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Course : CSE 4615 Wireless Networks
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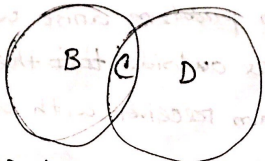
Ans. to Q no. 1(a) (i)

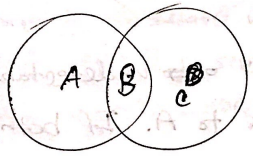
Case-1



(B, C) and (C, D)

Both B and D tries to communicate with C.
Here, D is hidden with respect to B, and vice-versa

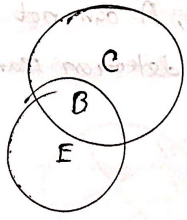
Case-2



(A, B) and (B, C)

Both A and C tries to communicate with B.
C is hidden with respect to A, and vice-versa.

Case-3



(B, E) and (B, C)

E and C tries to communicate with B.
C is hidden with respect to E, and vice-versa.

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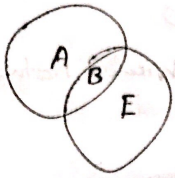
Case-4

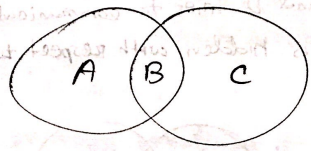


(A, B) and (B, E)

A and E tries to communicate with B.
A is hidden with respect to E, and vice-versa.

(ii)

Hidden station problem arise when there are two stations ~~out~~ which are outside ~~their~~ the other's range but they have a common receiver with whom they want to communicate



Ex - Here A is ~~outs~~ undetectable to C and C is undetectable to A. If both tries to send data to B at the same time then there will be hidden station problem. Because B can receive data from one station at a time. However, A can not know when C will send as C is outside A's detection range.

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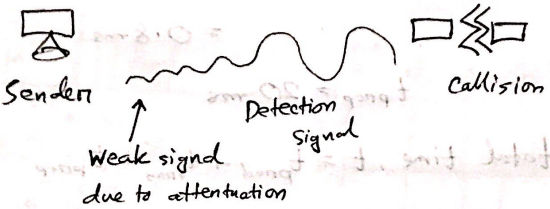
Ans to Qno 1(b)

Collision detection is only possible in Wired LAN.

The limitations of Collision detection in Wireless network is.

i) Attenuation

In wireless medium, signal loses strength/intensity as it travels for a longer period of time. This results in a weak collision detection signal which can not be processed, and thus collision remains undetected.

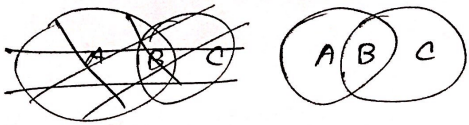


ii) Distortion

Wireless medium is unreliable which can distort a signal (change its bits) when it is sent. Hence, collision detection signals are often uninterpretable due to distortion.

iii) Hidden station Problem

Collision detection algorithms can not solve hidden station problem where two senders outside each other's range tries to communicate with a common receiver.



A and C are hidden to each other.

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Pstmnar

Ans to Qno. 1(c)

Time to produce a packet,

$$t_{prod} = \frac{2\times10^3\times8}{32\times\times10^6} \quad [\because 2kB = 2\times10^3\times8 \text{ bits}]$$

$$= 0.5 \text{ ms}$$

Transmission delay, $t_{trans} = \frac{2\times10^3\times8}{20\times10^6}$

$$= 0.8 \text{ ms}$$

$$t_{prop} = 20 \text{ ms}$$

total time, $t = t_{prod} + t_{trans} + t_{prop}$

~~$= 20 + 0.8 + 0.5$~~

$$= 0.5 + 0.8 + 20$$

$$= 21.3 \text{ msec.} \quad \text{(Ans.)}$$

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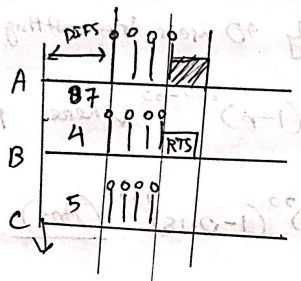
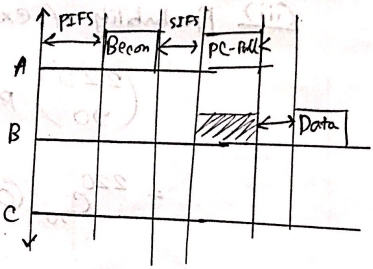
Ans to Qno. 3(a)

Point Cordination Function first establishes a 1 to 1 connection with Access Point and sender. During this time, only they can send and receive data. No, RTS and CTS handshaking is needed and it saves time. No, backoff time is required either. Due to this reason, it is guaranteed for the Receiver to receive data from sender. Thus, QoS is ensured.



DCF (no QoS)



PCF (QoS ensured)

vs

→ Not guaranteed for B to transmit since it depends on random number generated. If B generated, a random number 8, then C would have accessed the medium.

→ B is guaranteed to send data as there is no contention. When B is polled by A it will send data and QoS is ensured.

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Ans.to Qno.3(b)

(i) When circuit switching is used,

$$\frac{8\text{ Mbps}}{950\text{ kbps}} = \frac{8\times10^6}{950\times10^3} = 8.42 \approx 8 \text{ users.}$$

8 users can be supported. (Ans.)

(ii) Probability of a user transmitting is 0.18 (Ans.)

(iii) Probability of exactly 90 users transmitting is,

$$\binom{220}{90} p^{90}(1-p)^{220-90} \quad \text{where } p = 0.18$$

$$= {}^{220}C_{90}\,(0.18)^{90}(1-0.18)^{130} \quad \text{(Ans.)}$$

[using Binomial Distribution]

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Ans. to Q.no 3(c)

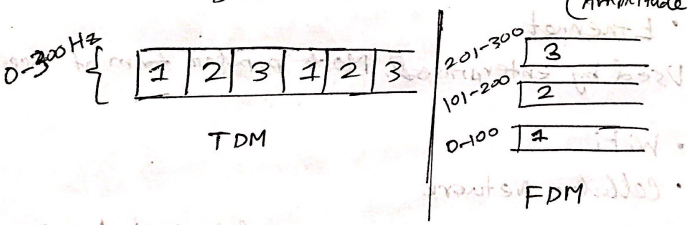
(i) Multiplexing → Multiple inputs resulting in a single output

Ex - i) Time division multiplexing (TDM),
ii) Frequency division multiplexing (FDM)

Here, in TDM, the medium can be accessed by 1 user for a specific time period. In FDM, the ~~bandwidth~~ is bandwith is divided into 'n' sub-band. At a time, 'n'-users can access the medium.

(ii) Modulation → ~~conversion of~~ modulating a signal ~~from digital to analog.~~

Ex - ~~Pulse Width Modulation~~, ~~Delta Modulation~~ i) FM / AM used in radios
(Frequency modulation).
(Amplitude Modulation)



(iii) Multiple Access → Access technology that allows multiple users to access the same medium.

Ex - i) Time Division Multiple Access (TDMA)
ii) Frequency Division Multiple Access (FDMA)
iii) Code Division Multiple Access (CDMA)

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Ans to Q.no. 3(d)

Access Networks → Network or the type of connections used by the end users to access the edge routers are called access networks.

Ex — • Modem or dial-up connection
• Digital Subscriber Line (DSL)

These are access networks for home, using the telephone line.

• Fiber to Home (Cable to Home)

Uses fiber optics to connect to edge router. Other cables like twisted pair, coax are also used.

• Ethernet

Used by enterprises. Most popular form of access network.

• WiFi
• Cellular Network

Wireless access networks used by both home and enterprise

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Ans to Q.no.2(a)

Here, 2 MPDUs need to be sent. There is a retransmission of data, i.e. during first transmission, some kind of collission occured and data is retransmitted.

$$C.W. = 2^{n-1}(CW_{min} - 1) \quad [C.W_{min} = 4]$$

$$= 2^{(2-1)} \times (4-1) \quad [n = 2 \text{ for second transmission}]$$

$$= 2 \times 3$$

$$= 6.$$

So, ~~rnd =~~ $0 < rnd \leq 6$

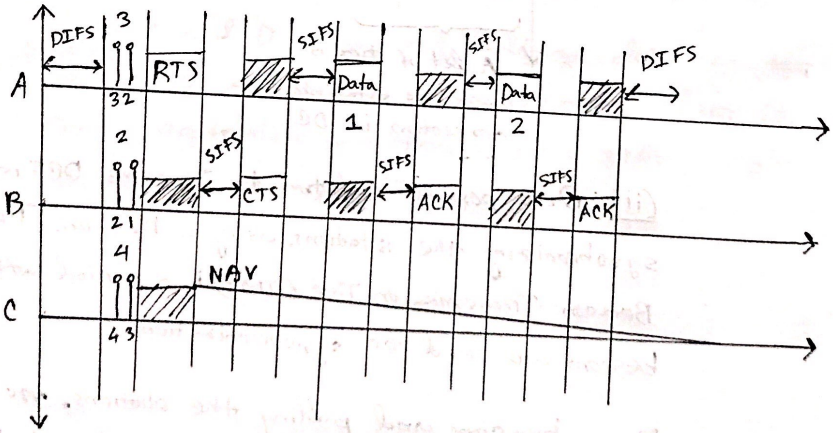

Fig: Timeline Diagram

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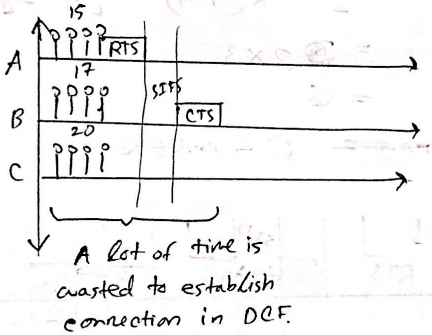
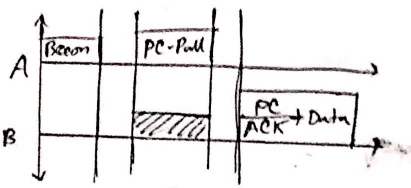
Ans to Q no 2 (b)

(i) The root cause of inefficiency is that the stations can ~~not~~ net communicate with each other and has no way to synchronize. This is why random backoff time and RTS-CTS handshaking is required. This wastes time and makes the network inefficient.



(ii) One possible solution to improve DCF is by synchronizing the stations, using a Beacon. The Target Beacon Transmission Time (TBTT) is a period after which beacons are send for synchronization.

Using beacons and polling the stations, no backoff time or RTS-CTS handshaking is required and thus makes the system more efficient.



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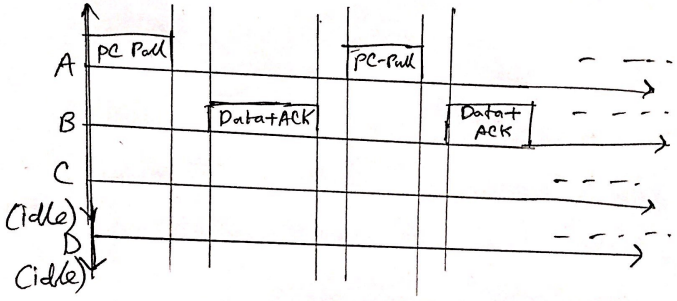
(iii)

One of the challenges of using, beacon and polling is that a single station will monopolize the medium for a long period of time, and thus making it difficult for other stations to access the medium.



Here C and D can not exchange data as the medium is ~~monopalized by B.~~ monopalized by B. During contention free period other stations might remain idle for a long time.

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