

University of Massachusetts Lowell
Department of Electrical and Computer Engineering
16.520 Computer Aided Engineering Analysis
Problem Set 6

1. Consider the convolution of the $N - pt$ impulse response $h(n)$ and the input signal x . The current and $N - 1$ past inputs are stored in a FIFO buffer of dimension N . The current value of the output is computed as

$$y = \sum_{n=0}^{N-1} h(n) * \text{buffer}(n)$$

The process is:

```
time_index=0

do for all time

    x = getx(time_index)
    push (x, buffer,N)
    y= convolve (buffer,h,N)

    time_index=time_index+1

enddo
```

For $N = 4$ and $h(n) = 0.5^n$ and $x = \delta(n)$ validate your program.

2. Using the LMS algorithm design a channel echo canceller.

- a. Validate your work using zero mean unit variance Gaussian white noise for filter order $N = 5$. The channel model is given by the impulse response $h(n) = \delta(n) + 0.5\delta(n - 1) + 0.5^2\delta(n - 2)$.
- b. Plot the ensemble averaged squared error as a function of the iteration count and convergence factor μ .