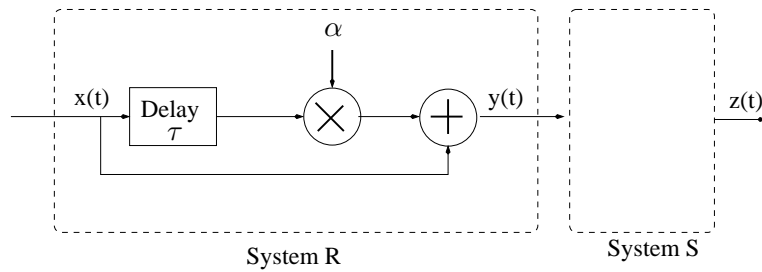


**Signals and Systems problem for the Spring 2014 MS Exam in ECE**

Suppose two continuous-time systems  $R$  and  $S$  are cascaded as shown in the diagram below. The system  $R$  has input  $x(t)$  and output  $y(t)$ , and system  $S$  has input  $y(t)$  and output  $z(t)$ . The assumptions in part (a) are independent from those of part (b), so do not mix them up.



(a) For the special case of  $\alpha = 1/2$  and  $\tau = 250$  microseconds, suppose the system  $S$  is an ideal low-pass filter on the interval  $\pm 1000$  Hz. Find the magnitude of the Fourier transform of the signal  $z(t)$  if  $x(t)$  is a delta function. Carefully label the plot.

(b) Suppose the system  $S$  is such that  $z(t) = x(t)$ . Draw a block diagram of system  $S$  Carefully label your blocks and signals.