SIGNAL AND SYSTEM PROGRAMMING ASSIGNMENT REPORT

Group partners- 1) Shreya Sachan(B20EE065)
2) Aditi Tiwari(B20EE005)

Theoretical Explanation

From the given data structure we have 193 samples of x[n] and y[n] . In question we also have h[n] value for the system from x[n] to y[n] in which blur happens, but when we try to go from y[n] to x[n] there are some noise and blur is added in sample for removing the noise we can go through
Two method are as under --

1) Firstly remove the noise and then remove the blur.
2) Firstly remove the blur and then remove the noise.

1) **Firstly remove the noise and them remove the blur --**

To remove the noise we had chosen the method of averaging the sample in a group of three. To average the value of y[n] we had to make a function denoising and implement that on our y[n] value. After this we got sample in which there is only blur .To remove
the blur we had taken the convolution of x[n] with h[n] and then we had taken the fourier transform of h[n] and y[n] to get the fourier transform of x[n]. After this we had taken the inverse fourier transform of x[n] and named that x1[n].

2) **Firstly remove the blur and then remove the noise --**

To remove the blur we had taken the convolution of x[n] with h[n] and then we had taken the fourier transform of h[n] and y[n] to get the fourier transform of x[n]. After this we had taken the inverse fourier transform of x[n]. In this way we can remove the blur from samples .After this we have to remove the noise from the signal .To remove the noise we had to take the average of three consecutive terms for each term .In this we can also remove the blur and noise from the sample.

This is the way which we had chosen to remove the noise and blurring from the sample.

[B20EE005
B20EE065]

* PROGRAMMING ASSIGNMENT *

* SNS *

We had given $h[n] = \frac{1}{16}[1\ 4\ \underset{\uparrow\, n=0}{6}\ 4\ 1]$

We had given temprature of an area. ~~Over time the~~ $x[n]$ is origional signal (value of temperature) but the received signal $y[n]$ had blur, distortion and noise. So we have to round the origional temperature value $x[n]$ from $y[n]$.
For that we have to remove the blur and noise from signal $y[n]$.

$$x[n] \xrightarrow[h[n]]{} y[n]$$

but we have to go $y[n] \xrightarrow[\substack{\text{denoise} \\ \text{deblurring}}]{} x[n]$

(i) To remove the noise from $y[n]$:-

$$y[n] = [a, b, c, d, e - - - ~~n~~, n-] \longrightarrow 193 \text{ samples}$$

we had taken the average of $y[n]$ in the group of five.

$$\text{Denoise } y'[n] = \left[\frac{0+0+a+b+c}{5}, \frac{0+a+b+c+d}{5}, - - - \right]$$

$$y'[n] = \left[\frac{a+b+c}{5}, \frac{a+b+c+d}{5}, - - \right]$$

This is the way we had choosen to denoise the signal $y[n]$.

~~After~~

$$x[n] \longrightarrow \boxed{\quad} \longrightarrow y'[n]$$

System $h[n]$

convolution $\div$ $y'[n] = x[n] * h[n]$

After taking the fourier transform

$$Y'(S) = X(S) \cdot H(s)$$

$$\left[\; X(S) = \frac{Y'(S)}{H(S)} \;\right]$$

After this we had sampled the $y[n]$.
After this we had taken the Inverse fourier transform of $X(S)$.

And After taking IFT we get the signal $x_I[n]$.

$$\boxed{\text{Fourier Transform} \div FT = \sum_{n=-\infty}^{\infty} x[n]\, e^{-j\omega n}}$$

$$\boxed{\text{Inverse Fourier Transform} \div IFT = \frac{1}{N} \sum_{n=0}^{N-1} x[n]\, e^{j\omega n}}$$

In this way we can remove the noise and Blur from signal.

(ii) Similarly in second case firstly we had taken the Fourier transform of y[n] and h[n] values

$$Y(S) = X(S) \cdot H(S) \quad , \quad \left[X(S) = \frac{Y(S)}{H(S)} \right]$$

$$\left[FT \Rightarrow \sum_{N=-\infty}^{\infty} x[n] \, e^{-j\omega n} \right]$$

After this we had ~~to~~ done sampling For Y(s) and H(s).

And then we had taken the Inverse Fourier transform of $\frac{Y(S)}{H(S)}$.

Now we got $X''(S)$ which is no blurring effect. $\left[IFT \Rightarrow \frac{1}{N} \sum_{n=0}^{N-1} x[n] e^{j\omega n} \right]$

Now we have to remove the noise from $X''(S)$.

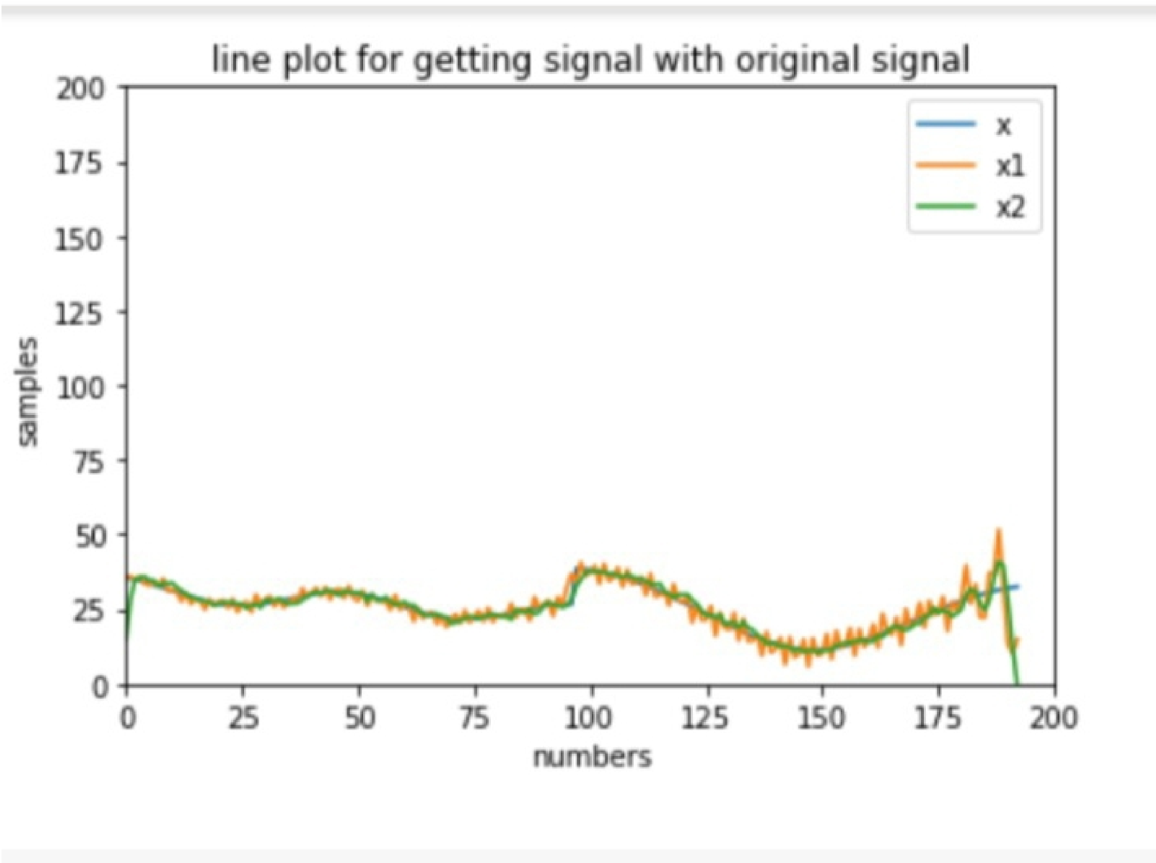
To Deblur the sample we had taken the average of every consecutive five terms. In this way we can also remove the noise from the y[n].

Now we had got the $x_2[n]$. which is approximately similar to x[n] graph.

Means It is almost free from noise and blur.

Result

On comparison of x[n] with x1[n] and x2[n] we had approx similar line plot graph.



Conclusion

From the graph we can clearly see that the x2[n] function is much more overlapping; the original graph of x[n].x1[n] still has some noise. So in this case it is better to first deblur the sample and then remove the noise from deblurred samples.

Contribution of Partners

We both have conducted multiple meets and have done the majority of the task together via Screen Sharing .

1) We both firstly make a rough picture of what we have to actually do.
2) After that we had taken the data frame of x[n] and y[n] with the help of pandas library and made a separate array for the values of x[n] and y[n].
3) Then we wrote the code to make the function for denoising of signal ,fourier transform of signal and inverse transform of signal .
4) After getting the Fourier transform we had done sampling of the y[n] signal .
5) For better understanding between the x1[n], x2[n] and x[n], we wrote the code to line plot of the signal with the help of matplotlib library and labeled that .