Problem 7

a) 10 users can be supported because each user requires one tenth of the bandwidth.

b) $p = 0.1$.

c) $\binom{40}{n} p^n (1-p)^{40-n}$.

d) $1 - \sum_{n=0}^{9} \binom{40}{n} p^n (1-p)^{40-n}$.

Problem 12

The queuing delay is 0 for the first transmitted packet, L/R for the second transmitted packet, and generally, $(n-1)L/R$ for the n^{th} transmitted packet. Thus, the average delay for the N packets is

$$(L/R + 2L/R + \ldots\ldots + (N-1)L/R)/N = L/RN(1 + 2 + \ldots\ldots + (N-1)) = LN(N-1)/(2RN) = (N-1)L/(2R)$$

Note that here we used the well-known fact that

$$1 + 2 + \ldots\ldots + N = N(N+1)/2$$

Problem 18

a) 40,000 bits

b) 40,000 bits

c) The bandwidth-delay product of a link is the maximum number of bits that can be in the link

d) 1 bit is 250 meters long, which is longer than a football field

e) s/R