EE 387 Signal Processing

Tutorial 2

Discrete Time Systems:

1.

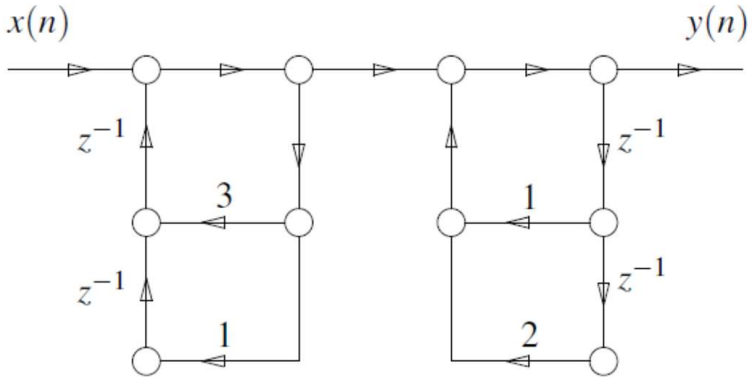
a. The system function of a causal, LTI system is given by

$$H(z) = \frac{1 + \frac{1}{5}z^{-1}}{\left(1 - \frac{1}{2}z^{-1} + \frac{1}{3}z^{-2}\right)\left(1 + \frac{1}{2}z^{-1}\right)}$$

Draw the signal flow graphs for implementation of the system in

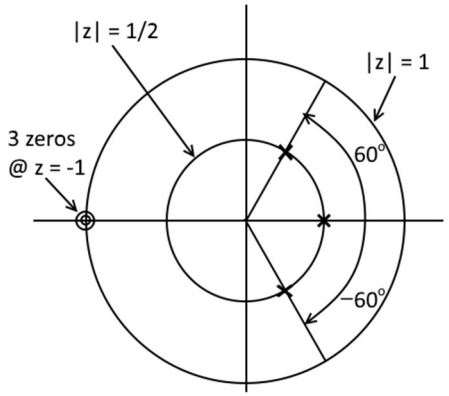
a. Direct Form I
b. Direct Form II
c. Cascade Form

b. A LTI system is realized by the signal flow graph shown below.



a. Determine the system function $H(z)$.
b. Is it possible to implement the system with fewer number of unit delays? Give reasons for your answer.

2. A z-plane pole-zero plot for a certain digital filter with three zeros and three poles is shown in the figure below. The filter has unity gain at dc.



a. Determine the system function in the form

$$\mathrm{H(z)} = \mathrm{A}\left[\frac{(1 + a_1 z^{-1})(1 + b_1 z^{-1} + b_2 z^{-2})}{(1 + c_1 z^{-1})(1 + d_1 z^{-1} + d_2 z^{-2})}\right]$$

giving numerical values for the parameters A,a_1, b_1, b_2, c_1, d_1 and d_2.

b. Draw block diagrams showing numerical values for path gins in the following forms:
   a. Direct form II (canonic form)
   b. Cascade form (make each section canonic, with real coefficients)

3. Determine the system function and the impulse response of the system shown in the figure below.