King Fahd University of Petroleum and Minerals
College of Computer Sciences and Engineering
Department of Computer Engineering

COE 344 – Computer Networks (T172)

Homework # 01 (*due date & time: Thursday 08/02/2018 during class period*)

Late homework submission will NOT be accepted

***** Show all your work. No credit will be given if work is not shown! *****

For all problems: 1 kbits = 1,000 bits, 1 Mbits = 1,000,000 bits

Problem # 1 (30 points; 10 points each): Consider sending a file of 60 Mbits over a path of 4 links. Each link transmits at a rate of 2 Mbps. The network is lightly loaded so that there are no queuing delays. Assume that the processing delay at each node is 1 millisecond, and that the propagation delay on each link is 20 milliseconds. Using these assumptions, answer the following:

a. Suppose the network is a **packet-switched** datagram network, and a connectionless service is used. Suppose that the file is broken into 15,000 packets. Now suppose each packet has 320 bits of header. How long does it take to send the file?
b. Repeat (a), but assume message switching is used (i.e., 320 bits are added to the file, and the file is **not** segmented).
c. Finally, suppose that the network is a **circuit-switched** network. Further, suppose that the transmission rate of the circuit between source and destination is 2 Mbps. Assuming the circuit is made up of 4 links with a propagation delay on each link being 20 milliseconds, a 500 milliseconds set-up time, and 160 bits of header appended to the entire file, how long does it take to send the file?

Problem # 2 (20 points):
Suppose users share a 2 Mbps link. Also suppose each user requires 250 Kbps when transmitting, but each user transmits only 5% of the time.

a. **(4 points)** When circuit switching is used, how many users can be supported?
b. **(4 points)** For the remainder of the problem, suppose packet switching is used. Find the probability that a given user is transmitting.
c. **(4 points)** Suppose there are 30 users. Find the probability that at any given time, exactly *n* users are transmitting simultaneously. (*Hint*: Use the binomial distribution.)
d. **(8 points)** Find the probability that there are 9 or more users transmitting simultaneously.