1. If all the links in the Internet were to provide reliable delivery service, would the TCP reliable delivery service be redundant? (8%)

Ans:

Although each link guarantees that an IP datagram sent over the link will be received at the other end of the link without errors, it is not guaranteed that IP datagrams will arrive at the ultimate destination in the proper order. (4%) With IP, datagrams in the same TCP connection can take different routes in the network, and therefore arrive out of order. TCP is still needed to provide the receiving end of the application the byte stream in the correct order. Also, IP can lose packets due to routing loops or equipment failures. (4%)

2. If the data bit is 101110 and the generator is 1001, how to calculate the Cyclic Redundancy Check (CRC)? (要寫出計算過程, 10%)

Ans:

First, we append 000 to the end of 101110. (2%) Then we divide 1001 into 101110000 we get 101011 (6%，計算過程一步驟一分), with a remainder of R = 11. (2%)
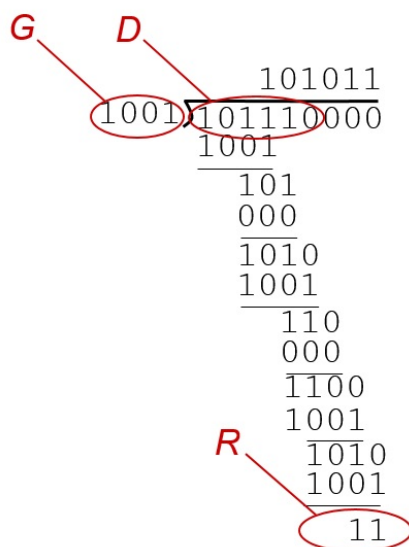
3. Explain the following terms: (a) Handoff (2%) (b) Hidden terminal problem (3%) (c) ARP protocol (2%) (d) 100BaseTX (2%) (e) Which algorithms are implemented by the switch and router? (4%) (13% total)

Ans: (a) handoff: mobile changes base station providing connection into wired network (2%)

(b) Hidden terminal problem (3%)

B, A hear each other

B, C hear each other

A, C can not hear each other

It means A, C unaware of their interference at B

(c) ARP: Address Resolution Protocol => IP/MAC address mappings for LAN nodes (2%)

(d) 100Mbps (1%), Twisted Pair (1%)

(e) routers maintain routing tables, implement routing algorithms (2%)

switches maintain switch tables, implement filtering, learning algorithms (2%)

4. List and explain two modes of wireless networks (名稱 4%, 說明 6%, 10% total)

Ans:

infrastructure mode: (2%)

- base station connects mobiles into wired network (2%)

ad hoc mode: (2%)

- no base stations (1%) nodes can only transmit to other nodes within link coverage (1%)
- nodes organize themselves into a network: route among themselves (2%)

5. List three types of multiple access protocols and describe how they work briefly. (9%)

Ans:

Three broad classes:

a. Channel Partitioning (2%)

divide channel into smaller "pieces" (time slots, frequency, code) to node for exclusive use (1%)

b. Random Access (2%)

channel not divided, allow collisions (1%)

c. "Taking turns" (2%)

Nodes take turns, but nodes with more to send can take longer turns (1%)

6. Describe how Ethernet uses <u>CSMA</u>/<u>CD</u> with <u>exponential backoff</u> (要寫出碰撞後如何動作) in detail (8%)

Ans:

- adapter doesn't transmit if it senses that some other adapter is transmitting, that is, carrier sense (2%)
- transmitting adapter aborts when it senses that another adapter is transmitting, that is, collision detection (2%)
- Before attempting a retransmission, adapter waits a random time, that is, random access with Exponential Backoff. (2%)
  - after mth collision, NIC chooses K at random from $\{0,1,2, \ldots, 2^m-1\}$. (2%) NIC waits $K \cdot 512$ bit times

7. How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? (畫圖並加以說明 8 %)

Ans:

- sender first transmits small *request-to-send (RTS)* packets to BS using CSMA; RTSs may still collide with each other (but they're short) (2%)
- BS broadcasts *clear-to-send (CTS)* in response to RTS; CTS heard by all nodes (2%)
- sender transmits data frame, other stations defer transmissions (2%)
- BS replies ACK to sender (2%)

6: Wireless and Mobile Networks 6-25
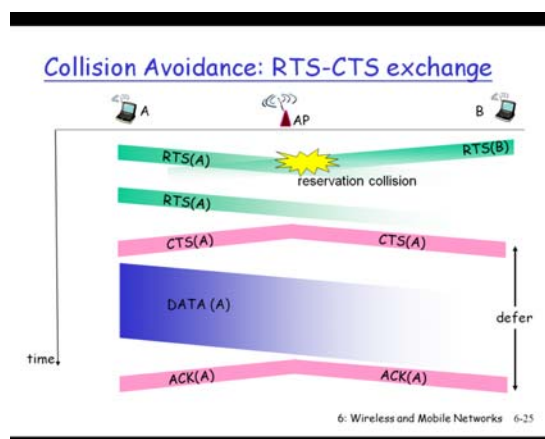
8. Consider sending an IP datagram from <u>host A to host B</u> in the LANs shown below. Write down <u>two generated frame headers</u> (A->Router and Router->B) with the Destination MAC address and Source MAC address and <u>the IP header</u> with the Source IP address and Destination IP address. (1% each, 8% total)
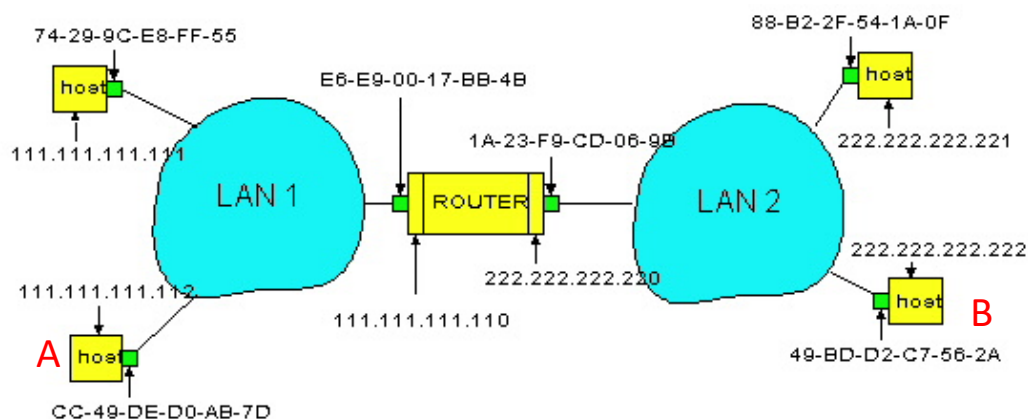
Ans:

From source A to Router

Destination MAC address	Source MAC address	Source IP address	Destination IP address
E6-E9-00-17-BB-4B	CC-49-DE-D0-AB-7D	111.111.111.112	222.222.222.222

From Router to B

Destination MAC address	Source MAC address	Source IP address	Destination IP address
49-BD-D2-C7-56-2A	1A-23-F9-CD-06-9D	111.111.111.112	222.222.222.222

9. 平時我們用的雙絞線 Ethernet 網路線是由(a)幾根不同顏色的線?分成幾對絞合在一起? (4%) 列出所有四種顏色。(4%) (b) 雙絞線 Ethernet 網路線的插頭是一種只能沿固定方向插入並自動防止脫落的塑料接頭,這種接頭的專有名詞是? (2%) (c) Ethernet 標準的名稱是 IEEE?wifi 標準的名稱是 IEEE?Bluetooth 標準的名稱是 IEEE? (6%) (16% total)

Ans (a)<u>8</u> 根不同顏色的線(2%),分成<u>4</u>對絞合在一起 (2%) 橙、藍、綠、棕 (4%)
(b) RJ45 (2%)
(c) <u>802.3</u>, <u>802.11</u>, <u>802.15</u> (6%)

10. Draw a figure to show the CDMA encoding and decoding processes for two senders and receivers if the CDMA code of sender1 and receiver 1 is (-1, 1, 1, 1, -1, -1, -1, -1) and that of sender 2 and receiver 2 is (1, -1, 1, 1, -1, -1, 1, 1). Please note source bits of sender 1 are (-1, 1) and those of sender 2 are (-1, -1). (計算過程要寫出來,encoding 時不能只寫相加的結果,decoding 時<u>只寫出來 receiver 1 的過程</u> 10%)

Ans:

(10%) (類似以下過程,必要部分要改)

$Z_{i,m}^1 = d_i^1 \cdot c_m^1$

channel, $Z_{i,m}^*$

$Z_{i,m}^2 = d_i^2 \cdot c_m^2$

$d_i^1 = \dfrac{\displaystyle\sum_{m=1}^{M} Z_{i,m}^* \cdot c_m^1}{M}$

slot 1 received input

slot 0 received input

receiver 1

code