

Set #1

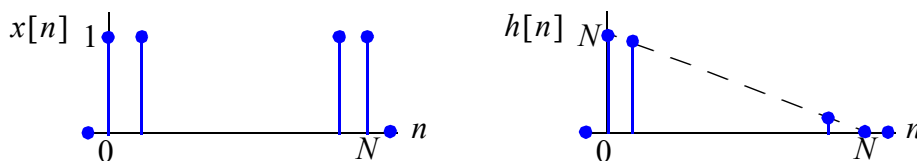
Due by Tuesday September 9, 2025 via Slack

Make note of the following:

- PDF papers, via Slack, are due at midnight on the due date
- Please start each new problem on a new page
- I prefer scanned engineering paper or a fine tablet grid

Problems:

1. Convolution of the finite sequences $x[n]$ and $h[n]$ as given below:



From basic properties of convolution we know that the nonzero values of the convolution lie at most on the interval $(0 + 0, N + (N - 1)) = (0, 2N - 1)$.

- (a) For the case $N = 5$ and find the convolution $y[n] = x[n] * h[n]$ using an approach of your choosing. Show your work. Ideas given in the hints page.
 - (b) Find the general solution for $y[n]$ for any $N > 0$. In the end you will have a piecewise function $y[n]$ that returns a value for $0 < n \leq 2N - 1$.
 - (c) Using (b) find the output values for $N = 10$. Call this $y_{\text{thy}}[n]$. Using a simple numerical convolution (in Python `y,ny=sigsys.conv_sum(x1, nx1, x2, nx2)` or in wxMaxima `y:listconv(x1,x2)`) find the output values. Call this $y_{\text{num}}[n]$. Both sequences of numbers should contain the same integer values.
 - (d) Use `stem()` in Python or `stemlist()` in wxMaxima to plot either output with the appropriate x-axis starting point.
2. Text problem 2.18 b, c, and e (justify your answers)
 3. Text problem 2.19 b, c, and e (justify your answers)
 4. Text problem 2.20.
 5. Text problem 2.23 b and d.
 6. For 10 bonus points Text problem 2.26.
 7. Text problem 2.30. I prefer a Python or wxMaxima simulation with support from the module `sigsys.py` in `scikit-dsp-comm` or in wxMaxima load `DSPTools.mac`, in both cases when worked as a simulation problem.