

Assignment 4: IP and Network Routing

1. (1 point) We made a distinction between the forwarding function and the routing function performed in the network layer. What are the key differences between routing and forwarding?
2. (1 point) What is a private network address? Should a datagram with a private network address ever be present in the larger public Internet?
3. (2 points) 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 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 through 11100001 01111111 11111111 11111111	2
otherwise	3

- a. Complete the following forwarding table according to the above setting, assuming longest prefix matching is used to decide where to forward a packet to the correct link interface. Note that the column of network prefix should be presented in decimal form of a.b.c.d/x. You need to decide how many entries that this table requires.

Forwarding Table:

[illegible]

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

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11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111
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4. (3 points) 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 128.16.0.0/12. Also suppose that Subnet 1 is required to support up to 300 interfaces, Subnet 2 is to support up to 120 interfaces, and Subnet 3 is to support up to 400 interfaces. Provide three network prefixes (of the form a.b.c.d/x) for the three subnets that satisfy these constraints.
5. (2 points) Consider a subnet with prefix 223.168.48.0/23. Suppose an ISP wants to create two subnets (Subnet 1 and Subnet 2) from the block of addresses defined by 223.168.48.0/23, with each block having the same number of IP addresses. Consider Subnet 1 takes addresses in the lower range, while Subnet 2 takes addresses in the upper range. What are the network prefixes (of the form a.b.c.d/x) for the two subnets?
6. (1 point) IPv6 uses 16-byte addresses. If a block of 1 million addresses is allocated every picoseconds, how long will the addresses last? Compare that with the age of our universe ($\approx 10^{10}$ years)