

Structures for Realization of Discrete Time Systems

1. The general linear constant coefficient difference equation characterizing an LTI discrete time system is:

- a) $y[n] = - \sum_{k=1}^N a_k y[n-k] + \sum_{k=0}^N b_k x[n-k]$
- b) $y[n] = - \sum_{k=0}^N a_k y[n-k] + \sum_{k=0}^N b_k x[n-k]$
- c) $y[n] = - \sum_{k=1}^N a_k y[n] + \sum_{k=0}^N b_k x[n]$
- d) None of the Mentioned

Answer: a

Explanation: We know that, the general linear constant coefficient difference equation characterizing an LTI discrete time system is given by the expression $y[n] = - \sum_{k=1}^N a_k y[n-k] + \sum_{k=0}^N b_k x[n-k]$

2. Which of the following is the rational system function of an LTI system characterized by the difference equation

$$y[n] = - \sum_{k=1}^N a_k y[n-k] + \sum_{k=0}^N b_k x[n-k] ?$$

- a) $\frac{\sum_{k=0}^N b_k x[n-k]}{1 + \sum_{k=0}^N a_k y[n-k]}$
- b) $\frac{1 + \sum_{k=1}^N a_k y[n-k]}{\sum_{k=0}^N b_k x[n-k]}$
- c) $\frac{\sum_{k=0}^N b_k x[n-k]}{1 + \sum_{k=1}^N a_k y[n-k]}$
- d) $\frac{1 + \sum_{k=0}^N a_k y[n-k]}{\sum_{k=0}^N b_k x[n-k]}$

Answer: c

Explanation: The difference equation of the LTI system is given as

$$y[n] = - \sum_{k=1}^N a_k y[n-k] + \sum_{k=0}^N b_k x[n-k]$$

By applying the z-transform on both sides of the above equation and by rearranging the obtained equation, we get the rational system function as

$$H(z) = \frac{\sum_{k=0}^N b_k z^{-k}}{1 + \sum_{k=1}^N a_k z^{-k}}$$

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3. Which of the following is used in the realization of a system?
a) Delay elements b) Multipliers c) Adders
d) All of the mentioned

Answer:d

Explanation: From each set of equations, we can construct a block diagram consisting of an interconnection of delay elements, multipliers and adders.

4. Computational complexity refers to the number of:
a) Additions b) Arithmetic operations c) Multiplications
d) None of the mentioned

Answer:b

Explanation: Computational complexity is one of the factors which is used in the implementation of the system. It refers to the numbers of Arithmetic operations (Additions, multiplications and divisions).

5. The number of times a fetch from memory is performed per output sample is one of the factors used in the implementation of the system.
a) True b) False

Answer:a

Explanation: According to the recent developments in the design and fabrication of rather sophisticated programmable DSPs, other factors, such as the number of times a fetch from memory is performed or the number of times a comparison between two numbers is performed per output sample, have become important in assessing the computational complexity of a given realization of a system.

6. Which of the following refers the number of memory locations required to store the system parameters, past inputs, past outputs and any intermediate computed values?
a) Computational complexity b) Finite world length effect
c) Memory requirements d) none of the mentioned

Answer:c

Explanation: Memory requirements refers the number of memory locations

