Problem Set 1  (Solutions are due Fri.  1-21-05)

1) Problem 1.9 in the book.

2) Problem 1.24 in the book.

3) An interesting problem which is difficult to solve in general is the following: Suppose there are $M$ nodes and $N$ links. How should the $N$ links be placed so that

(i) Every node can communicate with every other node (including itself), and

(ii) The maximum and/or average number of hops that a data packet traverses from source to destination is minimized.

For this assignment assume that every node has exactly two input and two output links (unidirectional links, e.g., optical fiber) as shown in the following figure, and that all source destination pairs (including the source-to-source loopback pair) are equally likely.

(a) It is not difficult to make a network from $M = 4$ nodes for which the maximum number of hops that needs to be traversed by any packet is 2 hops. Draw such a network and compute the average delay.

(b) Repeat (a) for $M = 8$ and a maximum number of 3 hops that needs to be traversed by any packet. Is the solution unique?

(c) Repeat (a) for $M = 16$. This is more challenging. What do you expect the maximum number of hops traversed by any packet to be? Can it be achieved?

4) The IEEE 802.15.x series of standards defines specifications for WPANs (wireless personal area networks). The starting point was the standardization of the Bluetooth system, but other standards for WPANs were added subsequently to accommodate more applications. To gain some experience with standards, find out what frequency bands are used by 802.15.x WPANs, what modulation methods are specified, and what the resulting data rates that can be used are.