

Template Week 6 – Networking

Student number:

Assignment 6.1: Working from home

Screenshot installation openssh-server:

```
wessel@helpdesk: $ sudo apt install openssh-server -y
[sudo] password for wessel:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
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-sftp-server openssh-server ssh-import-id
0 upgraded, 4 newly installed, 0 to remove and 5 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 [37.3 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 (2,658 kB/s)
Preconfiguring packages ...
Selecting previously unselected package openssh-sftp-server.
(Reading database ... 195977 files and directories currently installed.)
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) ...
Processing triggers for man-db (2.12.0-1ubuntu2) ...
Processing triggers for ufw (0.36-2-6) ...
wessel@helpdesk: $ 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.
wessel@helpdesk: $ 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
    2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
        link/ether 00:0c:29:9e:31:15 brd ff:ff:ff:ff:ff:ff
            altname enp2s1
            inet 192.168.139.130/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
                valid_lft 1772sec preferred_lft 1772sec
wessel@helpdesk: $
```

Screenshot successful SSH command execution:

```

wessel@helpdesk:~ 
C:\Users\wessel>ssh wessel@192.168.139.130
The authenticity of host '192.168.139.130 (192.168.139.130)' can't be established.
ED25519 key fingerprint is SHA256:3AgTBckUHz15efe4oTLXVAu0qufHEMAdc7CgCsaiU.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.130' (ED25519) to the list of known hosts.
wessel@192.168.139.130's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-33-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.

0 updates can be applied immediately.

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

*** System restart required ***

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.

wessel@helpdesk:$ |

```

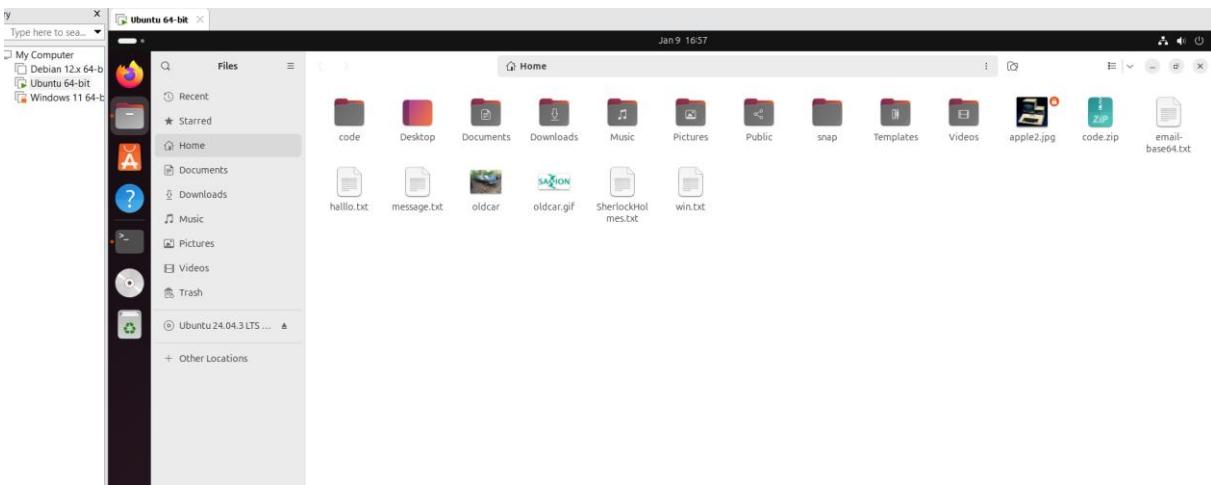
Screenshot successful execution SCP command:

```

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

wessel@helpdesk:~$ echo Hello from Windows > win.txt
wessel@helpdesk:~$ scp win.txt wessel@192.168.139.130:/home/wessel/
The authenticity of host '192.168.139.130 (192.168.139.130)' can't be established.
ED25519 key fingerprint is SHA256:J3AgTBckUHz15efe4oTLXVAu0qufHEMAdc7CgCsaiU.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.130' (ED25519) to the list of known hosts.
wessel@192.168.139.130's password:
win.txt
wessel@helpdesk:~$ 

```



Screenshot remmina:

Hij kom mijn ip niet vinden

Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:

```
wessel@helpdesk:~$ exit
logout
Connection to 192.168.139.130 closed.

C:\Users\wesse>nslookup amazon.com
Server: mijnmodem.kpn
Address: 2a02:a46f:3878:0:46fb:5aff:fecb:f5d3

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

C:\Users\wesse>nslookup google.com
Server: mijnmodem.kpn
Address: 2a02:a46f:3878:0:46fb:5aff:fecb:f5d3

Non-authoritative answer:
Name: google.com
Addresses: 2a00:1450:400e:806::200e
          142.251.142.206

C:\Users\wesse>
```

```
C:\Users\wesse>nslookup one.one.one.one
Server: mijnmodem.kpn
Address: 2a02:a46f:3878:0:46fb:5aff:fecb:f5d3

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

C:\Users\wesse>dns.google.com
'dns.google.com' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\wesse>nslookup dns.google.com
Server: mijnmodem.kpn
Address: 2a02:a46f:3878:0:46fb:5aff:fecb:f5d3

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

```
C:\Users\wesse>nslookup bol.com
Server: mijnmodem.kpn
Address: 2a02:a46f:3878:0:46fb:5aff:fecb:f5d3

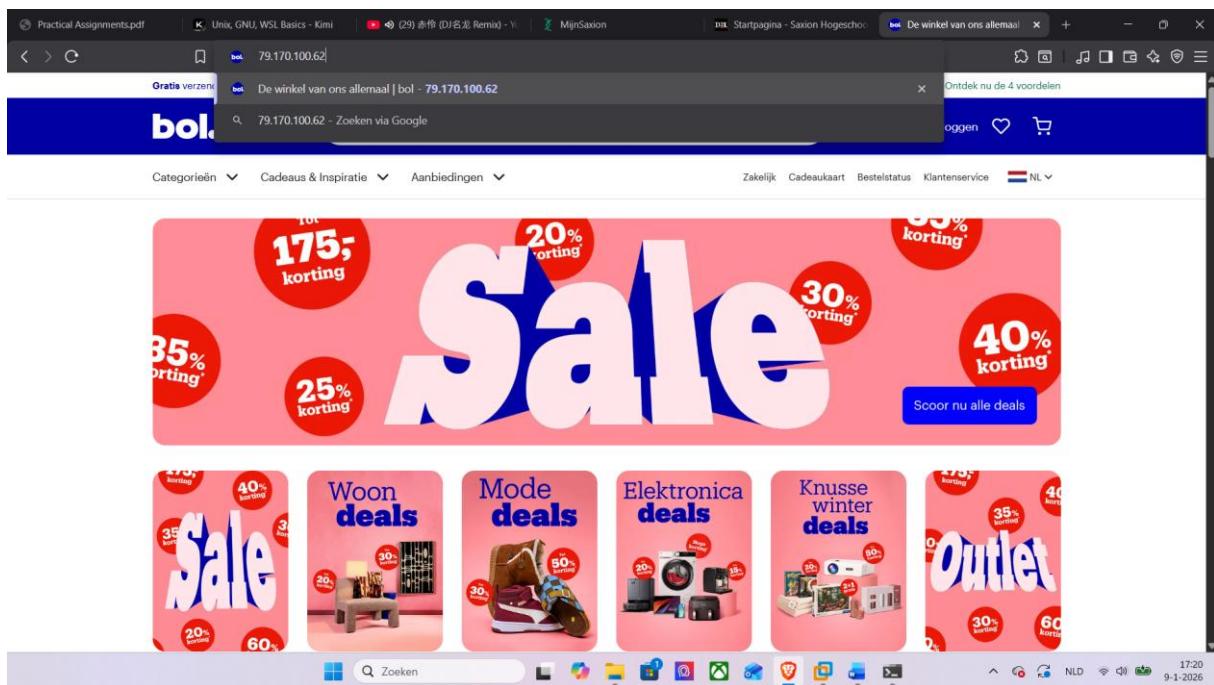
Non-authoritative answer:
Name: bol.com
Address: 79.170.100.62

C:\Users\wesse>
C:\Users\wesse>

C:\Users\wesse>nslookup w3schools.com
Server: mijnmodem.kpn
Address: 2a02:a46f:3878:0:46fb:5aff:fecb:f5d3

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

Screenshot website visit via IP address:



Assignment 6.3: subnetting

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

128

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

192.168.110.129 t/m 192.168.110.254 (126 bruikbare adressen)

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

```
wessel@helpdesk:~$ 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 1111111
=>
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 1111110
Broadcast: 192.168.110.255   11000000.10101000.01101110.1 1111111
Hosts/Net: 126                Class C, Private Internet
```

Explain the above calculation in your own words.

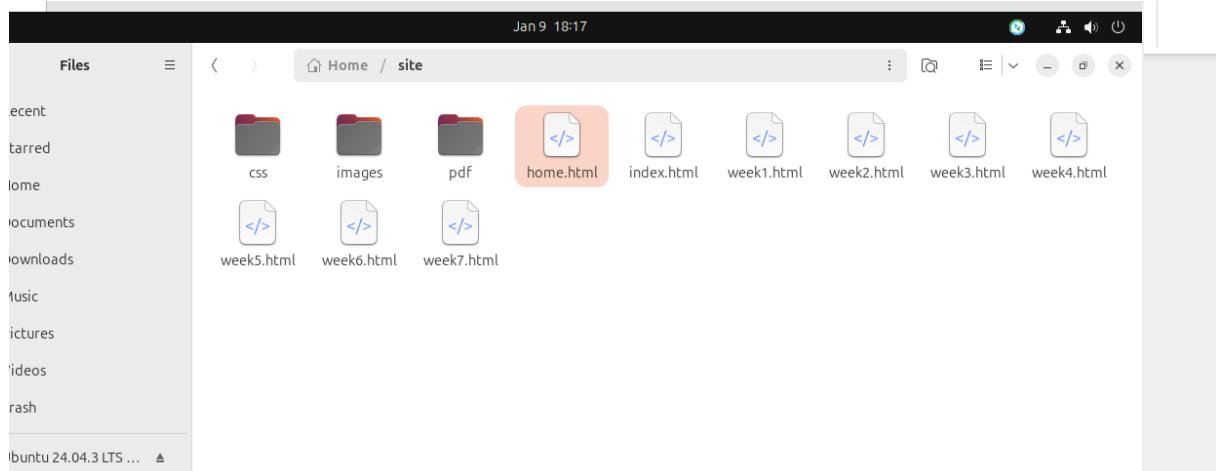
het subnet begint op 128, de eerste 129 is de gateway/printer enz., 254 is de laatste pc; 128 én 255 zijn 'gereserveerd' dus die mag je niet uitdelen

Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:

```
wessel@helpdesk:~$ 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:29:9e:31:15 brd ff:ff:ff:ff:ff:ff
        altname enp2s1
        inet 192.168.139.130/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
            valid_lft 928sec preferred_lft 928sec
```

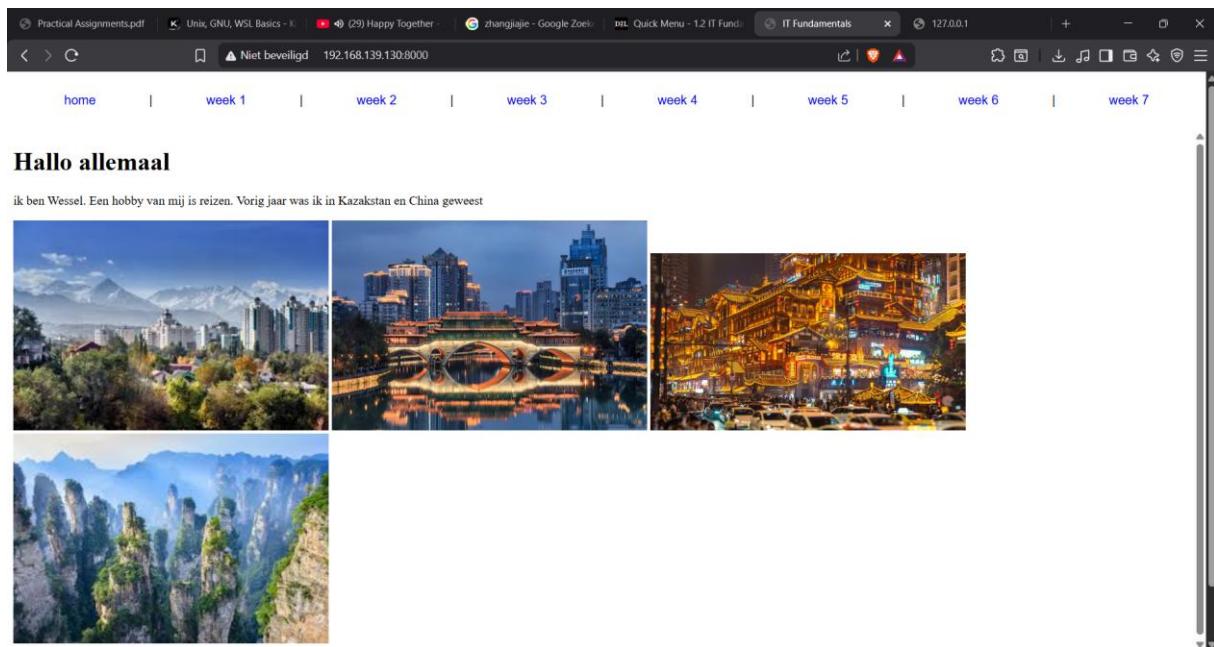
Screenshot of Site directory contents:



Screenshot python3 webserver command:

```
wessel@helpdesk:~$ python3 -m http.server 8000
Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000) ...
127.0.0.1 - - [09/Jan/2026 18:14:26] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:27] code 404, message File not found
127.0.0.1 - - [09/Jan/2026 18:14:27] "GET /favicon.ico HTTP/1.1" 404 -
127.0.0.1 - - [09/Jan/2026 18:14:34] "GET /code/ HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/ HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/home.html HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/css/mypdfstyle.css HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/css/mypdfstyle.css HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/images/almaty.png HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/images/chengdu.png HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/images/chongqing.png HTTP/1.1" 200 -
127.0.0.1 - - [09/Jan/2026 18:14:41] "GET /site/images/zhangjiajie.png HTTP/1.1" 200 -
```

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 {
    private static final Scanner sc = new Scanner(System.in);

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

```

System.out.println("\n1. Is number odd?");
System.out.println("2. Is number a power of 2?");
System.out.println("3. Two's complement of number");
System.out.println("4. Netwerk-segment ");
System.out.print("Keuze: ");
switch (sc.nextLine()) {
    case "1" -> oddDemo();
    case "2" -> powerOf2Demo();
    case "3" -> twosComplementDemo();
    case "4" -> netSegmentDemo();
    case "0" -> { return; }
    default -> System.out.println("Ongeldige keuze");
}
}

private static void oddDemo() {
    System.out.print("number: ");
    int n = Integer.parseInt(sc.nextLine());
    System.out.println((n & 1) == 1 ? "oneven" : "even");
}

private static void powerOf2Demo() {
    System.out.print("number : ");
    int n = Integer.parseInt(sc.nextLine());
    boolean ok = n > 0 && (n & (n - 1)) == 0;
    System.out.println(ok ? "macht van 2" : "geen macht van 2");
}

private static void twosComplementDemo() {
    System.out.print("Number: ");
    int n = Integer.parseInt(sc.nextLine());
    System.out.println("Two's complement: " + (~n + 1));
}

private static void netSegmentDemo() {
    System.out.print("IP : ");
    String input = sc.nextLine();
    String[] parts = input.split("/");
    String ip = parts[0];
    int cidr = Integer.parseInt(parts[1]);

    int[] net = calcNet(ip, cidr);
    System.out.printf("Netwerkadres: %d.%d.%d.%d/%d%n",
        net[0], net[1], net[2], net[3], cidr);
}

private static int[] calcNet(String ip, int cidr) {

```

```

int[] ipOct = toInts(ip);
int[] maskOct = cidrToMask(cidr);
int[] netOct = new int[4];
for (int i = 0; i < 4; i++) netOct[i] = ipOct[i] & maskOct[i];
return netOct;
}

private static int[] toInts(String s) {
    String[] p = s.split("\\.");
    int[] a = new int[4];
    for (int i = 0; i < 4; i++) a[i] = Integer.parseInt(p[i]);
    return a;
}

private static int[] cidrToMask(int bits) {
    int m = -1 << (32 - bits);
    return new int[]{m >> 24 & 0xFF, m >> 16 & 0xFF, m >> 8 & 0xFF, m & 0xFF};
}

```

The screenshot shows the IntelliJ IDEA interface. The left sidebar displays the project structure for 'andor' with 'src' selected. The main editor window shows the 'Main.java' code. The bottom part of the interface shows the 'Run' tab with a terminal window displaying command-line output related to network calculations.

```

public class Main {
    public static void main(String[] args) {
        @Usage
        private static int[] cidrToMask(int bits) {
            int m = -1 << (32 - bits);
            return new int[]{m >> 24 & 0xFF, m >> 16 & 0xFF, m >> 8 & 0xFF, m & 0xFF};
        }
    }
}

```

```

C:\Users\wesse\.jdks\ms-21.0.9\bin\java.exe "-javaagent:C:\Users\wesse\AppData\Local\Programs\IntelliJ IDEA Ultimate\lib\idea_rt.jar=51671" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath "C:\Saxion\Introductie programmeren\andor\out\production\andor" Main
1. Is getal oneven?
2. Is getal macht van 2?
3. Two's complement (negate)
4. Netwerk-segment (IP/cidr)
Keuze (0=stop): 4
IP met CIDR (bijv. 192.168.1.100/27): 192.168.1.100/27
Netwerkadres: 192.168.1.96/27
1. Is getal oneven?
2. Is getal macht van 2?
3. Two's complement (negate)
4. Netwerk-segment (IP/cidr)

```

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