CMSC3180: Data Communication and Networking
Assignment 5 Due on Friday (11/1) in class

Policies:

1. Discussions on these questions are welcomed and encouraged. However, you should NOT ask any other person to write solution for you or copy solutions from any other person directly. You should write the names of the persons from whom you received help and cite the references used if any.
2. Late turn in will cause a 10% deduction on your grade for each late day.

Question 1. (15 points) Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

a). Fill in the "Associated" column the 8-bit addresses (e.g., 00000011 – 00010000) specified by the "Destination Address Range" column.

Destination Address Range	Link Interface	Associated
00******	0	00000000 - 00111111
001*****	1	00100000 - 00111111
010*****	1	01000000 - 01011111
011*****	2	01100000 - 01111111
10******	2	10000000 - 10111111
110*****	3	11000000 - 11011111
111*****	0	11100000 - 11111111

b) Based on the forwarding table above, fill in the "Number" column the 8-bit IP addresses that will be forwarded to that interface, **using the longest prefix matching.** Briefly explain your answer.

Link Interface	Number
0	First link 0 instance: $2^6 = 64$, Second link 0 instance: $2^5 = 32$, 64+32 = 96
1	First link 1 instance: $2^5 = 32$, Second link 1 instance: $2^5 = 32$, 32+32 = 64
2	First link 2 instance: $2^5 = 32$, Second link 2 instance: $2^6 = 64$, 32+64 = 96
3	First link 3 instance: $2^5 = 32$, 32

Explanation:

Since the ending 5 or 6 bits are not defined, there are many possibilities that can be sent to these addresses. To find a range for these undefined addresses, we can calculate $2^{\#of\ unkown\ bits}$. By performing this calculation for all instances of the appropriate link interface, we can find an overall sum of addresses forwarded to that link interface.

Question 2. (15 points) Consider a router that interconnects four subnets: Subnet 1 to Subnet 4. Suppose all of the interfaces in each of these four subnets are required to have the prefix 158.83.254.0/24. 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 and Subnet 4 each is to support at least 25 interfaces. Provide four network addresses (of the form a.b.c.d/x) that satisfy these constraints. Explain your answer.

Subnets:	a.b.c.d/x
Subnet 1: prefix 158.83.254.0/24, 60 interfaces	158.83.254.0/26
Subnet 2: prefix 158.83.254.0/24, 90 interfaces	158.83.254.64/25
Subnet 3: prefix 158.83.254.0/24, 25 interfaces	158.83.254.128/27
Subnet 4: prefix 158.83.254.0/24, 25 interfaces	158.83.254.160/27

Calculations:
/24 = 32-24 = 8 bits Needed addresses: 2^8 = 256 **Subnet 1:** 2^6 = 64 addresses, 32 – 6 = 26 prefix **Subnet 2:** 2^7 = 128 addresses, 32-7 = 25 prefix **Subnet 3:** 2^5 = 32 addresses, 32-5 = 27 prefix **Subnet 4:** 2^5 = 32 addresses, 32-5 = 27 prefix

Explanation:

We can represent a router that interconnects four subnets with one matching prefix. This can be done by considering both the number of interfaces, total addresses needed, and host bits. This allows us to split up the prefix into 4 subnets, ranging across the allotted addresses. This allows us to allocate enough space without wasting any space or IP addresses.