Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

6.341: Discrete-Time Signal Processing

Fall 2005

Problem Set 4
Flowgraph Structures, Finite Wordlength Effects, Lattice Filters

Issued: Tuesday, September 27, 2005.   **Due:** Tuesday, October 4, 2005.

Reading: Chapter 6 through section 6.5. Sections 6.7 and 6.8 have more detailed discussions of coefficient quantization and quantization noise than we'll cover, but you should look through those sections for the essential points. Lattice filters are covered in the lecture notes handout.

Problem 4.1

OSB Problem 6.10

Problem 4.2

OSB Problem 6.11
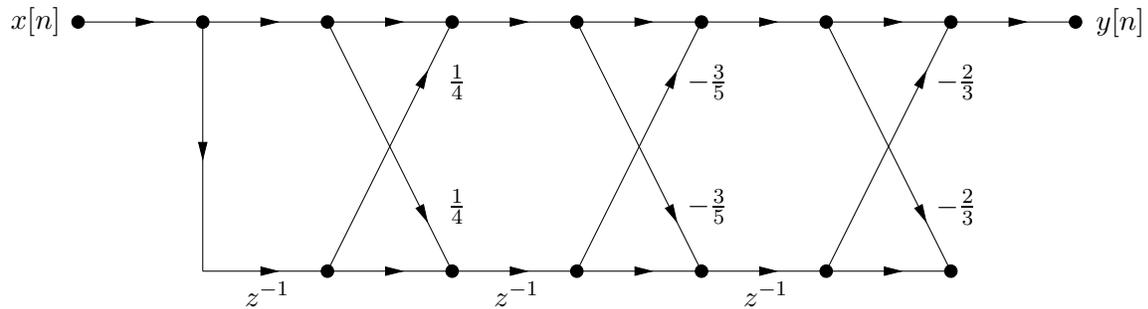
Problem 4.3

OSB Problem 6.12

Problem 4.4

OSB Problem 6.33

Problem 4.5

OSB Problem 6.42

Problem 4.6

(a) Determine the system function $H(z)$ relating the input $x[n]$ to the output $y[n]$ for the FIR lattice filter depicted below:

(b) Draw the lattice filter structure for the all-pole filter $1/H(z)$.

Problem 4.7

Determine and draw the lattice filter implementation of the following causal all-pole system function:

$$H(z) = \frac{1}{1 + \frac{3}{2}z^{-1} - z^{-2} + \frac{3}{4}z^{-3} + 2z^{-4}}$$

Is the system stable?

Problem 4.8

OSB Problem 5.68
(Note: This problem relates to issues raised in part A of project I.)