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NETWORK
EXAM 1

1) True/ False (10 points)

- F a- In a frame, the header usually contains an error checking component. F
- T b- TCP/IP supports routing, and is commonly used as an internetworking protocol. T
- F c- The trailer of a frame of a packet contains the destination address. F
- F ~~10~~ d- The shorter the maximum packet size, the longer is the packet transmission delay.
- T ~~X~~ e- Bit stuffing is used to prevent incorrect interpretation of the user data field. T
- T ~~X~~ f- The propagation delay is a function of the frame length and the propagation speed over a given data link. T
- T ~~X~~ g- Twisted pair cables are easy to install, very cheap and immune to crosstalk problem. T 4
- ~~11~~ h- Every network adapter card sees all packets sent on its segment, but it only interrupts the computer if the packet's address matches its individual address.
- F ~~X~~ i- With coax, duplex data communication can be provided only when two separate cables are used, one for the transmit channel and the other for the receive channel. F
- F ~~X~~ j- A data link layer provides error detection and end-to-end acknowledgement across multiple links. F

2) Match the OSI layer to the appropriate function, and give every layer its number in the OSI Model (8 POINTS):

- 7 Application layer ~~d~~ ~~d~~ a) Ensures messages are delivered error free and in order.
- 2 Data Link layer ~~g~~ ~~b~~ b) Determines route from source to destination.
- 3 Network layer ~~b~~ ~~b~~ c) Packet sent as a bit stream.
- 6 Presentation layer ~~e~~ d) Represents services that directly support user applications. 4
- 4 Transport layer ~~a~~ e) Deals with formatting, display and encryption.
- 1 Physical layer ~~c~~ f) Provides synchronisation between user tasks.
- 5 Session layer ~~f~~ ~~f~~ g) Deals with framing, data transparency and error control.

3) How many voice channels can we group using time-division multiplexing to form a 2.048 Mbps channel (assuming 2 channels are used for synchronisation and signalling). (4 POINTS)

$$64(x+2) = 2.048 \text{ Mbps}$$

TOM
 64

9) A company generates 600 invoices per day. Determine the appropriate minimum modem transmission speed in bps based on the following conditions:

- The peak load is twice the bits per day average transmission load.
- There is a need for 50% growth.
- All transmissions are to be done in a 6-hour workday. Assume each invoice is 5000 characters long. Also assume asynchronous transmission with one start bit, two stop bits and one parity bit.

102 mbps

(8 POINTS)

10) Consider a LAN with a total cable length of 2.5 Km, a frame size of 1200 bits and a total end-to-end delay of 0.4 ms. If you assume the propagation speed is 2×10^8 m/s and the transmission rate is 10 Mbps. Calculate the following:

- The transmission delay.
- The propagation delay. Is the propagation delay negligible?
- The processing and queuing delay (together).

a) $\frac{1200}{10 \cdot 10^6} = \frac{12}{10^5}$ sec

b) $\frac{2500}{2 \times 10^8} = 12.5 \times 10^{-6}$ sec

(8 POINTS)

c) $12 \times 10^{-4} + 12.5 \times 10^{-6} + 0.4 \times 10^{-3}$

11) It is required to transmit 1000 invoices between 2 cities running synchronous modems at 56 Kbps. Assume that each frame is 250 characters long, with 10 control characters per frame and 8 bits per character. Assume the average length of each invoice is 5000 characters.

a) How long will it take to transmit these 1000 invoices (file transfer time),

- First assume the BER = 0
- Then assume that the BER = 10^{-4}

done before

In order to decide whether to connect the 2 cities with analog leased lines or dial-up circuits you should answer the following questions:

b) Calculate the cost of dial-up connection between the 2 cities. Assume a month with 23 working days and the average dial-up rate is \$ 0.3 per minute, one minute minimum.

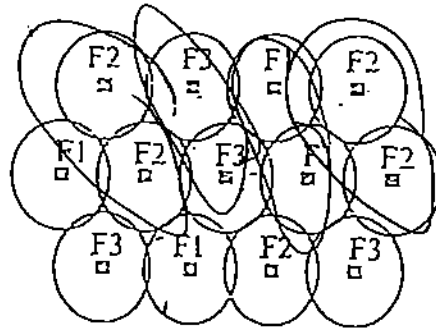
c) If the cost of an analog leased line between the 2 cities is \$300 per month, what invoice rate should a given city generates per day in order that the crossover from a dial-up circuit to analog leased circuit is really cost efficient? (25 POINTS)

~~done~~

6) Map the following services to the type of protocol (3 points)

- (c) Originally for Voice transmission (e)(c) a) SMTP ✓
- (f) Provide Reliable Transport layer service (Internet Protocols) (f) b) LAN ✓
- (a) Provide minimum Transport layer service (Internet Protocols) (g) d) PSTN ✓
- (b) Interconnect users in a small geographical area (b)(b) e) TELNET ✓
- (h) It is a "best-effort" delivery service (h)(h) f) ISDN ✓
- (e) Provide Broadband Communication services (e) g) TCP ✓
- (a) Protocol used for electronic mail (a)(a) h) UDP ✓
- (d) The remote terminal Protocol (d)(d) i) IP ✓

7) What is the problem with the following radio cellular network: (6 points)



Neighboring cells
Cochannel interference

8) Fill the 10 gaps with the appropriate word :

(10 points)

The ISO broke the communication subsystem into seven protocol layers. Each of these perform one of the two generic functions: Network-dependent functions and Application-oriented functions. They operate according to a defined protocol (set of rules).

The bandwidth is the range of frequencies present in a signal.

Any periodic function is represented by an infinite sum of sinusoidal frequencies.

The maximum signalling rate is equal to twice the bandwidth.

The channel capacity is the maximum bit rate that can be transmitted on a channel and is a function of signal avg. power and noise avg. power (Shannon-Hartley law).

9) Fill in the following words in the appropriate box: long distance, low cost, complexity, multimedia, one channel, simplicity, RF modem costs, no interference among sharing users, few hundred meters only. (10 points)

	Baseband	Broadband
Advantages	Simplicity, low cost	long distance multimedia No interference
Disadvantages	few hundred meters only one channel	Complexity RF modem costs

10) How long will it take to transmit 1000 invoices (file transfer time) between 2 cities running synchronous modems at 56 Kbps. Assume that each frame is 250 characters long, with 10 control characters per frame and 8 bits per character. Assume the average length of each invoice is 5000 characters.

- a) First Assume the BER = 0
b) Then assume that the BER = 10^{-4}

(16 points)

1000 invoices

synchronous modems block

Each frame 250 ch + 10 control (8 bits/char)

$L = 5000$ char

a) BER = 0

$$\# \text{ of frames/invoice} = \frac{5000}{250} = 20 \text{ frames/invoice}$$

$$\# \text{ of bits/invoice} = 20 \times 260 \times 8 = 41600 \text{ bits}$$

$$\text{Time to transmit 1000 invoices} = \frac{1000 \times 41600}{56000} = 742.85 \text{ s.}$$

b) BER = 10^{-4}

$$P^N = 1 - (1 - P)^N = 1 - 1 + NP = NP$$

$$P^N = \frac{(260 \times 8) \times 10^{-4}}{N} = \frac{2080 \cdot 10^{-4}}{N} = 0.208$$