

Problem Wk.3.3.3: Finding systems

A difference equation is in the form:

$$y[n] = c_0y[n-1] + c_1y[n-2] + \dots + c_{k-1}y[n-k] + d_0x[n] + d_1x[n-1] + \dots + d_jx[n-j]$$

Determine the difference equation representation for the following systems.

Specify the d Coeffs: $d_0 \dots d_j$ and the c Coeffs: $c_0 \dots c_{k-1}$ for each of the difference equations below. For each question, enter a sequence of numbers representing the coefficients.

If one set of coefficients is empty, enter `none`, otherwise enter a sequence of numbers separated by spaces (no commas, parens, brackets, etc).

1. Let $x[n]$ be an input sequence of digitized sound. We want to output a sound sequence $y[n]$ where every output sample is the average of the previous two input samples, that is, $n-1$, $n-2$. Don't worry about what happens on the first few samples.

Difference equation:

dCoeffs (input):

cCoeffs (output):

2. Assume that the input to a system is 0 for $n < 0$ and 1 for $n \geq 0$. The output is 0 for $n < 0$ and is equal to the sequence 10, 1, 1, 1, 1, . . . for $n \geq 0$. Hint: the answer has no cCoeffs.

Difference equation:

dCoeffs (input):

cCoeffs (output):

3. A Bank offers a 5% annual interest rate, the inputs are your deposits, and the output is the balance in your account. Let $x[n]$ represent the amount of money you deposit in the bank during year n and $y[n]$ represent your balance in the bank at the end of year n . Assume that deposits during year n are credited to the balance in year n but earn no interest until year $n + 1$.

Difference equation:

dCoeffs (input):

cCoeffs (output):

4. Assume that you deposit \$100 in the Bank in the year 2007 ($n=0$) and make no further deposits. Solve your difference equation numerically to determine your balance in the bank during years 0 through 25. Hint: All this requires is a very simple Python program.

What is your bank balance in the year 2011 ($n=4$)?

What is your bank balance in the year 2031 ($n=24$)?

MIT OpenCourseWare
<http://ocw.mit.edu>

6.01SC Introduction to Electrical Engineering and Computer Science
Spring 2011

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.