Discrete Time Systems: Overview

- The difference equation, the impulse response and the system function are equivalent characterization of the input/output relation of a LTI Discrete-time systems.
- LTI system can be modeled using :
 - 1. A Difference/Differential equation, y(n) = x[n] + x[n-1] + ...
 - 2. Impulse Response, h(n)
 - 3. Transfer Function, H(z)
- The systems that are described by the difference equations, can be represented by structures consisting of an interconnection of the basic operations of addition, multiplication by a constant or signal multiplication, delay and advance.

 The Adder, Multiplier, Delay & Advance is shown below:

1. Adder:

$$x[n]$$

$$y[n] \longrightarrow w[n] = x[n] + y[n]$$

2. Multiplier:

Modulator:

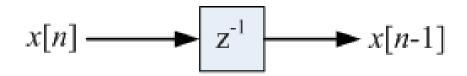
$$x[n] \longrightarrow A \qquad w[n] = Ax[n]$$

$$x[n]$$

$$y[n]$$

$$w[n] = x[n] y[n]$$

3. Delay:



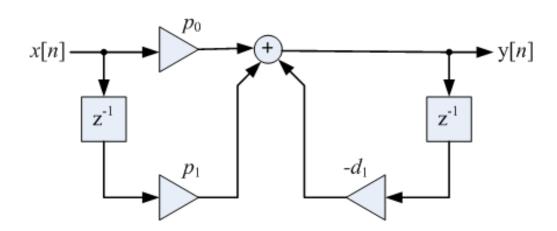
4. Advance:

$$x[n]$$
 \longrightarrow $x[n+1]$

 Consider a first-order causal LTI IIR digital filter described by

$$y[n] = -d_1y[n-1] + p_0x[n] + p_1x[n-1]$$

The block diagram representation is



- The implementation of LTI system can be realized in terms of Block Diagram and Signal Flow Graph.
- The LTI system can be represented in 2 manner:
 - a. Block Diagram
 - b. Mathematical Model