Homework 1 Due 09/23/2008 at 11:55pm. It must be turned in with MS WORD format.

Note Title   9/9/2008

P7. Suppose users share a 1 Mbps link. Also suppose each user requires 100 kbps when transmitting, but each user transmits only 10 percent of the time. (See the discussion of statistical multiplexing in Section 1.3.)

  a. When circuit switching is used, how many users can be supported?

  b. For the remainder of this problem, suppose packet switching is used. Find the probability that a given user is transmitting.

  c. Suppose there are 40 users. Find the probability that at any given time, exactly n users are transmitting simultaneously. (*Hint:* Use the binomial distribution.)

  d. Find the probability that there are 11 or more users transmitting simultaneously.

P12. Suppose N packets arrive simultaneously to a link at which no packets are currently being transmitted or queued. Each packet is of length L and the link has transmission rate R. What is the average queuing delay for the N packets?

P18. Suppose two hosts, A and B, are separated by 10,000 kilometers and are connected by a direct link of $R = 1$ Mbps. Suppose the propagation speed over the link is $2.5 \cdot 10^8$ meters/sec.

a. Calculate the bandwidth-delay product, $R \cdot d_{prop}$.

b. Consider sending a file of 400,000 bits from Host A to Host B. Suppose the file is sent continuously as one large message. What is the maximum number of bits that will be in the link at any given time?

c. Provide an interpretation of the bandwidth-delay product.

d. What is the width (in meters) of a bit in the link? Is it longer than a football field?

e. Derive a general expression for the width of a bit in terms of the propagation speed s, the transmission rate R, and the length of the link m.