Computer Network

Homework #3 for Chapter 4, 5

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Chapter 4

P5. 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:

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

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11001000 10010001 01010001 01010101 : 5th entry (link interface of 3)

11100001 01000000 11000011 00111100 : 3th entry (link interface of 2)

11100001 10000000 00010001 01110111 : 4th entry (link interface of 3)

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

- For the first address, it does not start with prefix of 1100~ which means it is out of the ranges. So the link interface 3 is allocated. Second and third addresses start with 11100001 where first 8 bits of 4,5th entries matched. For the second, for the 9th bit, it has 0 so that entry 3 was matched and for the third one, it has 1 for the 9th bit so the 4th entry (link interface 3) was allocated.

P6. Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

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

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P12. 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.

1. 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 : 214.97.255.0/24 (256 addresses)

Subnet B : 214.97.254.0/25 – 214.97.254.0/29(120 addresses)

Subnet C : 214.97.254.128/25 (128 addresses)

Subnet D : 214.97.254.0/31 (2 addresses)

Subnet E : 214.97.254.2/31 (2 addresses)

Subnet F : 214.97.254.4/30 (4 addresses)

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

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P17. Suppose you are interested in detecting the number of hosts behind a NAT. You observe that the IP layer stamps an identification number sequentially on each IP packet. The identification number of the first IP packet generated by a host is a random number, and the identification numbers of the subsequent IP packets are sequentially assigned. Assume all IP packets generated by hosts behind the NAT are sent to the outside world.

1. Based on this observation, and assuming you can sniff all packets sent by the NAT to the outside, can you outline a simple technique that detects the number of unique hosts behind a NAT? Justify your answer.
   1. Since all the packets except first IP packet is sequentially assigned, all we have to do is to identify how many discontinuous points exists. If there are 3 discontinuous points, it means there are 4 unique hosts.
2. If the identification numbers are not sequentially assigned but randomly assigned, would your technique work? Justify your answer
   1. No. the technique above use the characteristic of sequentially assignment, so if is not sequentially assigned, then it would not work.

Chapter 5

P3. Consider the following network. With the indicated link costs, use Dijkstra’s shortest-path algorithm to compute the shortest path from x to all network nodes. Show how the algorithm works by computing a table similar to Table 5.1

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P5. Consider the network shown below, 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.

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P7. Consider the network fragment shown below. x has only two attached neighbors, w and y. w has a minimum-cost path to destination u (not shown) of 5, and y has a minimum-cost path to u of 6. The complete paths from w and y to u (and between w and y) are not shown. All link costs in the network have strictly positive integer values.

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1. Give x’s distance vector for destinations w, y, and u.
   1. Dx(w) = 2, Dx(y) = 4, Dx(u) = 7
2. Give a link-cost change for either c(x, w) or c(x, y) such that x will inform its neighbors of a new minimum-cost path to u as a result of executing the distance-vector algorithm.
   1. We can consider two cases, otherwise, the cost will not be changed;
      1. Dx(w) is increased
      2. Dx(y) is decreased

If Dx(w) is increased by more than 5 so that the value becomes more than 7, then cost of the path to u becomes larger than that of through node y which is currently 11. For the second case, if the Dx(y) becomes less than 1, then the cost of the route though y get the smaller value which is less than 7, so the route minimum-cost path will be changed. However, the problem stated the condition that ‘All links in the network have strictly positive integer values’ so the second case will be realized.

1. Give a link-cost change for either c(x, w) or c(x, y) such that x will not inform its neighbors of a new minimum-cost path to u as a result of executing the distance-vector algorithm.

* As we saw above, changing the value of c(x, y) will not affect x to inform its neighbors of a new minimum-cost path to u.

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P11. Consider Figure 5.7. Suppose there is another router w, connected to router y and z. The costs of all links are given as follows: c(x,y)=4, c(x,z)=50, c(y,w)=1, c(z,w)=1, c(y,z)=3. Suppose that poisoned reverse is used in the distance-vector routing algorithm.

1. When the distance vector routing is stabilized, router w, y, and z inform their distances to x to each other. What distance values do they tell each other?

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1. Now suppose that the link cost between x and y increases to 60. Will there be a count-to- infinity problem even if poisoned reverse is used? Why or why not? If there is a count-to-infinity problem, then how many iterations are needed for the distance-vector routing to c(x,y)=3, c(y,z)=6, c(z,x)=4. c(x,y)=4, c(x,z)=50, c(y,w)=1, c(z,w)=1, c(y,z)=3. reach a stable state again? Justify your answer.
2. How do you modify c(y, z) such that there is no count-to-infinity problem at all if c(y,x) changes from 4 to 60?
   1. Cut the link between y and z

P14. Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link between AS2 and AS4.

1. Router 3c learns about prefix x from which routing protocol: OSPF, RIP, eBGP, or iBGP?
   1. eBGP.
2. Router 3a learns about x from which routing protocol?
   1. iBGP
3. Router 1c learns about x from which routing protocol?
   1. eBGP
4. Router 1d learns about x from which routing protocol?
   1. iBGP

For 3c to learns about prefix x, 4c send information about x through eBGP. 3c passes it through internal BGP. After that 1c learns it from 3a via eBGP and 1d gets the information through iBGP.

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P16. Consider the following network. ISP B provides national backbone service to regional ISP A. ISP C provides national backbone service to regional ISP D. Each ISP consists of one AS. B and C peer with each other in two places using BGP. Consider traffic going from A to D. B would prefer to hand that traffic over to C on the West Coast (so that C would have to absorb the cost of carrying the traffic cross-country), while C would prefer to get the traffic via its East Coast peering point with B (so that B would have carried the traffic across the country). What BGP mechanism might C use, so that B would hand over A-to-D traffic at its East Coast peering point? To answer this question, you will need to dig into the BGP specification.

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A. ISP C might advertise ISP B that it only have route via east coast. Then ISP B must have to send traffic to the east coast.

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자동 생성된 설명

P17. In Figure 5.13 , consider the path information that reaches stub networks W, X, and Y. Based on the information available at W and X, what are their respective views of the network topology? Justify your answer. The topology view at Y is shown below.

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* 1. X does not know about BC link and W does not know about AC and BC link.

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P19. In Figure 5.13, suppose that there is another stub network V that is a customer of ISP A. Suppose that B and C have a peering relationship, and A is a customer of both B and C. Suppose that A would like to have the traffic destined to W to come from B only, and the traffic destined to V from either B or C. How should A advertise its routes to B and C? What AS routes does C receive?

1. ISP A should advertise two routes to ISP B.

* A to W
* A to V

1. ISP A should advertise only one path.

* A-V

1. C receives three paths

* B-A-W
* B-A-V
* A-V