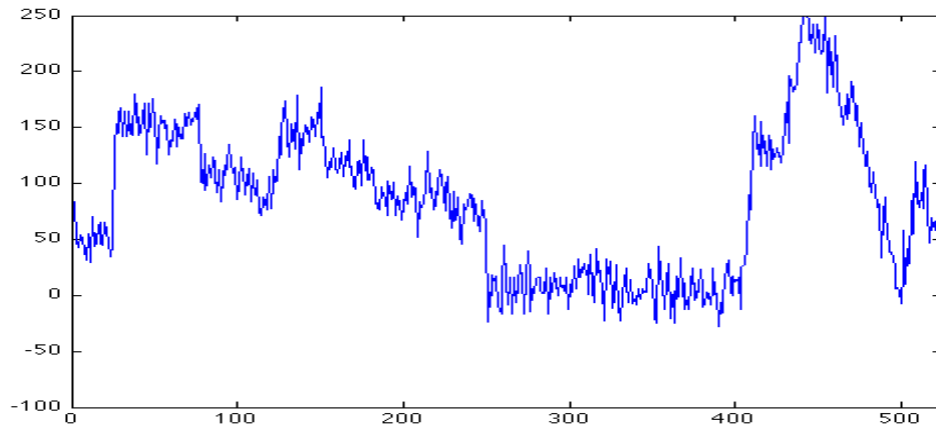


# Image and Data Tasks in Analysis 1

## Part I: Noise in a signal

Now we will explore image and data tasks as applications to real analysis. To begin this discussion will need to understand “noise” in data. Below is a 1-dimensional signal that has been corrupted by noise.



1. What features of the signal above come from the noise?
2. What do you think the original signal looked like? Using a contrasting color, sketch the original signal overlaid with the noisy image in the figure above.

## Part II: The set of data vectors as a metric space

In this section, we want to consider how to measure the difference between two data vectors using some of the metrics we’ve discussed.

1. Thinking of the metrics listed in the metric space handout class, what would the distance between a noisy signal and the original signal be? Just describe this in words.
2. Create another metric that may measure this same distance better.

## Part III: Play with some toy examples

Test your ideas above with the following signals by adding a little “random” noise to the following signals

1.  $x = ( 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1 \ 1 \ 1 \ 1 \ 1 \ 0 \ 0 \ 0 )$
2.  $x = ( x_1 \ x_2 \ x_3 \ x_4 \ x_5 \ x_6 \ x_7 \ x_8 \ x_9 \ x_{10} \ x_{11} \ x_{12} \ x_{13} \ x_{14} )$ , where  $x_n = \sin(\frac{7\pi}{n})$