Department of Electrical and Computer Engineering
Stony Brook University

ESE 305/EEO 301 Signals and Systems (Summer 2024)

Homework 3
Due Date: June 6, 2024 (11:59PM via Brightspace in single PDF file.)

This assignment is to be done individually.

Problem 1: Chapter 3, Problem 4

3.4 Consider a DT LTI system with impulse response $h[n] = 2e^{0.2n}$, for $n = 0, 1, 2, \ldots$. What is its output $y[n]$ excited by the input $u[n]$? Compute $y[n]$ for $n = 0 : 3$ if $u[n] = 1/(n+1)$ for $n = 0, 1, 2, \ldots$.

Problem 2: Chapter 3, Problem 6

3.6 Consider a DT LTI system with impulse response $h[0] = 0$ and $h[n] = 1$ for all $n \geq 1$. Find a difference equation to describe the system.

Problem 3: Chapter 3, Problem 9

3.9 Consider the difference equation

$$y[n] + 2y[n-1] = u[n-1] + 3u[n-2] + 2u[n-3]$$

Does it describe a causal system? What is its order?

Problem 4: Chapter 3, Problem 11

3.11 Compute the impulse response of the difference equation

$$y[n] + 2y[n-1] = u[n-1] + 3u[n-2] - 2u[n-3]$$

Is it FIR or IIR?

Problem 5: Chapter 3, Problem 13

3.13 Consider the positive-feedback system shown in Figure 3.12(a). Find its impulse response.

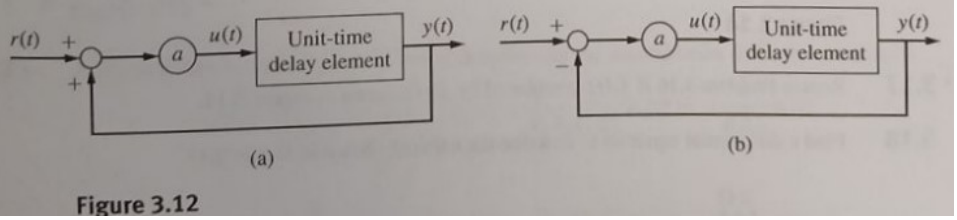

Figure 3.12

Problem 6: Chapter 3, Problem 15

3.15 Compute the integral convolution of $h_i(t)$ and $u_i(t)$, for $i = 1, 2$, shown in Figure 3.13.

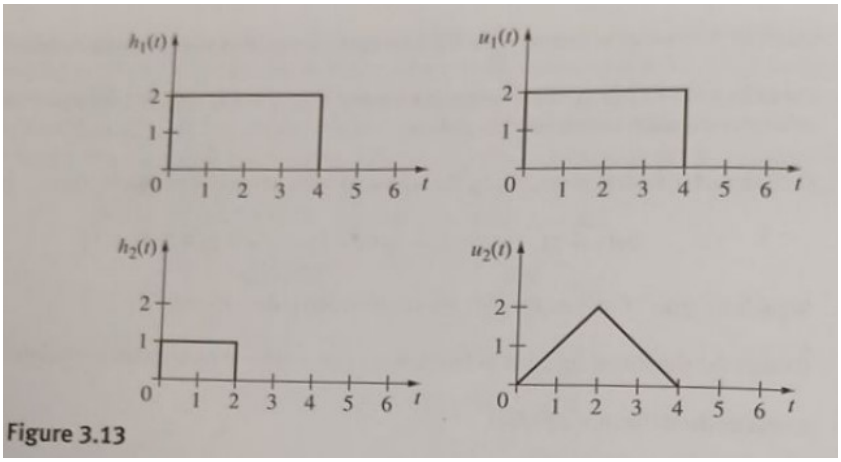

Figure 3.13

Problem 7: Chapter 3, Problem 16

3.16 Compute

$$y_1(t) = \int_{-\infty}^{\infty} f_1(t-\tau) f_2(\tau)\, d\tau$$

and

$$y_2 = \int_{-\infty}^{\infty} f_1(t) f_2(t)\, dt$$

for $f_1(t)$ and $f_2(t)$ shown in Figure 3.14. Note that the first integration is a convolution and yields a function of t. The second integration yields just a number.

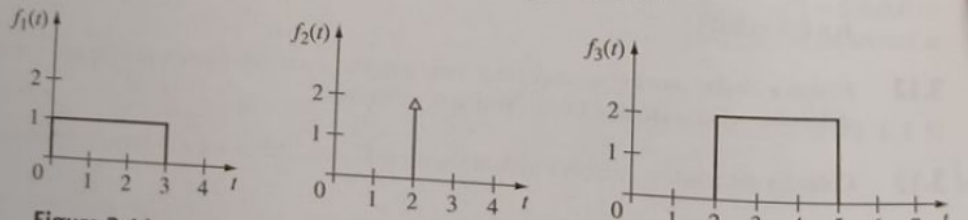

Figure 3.14