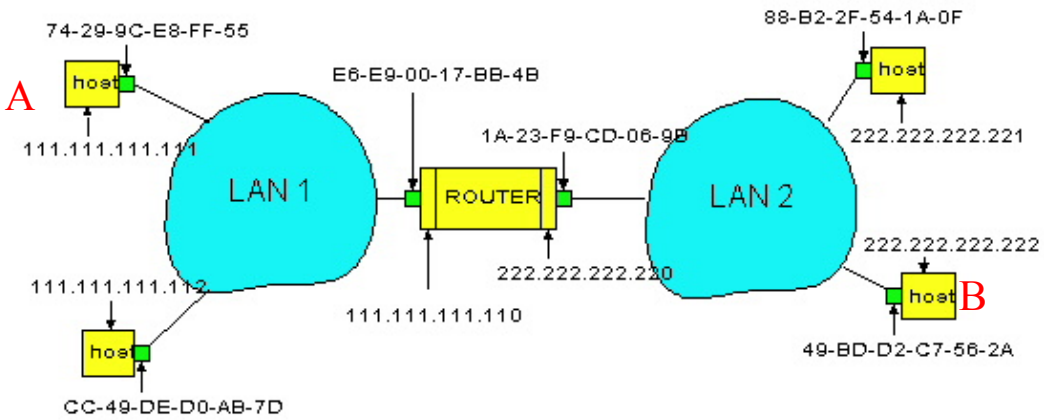
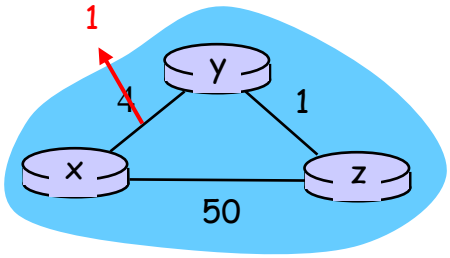
1. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) (9%)
2. How does IEEE 802.11 use CSMA/CA with RTS/CTS packets to avoid collision? 畫圖並加以說明(10%)
3. Draw a figure to describe components of cellular network architecture 畫圖並加以說明功能(10%)
4. Draw figures to describe the two modes of wireless networks. (10%)
5. (a) Classify the following wireless network standards into (1) wireless LAN, (2) personal area network and (3) cellular network. (6%)
   GSM, 802.11b, Bluetooth, 3G, GPRS, 802.11n
   (b) Classify CDMA, Token Passing and CSMA/CD into (1) Channel Partitioning (2) Random Access (3) Taking turns multiple access protocols. (3%)
6. (a) What is the ARP protocol used for? (3%) (b) If A wants to send datagram to B and B's MAC address is not in A's ARP table, how A uses ARP to find B's MAC address? (9%)
7. Describe and explain three different characteristics of wireless and wired networks? (9%)
8. Consider sending an IP datagram from host A to host B in the LANs shown below. Write down two generated frame headers (A->Router and Router->B) with the Destination MAC address and Source MAC address and the IP header with the Source IP address and Destination IP address. (1% each, 8% total)



9. Compare and contrast the advertisements used by RIP and OSPF. (8%)
10. List changing processes of three tables of node X, Y and Z with the distance vector algorithm, from the time before the X-Y link cost is changed from 4 to 1 to the time three tables are stabilized. (10%) (數值有變動時，要列出算式，不然不給分)



11. 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? 列出幾對線的顏色。 (6%) (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%)

1. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) in detail (9%)

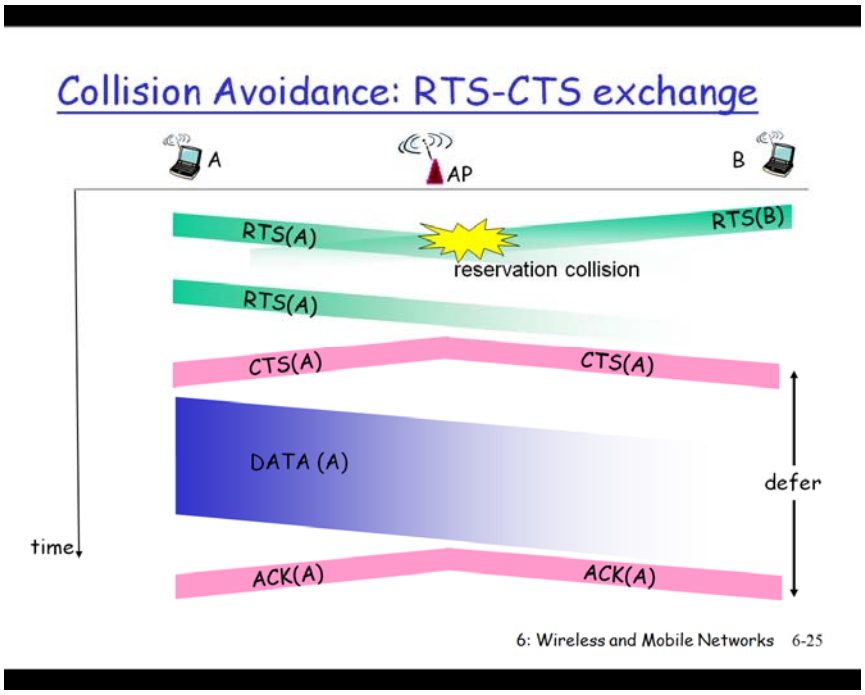
Ans:

- 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%)
  - first collision: choose K from {0,1}; delay is K· 512 bit transmission times (1%)
    after second collision: choose K from {0,1,2,3}…(1%)
    after ten collisions, choose K from {0,1,2,3,4,…,1023} (1%)

2. How does IEEE 802.11 use CSMA/CA with RTS/CTS packets to avoid collision? 畫圖並加以說明 (10%)

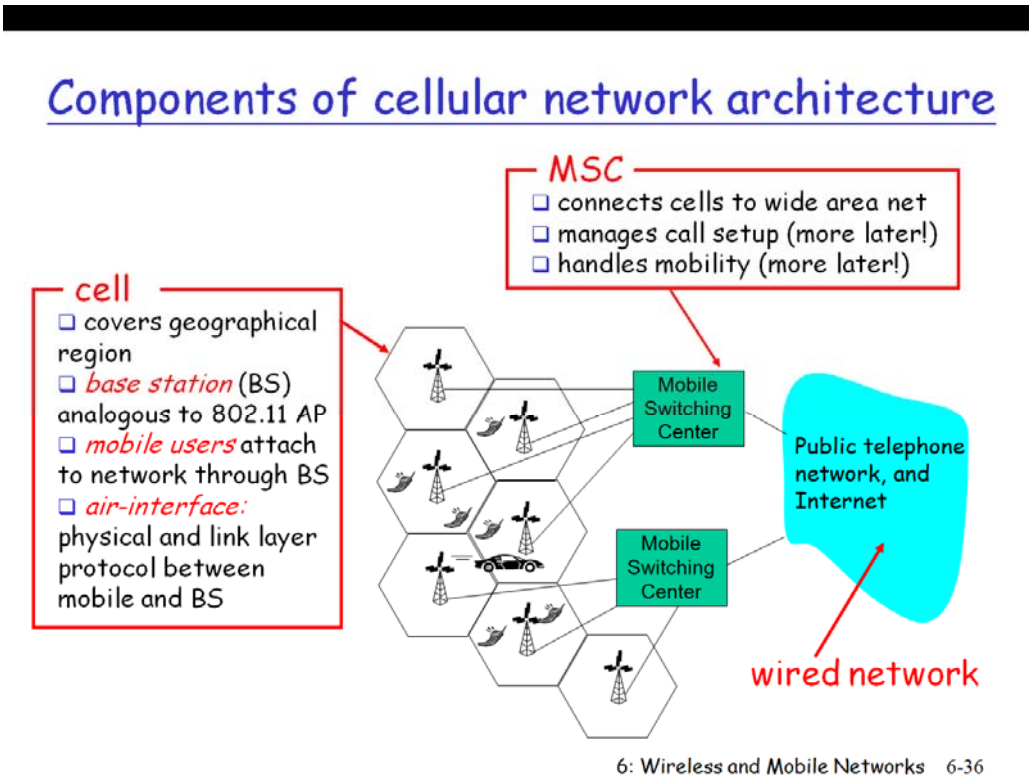
Ans:

- sender first transmits small *request-to-send (RTS)* packets to BS using CSMA; RTSs may still collide with each other (but they're short) (4%)
- BS broadcasts *clear-to-send (CTS)* in response to RTS; RTS heard by all nodes (4%)
- sender transmits data frame, other stations defer transmissions (2%)



3. Draw a figure to describe Components of cellular network architecture (10%)

Ans: MSC (2%); Cell (2%); BS (2%); MN (2%); wired core network (2%)

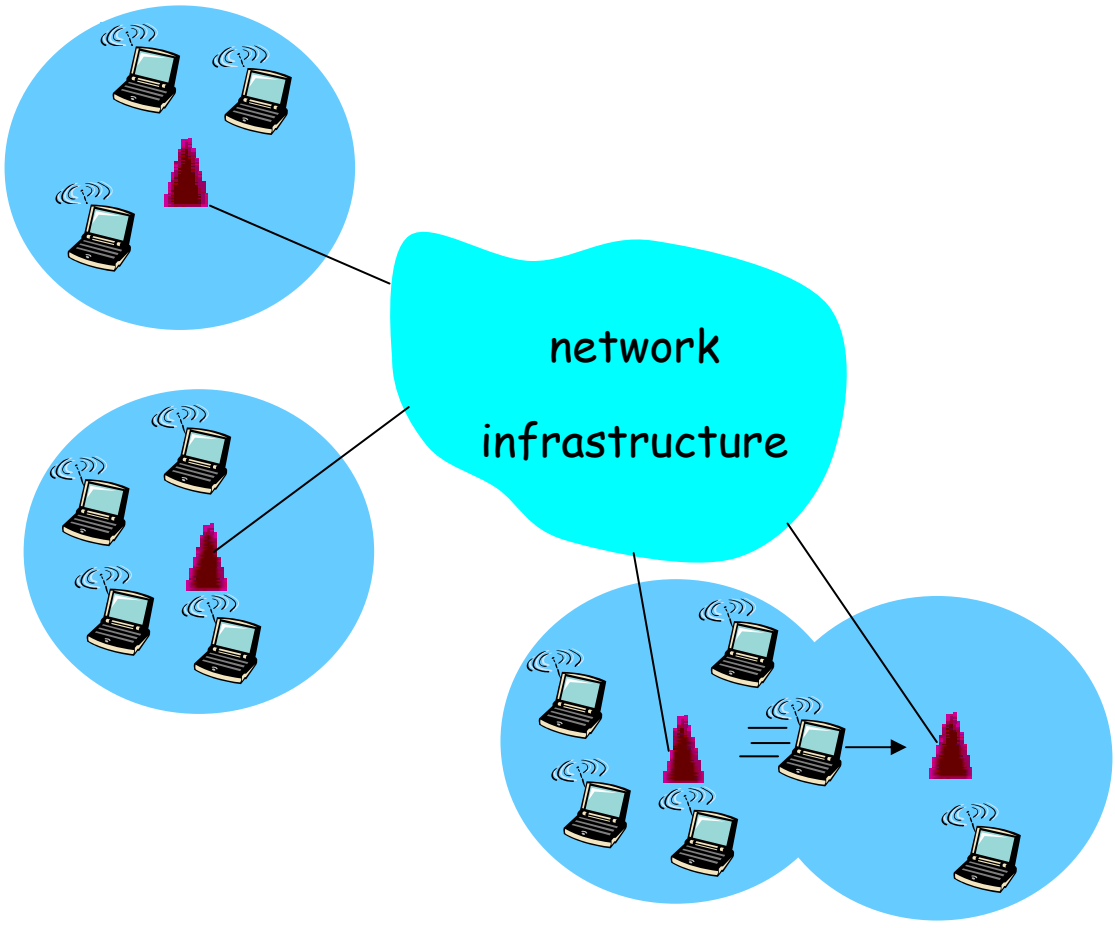


4. Draw figures to describe the two modes of wireless networks. (10%)

Ans:

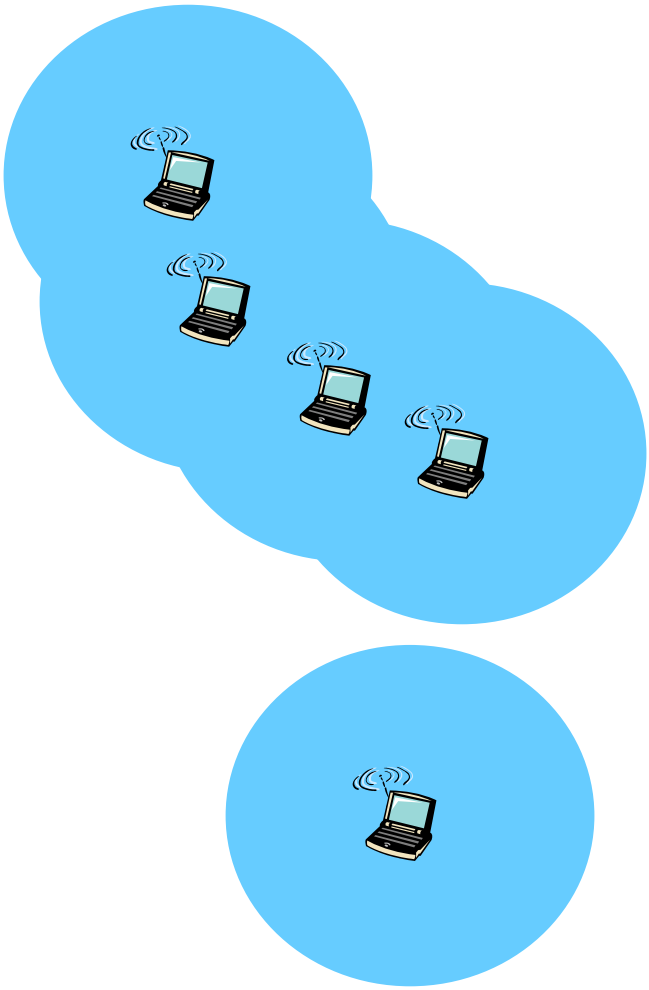
(a) infrastructure mode: (5%)

- cell (2%)
- base station connects mobiles into wired network (2%)
- mobile (1%)



(b) ad hoc mode: (5%)

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



5. (a) Classify the following wireless network standards into (1) wireless LAN, (2) personal area network and (3) cellular network. (6%)
GSM, 802.11b, Bluetooth, 3G, GPRS, 802.11n
(b) Classify CDMA, Token Passing and CSMA/CD into (1) Channel Partitioning (2) Random Access (3) Taking turns multiple access protocols. (3%)

Ans: (1% each)
(1) wireless LAN : *802.11b, 802.11n*
(2) personal area network: *Bluetooth,*
(3) cellular network: *GSM, 3G, GPRS*

(b) Channel Partitioning: CDMA; (1%)
Random Access: CSMA/CD (1%)
"Taking turns": Token Passing (1%)

6. (a) What is the ARP protocol used for? (3%) (b) If A wants to send datagram to B and B's MAC address is not in A's ARP table, how A uses ARP to find B's MAC address? (9%)

Ans:
(a) ARP: Address Resolution Protocol => IP/MAC address mappings for LAN nodes (3%)
(b) A wants to send datagram to B, and B's MAC address not in A's ARP table.

- A broadcasts ARP query packet, containing B's IP address (2%)
  - Dest MAC address = FF-FF-FF-FF-FF-FF (1%)

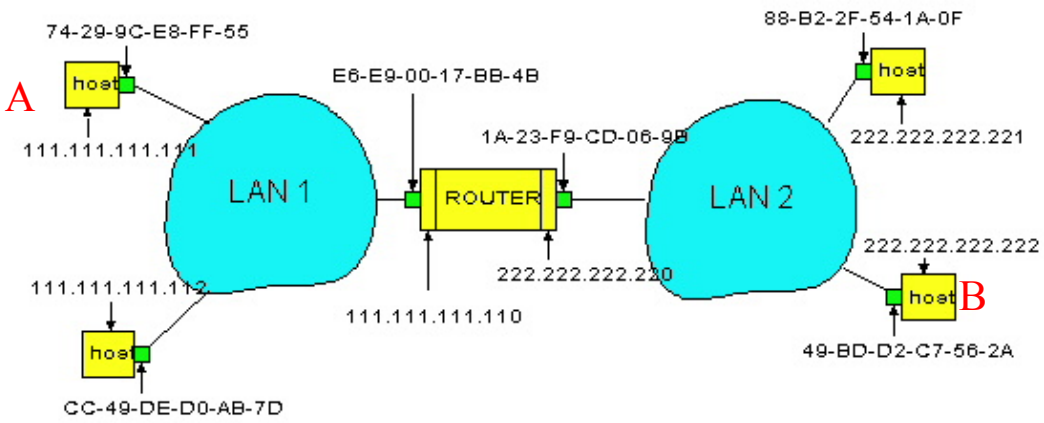
- all machines on LAN receive ARP query (1%)
- B receives ARP packet, replies to A with its (B's) MAC address (2%)
  - frame sent to A's MAC address (unicast) (1%)
- A caches (saves) IP-to-MAC address pair in its ARP table until information becomes old (times out) (2%)

7. Describe and explain three different characteristics of wireless and wired networks? (9%)

Ans:

- decreased signal strength (2%): radio signal attenuates as it propagates through matter (path loss) (1%)
- interference from other sources (2%): standardized wireless network frequencies (e.g., 2.4 GHz) shared by other devices (e.g., phone); devices (motors) interfere as well (1%)
- multipath propagation (2%): radio signal reflects off objects ground, arriving at destination at slightly different times (1%)

8. Consider sending an IP datagram from host A to host B in the LANs shown below. Write down two generated frame headers (A->Router and Router->B) with the Destination MAC address and Source MAC address and the IP header 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	74-29-9C-E8-FF-55	111.111.111.111	222.222.222.222

From Router to B

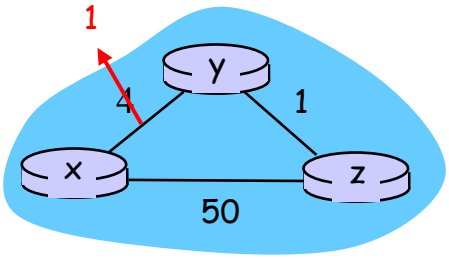
Destination MAC address	Source MAC address	Source IP address	Destination IP address
49-BD-D2-C7-56-2A	1A-23-F9-CD-06-9D	111.111.111.111	222.222.222.222

9. Compare and contrast the advertisements used by RIP and OSPF. (8%).

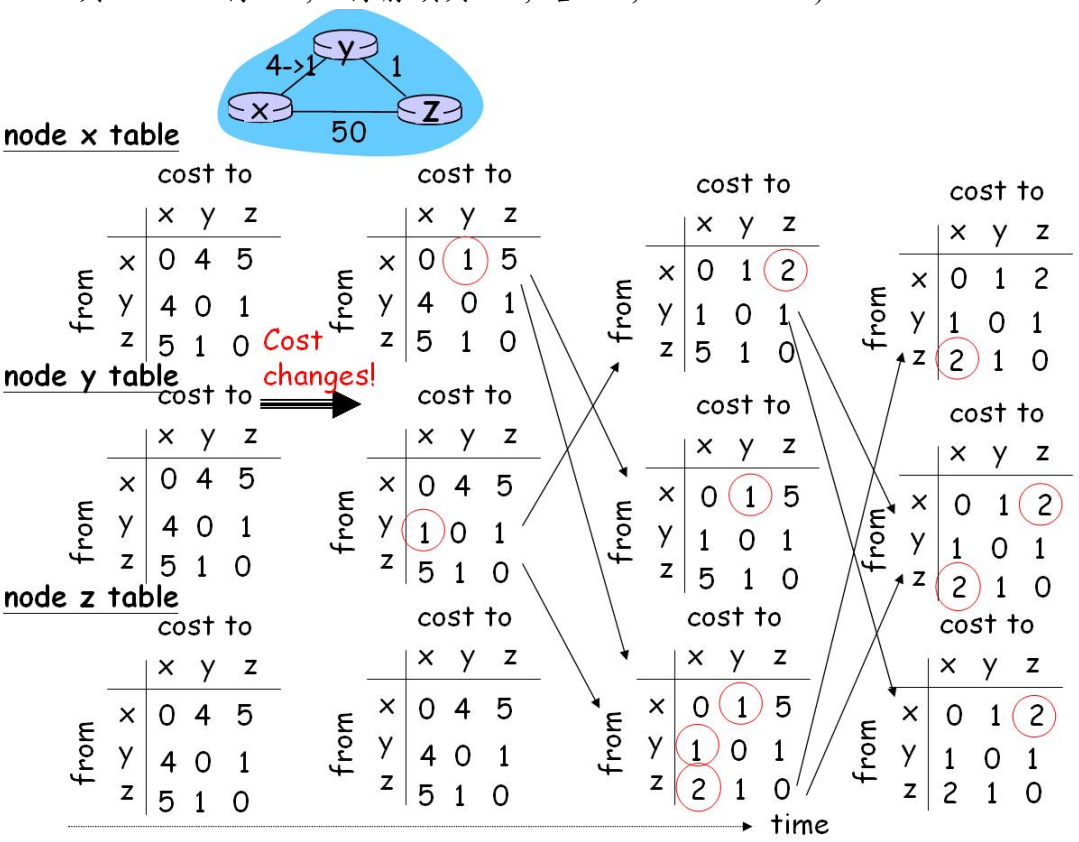
- With OSPF,
  - a router periodically broadcasts routing information to all other routers in the AS, not just to its neighboring routers. (2%)
  - This routing information sent by a router has one entry for each of the router's neighbors; the entry gives the distance from the router to the neighbor. (2%)
- A RIP advertisement sent by a router
  - contains information about all the networks in the AS, (2%)
  - although this information is only sent to its neighboring routers. (2%)

10. List changing processes of three tables of node X, Y and Z with the distance vector algorithm, from the

time before the X-Y link cost is changed from 4 to 1 to the time three tables are stabilized. (10%)



Ans:
(a) initial table X-Y cost from 4 -> 1
(4 行 table 共 8%，一行 2%, 2 行箭頭共 2%, 各 1%, => total 10%)



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Ans (a) 8 根不同顏色的線，分成 4 對絞合在一起 (6%)
橙、藍、綠、棕
(b) RJ-45 (2%)