[105-2] Computer Network – HW#3

Due: June 18 (Sun.), 9pm

1. 本次作業請於期限內至ceiba作業區上傳，格式為單一pdf檔案，檔案內應註記**系級、姓名及學號**；習慣手寫的同學，可以紙筆方式完成後掃描成**清晰pdf檔**上傳。
2. 請清楚標明每題**題號**，以及各小題答案（**粗體**、紅字、底線等等皆可）。如遇計算題應簡述計算過程，如遇解釋題亦應簡要解釋。
3. 本次作業有兩部分，第一部分為Textbook Problems，第二部分為Programming Problems。

-- Textbook Problems

Computer Networking: A Top-Down Approach, James Kurose and Keith Ross, PEARSON, 6th Edition, INTERNATIONAL EDITION

Chapter 4: P5, P10, P12, P17, P19, P22

Chapter 5: P3, P5, and P14

(題目電子檔如 **Appendix**)

-- Programming Problems

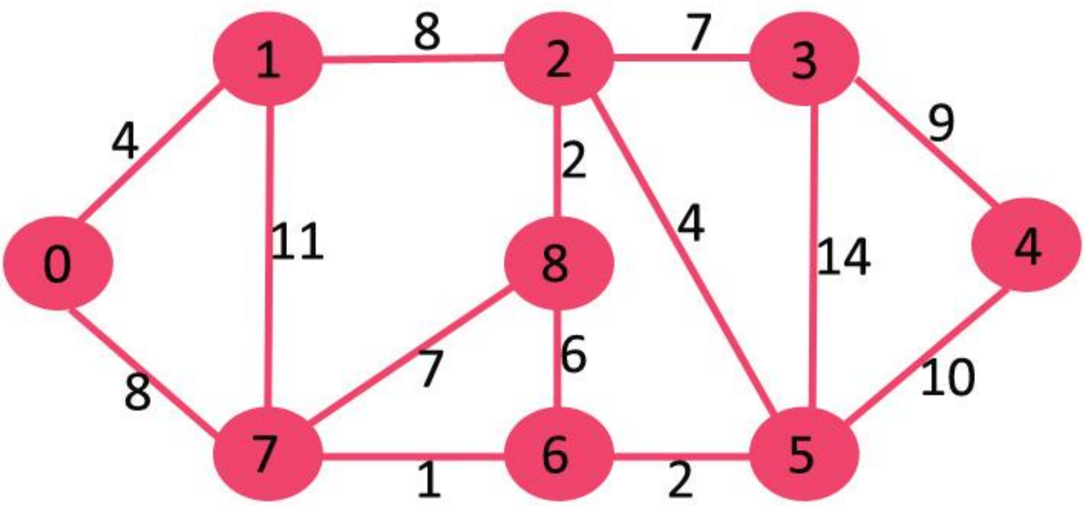

Fig. 1 Network Graph

Given the network topology as Fig. 1, please write a simple code in **ANY your familiar** programming language (i.e. C/C++, Java or Python…) to implement **distance-vector algorithm** and answer the following question:

1. What are the initial distance vectors*, when each node only knows the one-hop link cost to its directly-attached neighbors?

2. When the algorithm converges, what are the distance vectors in each of the routers.

3. **Finally, paste your code to pdf file. (**若是手寫請將程式碼附在掃描檔的最後頁，並註明之**)**

* Suppose that after the ith iteration, the distance vector in each of the nodes is:
D0(0,1,2,…,9) =(0,*,*,*,*,*,*,*,*,*)
D1(0,1,2,…,9) =(*,0,*,*,*,*,*,*,*,*)
D2(0,1,2,…,9) =(*,*,0,*,*,*,*,*,*,*)
….

Appendix

Chapter 4

P5. Consider a VC network with a 2-bit field for the VC number. Suppose that the network wants to set up a virtual circuit over four links: link A, link B, link C, and link D. Suppose that each of these links is currently carrying two other virtual circuits, and the VC numbers of these other VCs are as follows:

Link A	Link B	Link C	Link D
00	01	10	11
01	10	11	00

In answering the following questions, keep in mind that each of the existing VCs may only be traversing one of the four links.

a. If each VC is required to use the same VC number on all links along its path, what VC number could be assigned to the new VC?

b. If each VC is permitted to have different VC numbers in the different links along its path (so that forwarding tables must perform VC number translation), how many different combinations of four VC numbers (one for each of the four links) could be used?

P10. 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. Provide a forwarding table that has five 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:

11001000 10010001 01010001 01010101
11100001 01000000 11000011 00111100
11100001 10000000 00010001 01110111

P12. 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.

P17. 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 Networks D, E, and F.

a. 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.

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

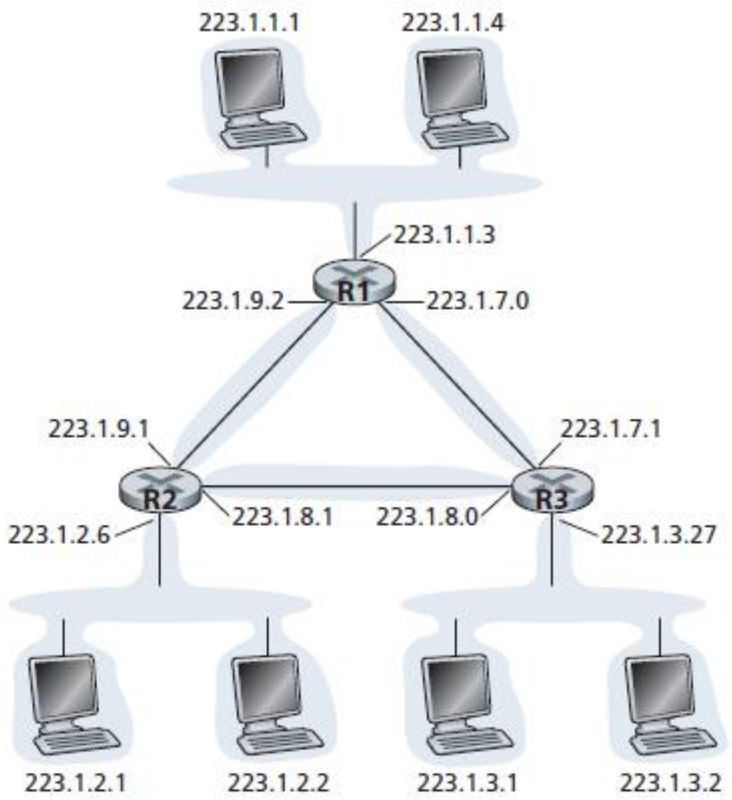

Figure 4.17 ♦ Three routers interconnecting six subnets

P19. Consider sending a 2400-byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation?

P22. 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.

a. 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.

b. If the identification numbers are not sequentially assigned but randomly assigned, would your technique work? Justify your answer.

Chapter 5

P3. Suppose the information portion of a packet (*D* in Figure 5.3) contains 10 bytes consisting of the 8-bit unsigned binary ASCII representation of string "Networking." Compute the Internet checksum for this data.

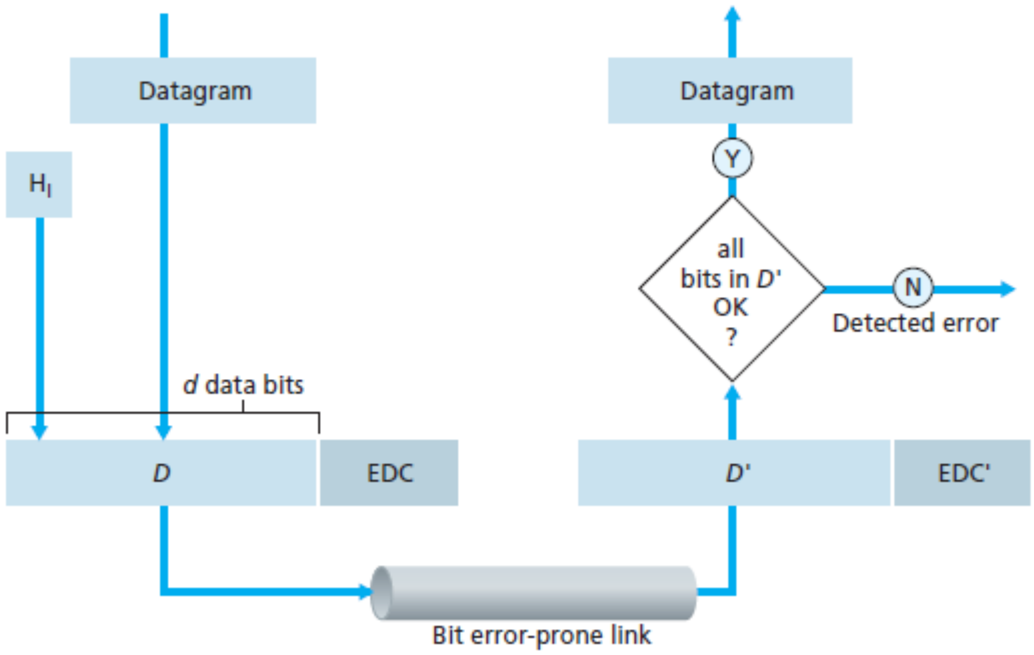

Figure 5.3 ♦ Error-detection and -correction scenario

P5. Consider the 7-bit generator, G=10011, and suppose that D has the value 1010101010. What is the value of R?

P14. Consider three LANs interconnected by two routers, as shown in Figure 5.33.

a. Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 uses addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.

b. Assign MAC addresses to all of the adapters.

c. Consider sending an IP datagram from Host E to Host B. Suppose all of the ARP tables are up to date. Enumerate all the steps, as done for the single-router example in Section 5.4.1.

d. Repeat (c), now assuming that the ARP table in the sending host is empty (and the other tables are up to date).

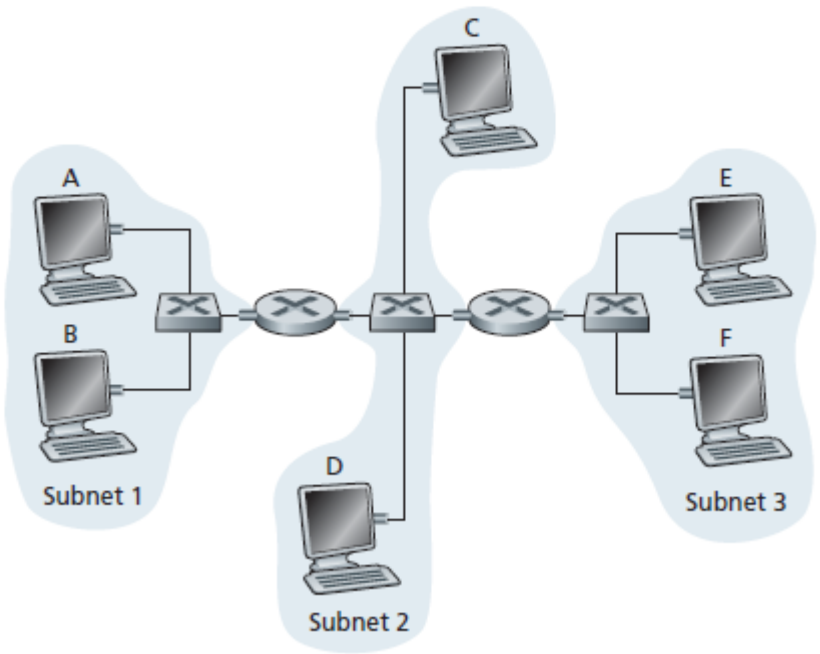

Figure 5.33 ♦ Three subnets, interconnected by routers