1 Objectives/Outcome:

1) Learn Circular Auto Correlation of signals, its properties and interpret the results
2) Learn Circular Cross Correlation of signals, its properties and interpret the results
3) Perform Circular Cross correlation on generated signals and speech signals as an application
4) Understand difference between Circular Correlation and Linear Correlation

2 Tasks

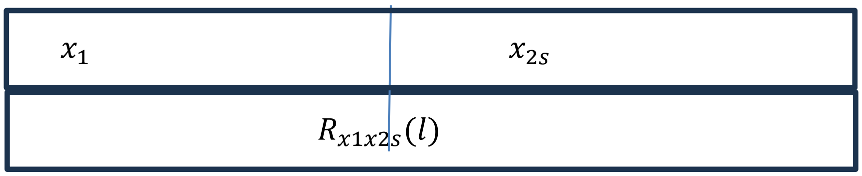
2.1 Task1: Signal preparation

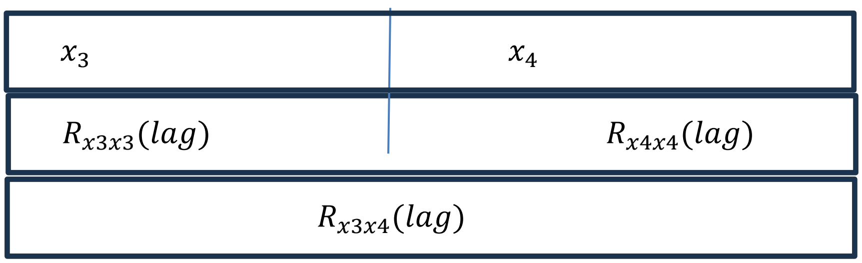
1) Generate discretised samples $x_1[n]$ of $x_1(t) = \cos(2\pi f_i t)$ for a total time of 0.025s where f_i is input frequency say 400Hz at sampling frequency $f_s = 8000Hz$
2) Generate noisy sinusoidal signal $x_2[n]$ from:
$$x_2(t) = x_1(t) + randomised\ noise\ using\ randn()$$
3) Generate shifted noise sinusoidal signal $x_{2s}[n]$ from:
(shiftvalue=30 for right shift by 30)
$$x_{2s}[n] = [zeros(1, shiftvalue), x2];$$
4) Record two voice signals
$x_3(n)$ – your recorded signal speaking say numbers 1, 2, 3, 4 in about 2s.
$x_4(n)$ – your recorded signal speaking say only 4.

2.2 Task2: Circular Auto-correlation

1) Perform circular correlation on each of the signals: $x_2[n]$ and $x_3[n]$. Use FFT to perform the same in frequency domain.
2) Perform cross circular correlation of:
    a. $x_1[n]$ with $x_2[n]$ (find sinusoidal in noise signal)
    b. $x_{2s}[n]$ with $x_1[n]$
    c. $x_3[n]$ with $x_4[n]$ (find match for saying 4 in another long speech)
3) Subplot in a figure all the signals as you can view them properly in figures as below: Interpret all the results.

$x_1[n]$	$x_2[n]$
$R_{x1x1}(l)$	$R_{x2x2}(l)$
$R_{x1x2}(l)$	


x_1
x_{2s}
$R_{x1x2s}(l)$


x_3
x_4
$R_{x3x3}(lag)$
$R_{x4x4}(lag)$
$R_{x3x4}(lag)$