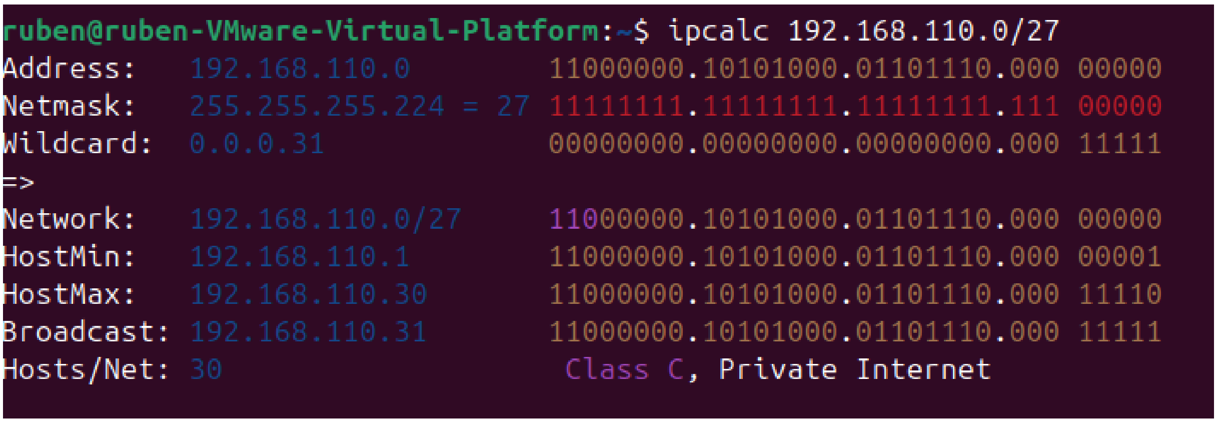
How many IP addresses are in this network configuration 192.168.110.128/25?
32 Total IP bits – 25 = 7 host bits
2 ^ 7 = 128
Network bits 25
subnet mask:
values : 128 64 32 16 8 4 2 1
first octet: 11111111
second octet: 11111111
third octet: 11111111
last octet: 10000000
so subnet mask = 255.255.255.128

What is the usable IP range to hand out to the connected computers?
The usable IP range is the range between the network address and the broadcast address so if the network address = 192.168.110.0 and the broadcast address = 192.168.110.31 the usable IP range = 192.168.110.1 - 192.168.110.30

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



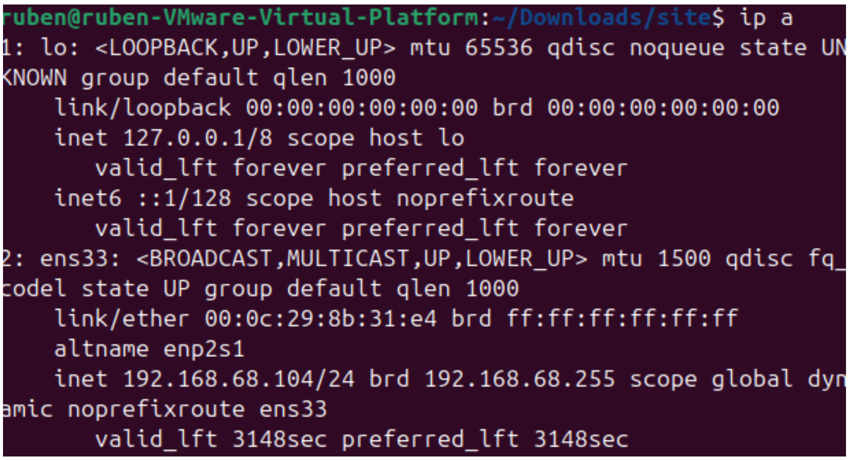
```
ruben@ruben-VMware-Virtual-Platform:~$ ipcalc 192.168.110.128/25
Address:   192.168.110.128      11000000.10101000.01101110.1 0000000
Netmask:   255.255.255.128 = 25 11111111.11111111.11111111.1 0000000
Wildcard:  0.0.0.127            00000000.00000000.00000000.0 1111111
=>
Network:   192.168.110.128/25   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
```



```
ruben@ruben-VMware-Virtual-Platform:~$ ipcalc 192.168.110.0/27
Address:   192.168.110.0        11000000.10101000.01101110.000 00000
Netmask:   255.255.255.224 = 27 11111111.11111111.11111111.111 00000
Wildcard:  0.0.0.31             00000000.00000000.00000000.000 11111
=>
Network:   192.168.110.0/27     11000000.10101000.01101110.000 00000
HostMin:   192.168.110.1        11000000.10101000.01101110.000 00001
HostMax:   192.168.110.30       11000000.10101000.01101110.000 11110
Broadcast: 192.168.110.31       11000000.10101000.01101110.000 11111
Hosts/Net: 30                    Class C, Private Internet
```

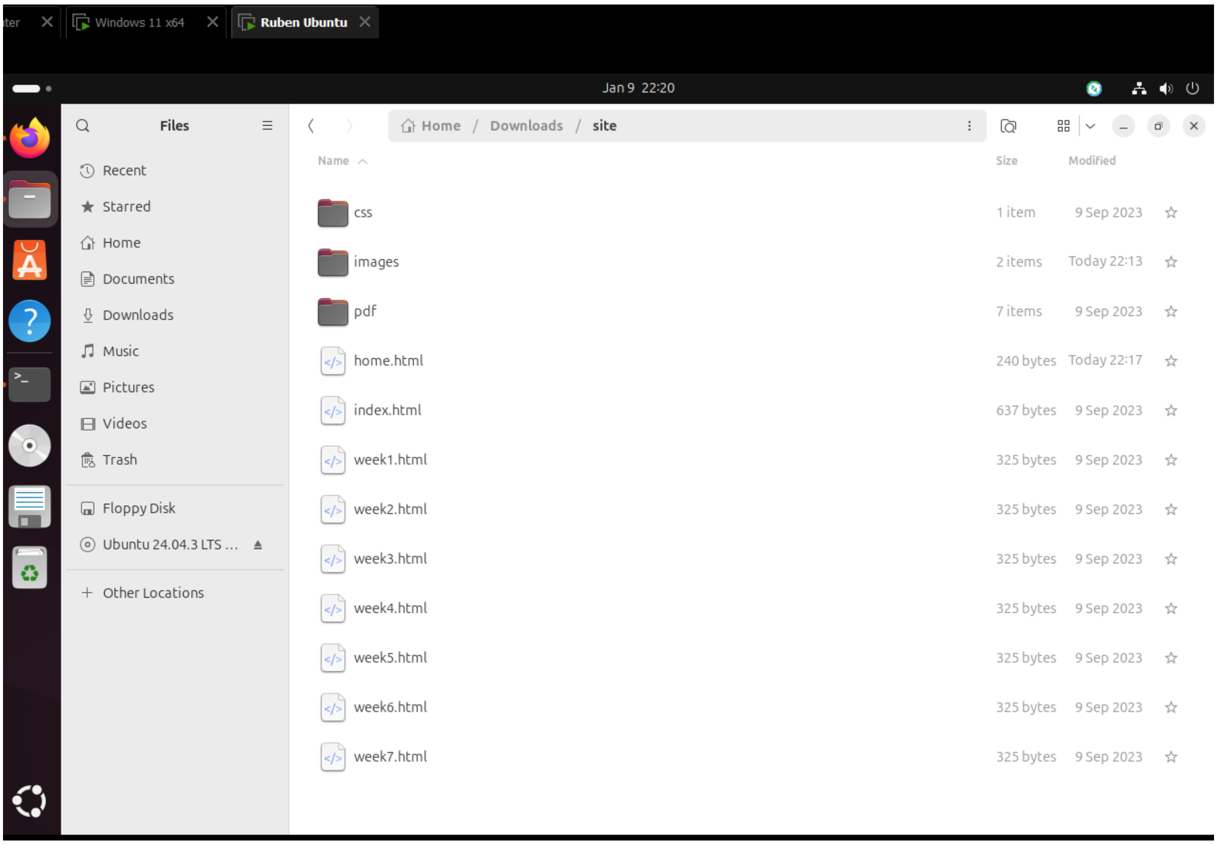
Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:



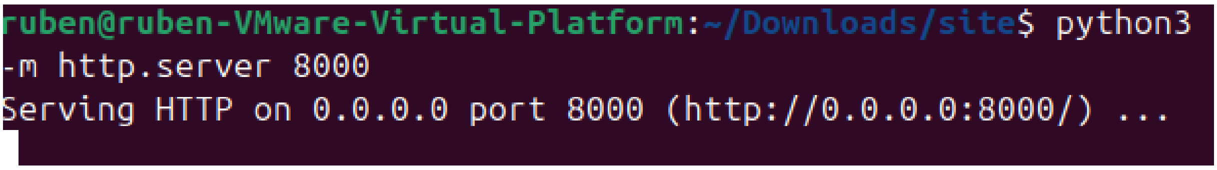
```
ruben@ruben-VMware-Virtual-Platform:~/Downloads/site$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UN
KNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::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 group default qlen 1000
    link/ether 00:0c:29:8b:31:e4 brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.68.104/24 brd 192.168.68.255 scope global dyn
amic noprefixroute ens33
       valid_lft 3148sec preferred_lft 3148sec
```

Screenshot of Site directory contents:



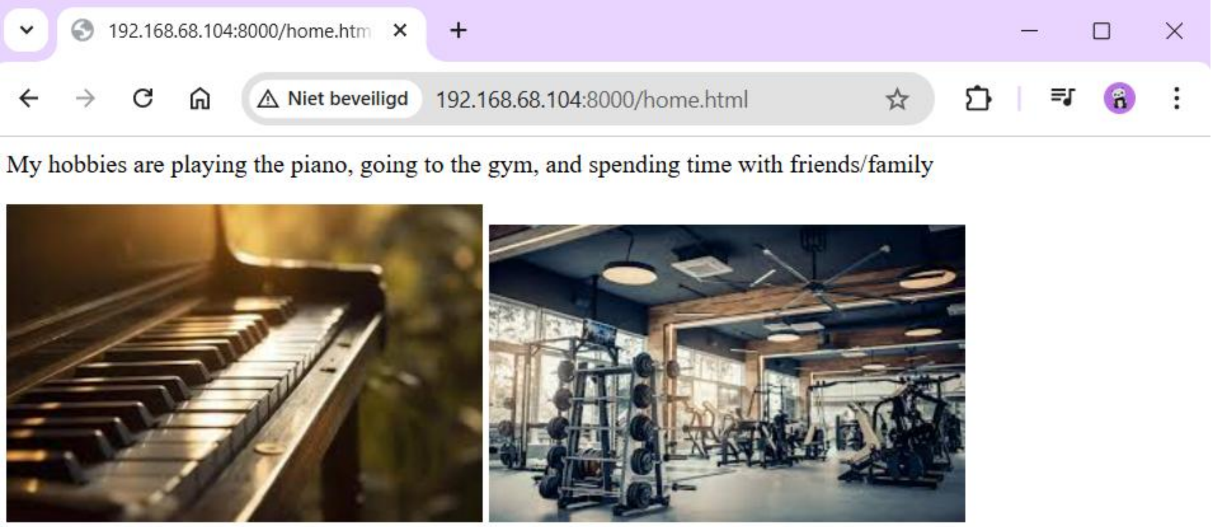
Name	Size	Modified
css	1 item	9 Sep 2023
images	2 items	Today 22:13
pdf	7 items	9 Sep 2023
home.html	240 bytes	Today 22:17
index.html	637 bytes	9 Sep 2023
week1.html	325 bytes	9 Sep 2023
week2.html	325 bytes	9 Sep 2023
week3.html	325 bytes	9 Sep 2023
week4.html	325 bytes	9 Sep 2023
week5.html	325 bytes	9 Sep 2023
week6.html	325 bytes	9 Sep 2023
week7.html	325 bytes	9 Sep 2023

Screenshot python3 webserver command:



```
ruben@ruben-VMware-Virtual-Platform:~/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:



My hobbies are playing the piano, going to the gym, and spending time with friends/family

Assignment 6.5: Network segment

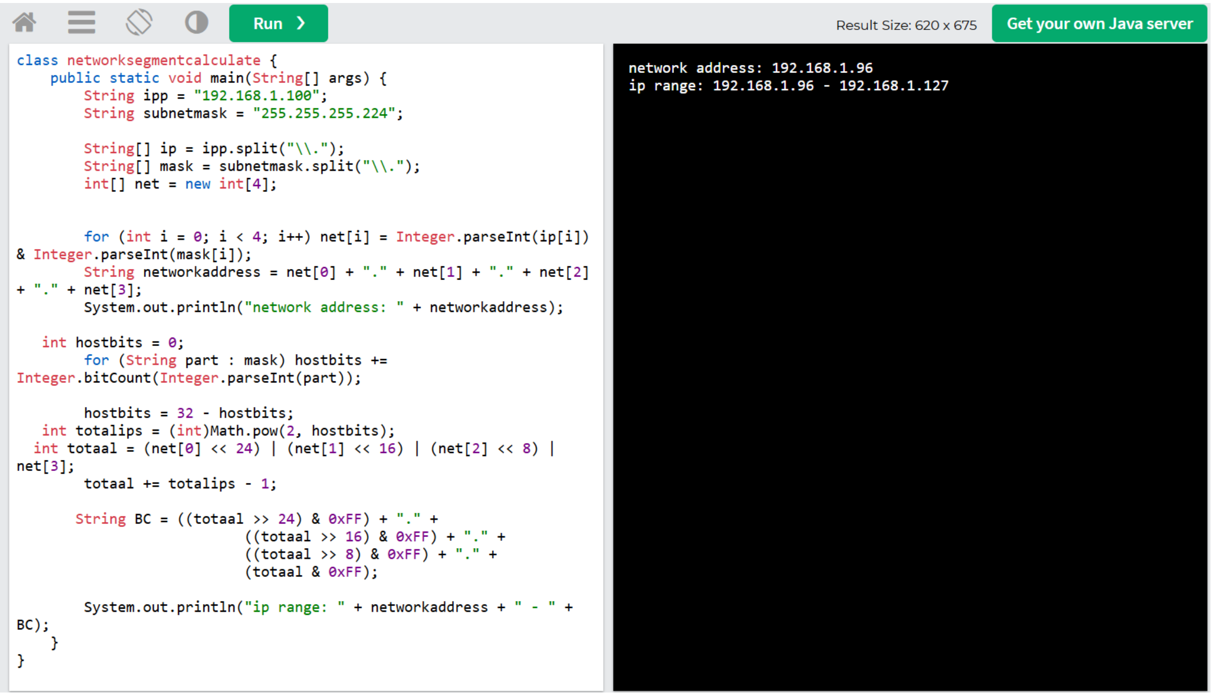
Remember that bitwise java application you've made in week 2? Expand that application so that you can also calculate a network segment as explained in the PowerPoint slides of week 6. Use the bitwise & AND operator. You need to be able to input two Strings. An IP address and a subnet.

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.

```
class networksegmentcalculate {
  public static void main(String[] args) {
    String ipp = "192.168.1.100";
    String subnetmask = "255.255.255.224";

    String[] ip = ipp.split("\\.");
    String[] mask = subnetmask.split("\\.");
    int[] net = new int[4];
    for (int i = 0; i < 4; i++) net[i] = Integer.parseInt(ip[i]) & Integer.parseInt(mask[i]);
    String networkaddress = net[0] + "." + net[1] + "." + net[2] + "." + net[3];
    System.out.println("network address: " + networkaddress);
  int hostbits = 0;
    for (String part : mask) hostbits += Integer.bitCount(Integer.parseInt(part));

    hostbits = 32 - hostbits;
  int totalips = (int)Math.pow(2, hostbits);
 int totaal = (net[0] << 24) | (net[1] << 16) | (net[2] << 8) | net[3];
    totaal += totalips - 1;

   String BC = ((totaal >> 24) & 0xFF) + "." +
             ((totaal >> 16) & 0xFF) + "." +
             ((totaal >> 8) & 0xFF) + "." +
             (totaal & 0xFF);
    System.out.println("ip range: " + networkaddress + " - " + BC);
}
}
```



```java
class networksegmentcalculate {
    public static void main(String[] args) {
        String ipp = "192.168.1.100";
        String subnetmask = "255.255.255.224";

        String[] ip = ipp.split("\\.");
        String[] mask = subnetmask.split("\\.");
        int[] net = new int[4];


        for (int i = 0; i < 4; i++) net[i] = Integer.parseInt(ip[i])
& Integer.parseInt(mask[i]);
        String networkaddress = net[0] + "." + net[1] + "." + net[2]
+ "." + net[3];
        System.out.println("network address: " + networkaddress);

   int hostbits = 0;
        for (String part : mask) hostbits +=
Integer.bitCount(Integer.parseInt(part));

        hostbits = 32 - hostbits;
   int totalips = (int)Math.pow(2, hostbits);
  int totaal = (net[0] << 24) | (net[1] << 16) | (net[2] << 8) |
net[3];
        totaal += totalips - 1;

       String BC = ((totaal >> 24) & 0xFF) + "." +
                           ((totaal >> 16) & 0xFF) + "." +
                           ((totaal >> 8) & 0xFF) + "." +
                           (totaal & 0xFF);

        System.out.println("ip range: " + networkaddress + " - " +
BC);
    }
}
```

```
network address: 192.168.1.96
ip range: 192.168.1.96 - 192.168.1.127
```

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