

PROBLEM:

Evaluate the “running” average:

$$y[n] = \frac{1}{L} \sum_{k=0}^{L-1} x[n-k]$$

for a specific input signal—a signal that turns on at $n = 0$. This is called the *unit step* signal, and is usually denoted by $u[n]$.

$$x[n] = u[n] = \begin{cases} 0 & \text{for } n < 0 \\ 1 & \text{for } n \geq 0 \end{cases}$$

- Make a plot of $u[n]$ before working out the answer for $y[n]$.
- Now compute the numerical values of $y[n]$ over the range $-5 \leq n \leq 10$, assuming that $L = 5$.
- Make a sketch of the output for both over the range $-5 \leq n \leq 10$, assuming that $L = 5$. Use MATLAB if necessary, but learn to do it by hand also.
- Finally, derive a general formula for $y[n]$ that will apply for any length L and for the index range $n \geq 0$.