

CS536 Homework 3

due Tue, Apr 14th, 1:30pm

April 7, 2009

Updated: 6 April 2009, 9:50pm

Submit your homework electronically in a text or PDF file. Email your solution to the professor by 1:30pm on Tuesday, Apr 14th. Late submission will not be accepted, nor will collaboration.

To receive credit, all submissions should contain this statement at the beginning: "By turning in this homework submission, I certify that this work was done solely by me." Questions about this homework should be directed to the TAs or the Professor, not to fellow classmates.

Problem 1 (10 pts)

Consider some of the pros and cons of virtual-circuit and datagram networks.

- a. Suppose that in the network layer, routers were subjected to stressful conditions that might cause them to fail fairly often. At a high level, what actions would need to be taken on such router failure? Does this argue in favor of VC or datagram architecture?
- b. Suppose that to provide a guarantee regarding the level of performance (for example, delay) that would be seen along a source-to-destination path, the network requires a sender to declare its peak traffic rate. If the declared peak traffic rate and the existing declared traffic rates are such that there is no way to get traffic from the source to the destination that meets the required delay requirements, the source is not allowed access to the network. Would such an approach be more easily accomplished within a VC or a datagram architecture?

Problem 2 (10 pts)

Consider a router with a switch fabric, 2 input ports (W and X) and 2 output ports (Y and Z). Suppose the switch fabric operates at 1.5 times the line speed.

- a. If, for some reason, all packets from X are destined to Y, and all packets from W are destined to Z, can a switch fabric be designed so that there is no input port queueing? Explain why or why not in one sentence.

- b. Suppose now packets from W and X are randomly destined to both Y and Z. Can a switch fabric be designed so that there is no input port queuing? Explain why or why not in one sentence.

Problem 3 (10 pts)

Consider a datagram network using 32-bit hose 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 01111111 11111111 11111111 to interface 0
- 11100000 10000000 00000000 00000000 through 11100000 10000001 11111111 11111111 to interface 1
- 11100000 10000010 00000000 00000000 through 11100000 11111111 11111111 11111111 to interface 2
- otherwise to interface 3

- a. Provide a forwarding table that has four entries, uses longest prefix matching, and forwards packets to the correct link interfaces.
- b. Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:

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11101000 10010001 01010001 01010101
11100000 10000001 01000011 00111100
11100000 11000000 00010001 01110111
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Problem 4 (10 pts)

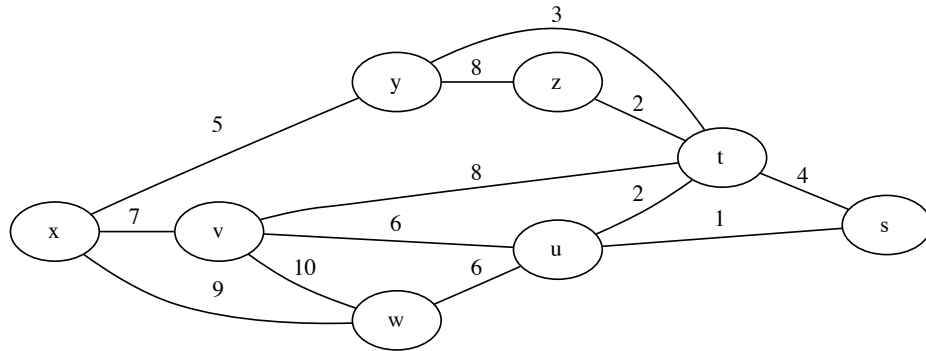
Consider a subnet with prefix 123.123.123.64/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 123.123.128/17. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?

Problem 5 (10 pts)

Consider sending a 3,000 byte datagram into a link that has an MTU of 1500 bytes. Upon exiting that link, the next router sends the packets through another link which has an MTU of 476 bytes. Suppose the original datagram is stamped with the identification number 423. How many fragments are generated? What are their characteristics?

Problem 6 (10 pts)

Consider the network below:

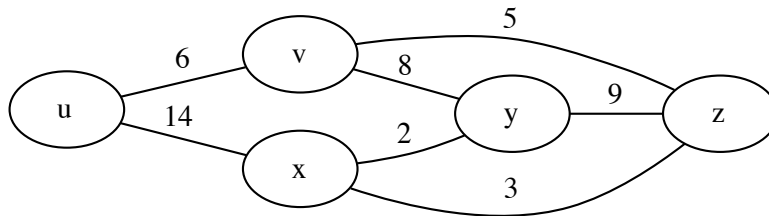


Using Dijkstra's algorithm, and showing your work using a table similar to the one shown in class slides, do the following:

- Compute the shortest path from s to all network nodes.
- Compute the shortest path from u to all network nodes.
- Compute the shortest path from x to all network nodes.
- Compute the shortest path from z to all network nodes.

Problem 7 (10 pts)

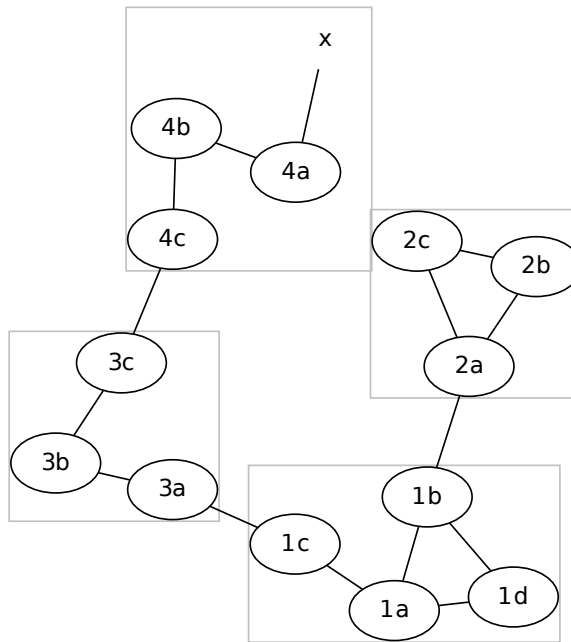
Consider the network below:



Assume each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance entries at node z .

Problem 8 (10 pts)

Consider the network below, which shows a network with 4 ASes (each enclosed in a box). Node identifiers begin with their AS number.



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.

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

Problem 9 (10 pts)

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 5,000 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?

Problem 10 (10 pts)

Delayed Internet Routing Convergence. List a major contribution of this paper, and three weaknesses of the paper.