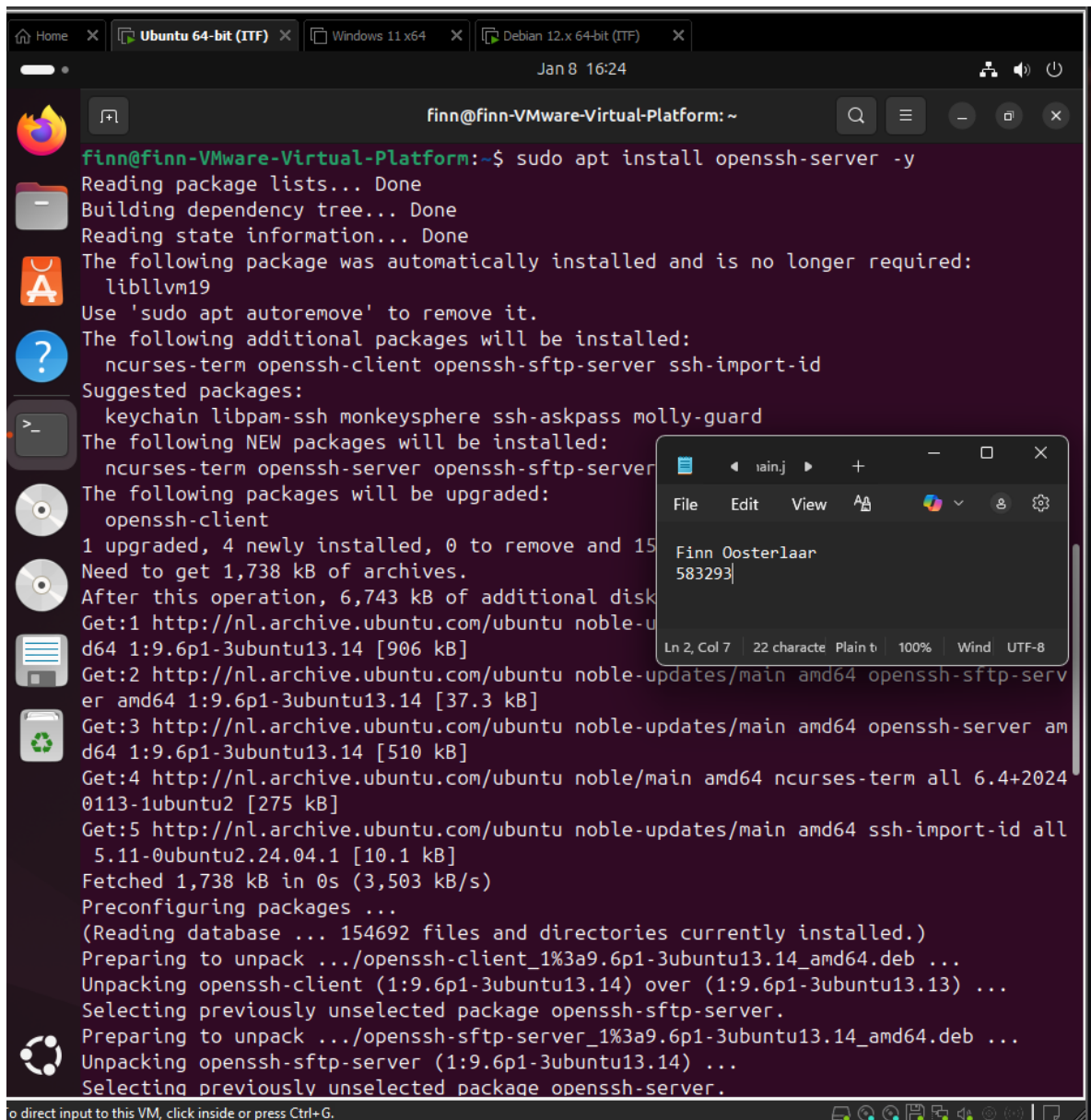


Template Week 6 – Networking

Student number: 583293

Assignment 6.1: Working from home

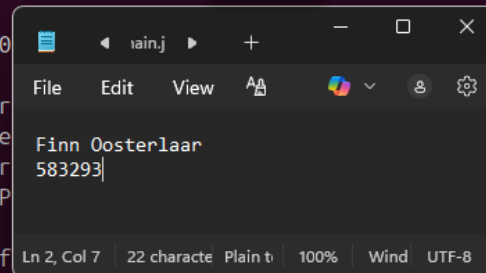
Screenshot installation openssh-server:



```
finn@finn-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-client openssh-sftp-server ssh-import-id  
Suggested packages:  
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard  
The following NEW packages will be installed:  
  ncurses-term openssh-server openssh-sftp-server  
The following packages will be upgraded:  
  openssh-client  
1 upgraded, 4 newly installed, 0 to remove and 15  
Need to get 1,738 kB of archives.  
After this operation, 6,743 kB of additional disk  
Get:1 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-sftp-server  
er amd64 1:9.6p1-3ubuntu13.14 [37.3 kB]  
Get:2 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-server am  
d64 1:9.6p1-3ubuntu13.14 [510 kB]  
Get:3 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-client  
d64 1:9.6p1-3ubuntu13.14 [906 kB]  
Get:4 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 ncurses-term all 6.4+2024  
0113-1ubuntu2 [275 kB]  
Get:5 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 ssh-import-id all  
5.11-0ubuntu2.24.04.1 [10.1 kB]  
Fetched 1,738 kB in 0s (3,503 kB/s)  
Preconfiguring packages ...  
(Reading database ... 154692 files and directories currently installed.)  
Preparing to unpack ../openssh-client_1%3a9.6p1-3ubuntu13.14_amd64.deb ...  
Unpacking openssh-client (1:9.6p1-3ubuntu13.14) over (1:9.6p1-3ubuntu13.13) ...  
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) ...  
Setting up openssh-client (1:9.6p1-3ubuntu13.14) ...  
Setting up openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...  
Setting up ncurses-term (6.4+20240113-1ubuntu2) ...  
Setting up openssh-server (1:9.6p1-3ubuntu13.14) ...  
Enabling password authentication for the OpenSSH server.  
Restarting the OpenSSH server.  
The OpenSSH server is now ready to accept connections.
```

Screenshot successful SSH command execution:

```
finn@finn-VMware-Virtual-Platform:~$ sudo systemctl enable --now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/sy
stemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
Created symlink /etc/systemd/system/ssh.service → /usr/lib/systemd/system/ssh.servi
ce.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /usr/lib/s
ystemd/system/ssh.service.
finn@finn-VMware-Virtual-Platform:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default ql
len 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 pfifo_fast group default ql
en 1000
    link/ether 00:0c:29:c4:5d:7a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.132/24 brd 192.168.139.255 scope global dynamic noprefixroute e
ns33
        valid_lft 1712sec preferred_lft 1712sec
finn@finn-VMware-Virtual-Platform:~$
```



The screenshot shows a Windows 11 desktop environment. At the top, there are taskbar icons for Home, Ubuntu 64-bit (ITF), Windows 11 x64, and Debian 12.x 64-bit (ITF). Below the taskbar is a terminal window titled 'finn@finn-VMware-Virtual-Pl...'. The terminal displays the output of an SSH command executed from a Windows command prompt. The output shows the SSH connection process, including host fingerprint verification and a warning about permanently adding the host to the known hosts list. The terminal then shows the Ubuntu 24.04.3 LTS login banner, which includes documentation links, update information (146 updates available), and a disclaimer about warranty. The prompt at the bottom of the terminal is 'finn@finn-VMware-Virtual-Platform:~\$'. The Windows taskbar at the bottom shows the weather (1°C), a search bar, and several application icons.

```
PS C:\Users\finn> ssh finn@192.168.139.132
The authenticity of host '192.168.139.132 (192.168.139.132)' can't be established.
ED25519 key fingerprint is SHA256:AYZeJDQc4m5LzBCIcG0m9pQ0me1AdvxIPVaeNi5zUg.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.132' (ED25519) to the list of known hosts.
finn@192.168.139.132'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.

146 updates can be applied immediately.
11 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

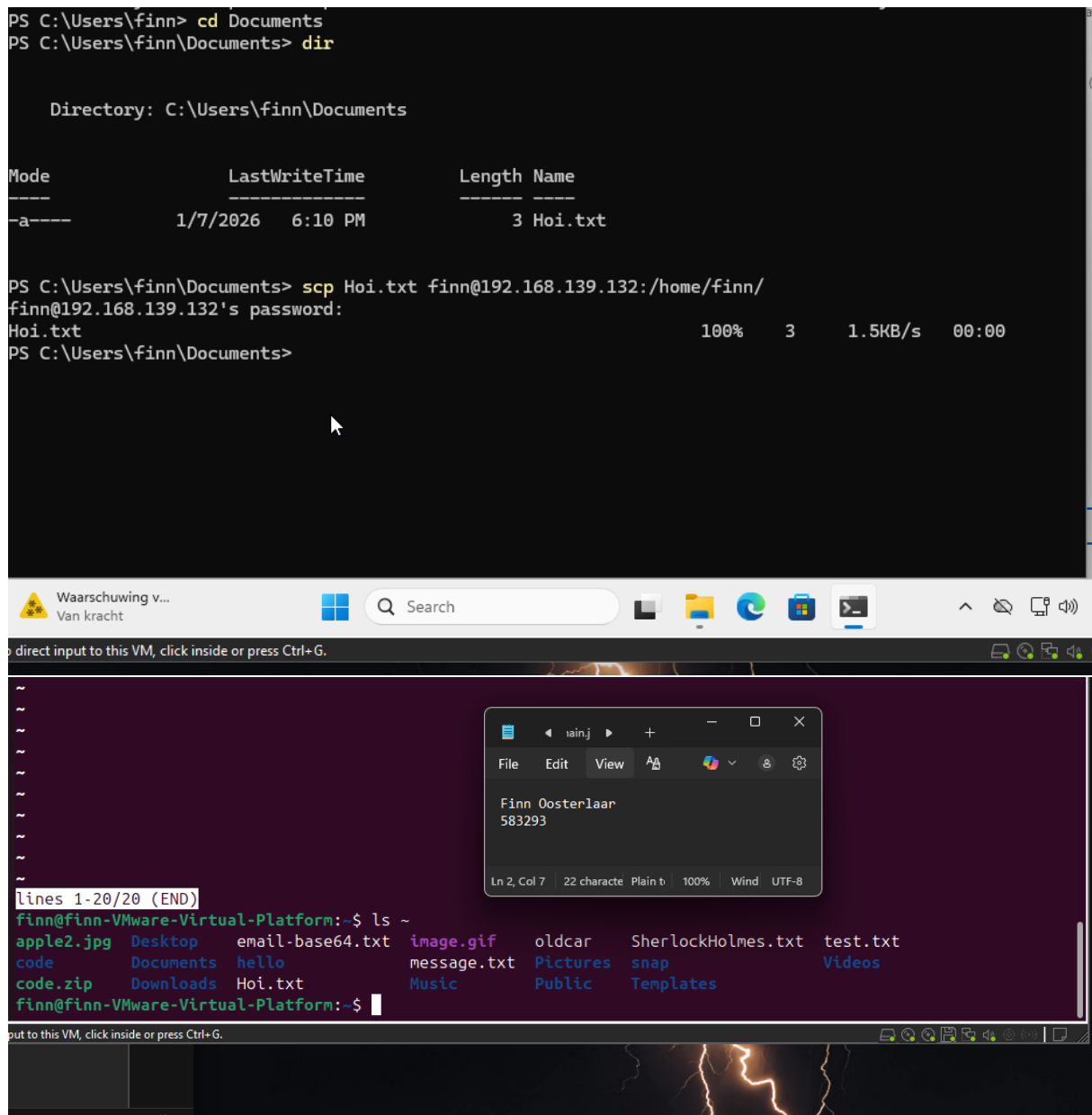
17 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm

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.

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

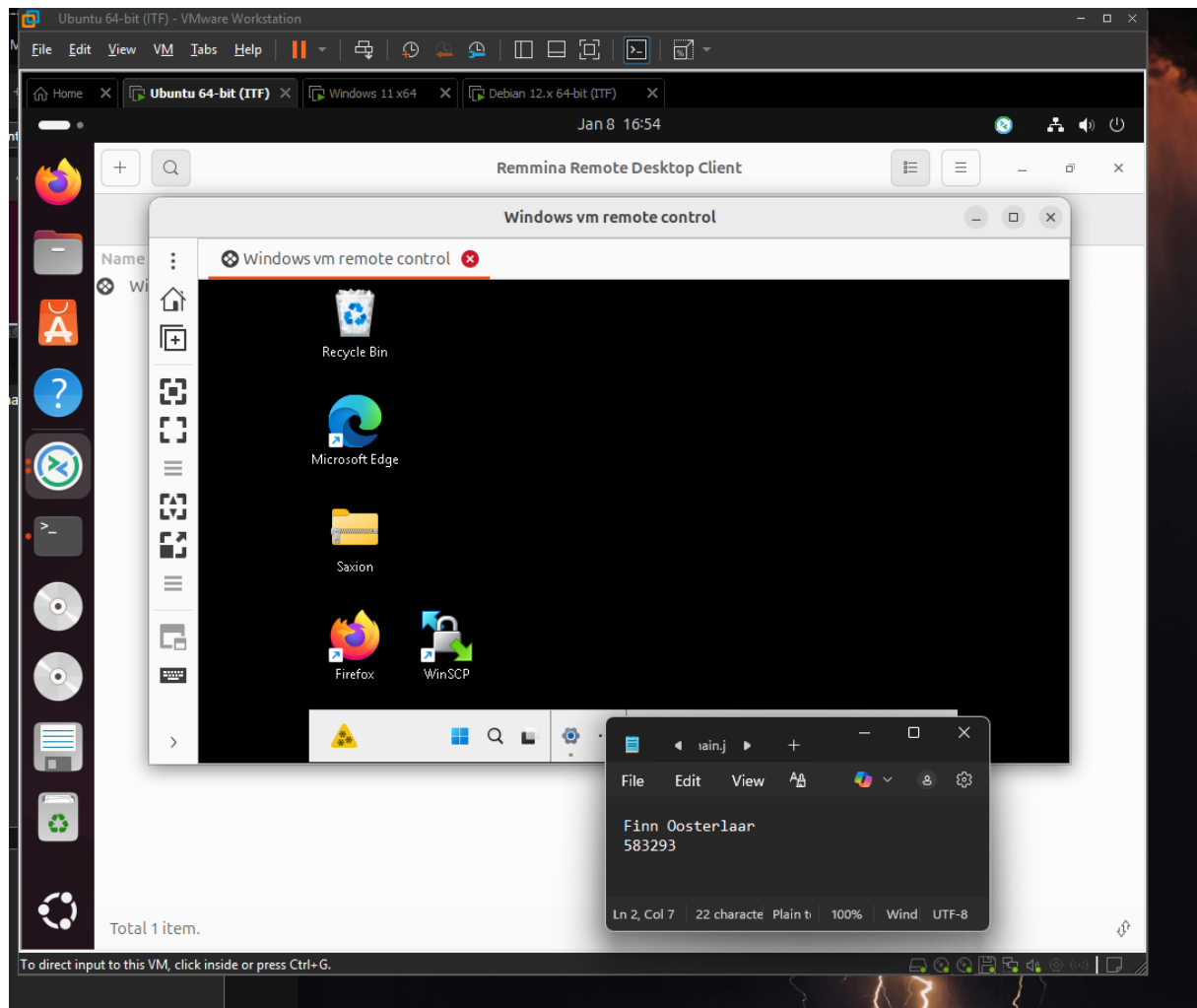
Screenshot successful execution SCP command:



De eerste screenshot laat zien dat ik op mijn windows vm het bestand Hoi.txt stuur naar de ubuntu vm via ssh.

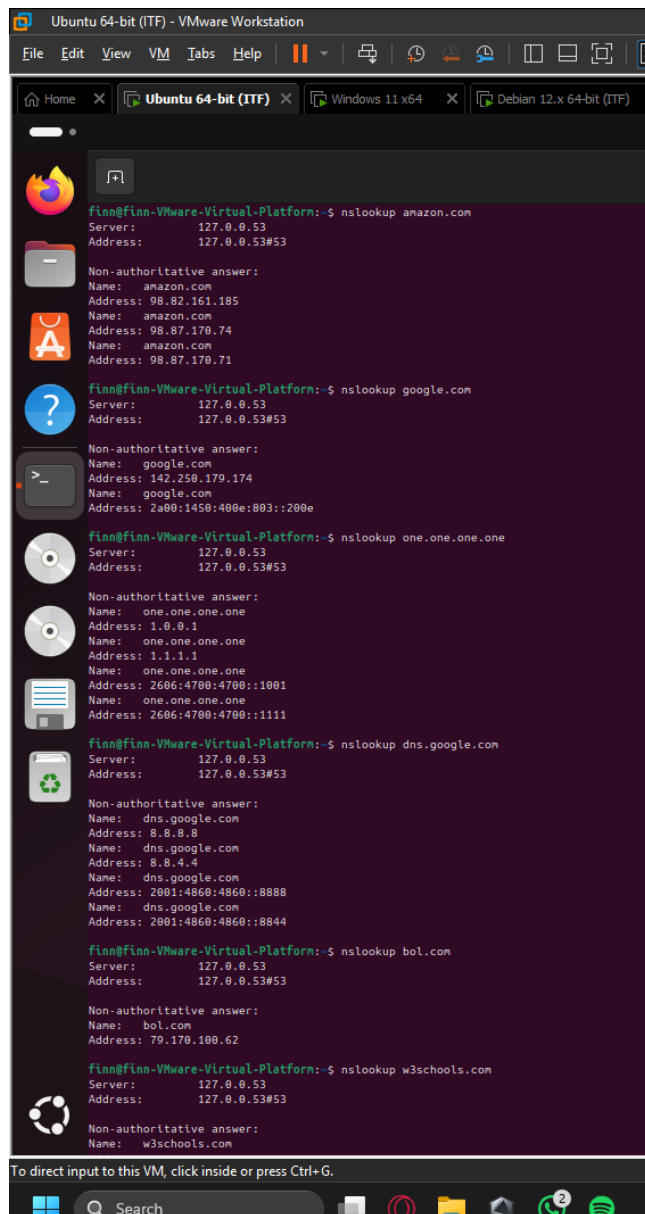
De tweede screenshot laat het bestand Hoi.txt zien op de ubuntu vm.

Screenshot remmina:

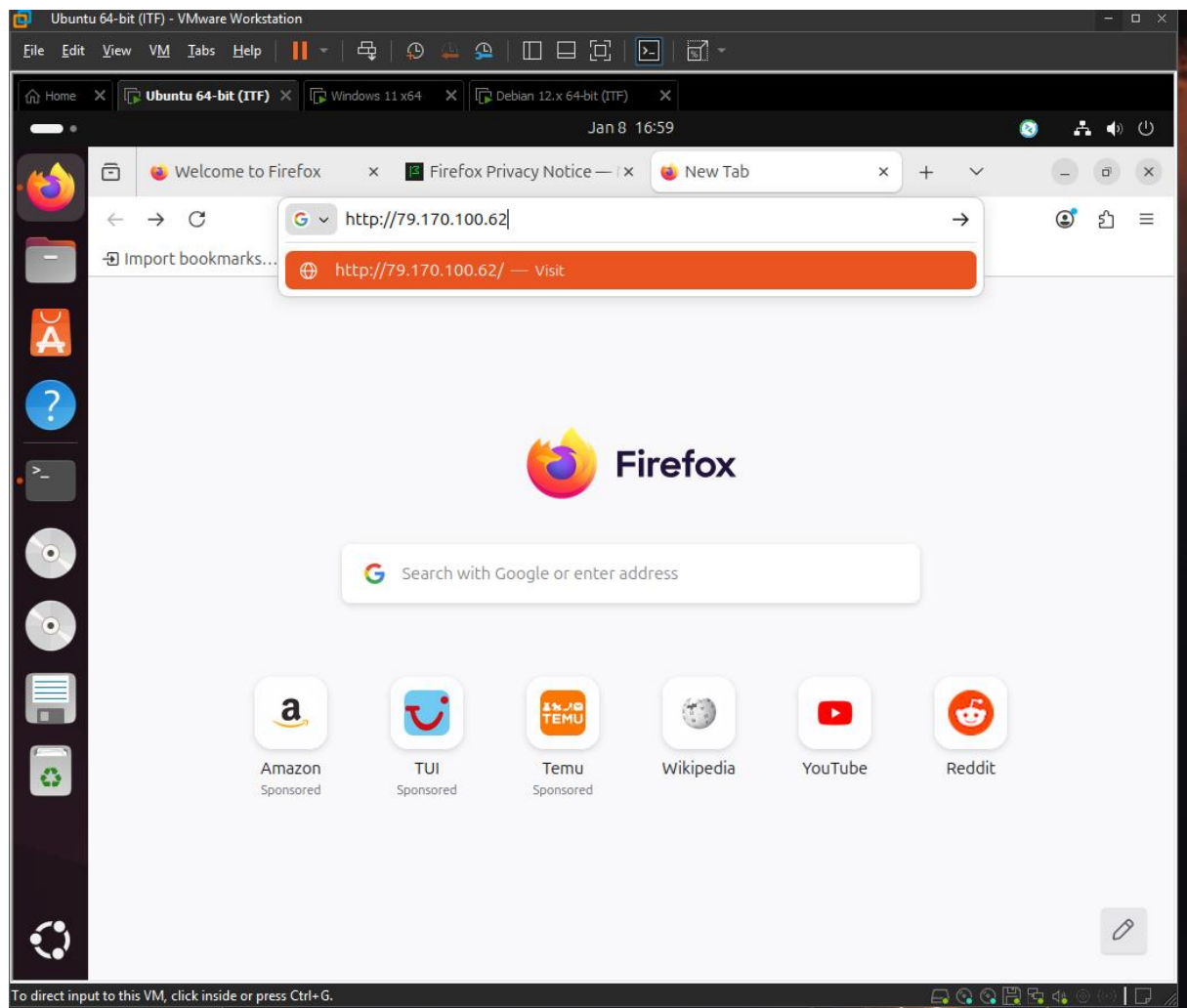


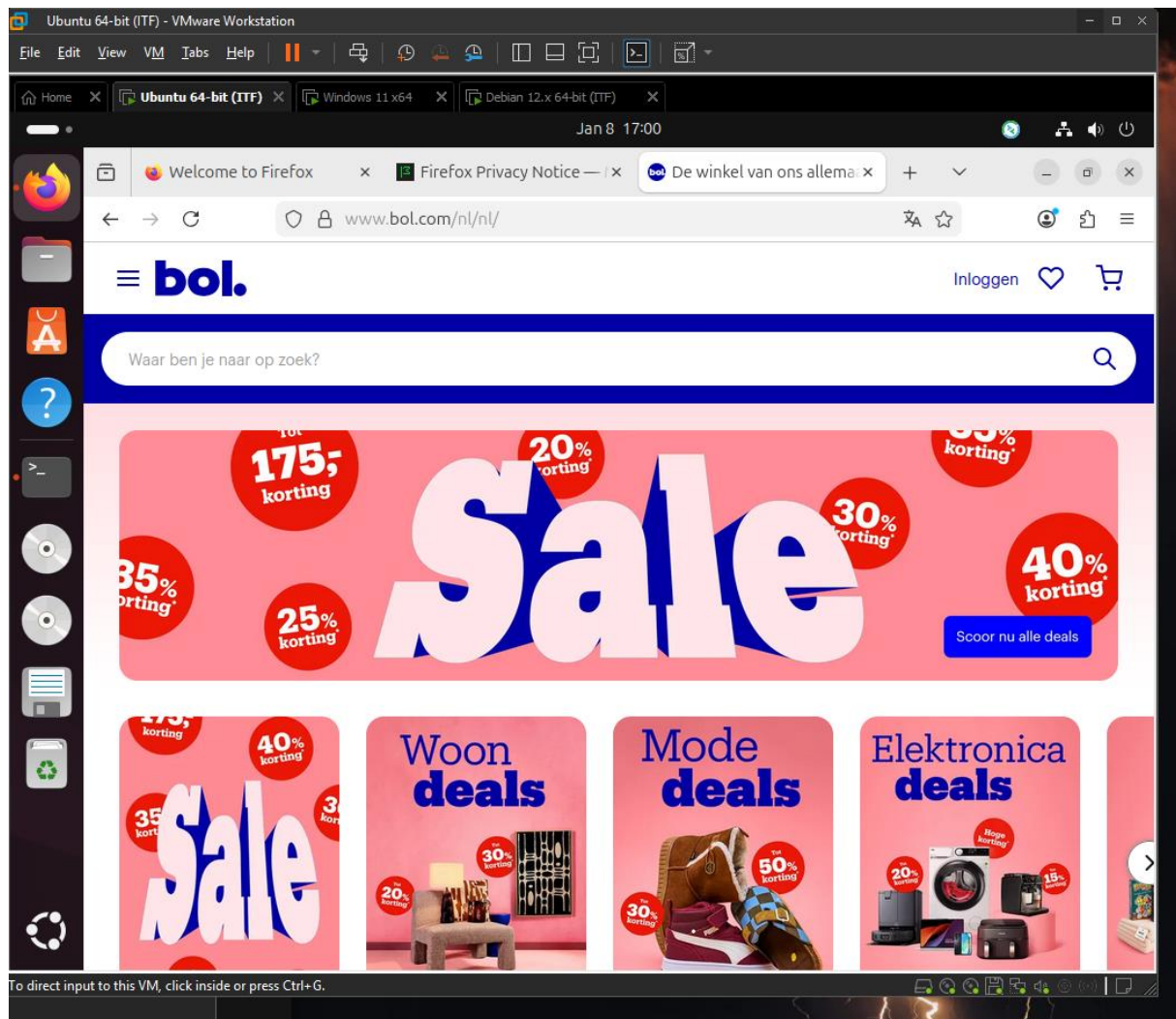
Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:



Screenshot website visit via IP address:





Assignment 6.3: subnetting

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

De /25 betekent dat er 7 bits over zijn voor hosts. Dus er zijn $2^7 = 128$ ip adressen.

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

192.168.110.128 en 192.168.110.255 zijn niet te gebruiken voor aangesloten computers aangezien die door het netwerk zelf gebruikt worden. Dat betekent dat de ip adressen van 192.168.110.129 tot en met 192.168.110.254 bruikbaar zijn. Dus 126 bruikbare ip adressen.

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


```
finn@finn-VMware-Virtual-Platform: ~  
finn@finn-VMware-Virtual-Platform:~$ ipcalc 192.168.110.128/25  
Address: 192.168.110.128 11000000.10101000.01101110.1 00000000  
Netmask: 255.255.255.128 = 25 11111111.11111111.11111111.1 00000000  
Wildcard: 0.0.0.127 00000000.00000000.00000000.0 11111111  
=>  
Network: 192.168.110.128/25 11000000.10101000.01101110.1 00000000  
HostMin: 192.168.110.129 11000000.10101000.01101110.1 00000001  
HostMax: 192.168.110.254 11000000.10101000.01101110.1 11111110  
Broadcast: 192.168.110.255 11000000.10101000.01101110.1 11111111  
Hosts/Net: 126 Class C, Private Internet  
finn@finn-VMware-Virtual-Platform:~$
```

Finn Oosterlaar
583293

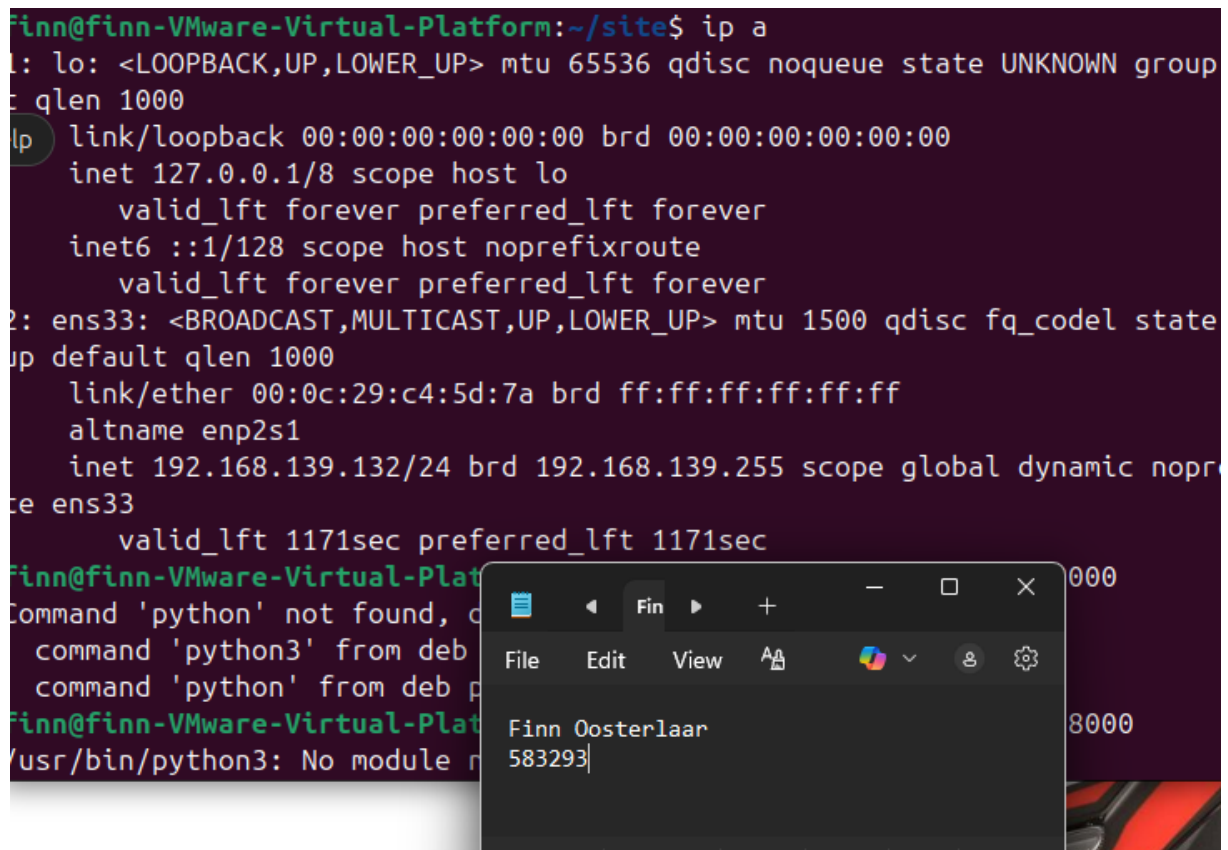
Explain the above calculation in your own words.

Bij een /25 netwerk wordt het normale /24 netwerk in twee gelijke delen gesplitst. Daardoor blijver er dus 7 bits over voor de hostadressen. Daarom heb je dus 128 IP adressen waarvan er twee gereserveerd zijn, een voor het netwerk en een voor het broadcasten van het netwerk. De rest kun je dus andere apparaten aan koppelen binnen je netwerk.

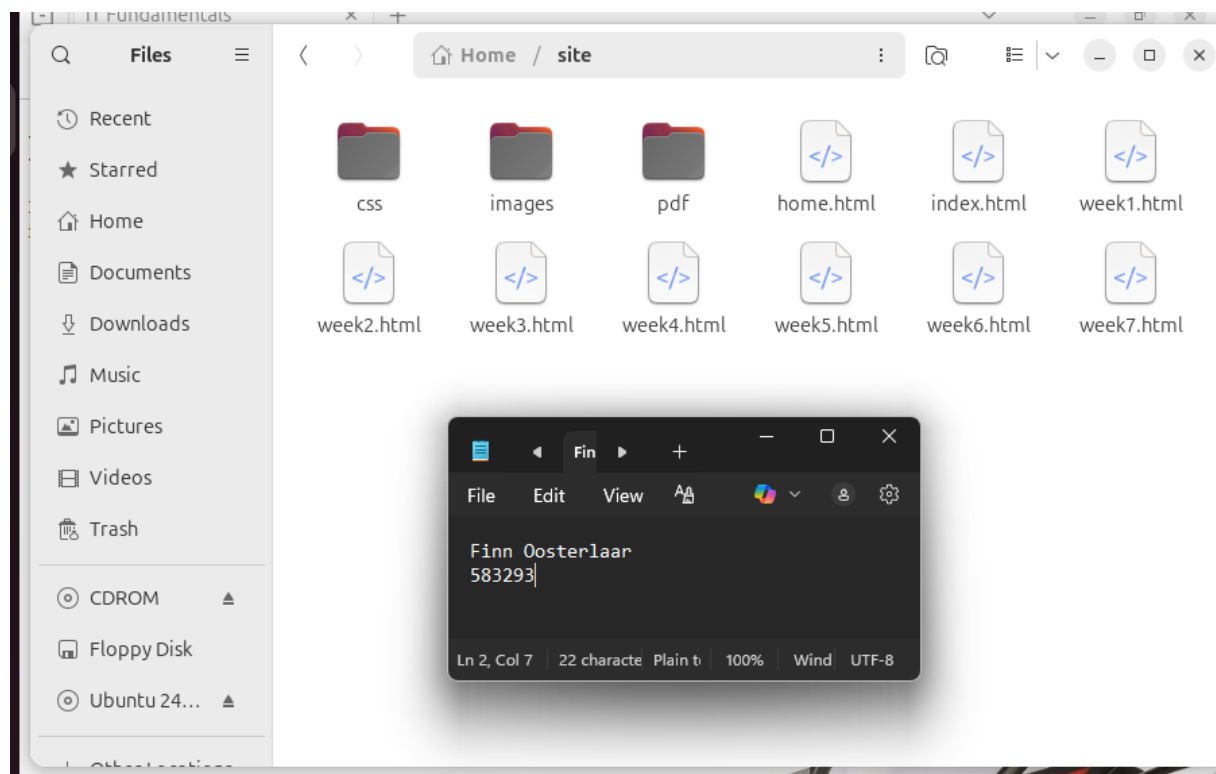
Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:

```
Fin@finn-VMware-Virtual-Platform:~/site$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group
    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
    link/ether 00:0c:29:c4:5d:7a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.132/24 brd 192.168.139.255 scope global dynamic nop
        valid_lft 1171sec preferred_lft 1171sec
Fin@finn-VMware-Virtual-Platform:~/site$ python3
Command 'python' not found, did you mean:
  command 'python3' from deb python3 (3.9.2-1)
  command 'python' from deb python (2.7.18-1)
Fin@finn-VMware-Virtual-Platform:~/site$ python3
/usr/bin/python3: No module named
```



Screenshot of Site directory contents:

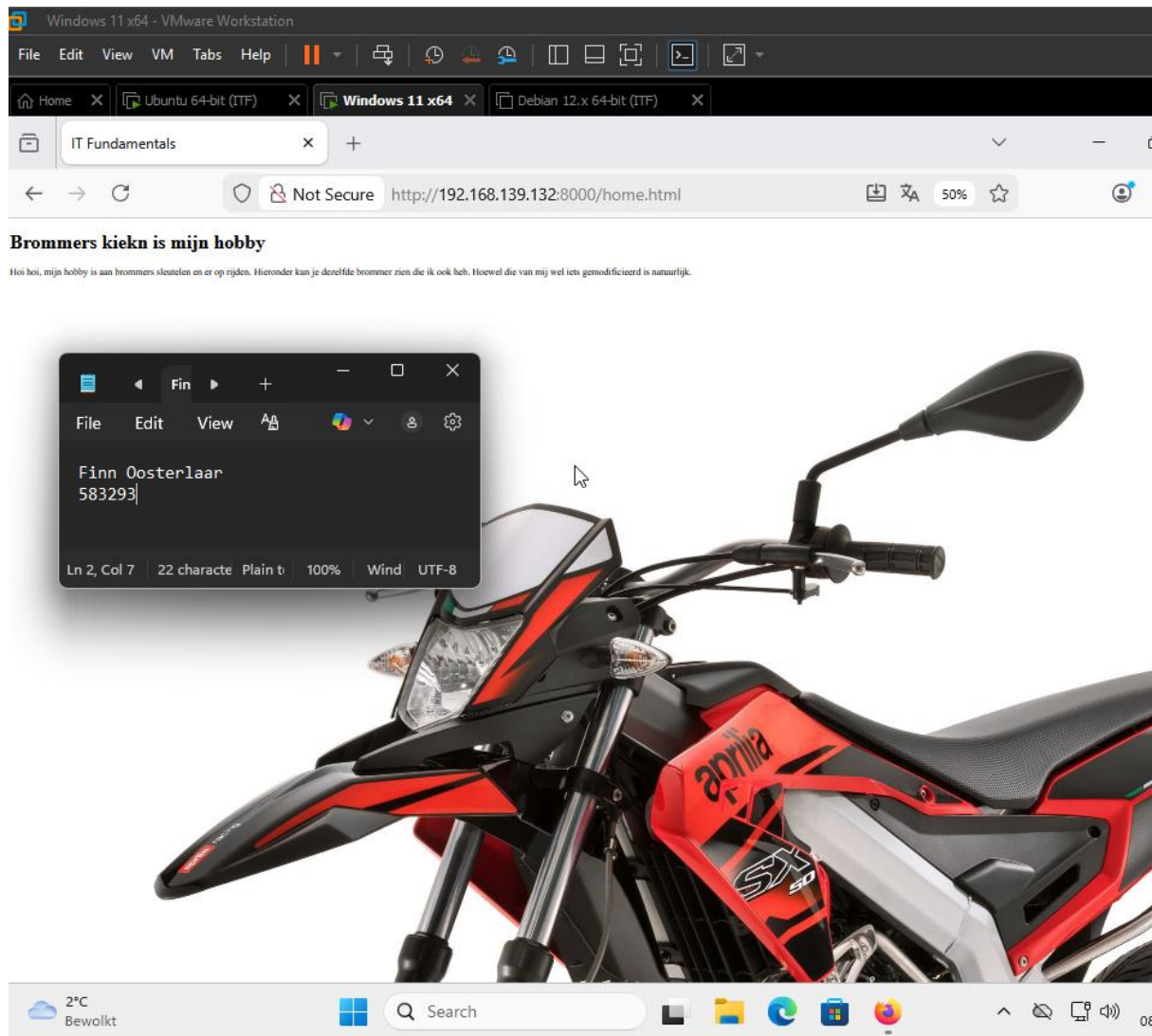


Screenshot python3 webserver command:

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



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 Main {
```

```
    public static void main(String[] args) {
```

```
        Scanner scanner = new Scanner(System.in);
```

```
        int choice;
```

```
        System.out.println("=== Bit Calculations Program ===");
```

```
        do {
```

```
            System.out.println("\nMenu:");
```

```
            System.out.println("1. Is number odd?");
```

```
            System.out.println("2. Is number a power of 2?");
```

```
            System.out.println("3. Two's complement");
```

```
            System.out.println("5. Calculate network segment");
```

```
            System.out.println("4. Exit");
```

```
            System.out.print("Choose option: ");
```

```
            choice = scanner.nextInt();
```

```

switch (choice) {
    case 1:
        System.out.print("Enter number: ");
        System.out.println("Odd? " + isOdd(scanner.nextInt()));
        break;

    case 2:
        System.out.print("Enter number: ");
        System.out.println("Power of 2? " + isPowerOfTwo(scanner.nextInt()));
        break;

    case 3:
        System.out.print("Enter number: ");
        System.out.println("Two's complement: " +
            twosComplement(scanner.nextInt()));
        break;

    case 5:
        int[] ip = new int[4];
        int[] subnet = new int[4];

        System.out.println("Enter IP address (4 numbers):");
        for (int i = 0; i < 4; i++) {
            ip[i] = scanner.nextInt();
        }

        System.out.println("Enter subnet mask (4 numbers):");
        for (int i = 0; i < 4; i++) {
            subnet[i] = scanner.nextInt();
        }

```

```

        int[] network = calculateNetwork(ip, subnet);

        System.out.println("Network address: "
            + network[0] + "." + network[1] + "."
            + network[2] + "." + network[3]);
        break;

    case 4:
        System.out.println("Exiting...");
        break;

    default:
        System.out.println("Invalid option!");
    }

} while (choice != 4);

scanner.close();
}

//week 2 methoden

public static boolean isOdd(int number) {
    return (number & 1) == 1;
}

public static boolean isPowerOfTwo(int number) {
    return number > 0 && (number & (number - 1)) == 0;
}

```

```

public static int twosComplement(int number) {
    return (~number) + 1;
}

// week 6 uitbreiding

public static int[] calculateNetwork(int[] ip, int[] subnet) {
    int[] network = new int[4];
    for (int i = 0; i < 4; i++) {
        network[i] = ip[i] & subnet[i];
    }
    return network;
}
}

```

```

finn@finn-VMware-Virtual-Platform: ~/java
finn@finn-VMware-Virtual-Platform:~/java$ javac Main.java
finn@finn-VMware-Virtual-Platform:~/java$ java Main
=== Bit Calculations Program ===

Menu:
1. Is number odd?
2. Is number a power of 2?
3. Two's complement
5. Calculate network segment
4. Exit
Choose option: 5
Enter IP address (4 numbers):
192 168 1 100
Enter subnet mask (4 numbers):
255 255 255 224
Network address: 192.168.1.96

```

Ready? Save this file and export it as a pdf file with the name: [week6.pdf](#)