ELIAS Karam
2000 1958

EXAM 2

1) True/ False   (15 POINTS)

a- The minimum size of an Ethernet frame is 32 bytes. F ✓

b- The maximum size of the data field in an Ethernet frame is 1500 bytes. T ✓

c- The network layer determines route from source to destination. T ✓

d- Ethernet LANs use CSMA/CA protocol. F ✓

e- Flooding broadcasts a frame to all ports other than the port from which the frame was received. T ✓

f- The function of the preamble in an Ethernet frame is collision avoidance. F ✓

g- It is possible for hosts on different LANs with different upper layers protocol stacks to communicate with each other. F ✓

h- Piggybacking is when a sender sends an I-frame it includes acknowledgement information into it instead of sending a special ack-frame. T ✓

i- A major advantage associated with the use of a LAN switch is its capability to support multiple simultaneous connections. F ✗

j- Idle RQ protocol operates in a half duplex mode. T ✓

2) Multiple choice.   (14 POINTS)
Operates at the network layer of the OSI model and links dissimilar topologies?
- Bridge
- Repeater ✓
- (•) Router

Which is not an encoding method?
- 4B5B
- (•) 6B9B ✓
- Manchester

8B6T is an encoding method that converts
- (•) 8 bits to 6 ternary voltage levels. ✓
- 8 levels to 6 bits.
- Binary to decimal.

Which of the following is a key characteristic of an FDDI network?
- (•) Self-healing capability ✓
- 10 Mbps operating rate
- IEEE standardization.

(18)

1) Multilple Choice   (22 Points)

The most popular type of network cable because it is easy to install and inexpensive?
- Coaxial
- ⊙ twisted-pair ✓
- fiber optic

A bridge filters traffic using which type of address?
- IP address
- ⊙ MAC address ✓
- TCP address

This network topology uses tokens. Only the computer with the token can send and receive data. Therefore you don't have any collisons.
- Bus ✓
- ⊙ Ring ✓
- star

Active hubs can ___ ?
- route the signal using the most efficient path
- send an acknowledgement once the packet is received
- ⊙ regenerate the signal like repeaters ✓

One important difference between routers and bridges is that when a bridge can't locate the destination address in its table it ___ ?
- sends the transmission to the default router
- dumps the packet
- ⊙ broadcasts the transmission to all ports ✓

If the destination of the packet is outside the local network then the packet is sent to the ___ ?   LAN
- Switch
- Bridge
- ⊙ default router ✓

The most common topology in use today among corporate users?
- ⊙ Bus
- Ring
- ⊙ star-bus ⇐

Network connection device that is capable of sending packets along multiple paths depending on which path is the most efficient?
- Bridge
- ⊙ Router ✓
- all of the above

The assignment of a subscriber to a new cell is referred to as
- Power adjustment

- Handoff
- (•) Conversion

The type of wireless networks that allows 2 clients to communicate directly to each other?
- (•) Ad hoc ✓
- Infrastructure
- Roaming

What is the type of wireless networking that requires the use of access points?
- Ad hoc ✓
- (•) Infrastructure
- Roaming

2) TRUE/ FALSE   (9 POINTS)

- The "Base" in 10BaseT refers to the Baseband signaling method. This means that when a station does transmit, it will use the entire bandwidth on the wire and will not share it. *False.* *Collision*
- Backoff in ETHERNET is when two packets are sent and collide with each other. *False* (what happens after Colision is that they back off for a small H ✓
- Adjacent channel interference can be reduced by 3-cell repeat pattern technique. *True.* ✓
- Absence of receiver in coverage area is detected by 4-way handshake procedure. *True.* ✓
- DSSS networks are inherently able to provide 3 to 4 times more total network capacity than FHSS networks. *False.* ✓
- Data from DSSS products is more easily intercepted than data from a FHSS product *True.* ✓

3) FAST ETHERNET $100 Mbp/s$ (10 POINTS)

How many messages per second can a Fast Ethernet LAN handles if it has a normalised throughput of 0.4 and the messages are 100 characters long using ASCII 8 bit codes.

$$Thr = Th (normalised) \times C$$
$$= 0.4 \times 100 \times 10^6 = 40 \times 10^6.$$

$$Th = \frac{Number \ of \ bits}{Time \sim 1sec} \Rightarrow Number \ of \ bits/s = 40 \times 10^6 \ bits$$
$$40 \times 10^6$$

$$One \ message = 100 \times 8 = 800 \ bits.$$

$$\frac{40 \times 10^6}{800} = 50\,000 \ messages/sec.$$

4) IDLE RQ (STOP AND WAIT)   (10 POINTS)

A channel has a data rate of 4 Kbit/s and a propagation delay of 20 ms. For which frame size does "stop and wait" give an utilisation of at least 50% ?

$$R = 4 \times 10^3 \, b/s. \qquad x = ?? \qquad T_x = \frac{x}{4 \times 10^3} \qquad \frac{T_p}{T_x} = \frac{20 \times 10^{-3}}{\frac{x}{4 \times 10^3}} = \left(\frac{80}{x}\right)$$

$$T_p = 20 \times 10^{-3} \, s.$$

$$U = 0.5 = \frac{1}{1 + 2a} = \frac{1}{1 + 2\left(\frac{T_p}{T_x}\right)} = \frac{1}{1 + 2\left(\frac{80}{x}\right)} \Rightarrow \frac{1}{1 + \frac{160}{x}} = 0.5$$

$$\Rightarrow 1 = 0.5 + \frac{80}{x} \Rightarrow \frac{80}{x} = 0.5 \Rightarrow x = \frac{80}{0.5} = \boxed{160 \text{ bit frame size}}$$

(circled: 10)

5) THROUGHPUT CALCULATION   (15 POINTS)

Assume that an Ethernet LAN has a throughput of $\boxed{U = \frac{1}{1 + 5a}}$ where $a = \frac{T_p}{T_x}$.

Which frame size gives you the maximum throughput? Prove your answer numerically.

Consider your LAN is made of a coaxial cable of 500 meters and that the signal velocity is $2.3 \times 10^8 \, m/s$.

(circled: 15)

Ethernet Lan $\Rightarrow$ 10 Mbps $\Rightarrow 10^7 \, b/s$

$$R = 10^7 \, b/s$$
$$D = 500 \, m$$
$$V = 2.3 \times 10^8 \, m/s \qquad T_p = \frac{d}{V} = \frac{500}{2.3 \times 10^8} = 2.17 \times 10^{-6}$$

maximum throughput $\Rightarrow U = 1$

$$1 = \frac{1}{1 + 5\left(\frac{T_p}{T_x}\right)} = \frac{1}{1 + 5\left(\frac{2.17 \times 10^{-6}}{\frac{x}{10^7}}\right)} = \frac{1}{1 + \frac{108.5}{x}}$$

$$\Rightarrow 1 + \frac{108.5}{x} = 1 \Rightarrow \frac{108.5}{x} = 0 \quad (\text{Impossible to establish get } U = 1)$$

But max throughput is when

Max. frame size in ethernet $\Rightarrow$ 1518 bytes = 12144 bits. ✓

So $U_{max} = \dfrac{1}{1 + 5\left(\dfrac{2.17 \times 10^{-6}}{1.2144 \times 10^{-3}}\right)} = \dfrac{1}{1 + 8.93445 \times 10^{-3}} = 0.991144$ ✓

$$\frac{2144}{10^7}$$

6) STOP & WAIT PROTOCOL   (9 POINTS)

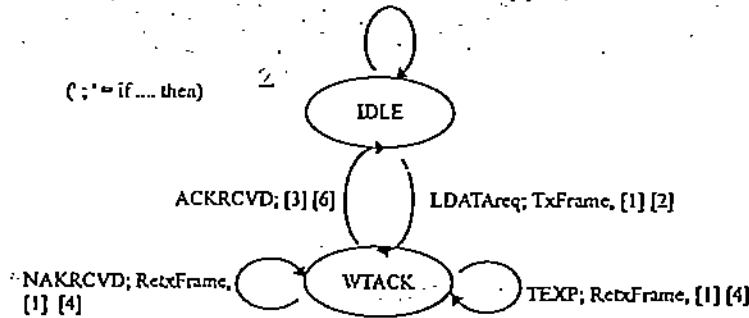The possible actions taken in Idle RQ protocol, primary are the following:

[1] start_timer. [2] Increment Vs. [3] Stop timer. [4] Increment RetxCount.
[5] Increment ErrorCount. [6] Reset RetxCount to zero.

(where Vs = Send sequence variable)

Fill in the following diagram the 9 missing appropriate actions

(; ' = if .... then)   2

ACKRCVD / NAKRCVD ; [5]

IDLE

ACKRCVD; [3] [6]   LDATAreq; TxFrame. [1] [2]

NAKRCVD; RetxFrame,   WTACK   TEXP; RetxFrame, [1] [4]
[1] [4]

$\frac{8 \times 10^6}{T_i + T_a + T_3}$

$\frac{8 \times 10^6}{Total}$

effective throughput = ?

(9)
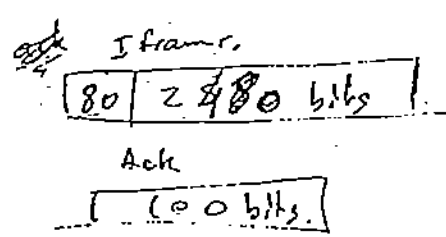
(12)

7) LAN Performance (15 POINTS)

10^6 char.

Assume that a file with a **million characters** is transmitted from one station to another. Compute the _total transmission time_ and the _effective throughput_ for the following cases:

D= 1km

A LAN with a bus topology with 2 stations at distance 1km from each other. Each packet is acknowledged with a 100 bit packet before the next packet is sent.

The propagation speed on the bus is $2 \cdot 10^8$ m/s. The bit rate is 10 Mbps and the packet size is 2560 bits (with) 80 bits of overhead

a) Packet size = 2560 bits   (assuming with the 80 bits)

D = 1 km.
V = 2×10⁸ m/
R = 10⁷ b/s

I frame.

| 80 | 2480 bits |

2560 bits per frame

Ack
| 100 bits |

file to be sent = $10^6 \times 8 = 8 \times 10^6$ bits.

$\frac{8 \times 10^6}{(2560 - 80)} = 3125$ packets to be

$\frac{8 \times 10^6}{2480} = 3225.8 \Rightarrow 3226$ frames to be sent.

first 3225 frames $\Rightarrow T = 3225 \times \left(\frac{T_p}{10^3}{2 \times 10^8} + \frac{T_x}{2560}{10^7} \right)$

$8 \times 10^6 - 3225(2480) = 2000$

last frame will contain.

$2000 + 80 = 2080$ bits

Last frame $\Rightarrow T = \left(\frac{T_p}{10^3}{2 \times 10^8} + \frac{T_x}{2080}{10^7} \right) T_p$ T_x

we need 2221 $T_p = \frac{10^3}{...}$ $= 100$