CSC425 SOCIAL CLUB Dr. H. Maalouf

EXAM 1

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SECTION: .....MWF..2-10.....

Ch.3 (Lastone)
Ch.2 (FSx, ASx,
BW EJ
Ch.9. Synchronous & Asynchronous

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

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 order in which information blocks are created when encapsulation with TCP/IP is used? (Select the best answer).

- Segments, packets or datagrams, frames, data, bits
- (•) Data, segments, packets or datagrams, frames, bits
- Bits, frames, segments, packets or datagrams, data
- Packets or datagrams, frames, segments, bits, data

Which of the following best describes the function of a connectionless-oriented protocol? (Select the best choice)

- A connectionless-oriented protocol requires an exchange of messages before data transfer begins.
- A connectionless-oriented protocol is a faster transfer method than a connection-oriented protocol.
- A connectionless-oriented protocol relies upon lower level protocols for data delivery and error handling.
- A connectionless-oriented protocol creates a virtual circuit with the destination host.

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

2) Protocol Order (10 POINTS)

Place the data *encapsulation* steps in the proper order by placing a number (1 through 5) on the step.

a. ____5____ Synchronization of a pattern of 1s & 0s with some clocking function, allows transmission on a medium and recognition of data bits.

b. ____2____ Data is segmented and packaged with information to allow the sending and receiving hosts to communicate reliably.

c. ____1____ Alphanumeric user input is formatted for sending over the internet work.

d. ____4____ A frame is built to allow communication over an interface to the network.

e. ____3____ Data is encapsulated with a network header specifying source and destination logical addresses.

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3) Probability Calculation (10 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?

$BER = 10^{-6} = P$, probability of frame corrupted

Probability without error $= 1 - PN$

$= 1 - 10^{-6} N$

$\Leftrightarrow$ # $N = 1024 \times 8 = 8192$ bits

$\Rightarrow P(\text{without error}) = \left[1 - \left(10^{-6} * 8192\right)\right] = \ldots$

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$1 - (1-P)^N$

$1 - (1-10^{-6})^{8192}$ if $NP \ll 1$

$\approx 1 - e^{-NP} =$

pipe = 10⁹

4) **Information Theory** **(13 POINTS)**

Consider a spectral band between 20.001 GHz and 20.021 GHz with a signal to noise ratio (S/N) of 15. What is the theoretical maximum data rate for this channel?

$S/N = 15$, $BW = 20.021G - 20.001G = 20Hz = W$ ✓

$\Rightarrow C_{max} = 2W\log_2\left(1+\frac{S}{N}\right) = 2\times 20\cdot\log_2(16) = 80\,bps$

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

no noise : $C = 2W\log_2(M) \Rightarrow 2W\log_2(M) \geq 100\times10^6$

$\Rightarrow 2\times20\times10^6\log_2(M) \geq 100\times10^6$

$\Rightarrow \log_2(M) \geq 2.5$

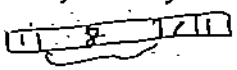
$\Rightarrow M = 8$

take $n = 3$

5) Synchronous/ Asynchronous Transmission **(14 POINTS)**

A data source produces 7 bit ASCII characters. Derive an expression for the maximum *effective* (i.e. useful) bit rate if the channel capacity is 1Mbits/s under the following conditions:

a) *Asynchronous* connection with 1 start bit, 2 stop bits and 1 parity bit.



$1+2+1+7 = 11$ bits

$\Rightarrow$ useful $= \frac{7}{11}\times10^6 = 583.33$ Kbps

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b) *Synchronous* connection with a frame consisting of 48 control bits and 128 information bits. The information field contains 8 bit ASCII characters, *including the parity bit.*

$48+128 = 176$ bits

$\Rightarrow \frac{7}{176}\times10^6 = 39.77$ Kbps

$\frac{112}{176}\times10^6$

6) - Error/ Flow Control **(16 POINTS)**

You are to select and configure a flow control method for the following system:

Length of link is 2000 Km. Signal propagation of 2×10^8 m/s.
Fixed packet length of 250 bytes. Bit rate of 20 Mbps.

a) What flow control method, stop-and-wait (Idle RQ) or sliding window (continuous RQ), would you choose to achieve at least 90% utilization.

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$U = 0.9$ * for idle: $T_p = \frac{2000\times10^3}{2\times10^8} = 10\,ms$ / $T_{tx} = \frac{250\times8}{20\times10^6} = 10^{-4}\,s$

$\Rightarrow U = \frac{1}{1+2a} = \frac{1}{1+200} = 0.00\%$

* for continuous: $U = \frac{K}{1+2a} \geq 0.9$ $\Rightarrow$ Find K!

we should use sliding R

b) If the link length is reduced to 200 meters, would your previous answer change? Carefully explain and give the answer for any changed parameters.

$T_p = \frac{200}{2\times10^8} = 1\,\mu s \Rightarrow U_{idle} = 0.38\%$

$\Rightarrow$ the utilization of the idle RQ becomes Higher when the link distance is shortened to 200 m ✓

7) Transmission & Propagation Delays **(21 POINTS)**

We are sending a 30 Mbits MP3 file from a source host to a destination host. All links in the path between source and destination have a transmission rate of 10 Mbps. Assume that the propagation speed is 2.10^8 meters/sec, and the distance between source and destination is 10 000 km.

A- There is only one link between source and destination:

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- Calculate the end-to-end (total) delay.

$T_p = \frac{10,000\times10^3}{2\times10^8} = 0.05\,s$, $T_{tx} = \frac{30M}{10M} = 3\,s$ ✓

$\Rightarrow T_{total} = 0.05 + 3 = 3.$

- How many bits will the source have transmitted when the first bit arrives at the destination?

1st bit arrives $\Rightarrow T_{tx} = \frac{N}{10\,Mbps}$, $T_p = 0.05$

$\Rightarrow \frac{T_p}{T_{tx}} = 1 \Rightarrow N = 500\,kbits$ ✓

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 end-to-end delay remain the same? If not, calculate its new value.

* no, doesn't remain the same

* $T_p' = \frac{N.T_{tx}}{0.5s} \Rightarrow T_{total} = 3.5\,s$

$T_t = T_p + 10\,T_x$

$T_t = 30.05\,s$