

Youn - Amkar
980577

EXAM 2

8-9

1) TRUE/FALSE

(12 POINTS)

- a) HDLC is used as a foundation for LAPB, LAPD and LLC protocols. ~~X~~ ✓ T
- b) In HDLC, a station places its own address in the address field when it transmits a ~~F~~
 demand response. ~~F~~
- c) The poll/ final (P/F) bit in a HDLC frame, is only recognised when it is set to 1. ✓ T
- d) LAPB is the data link protocol for ISDN signalling channel. ~~F~~
- e) It is possible to attach to the same LAN hosts with the same data link protocol but different upper layers protocol stack. ✓ T
- f) It is possible for hosts on different LANs with different upper layers protocol stacks to communicate with each other. ~~F~~
- g) A repeater boosts the signal power and extends a LAN effective length. ~~X~~ ~~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

2) PPP and SLIP Comparison (True / False)

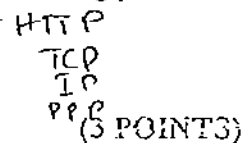
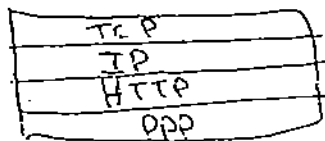
(9 POINTS)

- Both PPP and SLIP provide a way to encapsulate IP datagrams on a serial link. ✓ T
- SLIP provides A link control protocol (LCP) to establish, configure and test the data-link connection. ~~F~~
- PPP provides support for multiple protocols on a single serial line (not just IP). ✓ T
- SLIP provides a cyclic redundancy check on every frame. ~~F~~
- Dynamic negotiation of the IP address for each end could be done with SLIP. ~~F~~
- PPP provides the facility of compressing TCP and IP headers (similar to CSLIP). ✓ T

3) Protocol Stack

(4 POINTS)

Show (by drawing the protocol stack) the relationship of the following protocols. HTTP, PPP, TCP, IP.



4) Link Layer

(3 POINTS)

Which type of link protocol is most often used for dial-up connections to Internet Service Providers? (Please select only one alternative)

- a) HDLC
- b) CSMA/CA
- c) ATM
- d) PPP ✓

link layer protocol : PPP

~~0/3~~

5) Ethernet Hubs

(10 POINTS)

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- a) In a switched Ethernet hub the frames are only delivered to the addressed computer. What additional functionality is needed in a switched Ethernet hub compared to an ordinary Ethernet hub? *A variation of the switching hub is proposed. It provides a port that can operate at higher bit rate than the other ports.*
- b) What is the greatest advantage with using a switched Ethernet hub compared to an ordinary Ethernet hub? Motivate your answer.

The main advantage of a switching hub is to enable concurrent transmissions between different DTE's.

6) DATA LINK LAYER

(12 POINTS)

* 2

2 hosts are communicating over a link using stop-and-wait protocol (Idle RQ). The propagation delay is 2 ms, packet size is 1000 bits and the data rate is 2 Mbit/s.

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- a) Calculate the link utilisation U and show how the formula to calculate the utilisation is derived. Declare any approximations or assumptions made.
- b) How is the link utilisation affected if "sliding window" flow control is used with window size K of 6?

$T_p = 2 \text{ ms}$
 $m_b = 1000 \text{ b}$
 $R = 2 \text{ Mbp/s}$

$K = 6$

$1 + 2a < K$

$U = \frac{K}{1 + 2a}$

a) $U = \frac{1}{1 + 2a}$

7) Fill in the appropriate features in the appropriate box:

(10 POINTS)

* 8

- a) Easy to modify and add new computers. *star*
- b) Network can slow down in heavy traffic. *bus*
- c) Failure of one computer does not affect the rest of the network. *star*
- d) Media is inexpensive and easy to work with. *bus*
- e) Even performance despite many users. *ring*
- f) If the centralised point fails the network fails. *star*
- g) Failure of one computer can impact the rest of the network. *ring*
- h) Equal access for all computers. *ring*
- i) Cable break can affect many users. *bus*
- j) Economical use of cable. *bus*

$U = \frac{T_{ix}}{T_f + T_{ix}}$
 $T_{ix} \text{ tran}$
 Total time
 Frame propagation

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TOPOLOGY	ADVANTAGES	DISADVANTAGES
BUS	d - i	b - j
RING	e - g	g
STAR	a - c - h	f

d, A, d
 l, j, b
 = gh
 c, f, a

8) LANs internetworking

(12 POINTS)

A message from the TCP level consists of 3040 bits of data and a header of 160 bits of control information. The IP header is of 160 bits also. The message is then transferred over two local area networks that both uses 50 bits of headers. The first LAN has a maximum packet of 5000 bits while the second LAN has a maximum packet of 1200 bits. The 2 LANs are interconnected with a Router.

- a) Draw the different element of the network including the layers in each element.
- b) How many frames will go over LAN1 and over LAN2. Describe their contents.



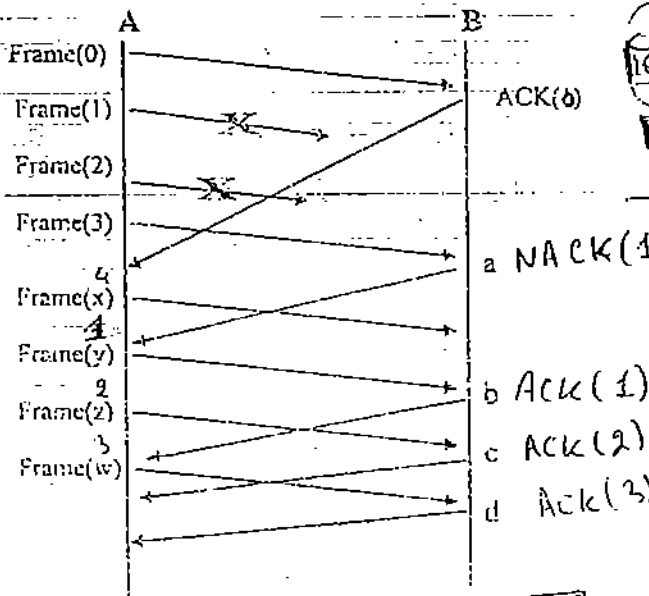
9) GO-BACK-N.

(12 POINTS)

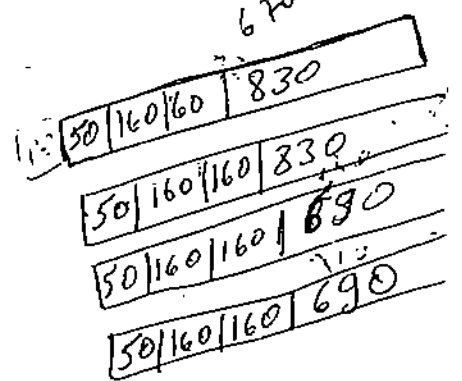
A transmitter (A) makes use of Go-Back-N-ARQ with a 3-bit sequence number and a window size of 7 frames to transmit information to a receiver (B). The sequence of messages is shown in the figure below.

The receiver returns ACK or NAK messages a-d.

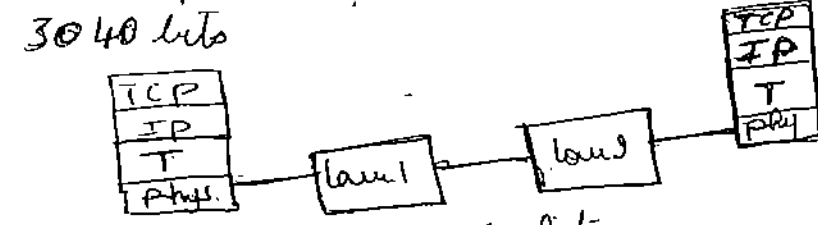
- a) What kind of messages are a - d? State if they are ACK or NAK and give the appropriate sequence numbers.
- b) Give the appropriate sequence numbers x-w.



Handwritten calculations and notes:
 160 | 160 | 3040
 160 | 160 | 40
 1200 Router
 + 150 LAN2
 1200 + 150 = 1350
 3200 - 1350 = 1850
 1850 / 950 = 1.947
 13.17



8) 3040 bits



TCP = 160 bits
 IP = 160 bits
 50 | 160 | 160 | 3040

no problem, since the max packet size is 5000 so 1 frame in LAN1

10) Ethernet LANs Performance

(16 POINTS)

Using figures below do the following:

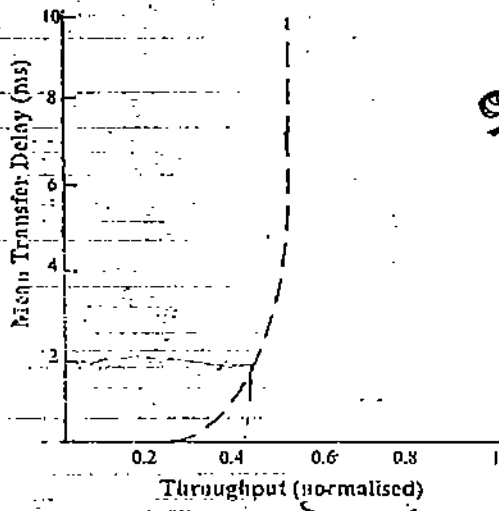
a- Calculate the (approximate) throughput in bps for a CSMA/CD LAN, if the mean transfer delay is equal to 2 ms:

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b- What is the percentage of decrease in throughput when the number of stations (users) increases from 1 to 20.

c- Can 100 users each generating 12 Mbytes file every 20 minutes share a CSMA/CD LAN? Motivate your answer.

d) How many messages per second can an Ethernet LAN handles if it has a normalised throughput of 0.25 and the messages are 90 characters long using ASCII 8 bit codes.



a) $Throughput = 0.18 \times 10 = 1.8 \text{ Mbps}$

b) $\% = \frac{0.5 - 0.3}{0.5} \times 100 = 40\%$

c) $100 \times 12 \times 10^6 \times 8 = 8 \times 10^6$

$\frac{8 \times 10^6}{20 \times 60} = 6666.67$

We cannot use it

$\frac{12 \times 10^6 \times 100 \times 8}{20 \times 60} = 8 \text{ Mbps} > ?$

$\frac{12 \times 10^6 \times 8 \times 100}{20 \times 60} = 8 \text{ Mbps}$

$\frac{8}{10} = 0.8$

