



A12.5 IP addresses and subnets

Name _____

Class _____

Date _____

What this lesson is about

Network and host identifiers, subnet masks with AND, IPv4 and IPv6, public and private addresses.

- Network and host
- Subnet masks
- IPv4 and IPv6
- Public and private addresses

Questions

6 marks in all

1. A host has the address 192.168.10.200 with subnet mask 255.255.255.224. What is its network address? [1 mark]

2. What does this program print? [1 mark]

```
address = 0b10110110
mask = 0b11110000
print(address & mask)
```

3. How many usable host addresses does a /27 subnet have? [1 mark]

4. Why was IPv6 introduced? [1 mark]

- ☐ A IPv4's 32-bit addresses were running out as more devices joined the Internet
- ☐ B IPv4 could not carry video
- ☐ C IPv4 addresses could not be written in denary
- ☐ D IPv4 did not support routers

5. Which of these are private (non-routable) IPv4 addresses? Choose all that apply. [1 mark]

Tick every answer that is true.

- ☐ A 10.4.0.1
- ☐ B 172.20.5.5
- ☐ C 192.168.1.1
- ☐ D 172.32.0.1
- ☐ E 8.8.8.8

6. A host with address 10.1.1.5/24 wants to send to 10.1.2.9. What does it do? [1 mark]
- ☐ A Sends the packet to its default gateway, because ANDing with the mask gives a different network
 - ☐ B Sends the packet directly, because both start with 10
 - ☐ C Asks DHCP for a new address
 - ☐ D Drops the packet, because 10.1.2.9 is private

The task: local or through the router?

The robot has the address 192.168.4.70 with prefix length 26. Write `to_int(address)`, which turns a dotted IPv4 string into one integer from 0 to $2^{32} - 1$, and `to_dotted(value)`, which turns such an integer back into a dotted string. Work the mask out from the prefix length, not by typing it. Then print, one per line: - mask: <dotted mask> - network: <dotted network address>, the robot's address AND the mask - broadcast: <dotted broadcast address>, the network address with every host bit set to 1 - hosts: <n>, the number of usable host addresses Then for each of 192.168.4.100, 192.168.4.130, 172.20.1.9, 8.8.8.8 and 192.168.4.65, in that order, print <address> <where> <kind>: where is local if it is on the robot's subnet and router if not; kind is private if it lies in one of the three private blocks and public otherwise. Use & to find network addresses. That is 9 lines in all. The robot does not drive.

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()

def to_int(address):
    return 0

def to_dotted(value):
    return "0.0.0.0"

robot, bits = "192.168.4.70", 26
```

Plan your program here, then type it in and press Run.



Do it on the robot

www.bugbotlab.com/learn/a12-5-ip-addresses-and-subnets/

The simulator checks it and tells you when it passes. Nothing to install, no account.

Challenges

1. Work out by hand the network address and number of hosts for `172.16.200.9/21` , then check with your program.
2. Write `shorten(ipv6)` that removes leading zeros from each group of a full IPv6 address.
3. A network needs 500 hosts. What is the longest prefix length that gives enough addresses?