4장 과제

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P8. Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000	
through	0
11100000 00111111 11111111 11111111	
11100000 01000000 00000000 00000000	
through	1
11100000 01000000 11111111 11111111	
11100000 01000001 00000000 00000000	
through	2
11100001 01111111 11111111 11111111	
otherwise	3

a. Provide a forwarding table that has five entries, uses longest prefix matching, and forwards packets to the correct link interfaces.

prefix match	interface
11100000 00	0
11100000 01000000	1
1110000	2
11100001 1	3
otherwise	3

b. Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:

11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111

first is link interface 3, second is link interface 2, third is link interface 3

P9. Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

prefix match	interface
00	0
010	1
011	2
10	2
11	3

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

Destination Address Range	Link Interface
00000000 through 00111111	0
01000000 through 01011111	1
01100000 through 01111111	2
10000000 through 10111111	2
11000000 through 11111111	3

number of addresses for interface 0 = $2^6 = 64$

number of addresses for interface 1 = $2^5 = 32$

number of addresses for interface 2 = $2^6 + 2^5 = 96$

number of addresses for interface 3 = $2^6 = 64$

P11. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. Provide thre network addresses (of the form a.b.c.d/x) that satisfy these constraints.

subnet 1 : 223.1.17.0/26 62개 가능
subnet 2 : 223.1.17.128/25 126개 가능
subnet 3 : 223.1.17.192/28 14개 가능

P14. Consider a subnet with prefix 128.119.40.128/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?

128.119.40.64/28
128.119.40.80/28
128.119.40.96/28
128.119.40.112/28

P15. Consider the topology shown in Figure 4.20. Denote the three subnets with hosts (starting clockwise at 12:00) as Networks A, B, and C. Denote the subnets without hosts as Networks D, E, and F.

a. Assign network addresses to each of these six subnets, with the following constraints: All addresses must be allocated from 214.97.254/23; Subnet A should have enough addresses to support 250 interfaces; Subnet B should have enough addresses to support 120 interfaces; and Subnet C should have enough addresses to support 120 interfaces. Of course, subnets D, E and F should each be able to support two interfaces. For each subnet, the assignment should take the form a.b.c.d/x or a.b.c.d/x – e.f.g.h/y.

Subnet A: 214.97.255/24 256개
Subnet B: 214.97.254.0/25 - 214.97.254.0/29 120개
Subnet C: 214.97.254.128/25 128개
Subnet D: 214.97.254.0/31 2개
Subnet E: 214.97.254.2/31 2개
Subnet F: 214.97.254.4/30 4개

b. Using your answer to part (a), provide the forwarding tables (using longest prefix matching) for each of the three routers.

To simplify the solution, assume that no datagrams have router interfaces as ultimate destinations. Also, label D, E, F for the upper-right, bottom, and upper-left interior subnets, respectively.

Router 1

Longest Prefix Match	**Outgoing Interface**
11010110 01100001 11111111	Subnet A
11010110 01100001 11111110 0000000	Subnet D
11010110 01100001 11111110 000001	Subnet F

Router 2

Longest Prefix Match	**Outgoing Interface**
11010110 01100001 11111111 0000000	Subnet D
11010110 01100001 11111110 0	Subnet B
11010110 01100001 11111110 0000001	Subnet E

Router 3

Longest Prefix Match	**Outgoing Interface**
11010110 01100001 11111111 000001	Subnet F
11010110 01100001 11111110 0000001	Subnet E
11010110 01100001 11111110 1	Subnet C

P17. Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes? Explain how you computed your answer.

Number of datagrams required $= \left\lceil \frac{5 \times 10^6}{1460} \right\rceil = 3425$