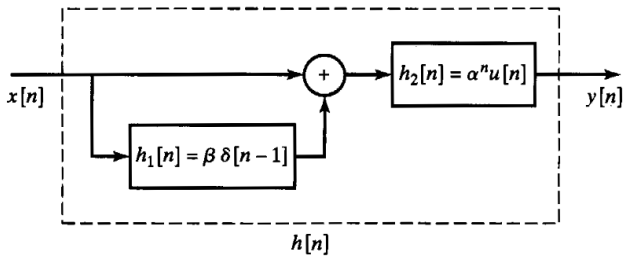


Oppenheimer Assignment 2

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Abstract—This document contains the solution to Exercise 2.42 (d) of Discrete-Time Signal Processing by Oppenheimer, Schaffer, Buck.

Problem 1. Consider the system in Figure below



(d) Is this system casual? Under what conditions would the system be stable?

Solution: From part (a), we have

$$h[n] = \alpha^n u[n] + \beta^{n-1} u[n-1] \quad (1)$$

$$\implies h[n] = 0, \quad n < 0 \quad (2)$$

This implies that the system is CAUSAL.

We know if a system is stable its Fourier transform exists. Therefore, the condition of stability is same as condition for the Fourier transform to exist which in turn is same as the condition imposed on frequency response from part (b).

$$H[e^{j\omega}] = \frac{1 + \beta e^{-j\omega}}{1 - \alpha e^{-j\omega}}, \quad \text{for } |\alpha| < 1. \quad (3)$$

The condition for the system to be STABLE is

$$|\alpha| < 1. \quad (4)$$