EE 565 Homework 3: Routing & End-to-End Queueing Delay

Instructor: Patrick Tague, Winter Quarter 2008

Homework Due: 10:30AM on 27 February 2008

Answers without work will receive no credit. If problems are solved using MATLAB, etc., please include code with your homework submission.

Consider the network topologies with 13 nodes given in Fig. 1. In each of Fig. 1(a) and Fig. 1(b), a routing topology is given with 4 network flows in which each packet traverses the same path through the network. Suppose that each link in the network has transmission rate $R = 1$ Mbps and packets arrive at each source s_i with rate λ according to a Poisson process. Assume that packets are of variable length L bits and that L is an exponentially distributed random variable with mean 1000 bits.

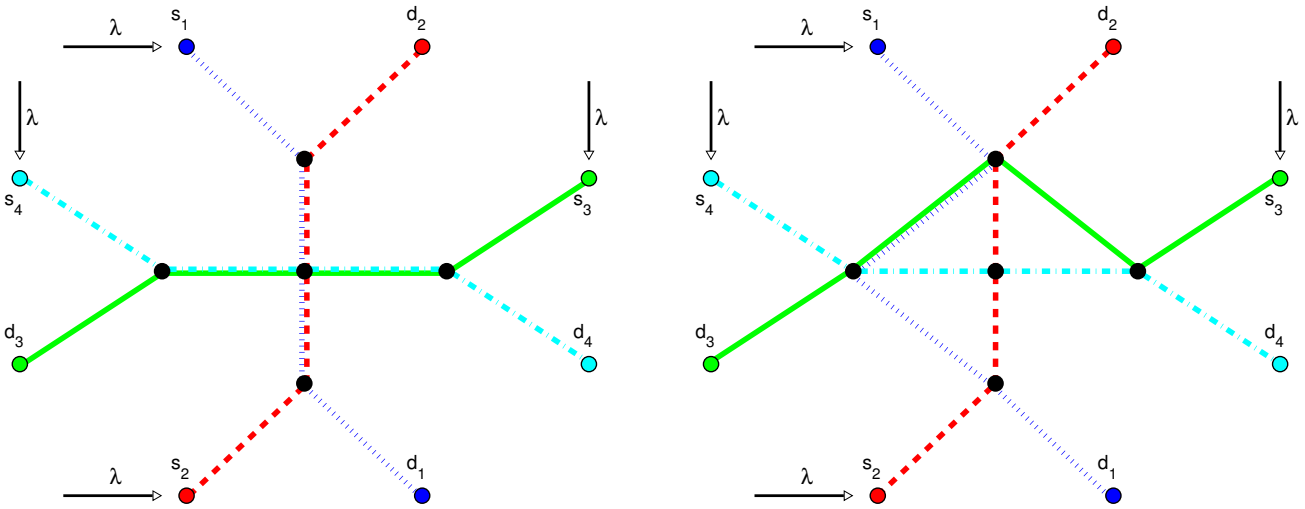

Figure 1: The routing topologies are given for problem 1.

(a) Ignoring processing and propagation delays, compute the expected total delay for each of the $s_i - d_i$ paths in the topology given in Fig. 1(a). Give explicit reasoning for all of your computations and give a detailed interpretation of your results. Comment on the values of λ that can be used to maintain finite delay.

(b) Repeat (a) for the topology given in Fig. 1(b).

(c) Can you find another routing topology for the given network with sources s_i and destinations d_i routing through the 5 intermediate nodes (the unlabeled ones) which yields a lower expected total delay compared to those in (a) and (b)? If so, illustrate the topology and repeat (a) for this topology. If not, why? State and justify any assumptions you make in your answer.