Name and surname: _____

Degree and Group: _____

NIA and Signature: _____

1. Data download

Each student must work with a different data file that can be downloaded from the following url (do not forget to replace your student number when copying the url in your browser):

```
http://www.tsc.uc3m.es/~jarenas/Kt5m7J/YourNIA.mat
```

If you are using python, the following code lines will allow you to read the data in a .mat file:

```
>>> import scipy.io
>>> data = scipy.io.loadmat('file_to_load.mat')
>>> variable1 = data['variable1']
>>> variable2 = data['variable2']
>>> ...
```

2. Questionnaire

A given signal record $x[n]$ has been generated by filtering another signal $u[n]$ with a linear and time invariant FIR filter, $s[n]$, with `M` non-zero coefficients (that can be stored in a length-M vector `s`). Signal $x[n]$ is produced by adding to the output of the filter a white and Gaussian noise, independent of the input signal, and with mean zero and variance `varN`.

Assume that the *a priori* distribution of vector `s` is a multidimensional Gaussian with mean $\mathbf{0}$ and covariance matrix given by the Identity matrix multiplied by `varS`.

Vectors `u` and `x` (both of length N) store the samples of $u[n]$ and $x[n]$, respectively, for $n = 0, 1, 2, \ldots, N-1$. Assume that $u[n] = 0$ for $n < 0$.

1. Obtain the MMSE estimator of `s` given `x`, and save the result in variable `sMSE`.
2. Compute the variance of $x[N]$ given $x[0], \ldots, x[N-1]$, and save the result in variable `vx`.
3. It is known that the third component of filter $s[n]$ is given by $s[2] = 0$. Obtain the MMSE estimator of `s` given `x`, and save the result in variable `sMSE0`.
4. Apply 25 iterations of the LMS algorithm to estimate filter $s[n]$ from `x`. To do so, initialize the filter estimate with an all-zero vector, and use an adaption step $\mu = 0{,}005$. Save the result in variable `s25`.
5. Compute the total square error given by

$$SSE = \sum_{n=0}^{N-1} (x[n] - y[n])^2$$

where $y[n]$ is the output of the filter obtained in the previous section (i.e., `s25`) for input $u[n]$. Save the result in variable `SSE`

3. Saving and uploading results

Save (at least) the variables mentioned in the exercises in a file called `results.mat`. The following matlab command performs this task for you:

```
save('results.mat', 'variable1', 'variable2', ...)
```

If you are using python, use instead:

```
>>> scipy.io.savemat('results.mat', {'variable1': variable1, 'variable2': variable2, ...
    ... })
```

Zip file `results.mat` together with your code in a file called `Lab3.zip`, and upload the .zip file to Aula Global before the deadline expires.