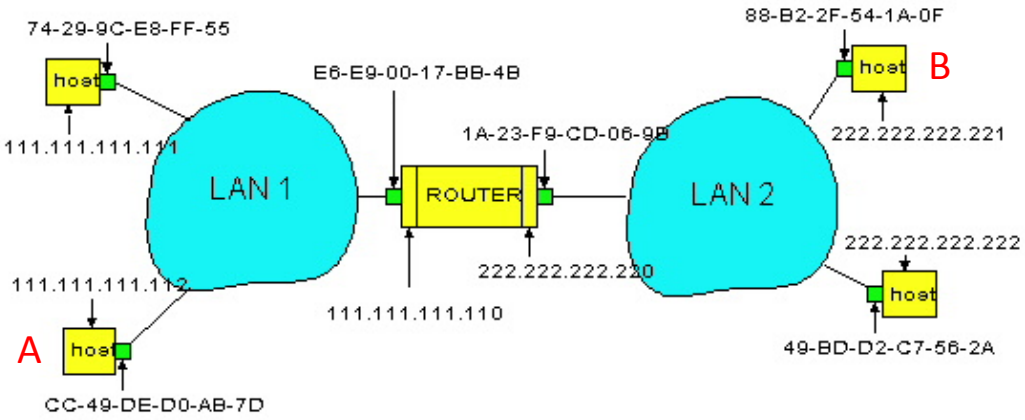
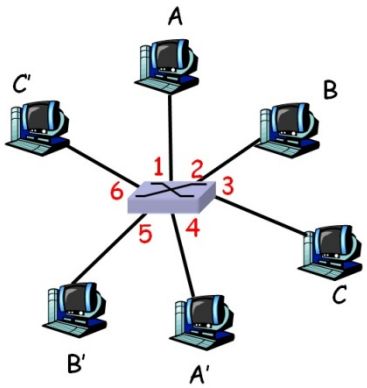
Advanced Computer Network Final (101/06/20)

1. (a) Explain why IEEE 802.11 cannot detect collision. (4%)
   (b) How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? 畫圖並加以說明(8 %)
2. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) in detail (12%)
3. List three types of multiple access protocols and describe how they work briefly. (9%)
4. (a) Why the hierarchical routing is needed? (4%)
   (b) What is the Intra-AS routing protocol? (2%) What is the Inter-AS routing protocol? (2%)
   (c) List two Intra-AS routing protocols. (4%) List one Inter-AS routing protocol. (2%)
   (d) Why different Intra- and Inter-AS routing ? (要列出兩者三點不同處) (6%)
5. 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)



6. 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%)
7. Describe the filtering/forwarding operation (algorithm) of the switch when (a) node A sends a frame to A' (6%) (b) node A' sends back a frame to A (6%) (說明時要提到 switch table 的變化)



8. Draw figures to describe two modes of wireless networks. (10%)
9. 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? (7%)

Advanced Computer Network Final (101/06/20)

1. (a) Explain why IEEE 802.11 cannot detect collision. (4%)
   (b) How IEEE 802.11 uses CSMA/CA with RTS/CTS packets to avoid collision? 畫圖並加以說明(8%)

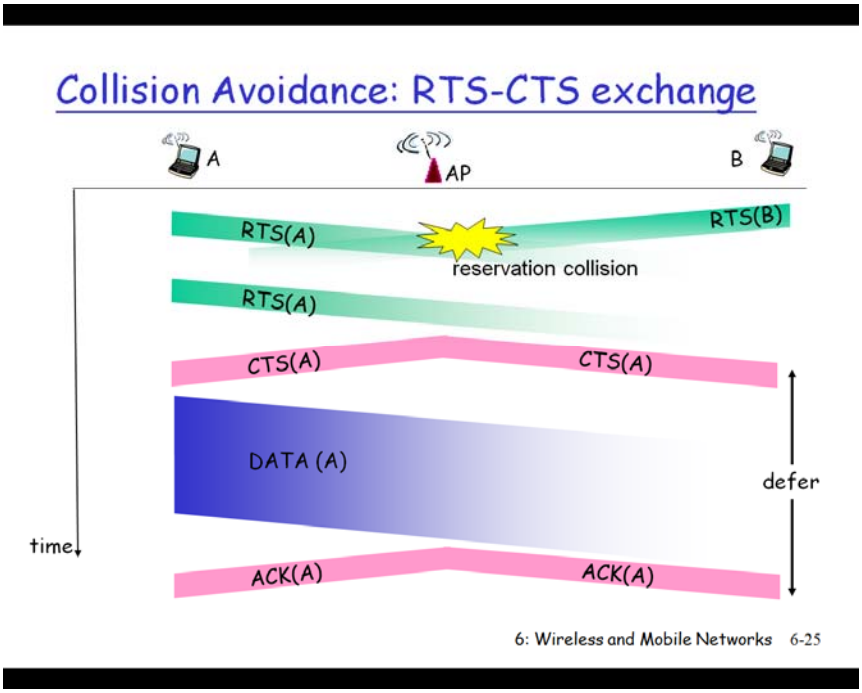
Ans:

(a)

- difficult to receive (sense collisions) when transmitting due to weak received signals (fading) (2%)
- can't sense all collisions in any case: hidden terminal (2%)

(b)

- 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%)



2. Describe how Ethernet uses CSMA/CD with exponential backoff (要寫出碰撞後如何動作) in detail (12%)

Ans:

- adapter doesn't transmit if it senses that some other adapter is transmitting, that is, carrier sense (3%)
- transmitting adapter aborts when it senses that another adapter is transmitting, that is, collision detection (3%)
- Before attempting a retransmission, adapter waits a random time, that is, random access with Exponential Backoff. (3%)
  - 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%)

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

Ans:

Advanced Computer Network Final (101/06/20)

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%)

4. (a) Why the hierarchical routing is needed? (4%)
(b) What is the Intra-AS routing protocol? (2%) What is the Inter-AS routing protocol? (2%)
(c) List two Intra-AS routing protocols. (4%) List one Inter-AS routing protocol. (2%)
(d) Why different Intra- and Inter-AS routing ? (要列出兩者三點不同處) (6%)

Ans:

(a) scale: with 200 million destinations:
can't store all dest's in routing tables! (2%)
routing table exchange would swamp links! (2%)

(b) routers in same AS run same "intra-AS" routing protocol (2%);
routers in different AS can run different inter-AS routing protocol

(c) intra-AS routing: routers in same AS run same "intra-AS" routing protocol; routers in different AS can run different intra-AS routing protocol (後面這句可以不寫) 或 sets entries for internal dests (2%)
Inter-AS routing protocol: is used to configure forwarding table of the router such that it can determine towards which gateway of this AS it should forward packets for dest x outside of AS. 或 sets entries for external dests (2%)

(c) Intra-AS routing protocols: RIP, OSPF or IGRP (4%)
Inter-AS routing protocols: BGP (2%)

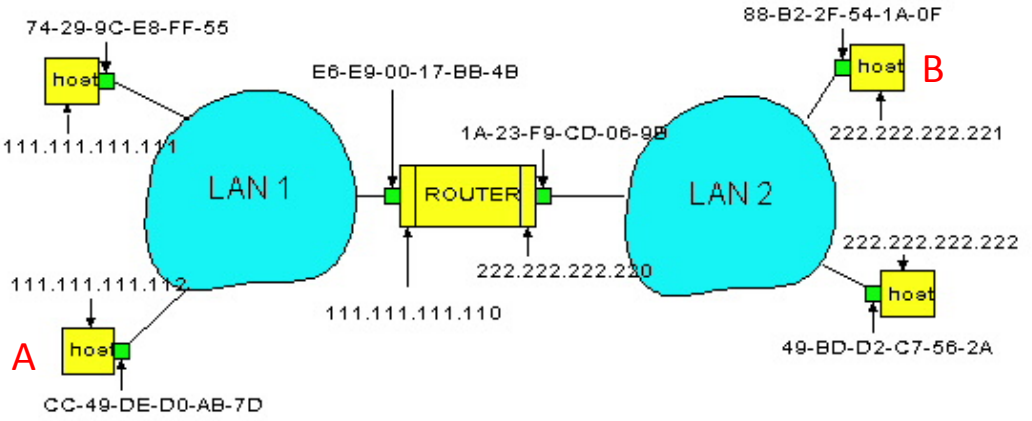
(d) Policy: (2%)
- Inter-AS: admin wants control over how its traffic routed, who routes through its net.
- Intra-AS: single admin, so no policy decisions needed

Scale: (2%)
- hierarchical routing saves table size, reduced update traffic

Performance: (2%)
- Intra-AS: can focus on performance
- Inter-AS: policy may dominate over performance

5. 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)

Advanced Computer Network Final (101/06/20)



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	222.222.222.221

From Router to B

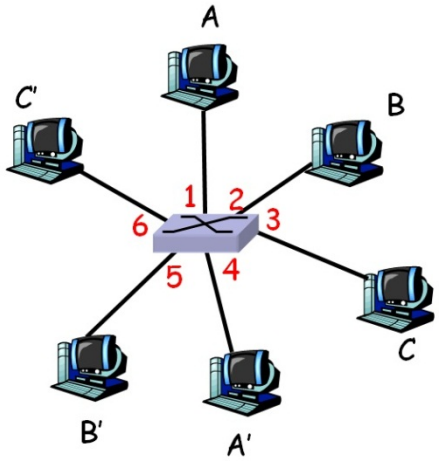
Destination MAC address	Source MAC address	Source IP address	Destination IP address
88-B2-2F-54-1A-0F	1A-23-F9-CD-06-9D	111.111.111.112	222.222.222.221

6. 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%)

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

(b) RJ-45 (2%)

7. Describe the filtering/forwarding operation (algorithm) of the switch when (a) node A sends a frame to A' (6%) (b) node A' sends back a frame to A (6%) (說明時要提到 switch table 的變化)



Ans:

(a) When the frame received, SW records link associated with sending host **A** in SW table (2%)

MAC address	Interface	TTL
A	1	XX

index switch table using MAC dest address **A'** (2%)

entry not found for destination, then flood to other interfaces! (2%)

(b) When the frame received, SW records link associated with sending host **A'** in SW table (2%)

MAC address	Interface	TTL
A	1	XX
A'	4	XX

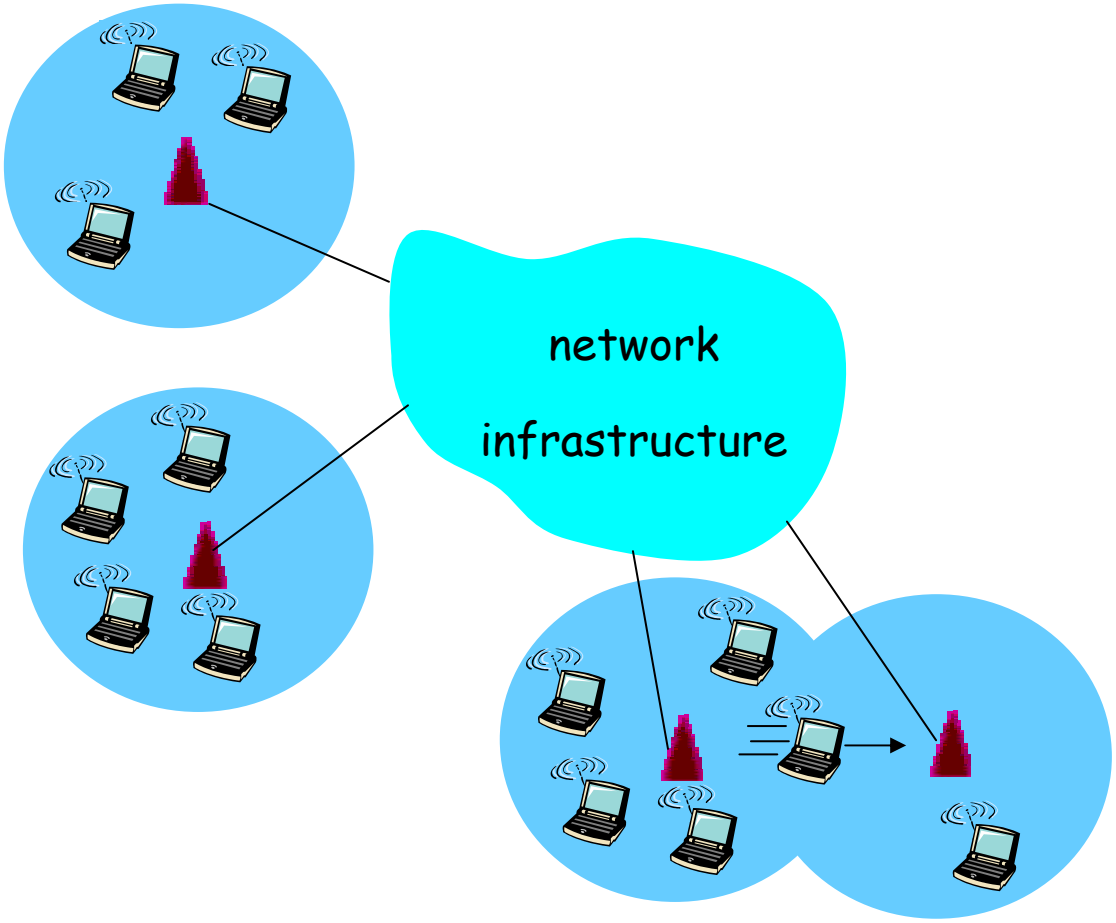
index switch table using MAC dest address **A** (2%)
entry found for destination, then forward the frame on interface **1** (2%)

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

Ans:

(a) infrastructure mode: (2%)

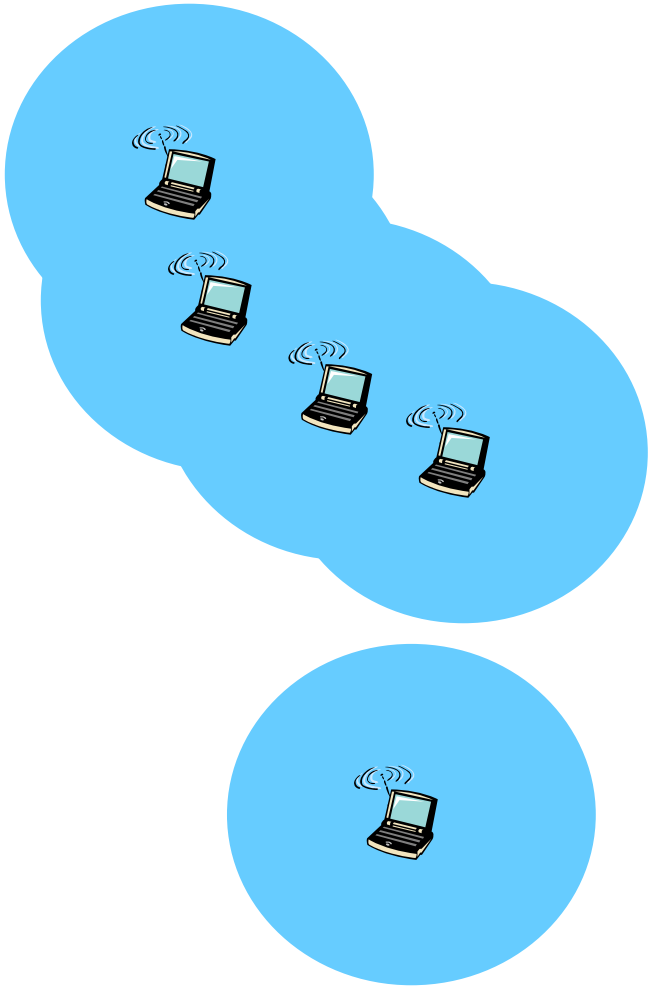
- cell (1%)
- base station connects mobiles into wired network (1%)
- mobile (1%)



(b) 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 (1%)

Advanced Computer Network Final (101/06/20)



9. 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? (7%)

Ans:

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 (3%)
  - Dest MAC address = FF-FF-FF-FF-FF-FF
  - all machines on LAN receive ARP query
- B receives ARP packet, replies to A with its (B's) MAC address (3%)
  - frame sent to A's MAC address (unicast)
- A caches (saves) IP-to-MAC address pair in its ARP table until information becomes old (times out) (1%)