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Homework #08
CSCI-3550 (Sec: 001)

1)

The two fundamental link layer "link/channel" types are point-to-point links and broadcast links. Point-to-point links are where only two endpoints share a link, whereas broadcast links can have multiple nodes share a link through coordination.

2)

The precise name that is given to the Protocol Data Unit (PDU) at the Link Layer is known as a frame.

3)

False. The Link Layer is not "network aware, as it focuses on framing, link access, reliability, error detection, the addressing scheme, and the transmission of frames between connected nodes within links. Additionally, since IP addresses and routing protocols are managed at a higher level at the Network Layer, the Link Layer is right below it.

4)

a) The three types of error-detection and correction schemes include parity checks, checksums, and cyclic redundancy checks (CRCs).

b) The predominant error-detection technique that is utilized at the Link Layer is the cyclic redundancy checks (CRCs).

5)

False.

6)

True.

01001010100101011110010101000101010101011100010101010010101010

The amount of ones is 30 and the Parity bit is 0 when it should be 1 for even parity, which means that going off on parity alone, the bit string does have at least one error.

7)

a) Forward Error Correction (FEC) allows for the ability of a receiver to both detect and fix errors in a much less costly way as it doesn't attach more bits to the data that is being transmitted. In contrast, the 1-bit Parity Check scheme can only be used to identify errors and cannot be used to correct them. On the other hand, the 2D parity scheme can identify errors but cannot fix multiple errors within a packet.

b) The primary benefit of using Forward Error Correction (FEC) is that it can be used to correct errors that occur during data transmission in real-time without the need to retransmit again to fix any errors. FEC is additionally used by communication systems to minimize the expenses related to data retransmission. Real-time network streaming apps over wireless networks, like YouTube or other video conferencing apps, are one particular example of how FEC helps. By encoding video frames with redundancy, FEC can reduce the likelihood of missing or corrupted frames, which can minimize playback disruptions. Other examples include deep-space radio links and wireless sensor networks.

8)

The three channel-partitioning schemes that are used in multiple-access protocols are time-division multiple access (TDMA), frequency-division multiple access (FDMA), and code-division multiple access (CDMA).

9)

$C = 1Gbps \rightarrow 1000Mbps$

$1/2e = 0.184 \rightarrow (18.4\%)$

Best throughput $R = 0.184\ x\ 1000Mbps \rightarrow 184Mbps \rightarrow 0.184\ Gbps$

10)

a) The binary codeword described by D(x) is

$D(x) = x^5 + x^3 + x + 1 \rightarrow (101011)_2$

b) The binary codeword described by the generator polynomial G(x) is

$G(x) = x^3 + x^2 + 1 \rightarrow (1101)_2$

c) The amount of EDC bits that will be appended to our data should be 3 bits,

as G(x) = 4 bits - 1 is 3 bits.

d) The value of EDC remainder bits should be: 110

e) The binary value corresponding to the quotient is: 110110