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CSC 425

1) MULTIPLE CHOICE (16 POINTS)

Which describes the correct order of the OSI model layers from *bottom* to *top*?

- (•) Physical, data link, network, transport, session, presentation, application
- Data link, physical, network, transport, session, presentation, application
- Physical, data link, network, transport, presentation, session, application
- Application, presentation, session, transport, network, data link, physical

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Which layer of the OSI model determines the route from the source computer to the destination computer?

- The transport layer
- The session layer
- (•) The network layer
- The physical layer

The data link layer of the OSI is responsible for what tasks?

- ~~Creating, maintaining, and ending sessions, and encryption~~
- (•) Reliable delivery of data and error control
- ~~Transferring and routing of packets on the network~~
- ~~Addressing and reassembling frames~~

Which of the following allows for two devices to communicate at the same time?

- Simplex
- Half duplex
- (•) Full duplex
- Complex

What type of communication ensures reliable delivery from a sender to a receiver without any user intervention?

- Communication-oriented
- Connectionless
- (•) Connection-oriented
- Physical

What is the advantage of using a connectionless-oriented protocol such as UDP?

- Packet acknowledgment may reduce overhead traffic
- Loss or duplication of data packets is less likely to occur
- (•) Packets are not acknowledged, which reduces overhead traffic
- The application relies on the transport layer for sequencing to data packets

In synchronous transmission, bit synchronization is achieved:

- SYN characters
- 10-bit preamble which precedes frame contents
- Faster receiver clock
- The clock information is embedded into the transmitted signal.

What application layer protocol is used by the E-mail service:

- FTP
- HTTP
- SMTP
- TELNET

2) True/False (10 POINTS)

1. The Statistical Multiplexer can cause additional time delays when traffic is particularly heavy.
2. In Statistical Multiplexer, if the DTE has no character to transmit, the microprocessor inserts a NUL character in the assigned slot.
3. Parity bit error detection method is mainly used with synchronous character-oriented transmission.
4. In Forward error control, each transmitted character or frame contains additional information so that the receiver can detect errors and determine also their place.
5. In character-oriented transmission, the frame contents don't need to be a multiple of 8 bits.
6. In baseband mode, the available bandwidth is divided into a number of lower bandwidth subchannels using FDM.
7. In twisted pair lines, the skin effect problem is due to high attenuation to high frequency signals.
8. HFC(Hybrid Fiber Coaxial Cable) makes it possible to share a standard telephone line between voice & computer data.
9. ADSL (Asymetric Digital Subscriber Line) uses frequency division multiplexing (FDM).
10. A major disadvantage of HFC is that the data transmission and the TV channels might interfere causing bit errors and lousy TV picture and sound.

3) Probability Calculation **(8 POINTS)**

Assume that a frame consists of 1024 characters and that a character has 8 bits. The bit error rate is $BER = 10^{-6}$. What is the probability that the frame gets transmitted without error?

$1-(1-p)^N$

(5) => nb of bits = 1024x8 = 8192 bits

=> pro = $1-(1-10^{-6})^{8192}$ = (crossed out)

4) Information Theory **(10 POINTS)**

Consider a spectral band between 20.001 GHz and 20.021 GHz. What is the theoretical maximum data rate for this noiseless channel?

(5) 20,021 - 20,001 = 20 MHz

Assume we want the bit rate to exceed the 100 Mbps, how many bits per signalling element should we use.

$m = \log_2 M$

=> $C = W \cdot m$ => $m = \frac{C}{W} = \frac{100}{20} = 5$ bits (crossed out)

5) Synchronous/ Asynchronous Transmission **(12 POINTS)**

Suppose a file of 10,000 bytes is to be sent over a line at 20 Kbps.

- Calculate the **overhead** in time (i.e. time lost or unuseful) when using **asynchronous** communication. Assume one start bit and one stop bit per character.

(8) $\frac{2}{80} \cdot 10000$ ... 2000

$\frac{10000}{10002} \cdot 20 = 19.99$

10000 → 20 kbps; 10002 → ? => 20,004 kbps => 0,004 kbps diff

=> overhead = $\frac{20}{0{,}004}$ = 2500 s

- Calculate the overhead in time when using **synchronous** communication. Assume that the data are sent in frames, and each frame consists of 1,000 Bytes and a header of 48 control bits per frame.

$\frac{10000}{10048} \cdot 20 = 19.9$ (crossed out)

x = 20,096 => 0,096 k difference speed. (crossed out)

$\frac{10000}{1000}$ = 10 frames

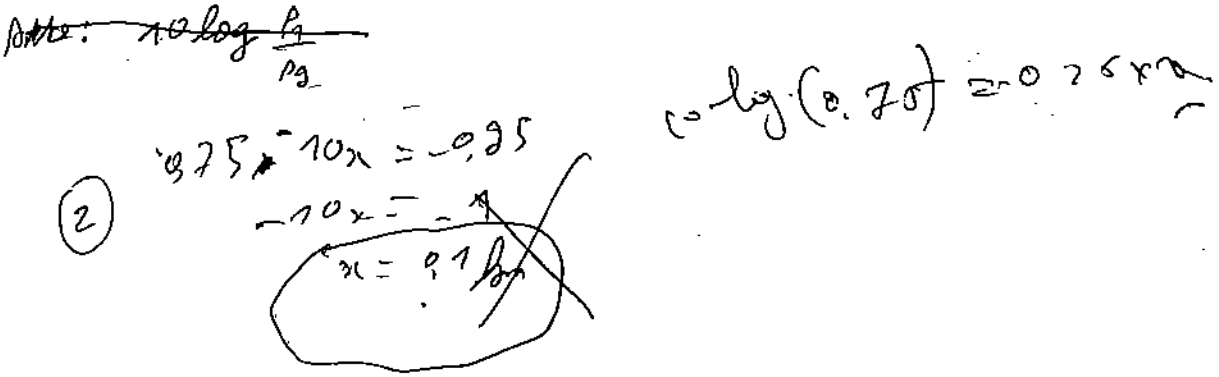
Nb of control bits: 48x10 = 480 bits

=> $x = \frac{10480 \times 20}{10000}$ = 20,96 kbps => $\frac{0{,}96}{10}$ = 0,096 s

10 [illegible] = 10,41

6) OPTICAL LINK DESIGN **(8 POINTS)**

An electromagnetic wave is transmitted over an optical fiber with attenuation of 0.25 dB/km. Calculate the length of the fiber if the wave experiences a 75% attenuation from its start value.



7) Invoice Rate **(12 POINTS)**

It is required to transmit X invoices daily between 2 cities running modems at 56 Kbps. Assume that the maximum frame size is 260 characters long, with 250 characters of data and 10 control characters per frame and 8 bits per character.

Assume the average length of each invoice is 5000 characters and a month with 23 working days. If the cost of a dial-up rate is \$ 0.2 per minute, what invoice rate X should a given city generates per day in order that the total cost of the dial-up connections is \$299 per month.

8) Transmission Delays (10 POINTS)

We are sending a 30 Mbits file from a source host to a destination host. The path between source and destination have a transmission rate of 10 Mbps.

a. Calculate the transmission delay.

$\frac{30}{10} = 3$ s

(5)

b. Now suppose there are 10 TDM channels in the link between the source and destination. The MP3 file is sent over one of the channels. Does the transmission delay remain the same? If not, calculate its new value.

No

3,5 ~~m~~

9) Time Division Multiplexing (10 POINTS)

We have four sources, each creating 250 characters per second. ... interleaved unit is a character and 1 synchronizing bit is added to each fram...

250 × 8 = 2K

- The bit rate of each source,

R = ~~P × C × 1000~~

$\frac{250 \times 8}{33} = 60,6$ ~~s~~

- the duration of each character in each source,

(0) 1/250

~~4000~~ .

- the number of bits in each frame,

33 bit

1 | 1 | 6 | 1 | 1 | 6 | 1 | 1 | 6 | 1 | 1 | 6

- the data rate of the link.