18-345 Introduction to Telecommunication Networks

Problem Set 1

September 2 1999 **Due: September 13, 1999**

1. Consider a network of N users where every user is connected to every other user through a dedicated bidirectional link. How many links are required to interconnect N users? If each link is 1000 m long, how much cable is required to interconnect 100 users? For a network of 100 users, find the maximum utilization of resources (links).
2. A digital telephone connection provides a data rate of 64 Kb/s (kilobits per second). Using this transmission medium, how long would it take to transmit a 20 MB (megabyte) file.
3. A document processing system store images of 8.5 x 11 inch pieces of paper at 300 dots-per-inch. Each point of the picture can be one of 8 different shades of grey (3 bits per pixel). How much storage space is required for each document if no compression of the image is done?
4. Approximately how long would it take to transmit the contents of an entire CD-ROM, 660 megabytes (1 megabyte = 2^20 bytes), using a 2400 bit-per-second modem?
5. A digital telephone is being developed to operate over a datagram network in which each datagram carries 48 bytes of data. The telephone takes an 8 bit sample 8000 times each second, and does not transmit a datagram until a full 48 bytes is available. What is the absolute minimum delay between a word being spoken, and that word being heard at the other end?
6. Slow-Net, Inc. has two dedicated links connecting their downtown and suburban offices. Each link fails one day per month, on average. How often do the links fail on the same day?