LE/EECS 3213 E Communication Networks Fall 2014
Quiz #2, Thurs. Oct. 16, 2014 Name: _____

1. (*5 points*)

1.) [1] Which is higher offered load or carried load?

offered load

2.) [1] Which layer in the network hierarchy is concerned with the selection of a pass across the network?

network layer

3.) [1] Which layer is concerned with end-to-end service across a network: the transport layer, the network layer, the data link layer, or the physical layer? (pick only one).

transport

4.) [1] The amount of time it take me to get packet bits into a wire is called the: propagation time, the transmission time, the processing time, or the acknowledgment time? (pick only one).

transmission time or acknowledgment time

5.) [1] Which takes up more spectrum (i.e. frequency) a square pulse of duration T seconds [i.e. rect(t/T)] or a sinc pulse with first zero crossing at T seconds [i.e. sinc(t/T))].

square pulse

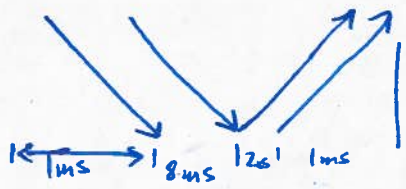
2. (*5 points*) Your systems data rate is 10-Mbps. You have a 10-kbyte (i.e. 10^3 bytes) message to send over 200-km. Before you can send another message you need to wait for a 2-kbyte acknowledgment. What is the throughput?

$$t_{prop}^{-1} = \frac{\frac{2}{3}c}{200\times10^3} = \frac{2\times10^8}{200\times10^3} = 1000\ s^{-1}$$

$t_{prop} = 1ms$

$$t_{tx} = \frac{8\times10\times10^3}{10\times10^6} = 8\,ms$$

$$t_{ack} = \frac{2\times10\times10^3}{10\times10^6} = 2\,ms$$



$t_{delay} = 12\,ms$ to send 10 kbytes

$$\therefore\ S = \frac{8\times10\times10^3}{12\times10^{-3}} = 6.67\ Mbps$$

3. (*5 points*) Packets arrive at a router at a rate of 1000 per second. Average packet size is 1250 bytes. The router can process incoming data at a rate of 150 Mbps. On average what delay does a packet encounter due to this router? (That is, on average how long does it take a packet to get out of the router after it has arrived at the back of the buffer queue)?

$\lambda = 1000$

$\mu = \frac{150 \times 10^6}{8 \times 1250} = 15{,}000$ packets per second

$T = \frac{1}{\mu - \lambda} = 71.4\,\mu s$

$c = 3 \times 10^8$ m/s (in free space), $c = 2 \times 10^8$ m/s (in media), 1 km $= 10^3$ m, 1 ms $= 10^{-3}$ s, 1 Mb $= 10^6$ b

$$\log_x y = \frac{\log_a y}{\log_a x}$$

$$C = W_c \log_2(1 + \text{SNR})$$

$$y = \int_a^b x\mathrm{d}x = \frac{x^2}{2}\Big|_a^b = (b^2 - a^2)/2, y = \int_a^b x^2\mathrm{d}x = \frac{x^3}{3}\Big|_a^b = (b^3 - a^3)/3$$

$$y(t) = a_0 + \sum_{k=1}^{\infty} a_k \cos(2\pi f_0 \cdot k \cdot t) + \sum_{k=1}^{\infty} b_k \sin(2\pi f_0 \cdot k \cdot t)$$

$$f_0 = \frac{1}{T}, a_0 = \frac{1}{T}\int_0^T y(t)\mathrm{d}t, a_k = \frac{2}{T}\int_0^T y(t) \cdot \cos(2\pi f_0 \cdot k \cdot t)\mathrm{d}t, b_k = \frac{2}{T}\int_0^T y(t) \cdot \sin(2\pi f_0 \cdot k \cdot t)\mathrm{d}t$$

$$\text{SNR [dB]} = 10\log(\text{SNR}), \text{SNR [dB]} = 6m - 7.2$$

$$\mathcal{F}\{\text{rect}(t/T)\} = T\text{sinc}(fT) = T\sin(\pi fT)/\pi fT$$

$$\mathcal{F}\{\text{sinc}(t/T)\} = T\text{rect}(fT)$$