# Exercise 0

Run the python script **example.py** from the lecture materials folder. Do you understand how the autocorrelation can be used as e.g. heart rate detector (in the case of an ecg)? Go through the different properties of and see which one smake sense, and which ones doesn't.

# Exercise 1

Download **exercise1.py** and **ecg.xlsx** from the lecture material directory. The script defines a template of one ECG beat. Use the template together with the cross-correlation to find the location of all heart beats in the ECG. Then, based on these locations align the beats (e.g. in a n by 70 matrix, where each row is an aligned heart beat), and use the aligned beats to form a mean or median beat.

# Exercise 2

Consider an EMG signal detected with additive noise. The EMG signal and the noise are WSS stochastic processes with zero mean. They are independent. The EMG signal has known autocorrelation function and the noise has autocorrelation function . Let the summation of the EMG signal and the noise be Y(t), determine the autocorrelation function of . Is WSS?

# Exercise 3

Consider a stochastic process with uniform distribution of the amplitude between and . The variance of is . The samples of are independent from each other. . is a random variable with uniform distribution in the interval . is independent of .

*Compute* ***mean****,* ***autocorrelation****,* ***autocovariance****, and* ***variance*** *of the stochastic process,*

Hint1:

Hint2: can be solved using integration by substitution.

# Exercise 4

Consider an EEG signal with known autocorrelation function and zero mean. The signal is filtered by a filter with impulse response . Find the mean and autocorrelation function of the output signal.

To solve exercise 4, we must know:

* the what the convolution integral:
* the sifting property due to the two dirac impulses: