**Fall 2023 CS120 Homework Assignment #2**

**Due Date: Nov. 25, 2023**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Please read the following instructions carefully before answering the questions:**

* This assignment is to be completed by each student **individually**.
* There are a total of **8** questions.
* When you write your answers, please try to be precise and concise.
* Fill your name and student ID at the first page.
* Please typeset the file name and format of your submission to the following one: YourID\_CS120\_HW2.pdf (Replace “YourID” with your student ID). Submissions with wrong file name or format will **NOT** be graded.
* Submit your homework through Blackboard.

1. (10 points) Suppose we have the forwarding tables shown in Table 1 for nodes A and F, in a network where all links have cost 1. Give a diagram of the smallest network consistent with these tables.

|  |  |  |
| --- | --- | --- |
| Table 1: Forwarding Tables for Exercise 1 | | |
| A | | |
| Node | Cost | Next hop |
| B | 1 | B |
| C | 2 | B |
| D | 1 | D |
| E | 2 | B |
| F | 3 | D |
| F | | |
| Node | Cost | Next hop |
| A | 3 | E |
| B | 2 | C |
| C | 1 | C |
| D | 2 | E |
| E | 1 | E |

1. (10 points) Consider the virtual circuit switches in Figure 1. Table 2 lists, for each switch, what <port, VCI> (or <VCI, interface>) pairs are connected to what other. Connections are bidirectional. List all endpoint-to-endpoint connections.

C

D

B

2 2 2

S3

1 3 1 3 1 3

S1

S2

E

A

Figure 1

|  |  |  |  |
| --- | --- | --- | --- |
| Table 2: VCI Tables for Switches in Figure 1 | | | |
| Switch S1 | | | |
| Port | VCI | Port | VCI |
| 1 | 2 | 3 | 1 |
| 1 | 1 | 2 | 3 |
| 2 | 1 | 3 | 2 |
| Switch S2 | | | |
| Port | VCI | Port | VCI |
| 1 | 1 | 3 | 3 |
| 1 | 2 | 3 | 2 |
| Switch S3 | | | |
| Port | VCI | Port | VCI |
| 1 | 3 | 2 | 1 |
| 1 | 2 | 2 | 2 |

1. (10 points) Consider the arrangement of learning bridges shown in Figure 2. Assuming all are initially empty, give the forwarding tables for each of the bridges B1 to B4 after the following transmissions:

* A sends to C
* C sends to A
* D sends to C

Identify ports with the unique neighbor reached directly from that port; that is, the ports for B1 are to be labeled “B1\_A” and “B1\_B2”.

B3

C

A

B2

B1

B4

D

Figure 2

1. (5 points) Suppose a TCP message that contains 1024 bytes of data and 20 bytes of TCP header is passed to IP for delivery across two networks interconnected by a router (i.e., it travels from the source host to a router to the destination host). The first network has an MTU of 1024 bytes; the second has an MTU of 576 bytes. Each network’s MTU gives the size of the largest IP datagram that can be carried in a link-layer frame. Give the sizes and offsets of the sequence of fragments delivered to the network layer at the destination host. Assume all IP headers are 20 bytes.
2. (5 points) Table 3 is a routing table using CIDR. Address bytes are in hexadecimal. The notation “/12” in C4.50.0.0/12 denotes a netmask with 12 leading 1 bits: FF.F0.0.0. Note that the last three entries cover every address and thus serve in lieu of a default route. State to what next hop the following will be delivered
3. C4.5E.13.87
4. C4.5E.22.09
5. C3.41.80.02
6. 5E.43.91.12
7. C4.6D.31.2E

|  |  |
| --- | --- |
| Table 3: Routing Table for Exercise 5 | |
| Net/Mask Length | Next hop |
| C4.50.0.0/12 | A |
| C4.5E.10.0/20 | B |
| C4.60.0.0/12 | C |
| C4.68.0.0/14 | D |
| 80.0.0.0/1 | E |
| 40.0.0.0/2 | F |
| 00.0.0.0/2 | G |

1. (20 points) An organization has been assigned the prefix 212.1.1/24 (class C) and wants to form subnets for four departments, with hosts as follows:

A 75 hosts

B 35 hosts

C 20 hosts

D 18 hosts

There are 148 hosts in all.

(a) Give a possible arrangement of subnet masks to make this possible. (10 points)

(b) Suggest what the organization might do if department D grows to 32 hosts (Hint: Give A two subnets). (10 points)

1. (30 points) For the network shown in Figure 3, give global distance–vector tables like those of Tables 3.10 and 3.13 in textbook (refer to Computer Networks, Fifth Edition) when:

(a) Each node knows only the distances to its immediate neighbors. (10 points)

(b) Each node has reported the information it had in the preceding step to its immediate neighbors. (10 points)

(c) Step (b) happens a second time. (10 points)

B

A

C

F

1

3

D

E

2

2

6

8

Figure 3

1. (10 points) For the network given in Figure 3, show how the link-state algorithm builds the routing table for node D.