Signal and System Final Exam

Problem 1   CT LTI Causal Feedforward System

$$x(t) \longrightarrow \boxed{h_1(t)} \longrightarrow \boxed{h_2(t)} \longrightarrow \boxed{h_3(t)} \longrightarrow y(t)$$
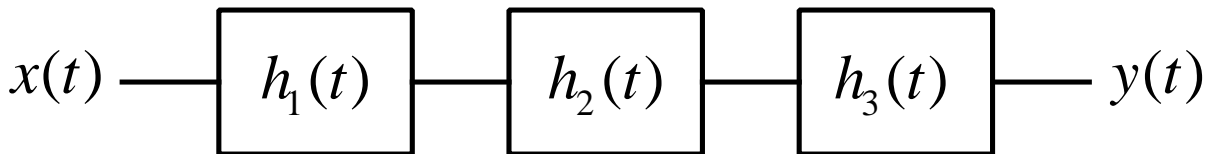
In this system, $h_1(t) = \delta(t-1)$

$\qquad\qquad\qquad h_2(t) = \delta(t-2)$

$\qquad\qquad\qquad h_3(t) = \delta(t-3)$.

(1) Please find the impulse response of the system (i.e. h(t))
     and plot h(t). (5%)
(2) Please find the transfer function of the system (i.e. H(s)). (5%)

Problem 2   CT LTI Causal Feedforward System

$$x(t) \longrightarrow \boxed{h_1(t)} \longrightarrow \boxed{h_2(t)} \longrightarrow \boxed{h_3(t)} \longrightarrow y(t)$$

In this system, $h_1(t) = u(t)$

$\qquad\qquad\qquad h_2(t) = u(t)$

$\qquad\qquad\qquad h_3(t) = \delta(t-1)$.

(1) Please find the impulse response of the system (i.e. h(t))
     and plot h(t) . (5%)
(2) Please find the transfer function of the system (i.e. H(s)). (5%)
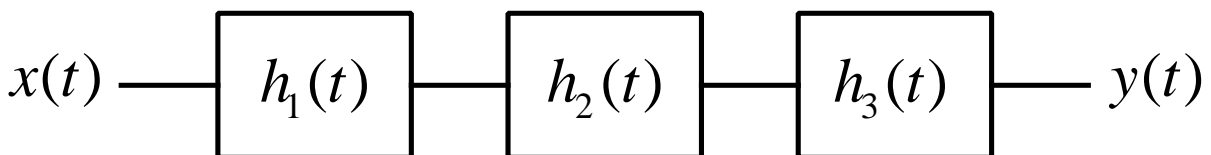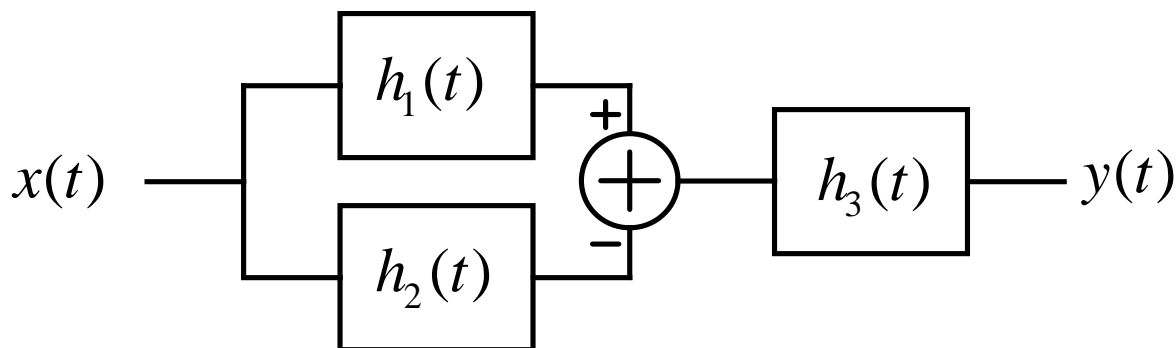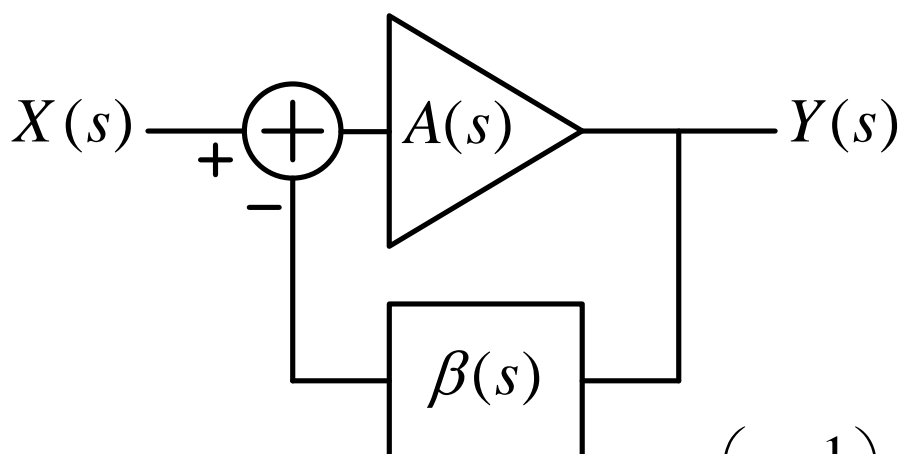
Problem 3   CT LTI Causal Feedforward System

In this system, $h_1(t) = \delta(t)$

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

$$h_3(t) = e^{-2t}u(t) .$$

(1) Please find the impulse response of the system (i.e. h(t)). (5%)
(2) Please find the transfer function of the system (i.e. H(s))
   and plot the pole-zero plot. (5%)

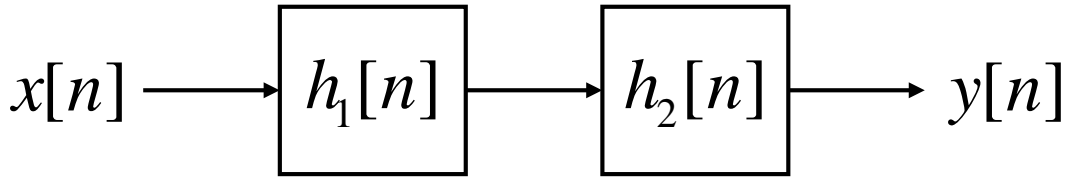# Problem 4   CT LTI Causal Feedback System

In this CT LTI causal system, $A(s) = \left(1 + \dfrac{1}{s}\right) \times \dfrac{1}{s}$

$$\beta(s) = 2$$

(1) Please find the impulse response of the system (i.e. h(t)). (5%)
(2) Please find the transfer function of the system (i.e. H(s))
   and plot the pole-zero plot. (5%)
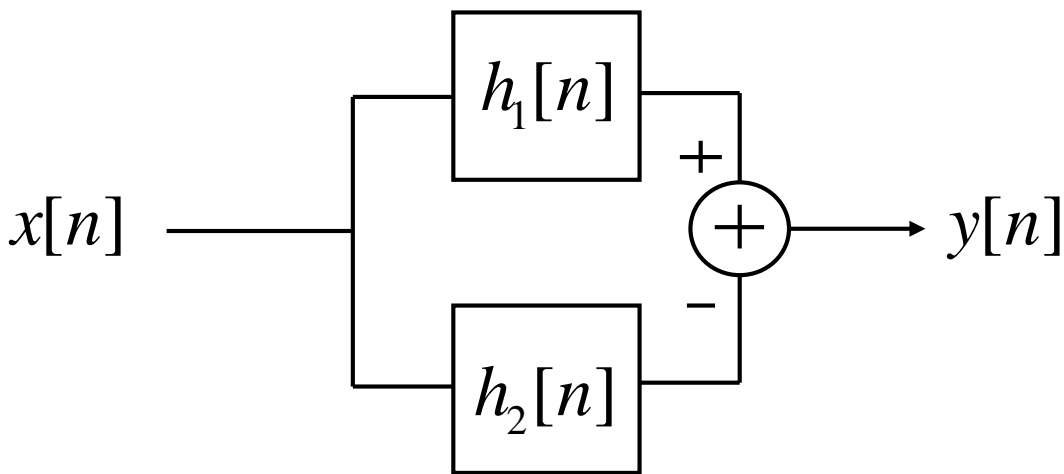
Problem 5   DT LTI Causal Feedforward System

$$x[n] \longrightarrow \boxed{h_1[n]} \longrightarrow \boxed{h_2[n]} \longrightarrow y[n]$$

$$h_1[n] = u[n-1] \qquad h_2[n] = u[n-2]$$

(1) Please find the impulse response (i.e. h[n]). (5%)
(2) Please find the transfer function (i.e. H(z)). (5%)
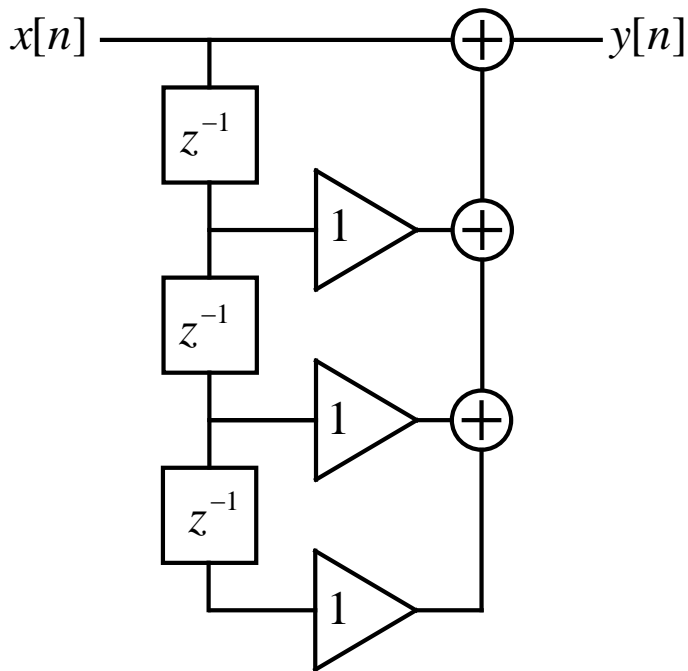

Problem 6 DT LTI Causal Feedforward System

$$h_1[n] = 0.5^n \cos(\frac{\pi}{4} n) u[n]$$

$$h_2[n] = 0.5^n \sin(\frac{\pi}{4} n) u[n]$$

(1) Please find the impulse response (i.e. h[n]). (5%)
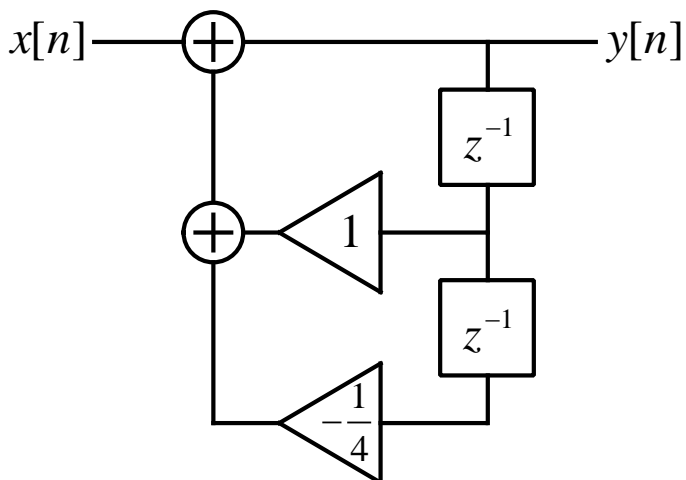(2) Please find the transfer function (i.e. H(z)). (5%)

Problem 7   DT LTI Causal Feedforward System

Assuming it is a causal, please answer the following questions.
(1) Please find the impulse response (i.e. h[n]). (5%)
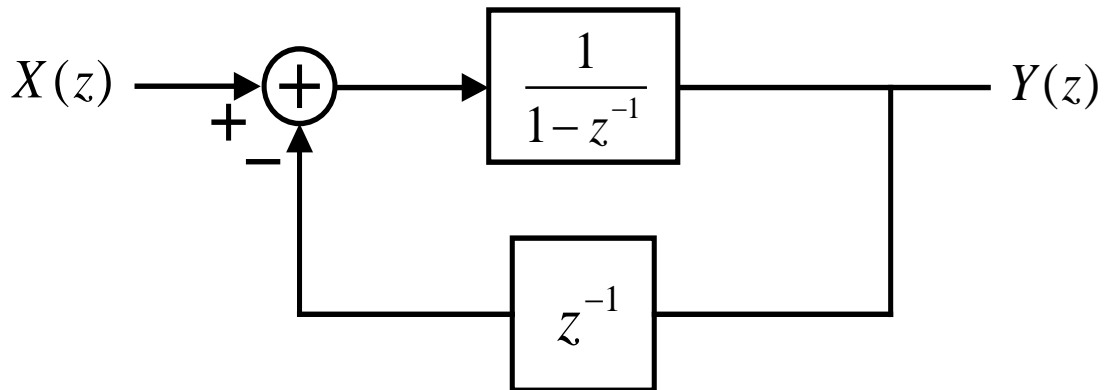(2) Please find the transfer function (i.e. H(z)) and plot the pole-zero plot. (5%)

Problem 8 DT LTI Causal Feedback System

Assuming it is a causal, please answer the following questions.
(1) Please find the impulse response (i.e. h[n]). (5%)
(2) Please find the transfer function (i.e. H(z)). (5%)

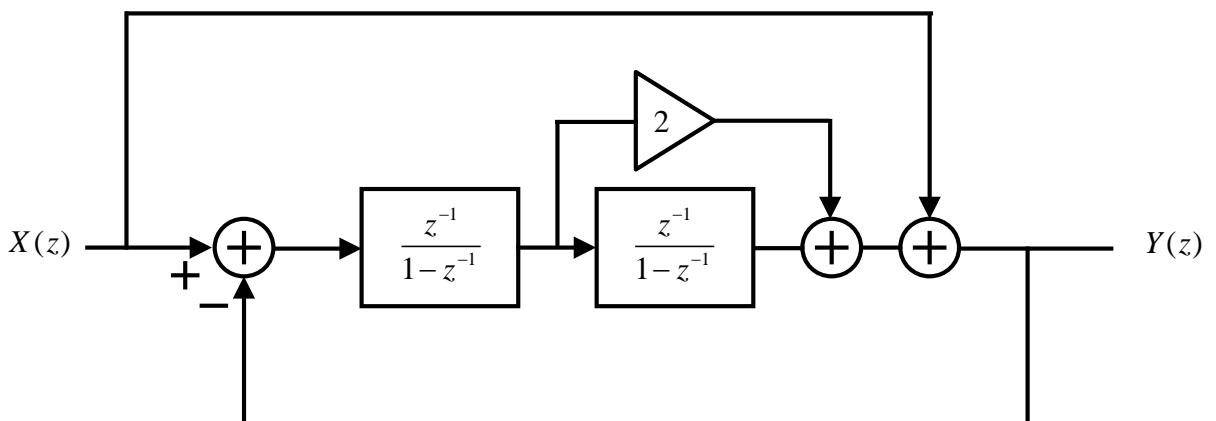## Problem 9   DT LTI Causal Feedback System

Assuming it is a causal, please answer the following questions.
(1) Please find the impulse response (i.e. h[n]). (5%)
(2) Please find the transfer function (i.e. H(z)). (5%)

Problem 10 DT LTI Causal Feedback System

Assuming it is a causal, please answer the following questions.
(1) Please find the impulse response (i.e. h[n]). (5%)
(2) Please find the transfer function (i.e. H(z)). (5%)