ECE 466- Computer Networks II

Problem Set #5

1. Derive the deconvolution $f \oslash g$ for functions f and g given by:

$$f(t) = \begin{cases} 0\ , & t \leq 0 \\ t+3\ , & t > 0 \end{cases}\ , \qquad g(t) = \begin{cases} 0\ , & t \leq 0 \\ 2t+1\ , & t > 0 \end{cases}\ .$$

2. Consider the network with two constant rate links (with rates C_1 and C_2) and a delay element (with delay W) as shown in Figure 1.

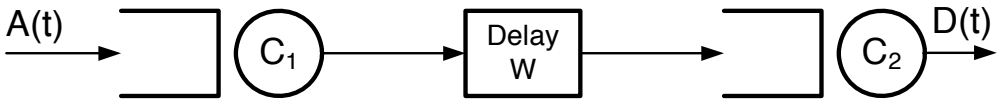

Figure 1:

Suppose that the arrivals from A are regulated by a dual leaky bucket with peak rate $P = 1\ Mbps$, average rate $\rho = 0.5\ Mbps$ and burst size $\sigma = 15,000\ bits$. Also, suppose that $W = 10\ ms$.

Determine the minimum rates for C_1 and C_2 so that the backlog in the network does not exceed 1000 $bits$.

3. Consider the traffic of an MPEG video stream that is regulated with a leaky bucket with average rate $\rho = 0.15\ Mbps$ (Mbps = Megabits per second), and maximum burst size size $\sigma = 15,000\ bits$.

   (a) The output of the regulator feeds into a constant rate link with capacity $C = 300\ kbps$. Determine the maximum backlog and the maximum delay at the link.

   (b) Suppose that the regulator is a dual leaky bucket with peak rate $P = 1\ Mbps$ (in addition to $\rho = 0.15\ Mbps$ and $\sigma = 15,000\ bits$). Determine the maximum backlog and the maximum delay at the link.

   (c) Continue with the assumptions in (b). Instead of a single link, now assume that the traffic goes through a sequence of three links with rates $C_1 = 400\ kbps$, $C_2 = 200\ kbps$, and $C_3 = 300\ kbps$, for the first, second and third link, respectively. Determine the maximum backlog and the maximum delay in the network.