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COMP90007 Assessment1

Question 1:

At first, length of one message = M bytes.

Length of headers from layer 1 to 6 = 20 + 30 + 80 + 30 + 20 + 110

$$= 290 \text{ bytes.}$$

Final, in lowest layer, length of a whole message = M + 290 bytes.

Therefore, the fraction of bandwidth filled with headers:

$$RESULT = \frac{290}{(M + 290)}$$

Question 2:

Propagation delay in both cases:

P-delay = 10,000 / 200,000 = 0.05 s.

The size of whole image:

Size = 1,920 * 1,080 * 2 KB = 1,920 * 1,080 * 2 * 8 Kb

$$= 33,177,600 \text{ Kb} = 33,177.6 \text{ Mb}$$

1. T-delay $= \dfrac{Size}{Speed1} = \dfrac{33,177,600}{56}s \approx 592,457.143$ s.

Therefore,

Delay = P-delay + T-delay $\approx$ 592,457.193 s.

2. T-delay $= \dfrac{Size}{Speed2} = \dfrac{33,177.6}{1}s = 33,177.6$ s.

Therefore,

Delay = P-delay + T-delay = 33,177.65 s.

Question 3:

According to Shannon's theorem:

$$Max.datarate = Blog_2(1 + \frac{S}{N})bps$$

Then:

$$56{,}000 = 4{,}000 * log_2(1 + \frac{S}{N})$$

$$log_2(1 + \frac{S}{N}) = 14$$

$$\frac{S}{N} = 2^{14} - 1 = 16{,}383$$

Therefore:

$$SNR_{dB} = 10 * log_{10}\frac{S}{N} \approx 42.1 dB$$

Question 4:

1. Bit stuffing: automatically add a 0 bit after five consecutive 1 bits.

    Begin: 011110111110111111101111100

    Stuffing: $01111011111_011111_01011111_000$

    Final: 0111101111100111110101111000

2. Assume: this code has k check bits.

    Plus: $16 = 2^k - k - 1$.

    We can get $4 < k < 5$.

      Therefore, 5 check bits ensure the receiver can correct a single bit

    error.

Question 5:

The most important knowledge is the lower layer provide services to the upper layer.

1. In this question, for layer k, only the algorithm of operations that layer k provided is changed. The operations are not changed. Therefore, for layer k + 1, since the services provided by layer k are not changed, it **doesn't** impact the operations at layer k + 1.

For layer k - 1, this layer only provided services to layer k. So the change in layer k **cannot** impact the operations at layer k - 1.

2. In this question, Since the layer k + 1 uses the the services provided by layer k which is changed. So it **does** impact the operations at layer k + 1.

For layer k - 1, it is only the services provider for layer k. The changes in layer k **cannot** impact the operations at layer k - 1.