

National University of Singapore
School of Computing

CS2105

Tutorial 5

Answer paper

1. [KR, Chapter 4, R13] What is the 32-bit binary equivalent of the IP address 202.3.14.25?

11001010 00000011 00001110 00011001

2. Write down the first and last IP addresses of the subnet associated with the following IP address:

a) 244.233.234.12/4

244 = 11110100

First IP address in this subnet = 11110000 00000000 00000000 00000000 = 240.0.0.0

Last IP address in this subnet = 11111111 11111111 11111111 11111111 = 255.255.255.255

b) 10.45.123.34/19

123 = 01111011

First IP address in this subnet = 00001010 00101101 01100000 00000000 = 10.45.96.0

Last IP address in this subnet = 00001010 00101101 01111111 11111111 = 10.45.127.255

3. Combine the following three blocks of IP addresses into a single block:

a) 16.27.24.0/26

b) 16.27.24.64/26

c) 16.27.24.128/25

16.27.24.0/24

4. [Modified from KR, Chapter 4, P16]

a) Consider a subnet with network prefix 192.168.56.128/26. Give an example IP address (of form xxx.xxx.xxx.xxx) that belongs to this network.

Any IP address in the range 192.168.56.128 to 192.168.56.191

- b) Suppose an ISP owns the block of addresses of the form 192.168.56.128/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the network prefixes (of form a.b.c.d/x) for the four subnets?

Network Prefix	Binary Expression
192.168.56.128/28	11000000 10101000 00111000 10000000
192.168.56.144/28	11000000 10101000 00111000 10010000
192.168.56.160/28	11000000 10101000 00111000 10100000
192.168.56.176/28	11000000 10101000 00111000 10110000

5. [KR, Chapter 4, P7] Consider a datagram network using 8-bit addresses. Suppose a router has the following forwarding table:

Prefix Match	Interface
11	0
101	1
100	2
otherwise	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

Prefix Match	Interface	IP Range	No. of IP
11	0	1100 0000 – 1111 1111	64
101	1	1010 0000 – 1011 1111	32
100	2	1000 0000 – 1001 1111	32
otherwise	3	0000 0000 – 0111 1111	128

6. What is private IP address? Does LumiNUS use private or public IP? When your laptop is connected to NUS network, does it receive a private or public IP?

(Part of the following answer is modified from RCF1918:
<https://tools.ietf.org/html/rfc1918>)

The Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP address space for private networks:

10.0.0.0 - 10.255.255.255 (10/8 prefix)

172.16.0.0 - 172.31.255.255 (172.16/12 prefix)

192.168.0.0 - 192.168.255.255 (192.168/16 prefix)

An enterprise that decides to use private IP addresses can do so without any coordination with IANA or an Internet registry. The address space can thus be used by many enterprises.

However, private IP addresses cannot have IP connectivity to any host outside of the enterprise. NAT or application layer gateways are needed to map private to public address and vice versa when traffic goes in and out private network.

Private IP is initially designed for experimentation purpose, but now used as a way to alleviate IPv4 address exhaustion. Its use is very common today.

LumiNUS use public IP address (137.132.10.10). Students may use `ping` command to check it. Laptops of students are assigned private IP addresses (e.g. 172.26.184.76).