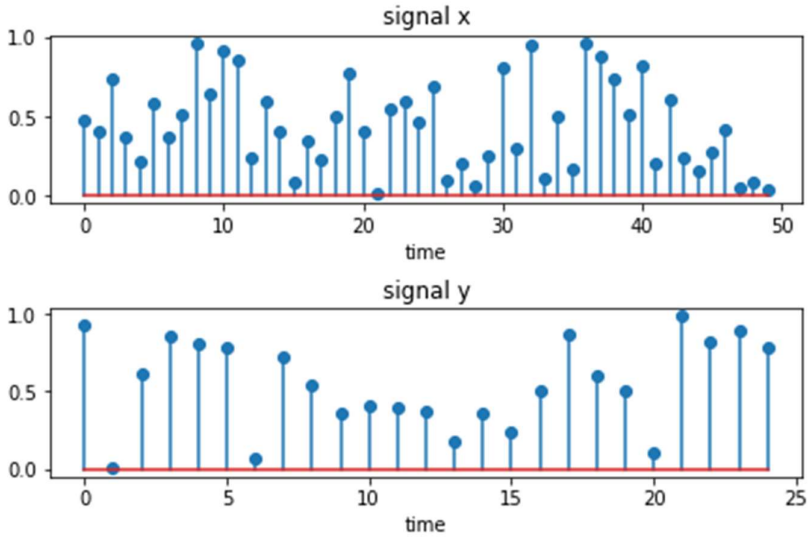
Digital Signal Processing Lab (EE 521)

Assignment - 1

Task:

1. Implementation of Convolution, Correlation and Autocorrelation between two discrete sequences in python.

Input signals :



Convolution :

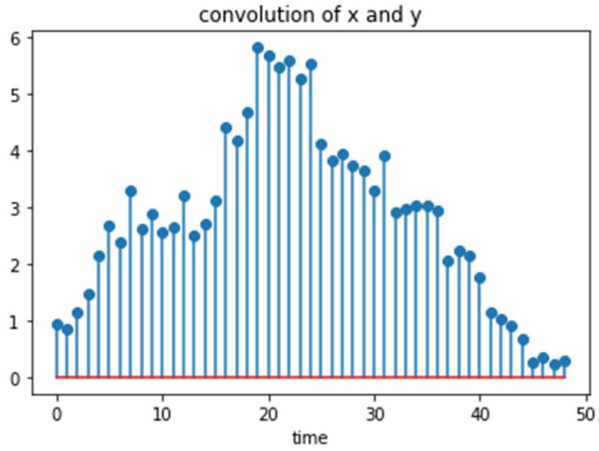
Convolution operation relates the output sequence y(n) of a linear-time invariant (LTI) system, with the input sequence x(n) and the unit sample sequence h(n) as

$$y[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k]$$

Length of output signal = m+n-1

m – length of input signal

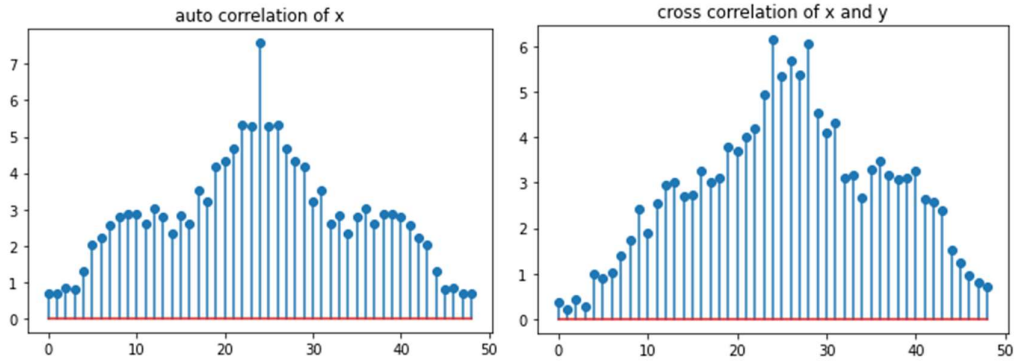
n – length of impulse response signal



Correlation: Depending on whether the signals considered for correlation are same or different, we have two kinds of correlation: *autocorrelation* and *cross-correlation*.

Autocorrelation: This is a type of correlation in which the given signal is correlated with itself, usually the time-shifted version of itself. Mathematical expression for the autocorrelation of discrete time signal x[n] is given by

$$R_{xx}[m] = \sum_{n=-\infty}^{\infty} x[n]\, x^{\star}[n-m]$$



Cross-Correlation: This is a kind of correlation, in which the signal in-hand is correlated with another signal so as to know how much resemblance exists between them. Mathematical expression for the cross-correlation of discrete time signals x[n] and y[n] is given by

$$R_{xy}[m] = \sum_{n=-\infty}^{\infty} x[n]\, y^{\star}[n-m]$$

Code : https://colab.research.google.com/drive/1UMnvru1PfrrwSNAutcDia8Gigq7lo5XG