Homework Assignment #5 (Due: Mon, Oct 30, 2000)

CSE 5347: Telecommunication Networks Design

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http://www-cse.uta.edu/~das/5347.html

1. Carry out Floyd’s algorithm on the following network (showing all the steps) to compute all-to-all shortest paths.

   | A  | B  | C  | D  | E  |
---|----|----|----|----|----|
A | 0  | 3  | 2  | 0  | 0  |
B | 0  | 0  | 0  | 2  | 0  |
C | 0  | −5 | 0  | 0  | 2  |
D | 0  | 0  | 1  | 0  | 1  |
E | 0  | 0  | 0  | 0  | 0  |

(a) What do the negative numbers (in those particular places) on the main diagonal signify?
(b) What happens if you apply Bellman-Ford’s algorithm on this network? Is it possible to test for negative cycles?

2. Suppose we want to find the longest path in a network containing no negative edge weight.

   (a) Can you modify Dijkstra’s shortest path algorithm to solve this problem? Justify your answer.
   (b) Under what circumstances is it possible to find the longest path in a network.

3. There is a 6-node (undirected) network with links (A,B), (A,D), (B,C), (B,E), (C,F), (D,E), (E,F). All link capacities are full duplex and have capacities of 56 Kbps. There is a requirement of 7 Kbps between each pair of nodes in each direction. The objective is to minimize the maximum link utilization.

   (a) Find the best routing you can.
   (b) What is the minimum possible value for the maximum link utilization. Why?
   (c) How close was the answer?

4. There are two paths, $P_1$ and $P_2$, between a given pair of nodes with capacities of 10 Kbps and 30 Kbps, respectively. It is required that a total of 10 Kbps of traffic be sent over these two paths: $X$ over $P_1$ and $10,000 - X$ over $P_2$.

   (a) Assuming independent arrivals and exponential message lengths with an average length of 1000 bits, find the optimal value of $X$ using binary search. Check the answer by setting the derivative of delay with respect to $X$ to zero.
   (b) Suppose $P_2$ is a satellite channel with an added propagation delay of 250 msec. What is the optimal value of $X$ now?