American University of Beirut
Department of Electrical and Computer Engineering

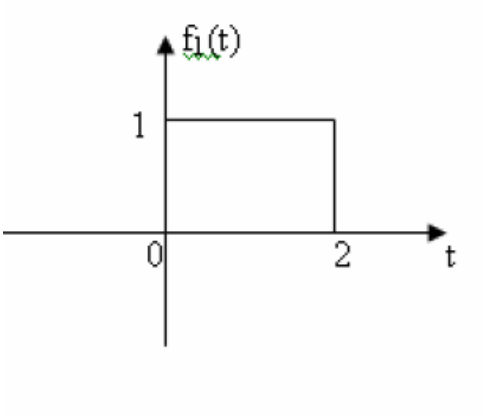
EECE 440 Signals and Systems

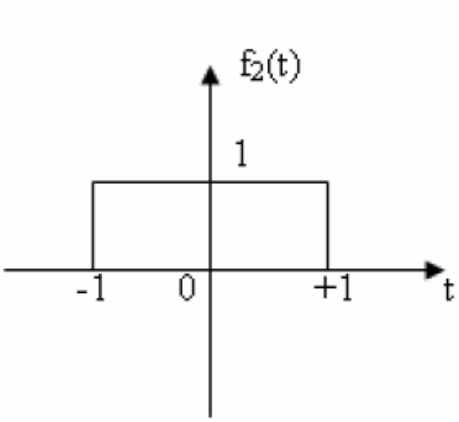
Homework 2: Due Thursday March 8, 2007
at 12:00 noon

Problem 1

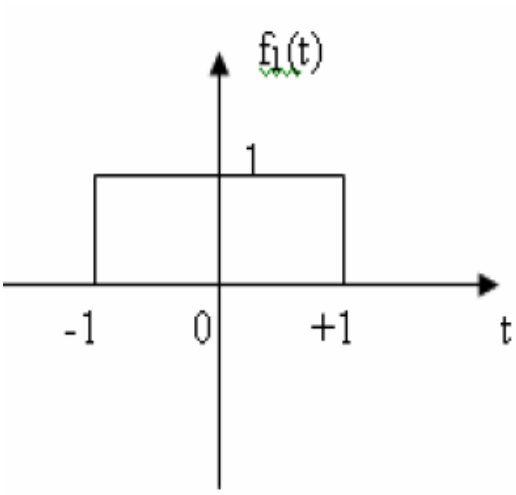
Determine and plot the convolution integral $f_1(t)*f_2(t)$ for:

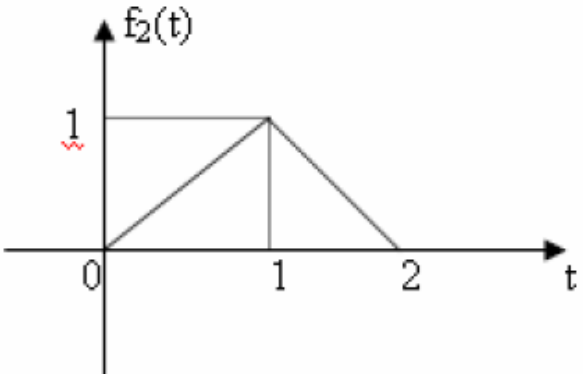
a)





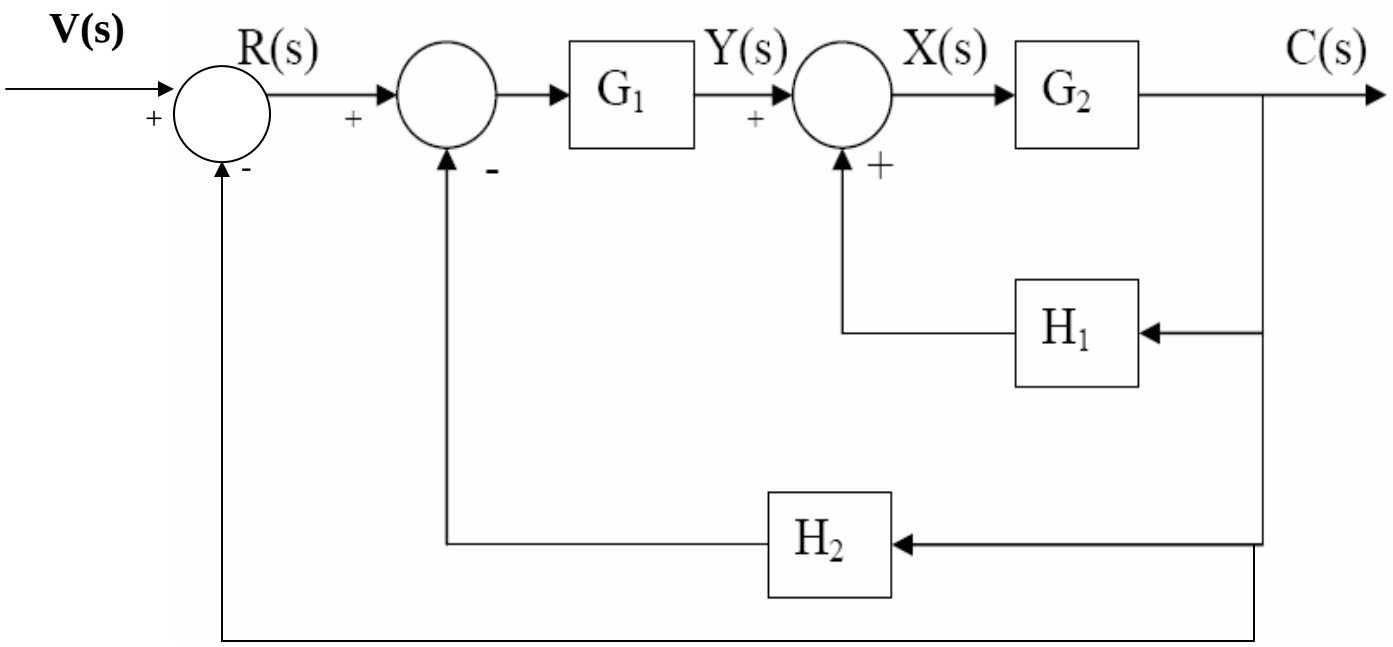
b)





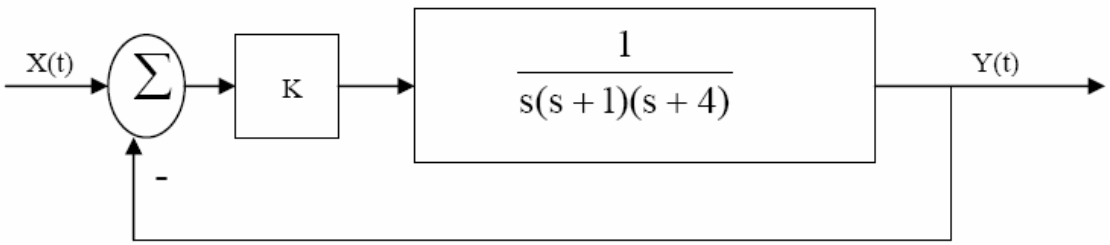
Problem 2

Determine the transfer function C(s)/V(s) of the System below



Problem 3

Consider the unit feedback system shown below:



a) Determine the error signal E(s).

b) Determine the range of K for the system to be stable.

Problem 4

The transfer function of a linear control system is given by:

$$\frac{C(s)}{R(s)} = \frac{1}{s^2 + 3s + 2}$$

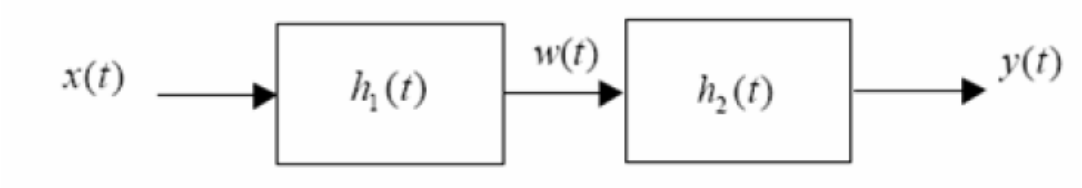
a) Determine the state equation for this system.

b) Determine the corresponding output equation.

Problem 5

The input signal of the LTI system shown below (initially at rest) is

x(t) = u(t)-u(t-3)



The impulse responses of the subsystems are:

$$h_1(t) = \left(e^{-t} + e^{-2t}\right)u(t)$$

$$h_2(t) = e^{-3t}u(t)$$

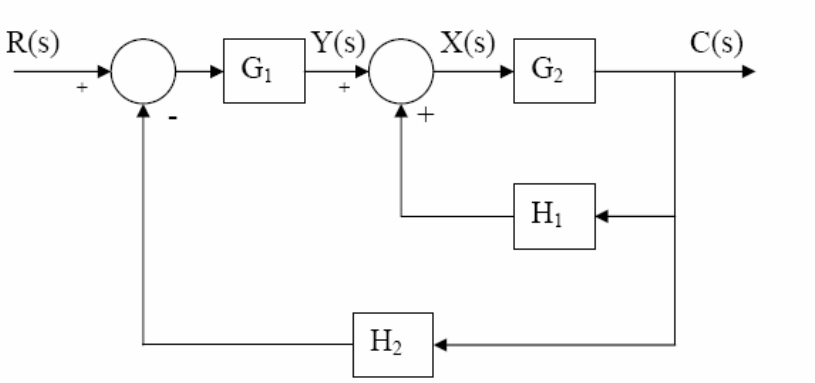
a) Compute the impulse response h(t) of the overall system.

b) Find an equivalent system (same impulse response) configured as a parallel interconnection of two LTI subsystems.

c) Sketch the input signal x(t). Compute the output signal y(t).

Matlab

Problem 1



Write an M file that computes the transfer function C(s)/R(s) of the system above given that: $G_1 = \frac{s^2 + 3s + 5}{s^3 + 2s + 1}$; $G_2 = 4$; $H_1 = \frac{1}{s + 4}$; and $H_2 = \frac{s + 1}{s^2 + 2s + 2}$.

Problem 2

Use Matlab to determine whether the system with the transfer function shown below is stable. Get a state space representation of the system.

$$H(s) = \frac{s^2 + 3s + 4}{s^6 - 2s^5 + 7s^3 - 3s^2 + s + 1}$$