COMP90007 Internet Technologies
Semester 2, 2019
Assignment 1 Solution

Question 1 (1 point)

The total number of header bytes per message = (20+30+80+30+20+110).

Hence the space wasted on headers = 290.

The total message size is then M + 290.

The fraction of bandwidth wasted on headers = 290/(M + 290)

Question 2 (1 point)

If 2KB is considered as 2*1000 bytes

Size of the image: 1920*1080*2*1000*8 = 33,177,600,000 bits

1) For 56 kbps,
   Transmission delay = 33,177,600,000/56000 = 592,457.14 s
   Propagation delay = 10000/200000 = 0.05 s
   Latency = 592,457.19 s
2) For 1Mbps,
   Transmission delay = 33,177,600,000/1000000 = 33,177.6 s
   Propagation delay = 10000/200000 = 0.05 s
   Latency = 33,177.65 s

Alternative solution:

If 2KB is considered as 2*1024 bytes

Size of the image: 1920*1080*2*1024*8 = 33,973,862,400 bits

1) For 56 kbps,
   Transmission delay = 33,973,862,400/56000 = 606,676.11 s
   Propagation delay = 10000/200000 = 0.05 s
   Latency = 606,676.16 s
2) For 1Mbps,
   Transmission delay = 33,973,862,400/1000000 = 33,973.86 s
   Propagation delay = 10000/200000 = 0.05 s
   Latency = 33,973.91 s

Question 3 (1 point)

Based on Shannon's limit,

Max data rate = $B*\log_2(1+S/N)$

Given B = 4 kHz, data rate we would like to achieve 56 kbps

S/N = 2^(56/4)-1 = 2^14 – 1 = **16383**

Or, if students give SNR in dB, the answer is $10*\log_{10}(16383) \approx$ ***42.14dB***

Question 4 (1 point)

1) After bit stuffing (adding a 0 bit after 5 consecutive ones), this stream becomes 01111011111**0**01111**0**1011111**0**00
2) Using hamming code, the number of check bits and the length of data should be
   n = 2^k – k – 1
   when n = 16, minimum k is 5
   Therefore, we need at least 5 check bits.

Question 5 (1 point)

1) This has no impact on the operations at layers k – 1 or k + 1.
2) There will be no impact on layer k-1, but layer k+1 will be affected.