Chapter 4 Problems [Name]

Problems 1, 9-13, 15, 16, 18, 19, 21,24, 26, 30, 52 WS: IP only

I worked on this Assignment with: [names]

1. In this question, we consider some of the pros and cons of virtual-circuit and datagram networks.  
   1. Suppose that routers were subjected to conditions that might cause them to fail fairly often. Would this argue in favor of a VC or datagram architecture? Why?

**Answer**

* 1. Suppose that a source node and a destination require that a fixed amount of capacity always be available at all routers on the path between the source and destination node, for the exclusive use of traffic flowing between this source and destination node. Would this argue in favor of a VC or datagram architecture? Why?

**Answer**

* 1. Suppose that the links and routers in the network never fail and that routing paths used between all source/destination pairs remain constant. In this scenario, does a VC or datagram architecture have more control traffic overhead? Why?

**Answer**

1. 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:

|  |  |
| --- | --- |
| 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 |

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

**Answer:**

|  |  |
| --- | --- |
|  | 0 |
|  | 1 |
|  | 2 |
|  | 3 |

* 1. Describe how your forwarding table determines the appropriate link interface for datagrams with destination address:

**Answer:**

|  |  |
| --- | --- |
| Address | **Short Answer** |
| 11001000 10010001 01010001 01010101 |  |
| 11100001 01000000 11000011 00111100 |  |
| 11100001 10000000 00010001 01110111 |  |

1. Consider a datagram network using 8-bit host address. 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.

**Answer:**

|  |  |
| --- | --- |
| Interface | 8-bit address range(s) |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |

1. 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 |
| 1 | 0 |
| 10 | 1 |
| 111 | 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.

**Answer:**

|  |  |
| --- | --- |
| Interface | 8-bit address range(s) |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |

1. Consider a router that interconnects three subnets: Subnets 1, 2, and 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17.0/24. Also suppose that Subnet 1 is required to support 63 interfaces, Subnet 2 is to support up to 95 interfaces, and subnet 3 is to support up to 16 interfaces. Provide three network address of the form a.b.c.d/x that satisfy the constraints.

**Answer:**

1. In section 4.2.2 an example forwarding table (using longest prefix matching) is given. Rewrite this forwarding table using the a.b.c.d/x notation instead of the binary string notation.

**Answer:**

|  |  |
| --- | --- |
| **Address** | **Link Interface** |
|  |  |
|  |  |
|  |  |
|  |  |

1. Consider a subnet with prefix 128.119.40.128/26. Give an example of one IP address (of the form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 128.119.40.64/25. Suppose it wants to creat four subnets from this block, with each block having the same number of IP addresses. What are the network addresses (of the form a.b.c.d/x) for the four subnets?

**Answer:**

|  |
| --- |
|  |
|  |
|  |
|  |

1. Consider the topology shown in Figure 4.17. Denote the three subnets with hosts (starting clockwise at 12:00) as Networks A, B, and C. Denote the subnets without hosts as Network D, E, and F.



* 1. Assign network addresses to each of these six subnets, with the following constraints:
* All addresses must be allocated from 214.97.254.0/23
* Subnet A should support 250 interfaces
* Subnet B should support 120 interfaces
* Subnet C should support 120 interfaces
* Subnets D, E and F should support two interfaces each.
* 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 where the second notation means to subtract the second range from the first.

**Answer:**

|  |  |
| --- | --- |
| Subnet A |  |
| Subnet B |  |
| Subnet C |  |
| Subnet D |  |
| Subnet E |  |
| Subnet F |  |

* 1. Using your answer from a., provide the forwarding tables (using longest prefix matching) for each of the three routers.

**Answer:**

|  |  |
| --- | --- |
| **Router 1** | |
| **Prefix Match** | **Interface** |
|  |  |
|  |  |
|  |  |

|  |  |
| --- | --- |
| **Router 2** | |
| **Prefix Match** | **Interface** |
|  |  |
|  |  |
|  |  |

|  |  |
| --- | --- |
| **Router 3** | |
| **Prefix Match** | **Interface** |
|  |  |
|  |  |
|  |  |

1. 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 (show) how you computed your answer.

**Answer:**

1. Consider the network setup in Figure 4.22. Suppose that the ISP instead assigns the router the address 24.34.112.235 and that the network address of the home network is 192.168.1.0/24.
   1. Assign addresses to all interface in the home network.

**Answer:**

|  |  |
| --- | --- |
| Interface | IP (your answer) |
| Router |  |
| Host A |  |
| Host B |  |
| Host C |  |

* 1. Suppose each host has two ongoing TCP connections, all to port 80 at host 128.119.40.86. Provide the six corresponding entries in the NAT translation table.

**Answer:**

|  |  |
| --- | --- |
| NAT translation table | |
| WAN side | LAN side |
|  |  |
|  |  |
|  |  |

1. In this problem we’ll explore the impact of NATs on P2P applications. Suppose a peer with username Arnold discovers through querying that a peer with username Bernard has a file it wants to download. Also suppose that Bernard and Arnold are both behind a NAT. Try to devise a technique that will allow Arnold to establish a TCP connection with Bernard without application-specific NAT configuration. If you have difficulty devising such a technique, discuss why.

**Answer:**

1. Consider the network shown on p 430. With the indicated link costs, use Dijkstra’s shortest-path algorithm to compute the shortest path from to all network nodes. **SHOW how the algorithm works by computing a table similar to Table 4.3**.

**Answer:**

**(Edit table as needed)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Step | N’ | D(t), p(t) | D(u), p(u) | D(v), p(v) | D(w), p(w) | D(y), p(y) | D(z), p(z) |
| 0 |  |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |  |

1. Consider the network shown for this problem on page 430, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node z.

**Answer: (edit table as needed)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Cost to | | | |
| From |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. Consider the count-to-infinity problem in the distance vector routing algorithm. Will the count-to-infinity problem occur if we decrease the cost of a link? Why? How about if we connect two nodes which do not have a link?

**Answer:**

1. What is the size of the multicast address space? Suppose now that two multicast groups randomly choose a multicast address. What is the probability that they choose the same address? Suppose now that 1,000 multicast groups are ongoing at the same time and choose their multicast group addresses at random. What is the probability that they interfere with each other?

**Answer:**

**Wireshark Answers for IP lab:**