Advanced Computer Network Final (100/06/23)

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. Explain the following terms: (a) Handoff (b) Hidden terminal problem (c) Basic Service Set (BSS) in infrastructure mode (d) *mobility.* (3% each, 12% total)

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

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

5. Classify the following wireless network standards into (a) wireless LAN, (b) personal area network. (c) 2G cellular network. (d) 2.5G cellular network. (e) 3G cellular network. (f) 3.5G cellular network. (12%)
   HSDPA, GSM, 802.11b, UMTS, GPRS, Bluetooth

6. (a) List three characteristics of CDMA (6%) (b) Draw a figure to show the CDMA encoding and decoding processes for two senders and receivers if the CDMA code of sender1 and receiver1 is (-1, 1, 1, 1, -1, -1, -1, -1) and that of sender2 and receiver2 is (1, -1, 1, 1, -1, -1, 1, 1). Please note source bits of sender1 are (-1, 1) and those of sender2 are (-1, 1). (計算過程要寫出來，encoding 時不能只寫相加的結果，decoding 時只做 receiver1, 8%)

7. (a) Describe four steps for a host to *associate* with an 802.11 AP. (8%) (b) Which two information of the AP is received by the host? (4%) (c) Explain the passive scanning process. (6%)

8. Compare hub and switch (12%)

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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 %)

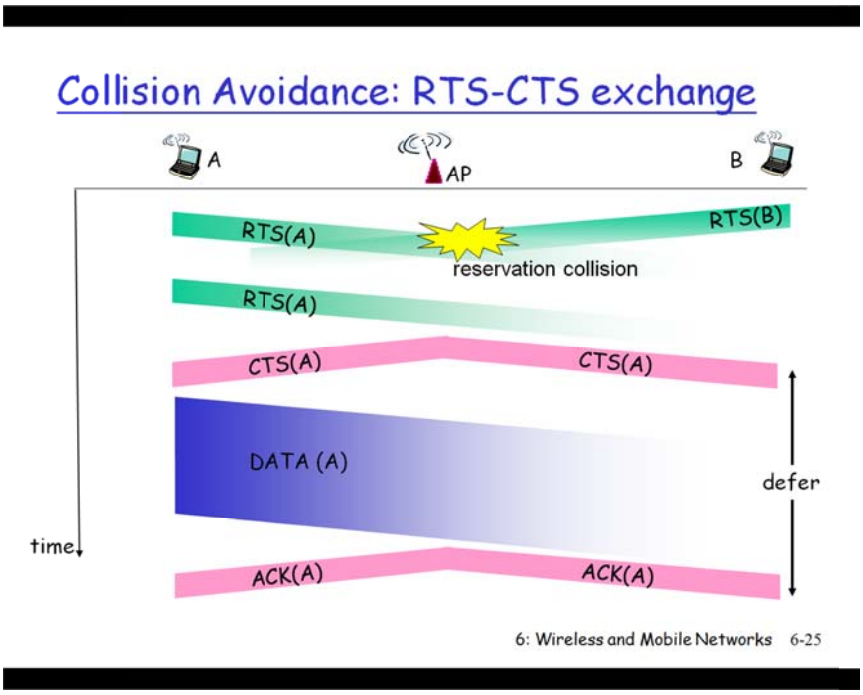
Ans:

(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; RTS heard by all nodes (2%)
- sender transmits data frame, other stations defer transmissions (2%)
- BS replies ACK to sender (2%)



2. Explain the following terms: (a) Handoff (b) Hidden terminal problem (c) Basic Service Set (BSS) in infrastructure mode (d) *mobility.* (3% each, 12% total)

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

(b) Hidden terminal problem

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

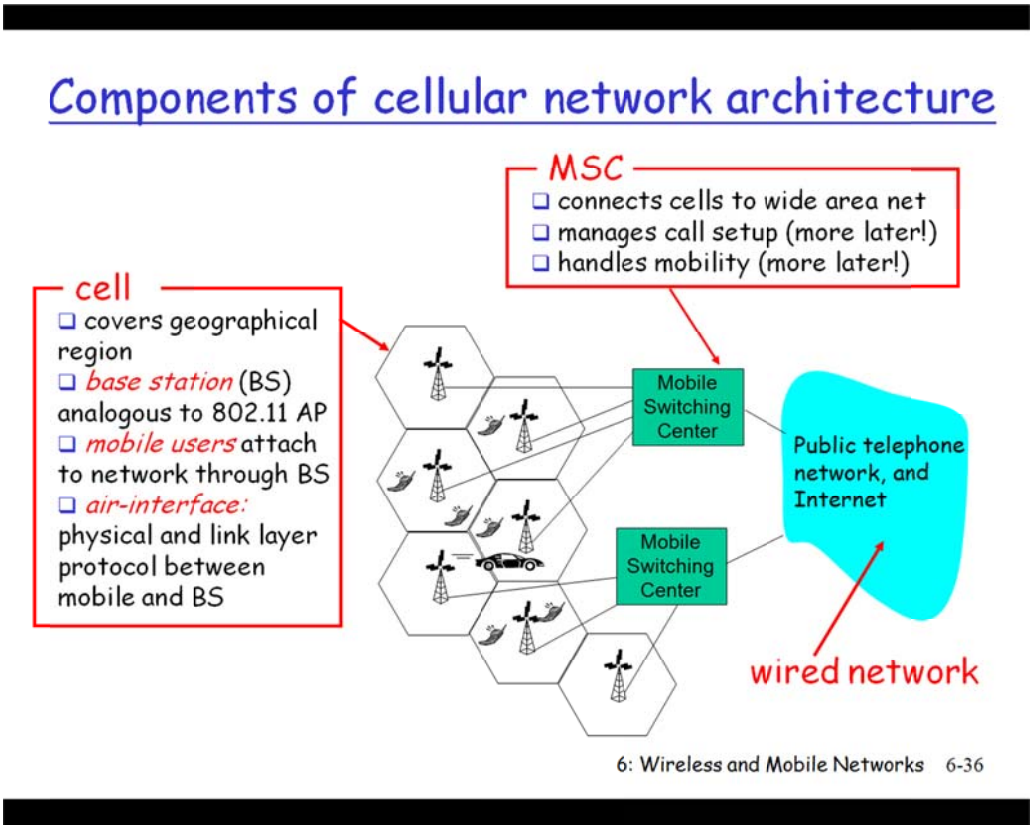
(c) Basic Service Set (BSS) in infrastructure mode: i.e., cell, contains:

- wireless hosts (1%)
- access point (AP): base station (2%)

(d) mobility: handling the mobile user who changes point of attachment to network

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%)

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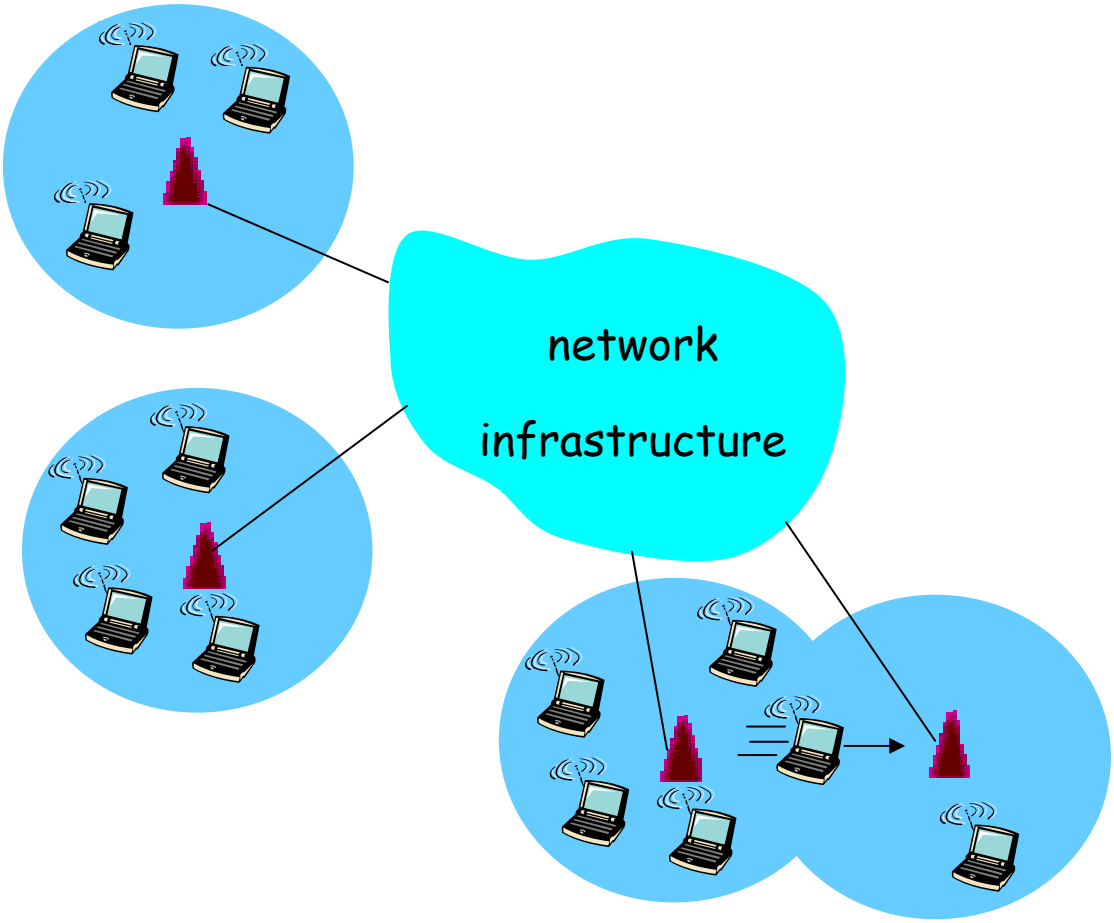

(b) ad hoc mode: (5%)

- 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%)

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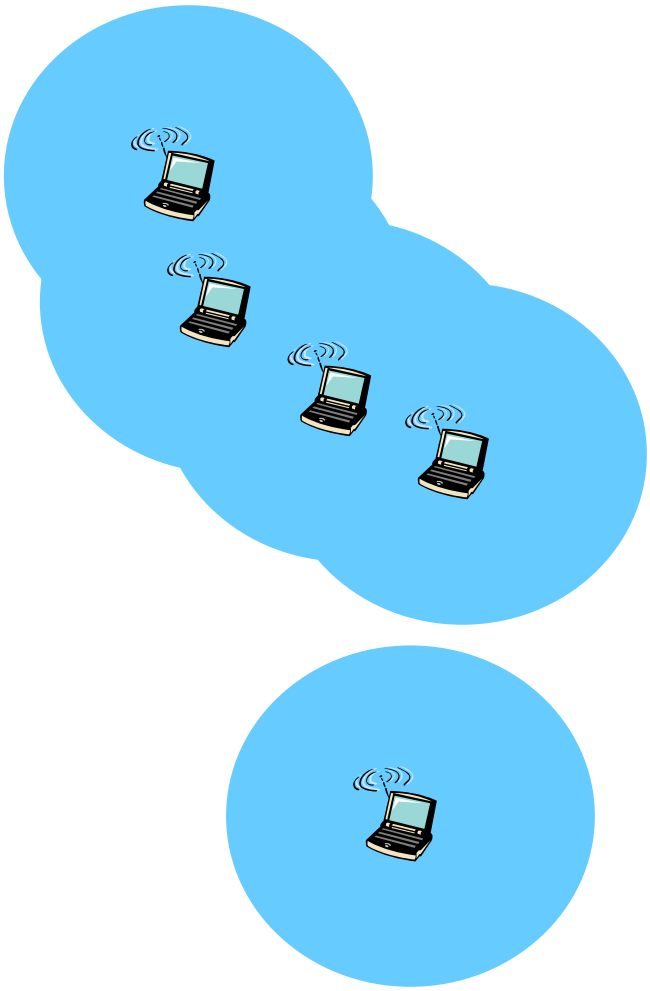

5. Classify the following wireless network standards into (a) wireless LAN, (b) personal area network. (c) 2G cellular network. (d) 2.5G cellular network. (e) 3G cellular network. (f) 3.5G cellular network. (12%)
   HSDPA, GSM, 802.11b, UMTS, GPRS, Bluetooth

Ans: (2% each)

(a) wireless LAN : *802.11b,*
(b) personal area network: *Bluetooth,*
(c) 2G cellular network: *GSM*
(d) 2.5G cellular network: *GPRS*
(e) 3G cellular network: UMTS
(f) 3.5G cellular network: *HSDPA*

6. (a) List three characteristics of CDMA (6%) (b) Draw a figure to show the CDMA encoding and decoding processes for two senders and receivers if the CDMA code of sender1 and receiver1 is (-1, 1, 1, 1, -1, -1, -1, -1) and that of

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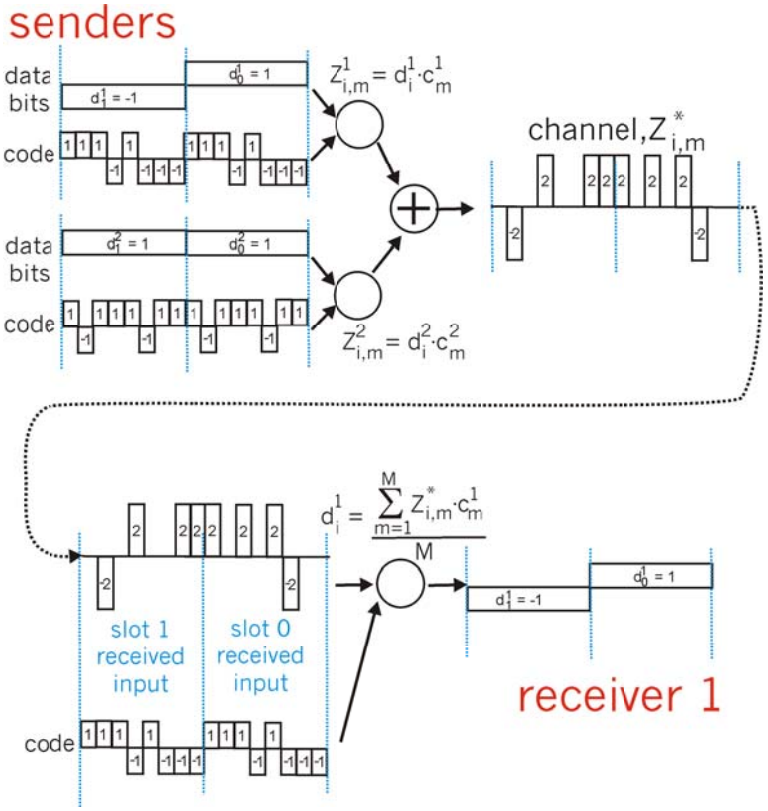
Ans:

(a) CDMA (Code Division Multiple Access)

- unique "code" assigned to each user; (2%)
- all users share same frequency, but each user has own "chipping" sequence (i.e., code) to encode data (2%)
- allows multiple users to "coexist" and transmit simultaneously with minimal interference (if codes are "orthogonal") (2%)

(b) (8%) （類似以下過程，必要部分要改）



7. (a) Describe four steps for a host to *associate* with an 802.11 AP. (8%) (b)Which two information of the AP is needed? (4%) (c) Explain the passive scanning process. (6%)

Ans: (a)

(1) scans channels, listening for *beacon frames* (2%)
(2) selects AP to associate with (2%)
(3) may perform authentication (2%)
(4) will typically run DHCP to get IP address in AP's subnet (2%)

(b) AP's name (SSID) and MAC address (4%)

(c) Passive Scanning:

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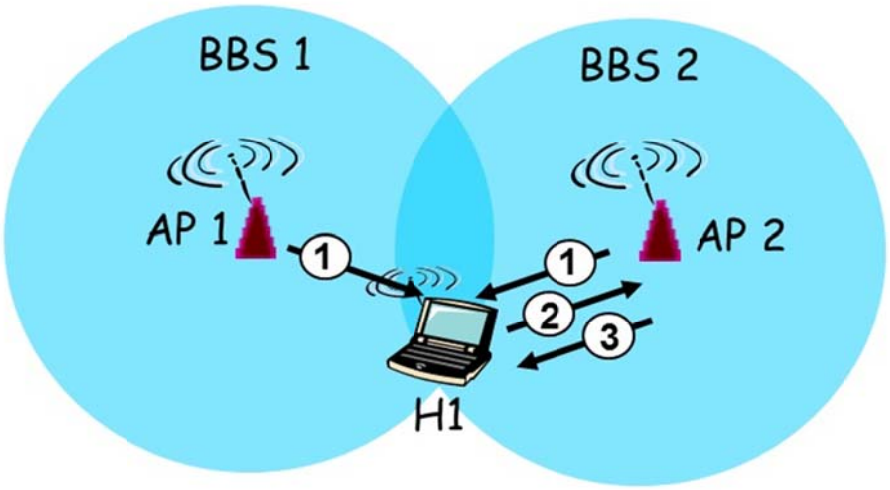
(1) beacon frames sent from APs (2%)
(2) association Request frame sent: H1 to selected AP (2%)
(3) association Response frame sent: H1 to selected AP (2%)



8. Compare hub and switch (12%)

Ans:

Hub: physical-layer ("dumb") repeaters. (2%)
- bits coming in one link go out all other links at same rate (1%)
- all nodes connected to hub can collide with one another (1%)
- no frame buffering (1%)
- no CSMA/CD at hub: host NICs detect collisions (1%)

Switch:
- link-layer device: smarter than hubs, take active role
  - store, forward Ethernet frames
  - examine incoming frame's MAC address, selectively forward frame to one-or-more outgoing links (1%) when frame is to be forwarded on segment, uses CSMA/CD to access segment (1%)
- transparent
  - hosts are unaware of presence of switches (2%)
- plug-and-play, self-learning
  - switches do not need to be configured (2%)