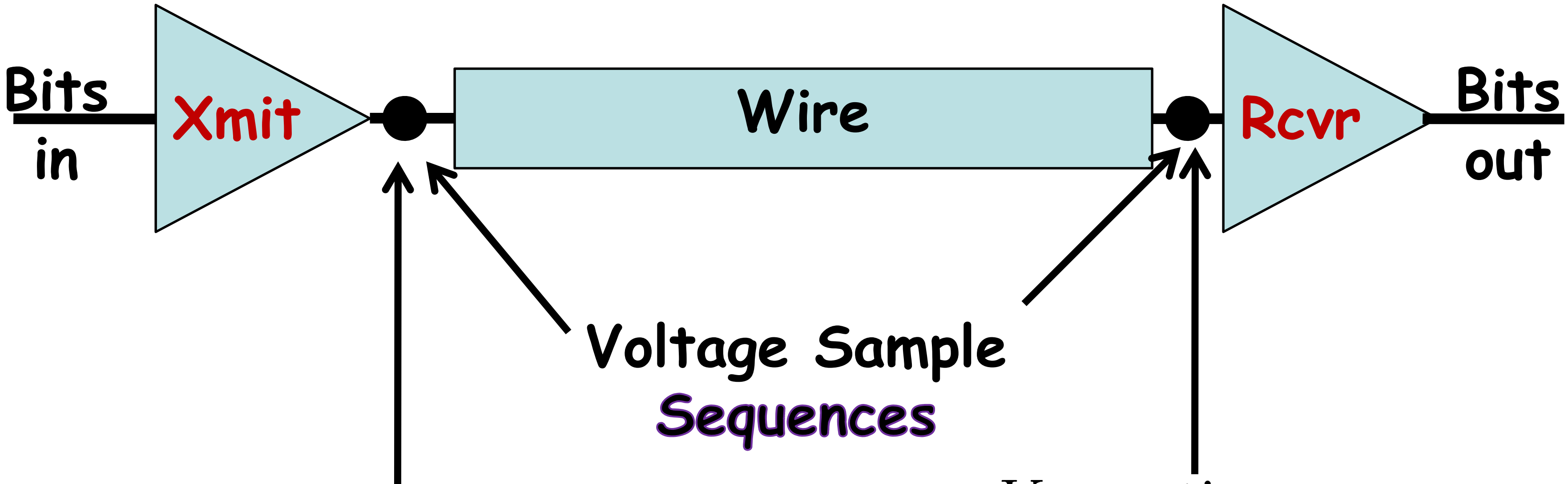
6.02 Lecture 3 – Unraveling Wires

- Quick Reminder about Problem
  - Slow Wires and Eye diagrams
  - Wires model Casual and LTI
  - Improvements by processing
- Unit Sample Response
  - Convolution Sum
  - Connection to Difference Equations
  - Deconvolution
- Flip and slide convolution
  - Lends insight in to system response

Transmission Setup and Notation



$X \equiv \text{entire sequence}$

$x[n] \equiv n^{th} \text{ sample value}$

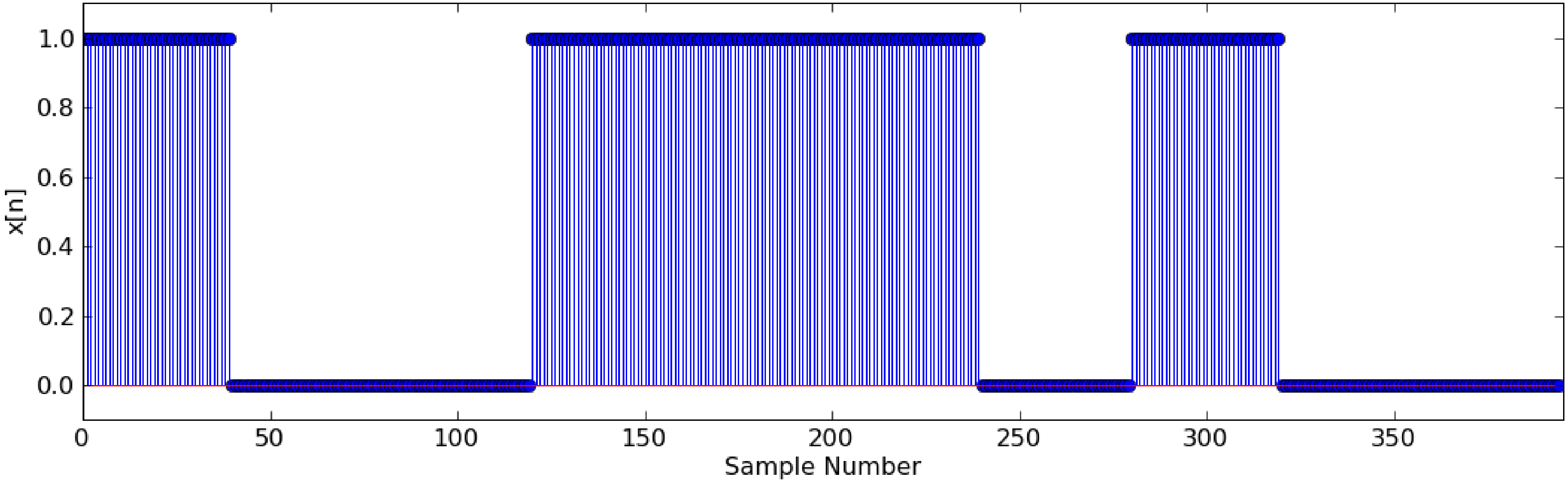
$Y \equiv \text{entire sequence}$

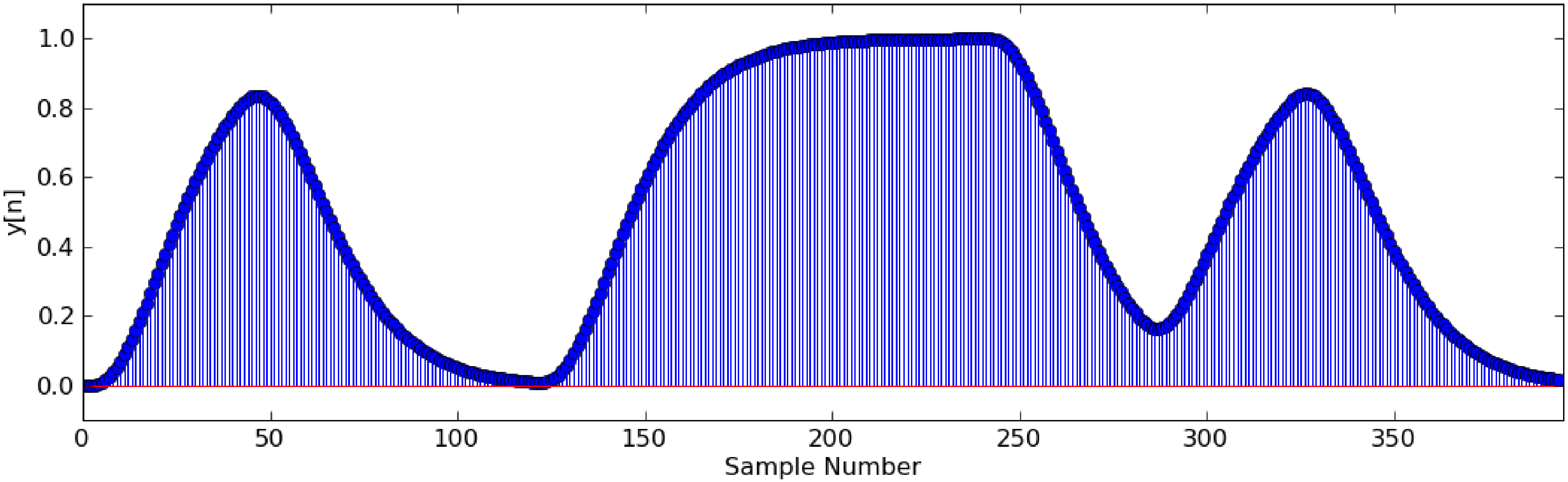
$y[n] \equiv n^{th} \text{ sample value}$

Sample Rates:

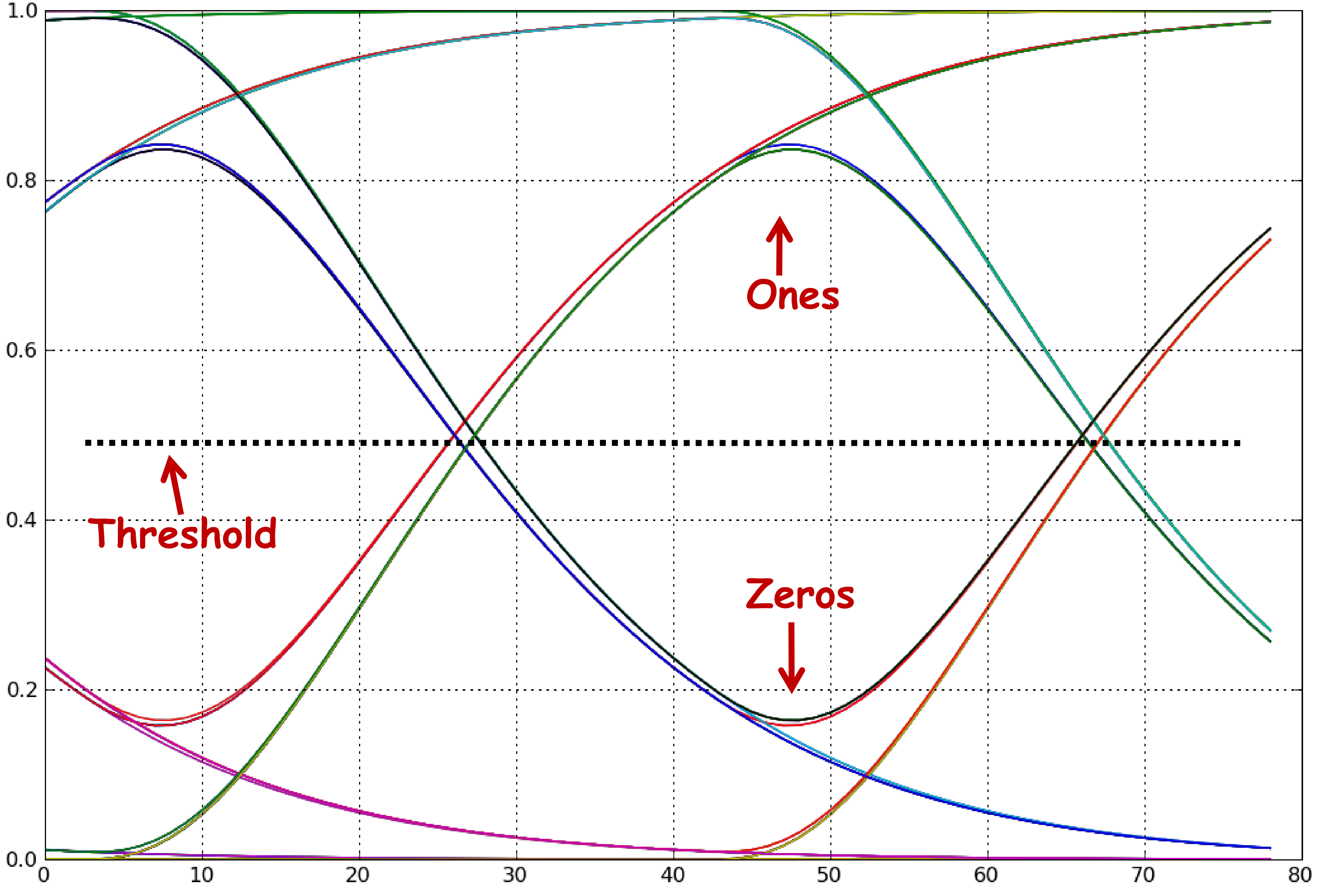
- 256,000 Samples/Second (lab)
- Up to gigaSamples/Second (Real World)

Slow Wire and 40 Samples per bit

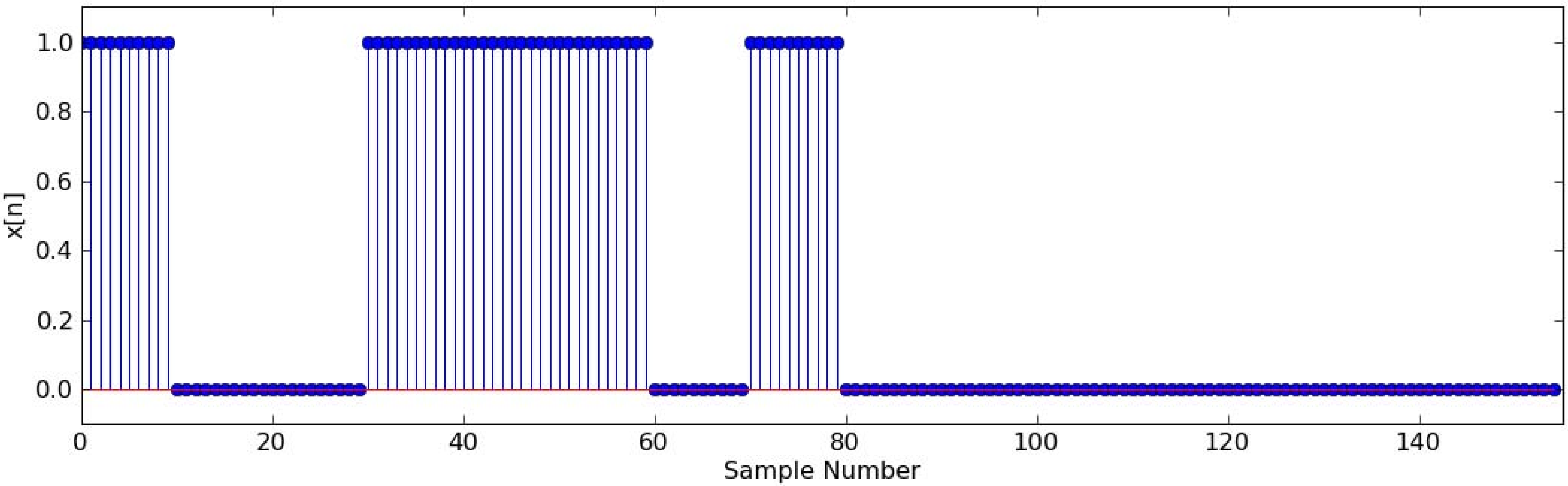


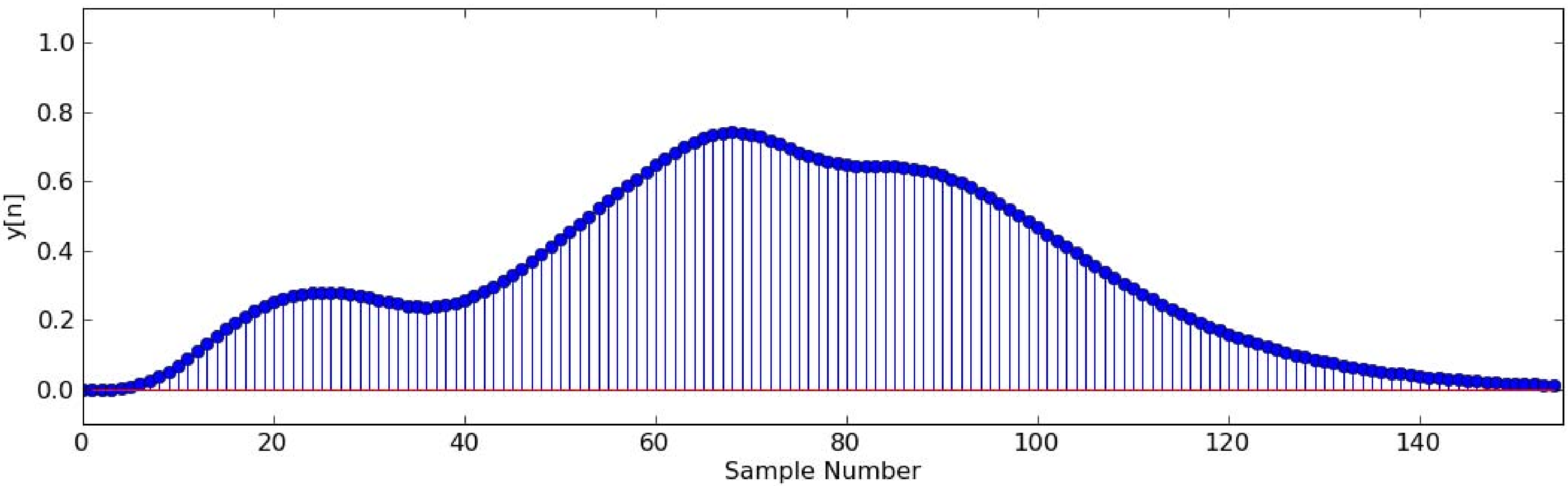


40 Samples per bit Eye diagram

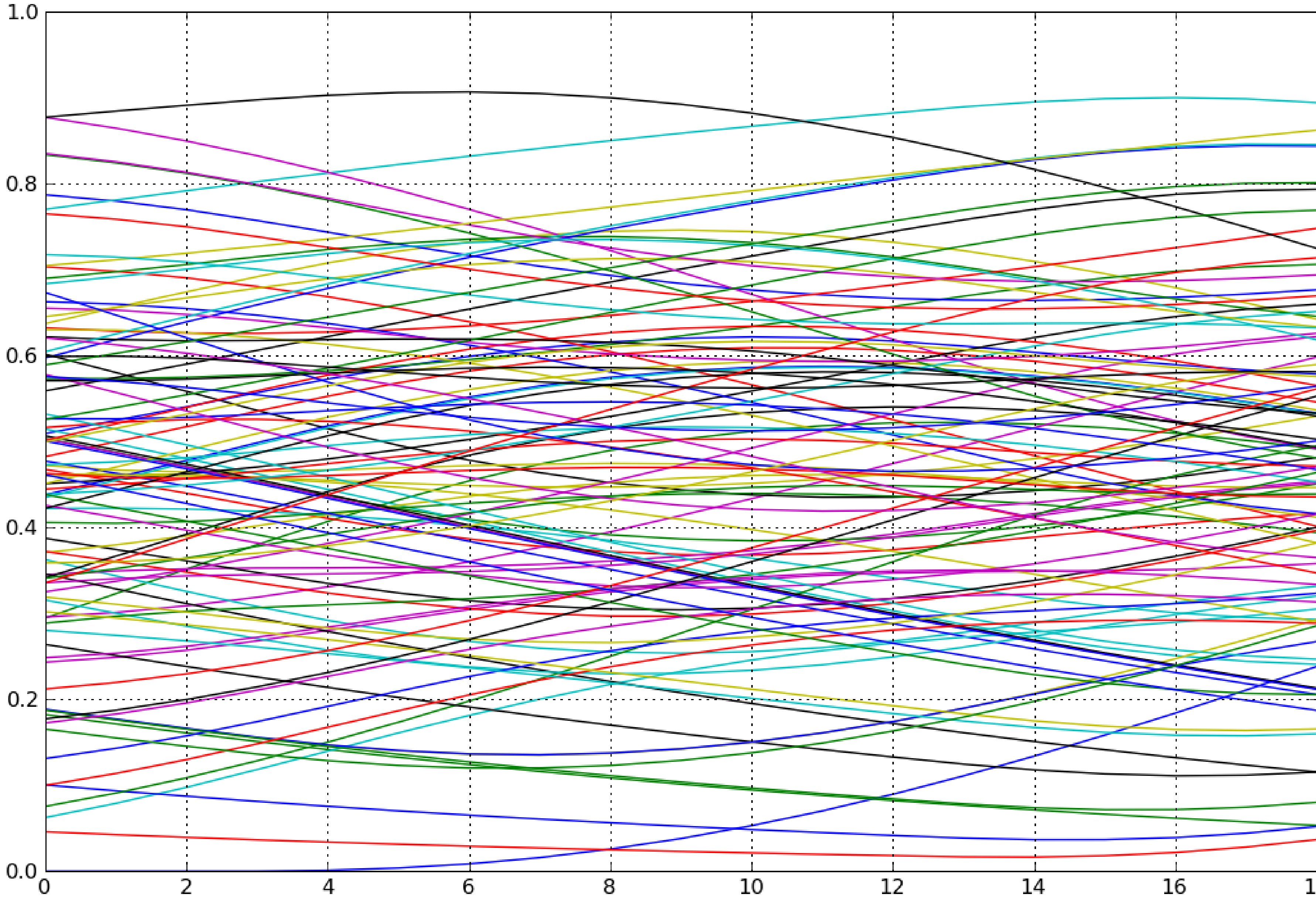


Slow Wire and 10 Samples per bit

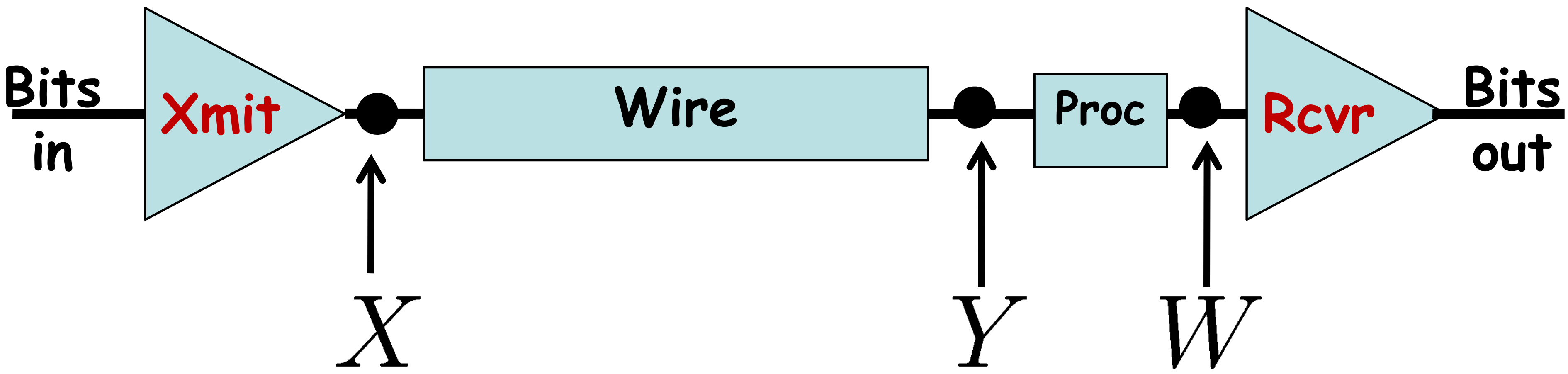




10 Samples per bit Eye diagram

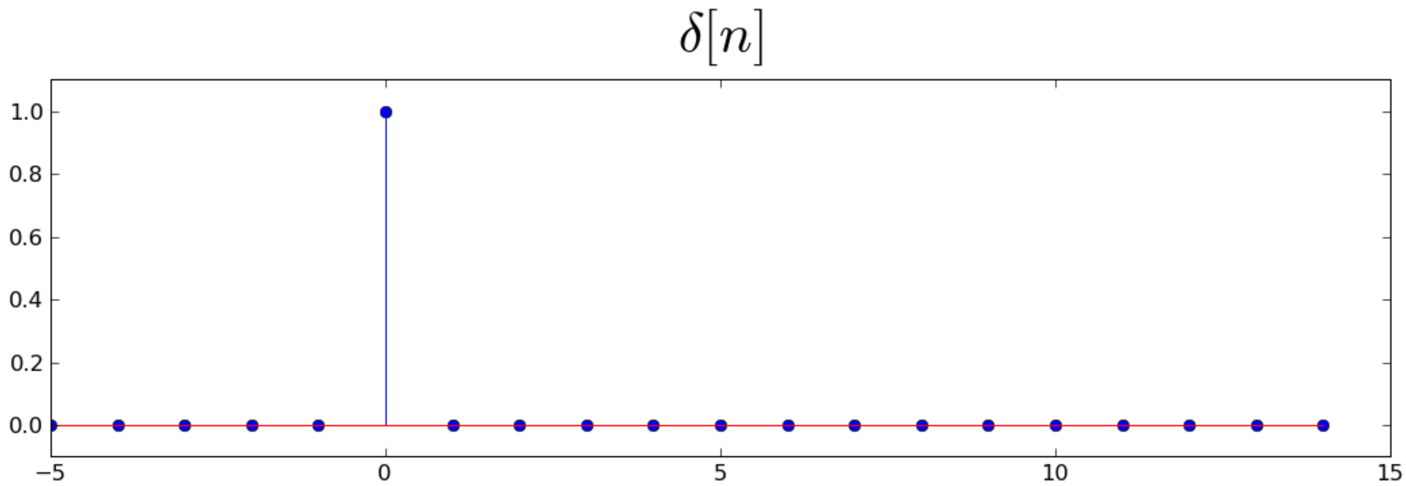


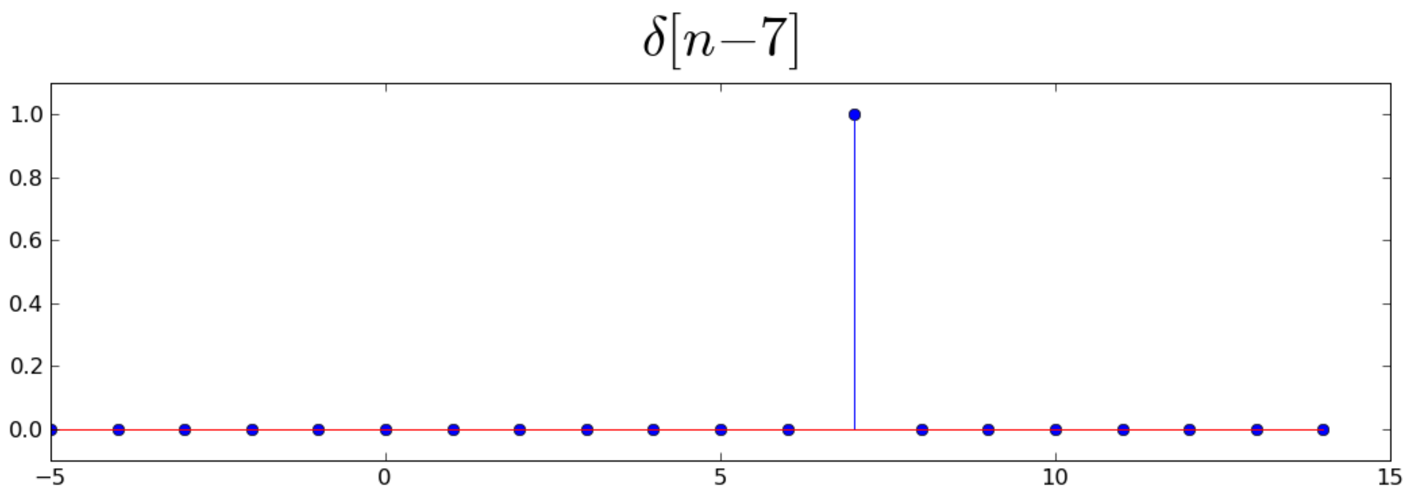
Can Signal Processing Help?



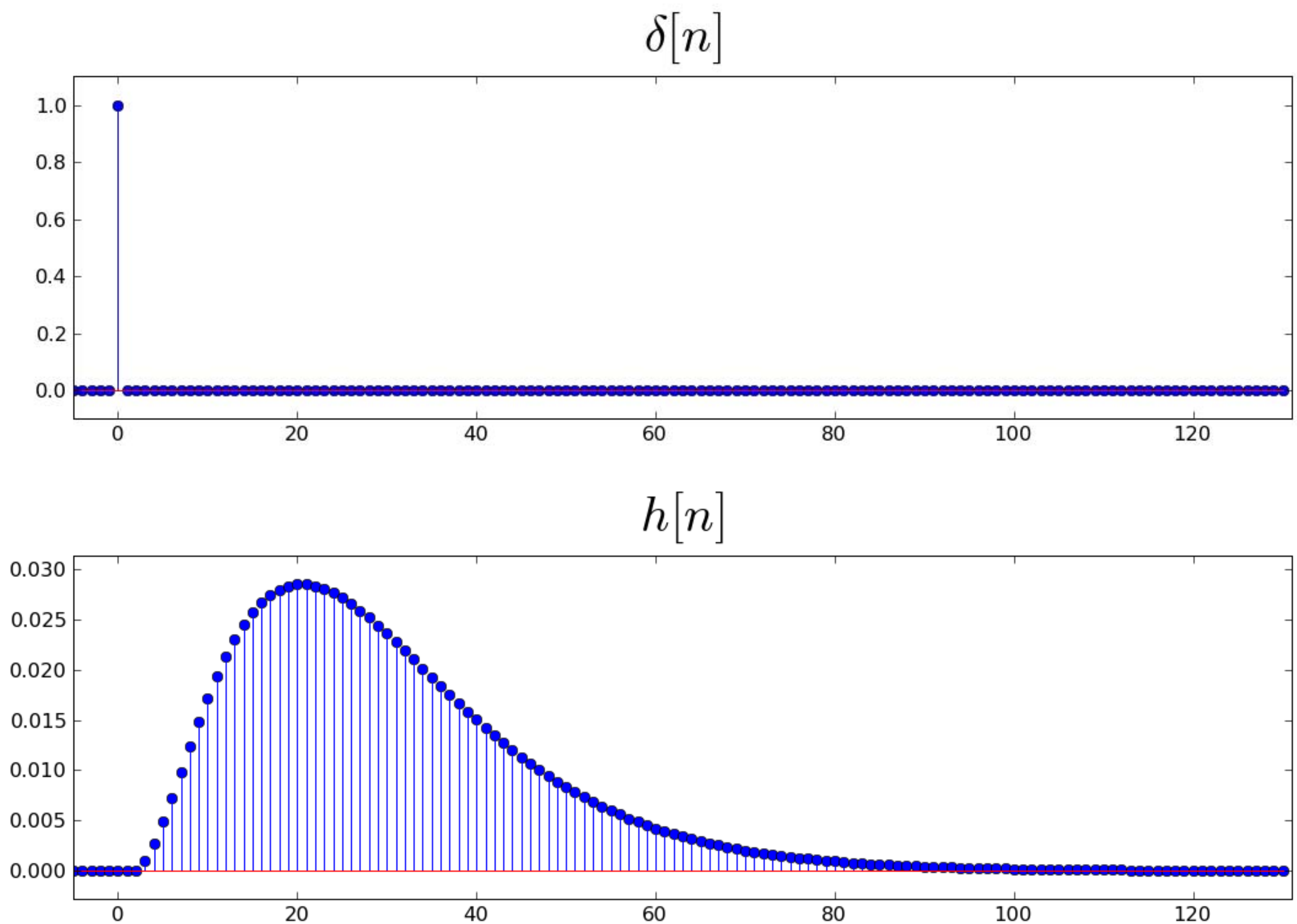
Model Wire as Causal and Linear Time-Invariant

Unit Sample Reminder



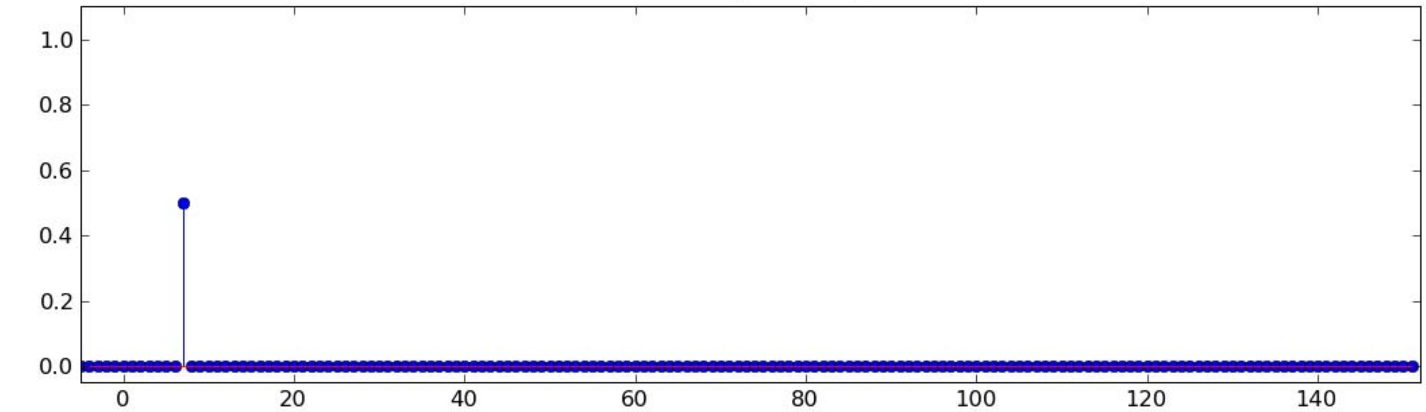


Unit Sample Response (slow wire)

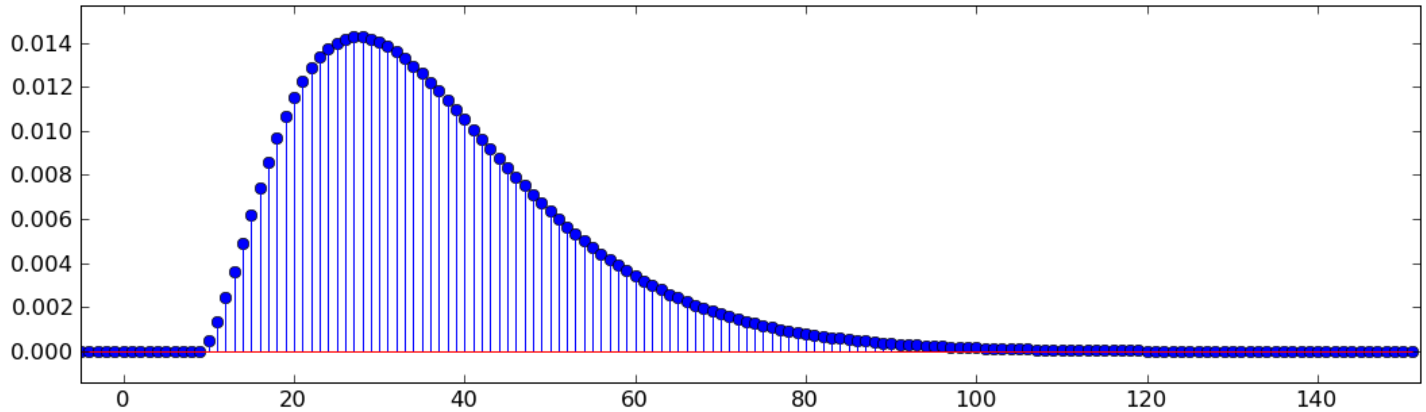


Shifted and Scaled Unit Sample Response

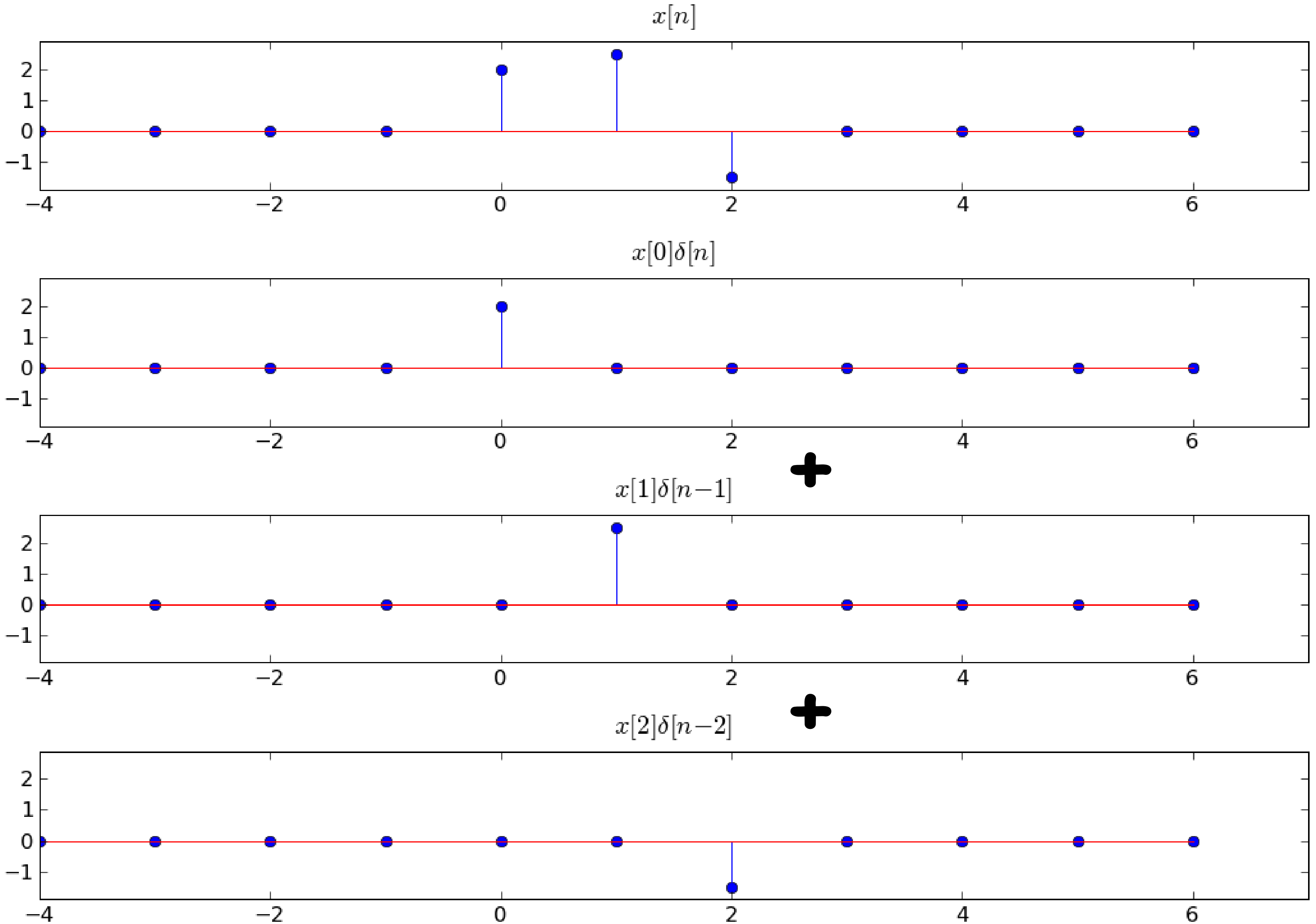
$0.5\delta[n-7]$



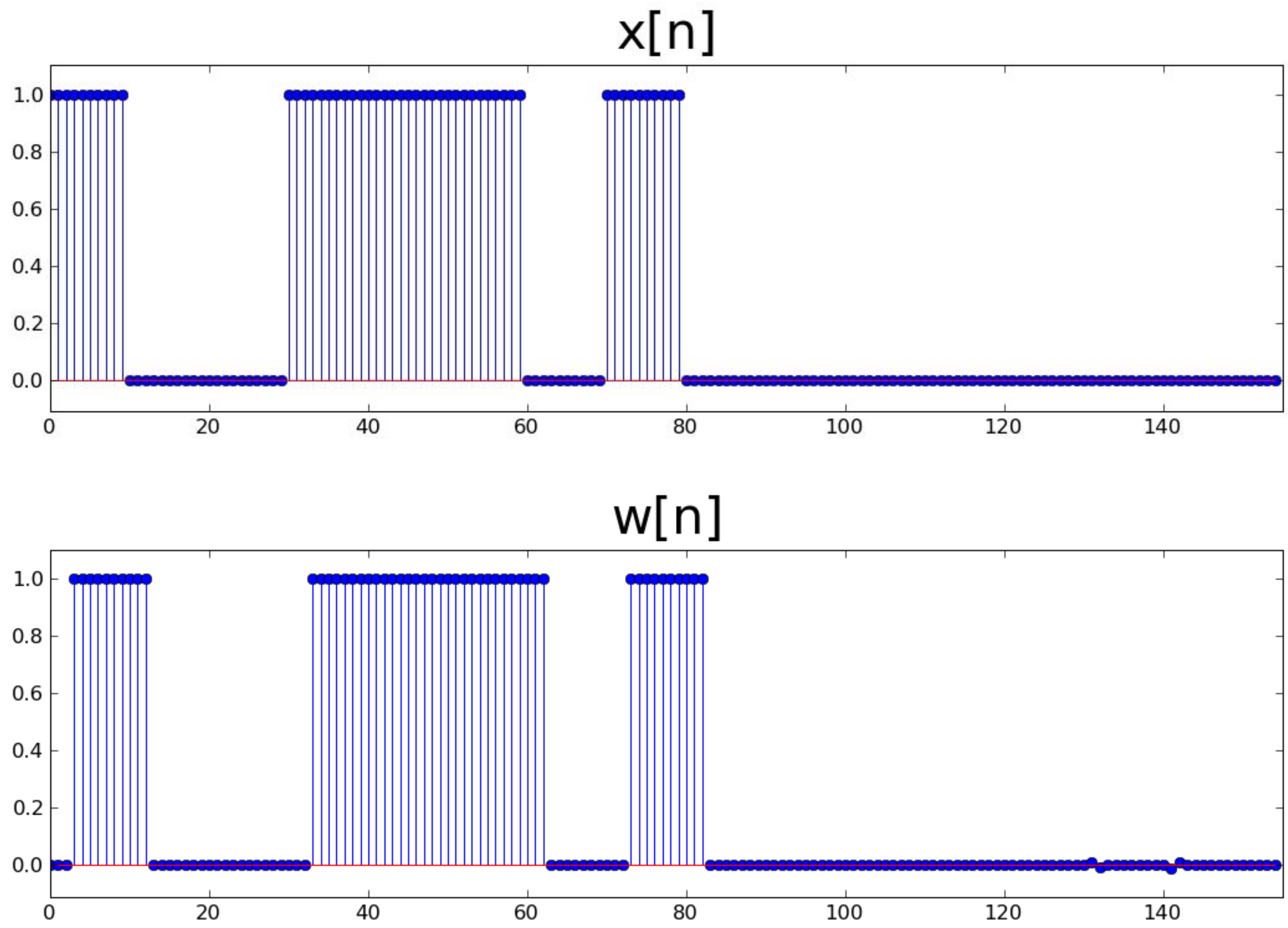
$0.5h[n-7]$



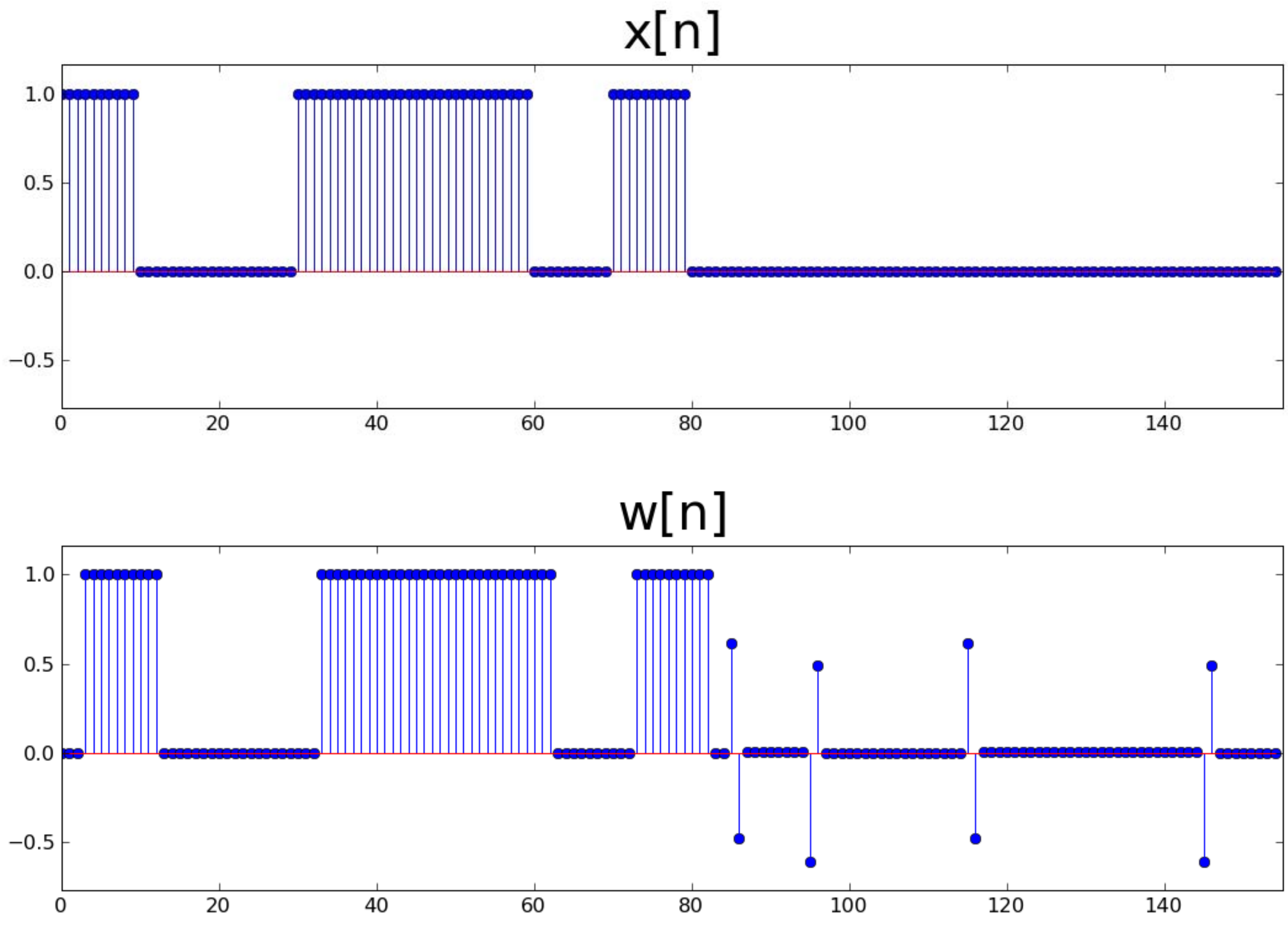
Decomposing X



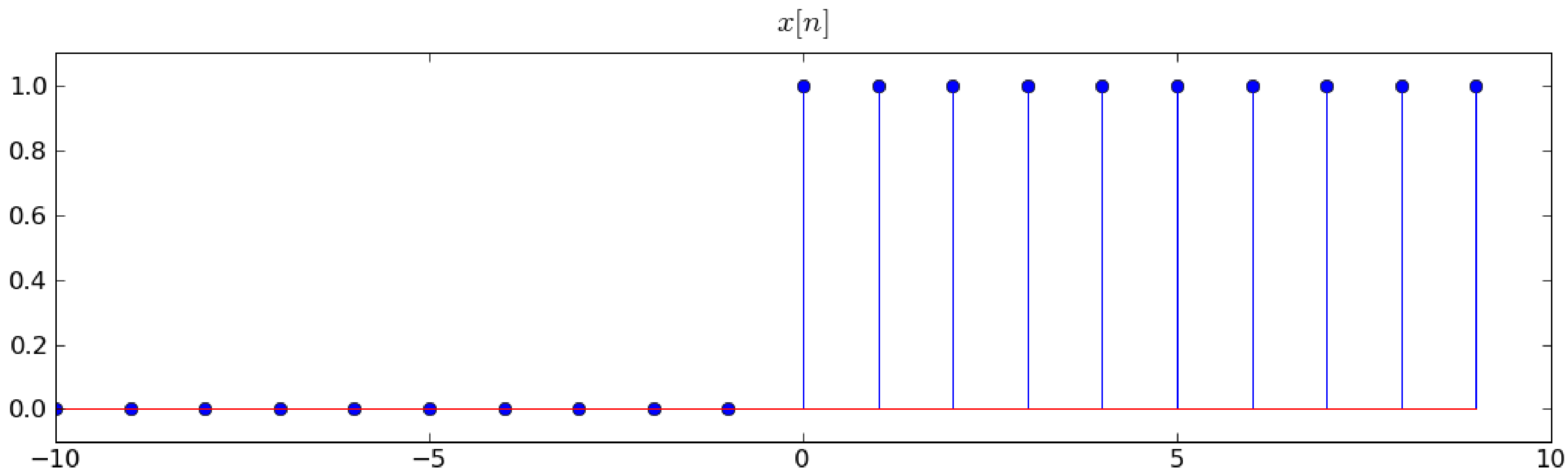
Deconvolution Result

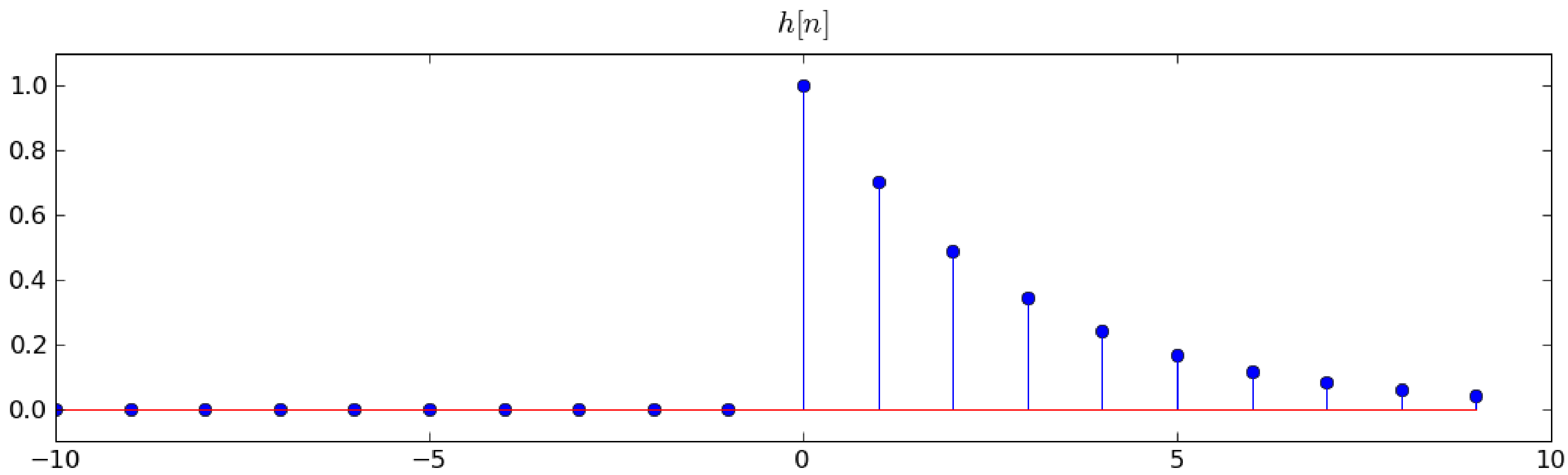


Deconvolution Result (Truncated h)

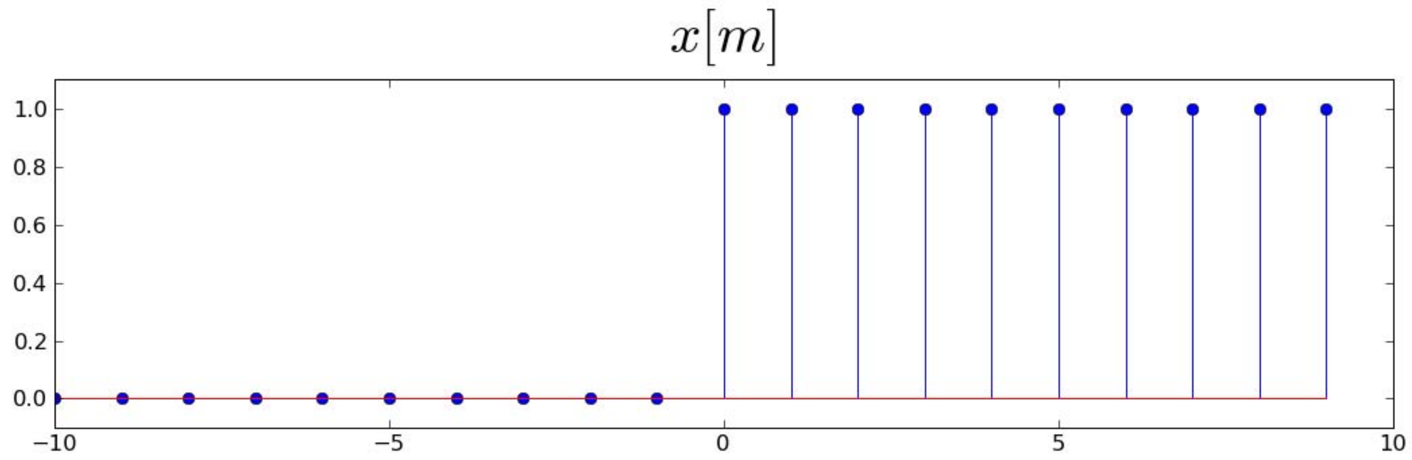


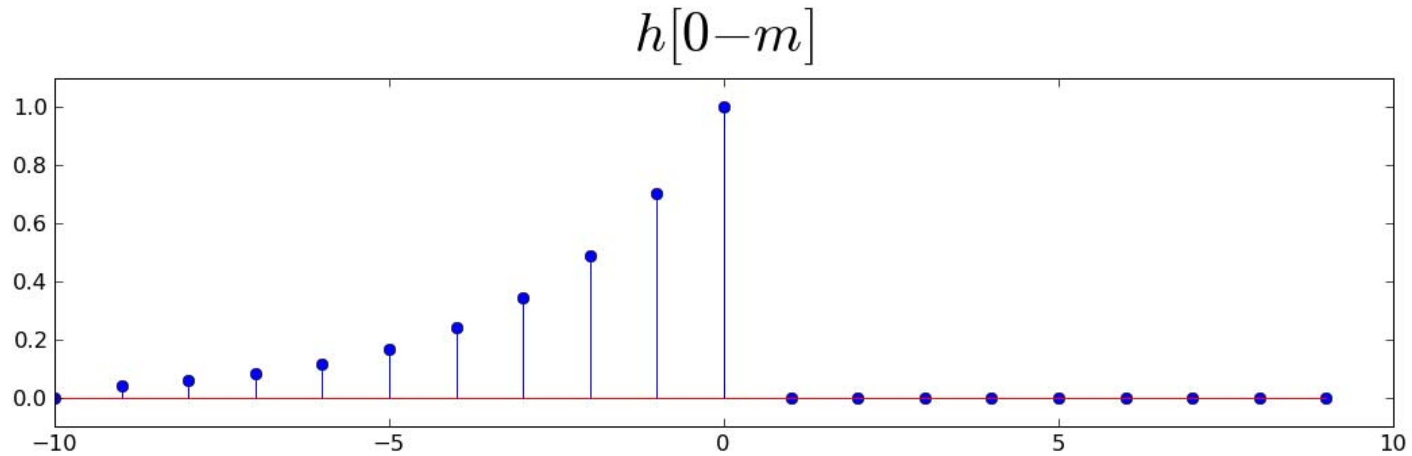
Example x[n] and h[n]



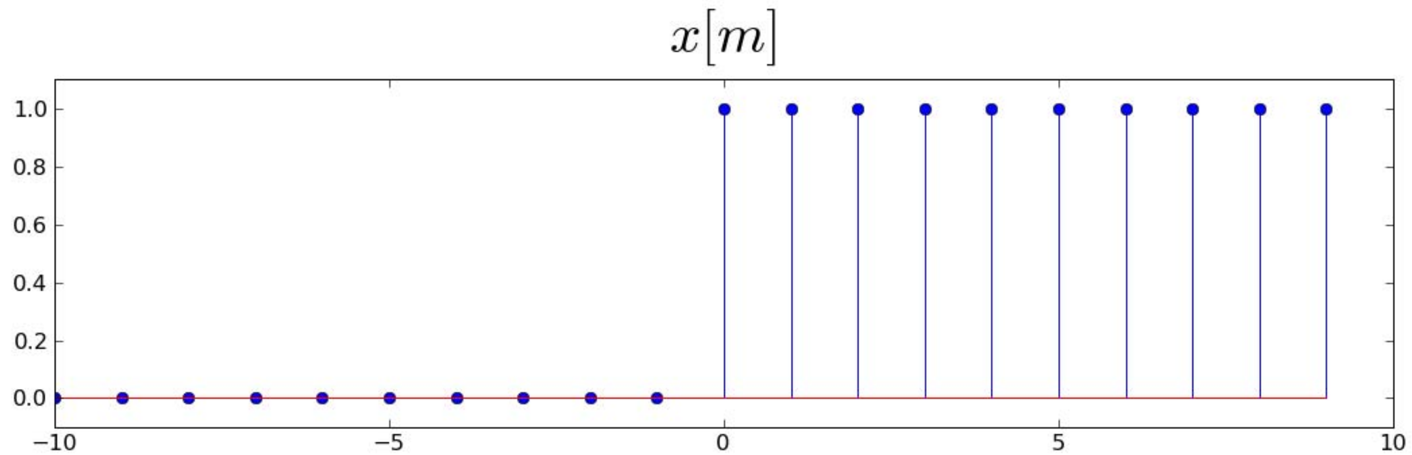


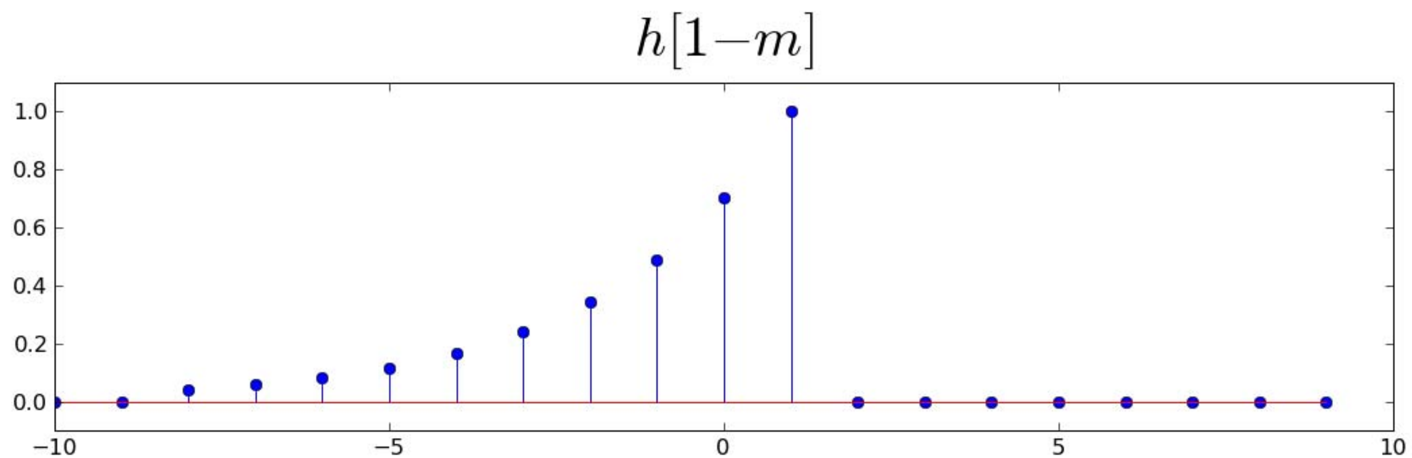
Evaluating y[0]





Evaluating y[1]





Evaluating y[2]