Exercise 1 - Approximating and smoothing functions using wavelets.

In this exercise you will compare how different wavelets act on a function. We use *matlab* and the *wavelet toolbox*.

Download the code from the course's internetpage. Then start up matlab version 6.5 or higher (using the command `matlab65`). In the matlab command window, type `cd <directory>` to change to the directory where you have the source code for the exercises. You will need to change the source code later, so open `exercise1.m` by using the `open` button or menu item.
The source code will appear in your matlab window and you are ready to edit it (never forget to save after making changes). *Useful tip:* whenever you are uncertain about the usage of a function, use the `help` command.
You will find the parameters that you can change at the top of the file:

`N`	Number of sampling points for the function
`dommin`	Minimum value for the domain of the function
`dommax`	Maximum value for the domain of the function
`levels`	Number of decomposition levels in the wavelet transform
`delta`	Amount of uniform noise added to function is in $\Delta * [-0.5, 0.5]$.
`threshold`	The wavelet coefficients in $[-$`threshold`$, +$`threshold`$]$ are set to zero

Before executing the program you need to select a function. Do this by opening `func.m` and setting the variable `x`. You may also add your own functions here. Set the domain to reasonable values, choose `N` around 100 and set `delta` and `threshold` to zero. Run the program with the command `exercise1('wavelet')`. For `'wavelet'` you can choose any wavelet that is supported in the wavelet toolbox (try `help waveinfo`). A figure will pop up, in clockwise order you get

- The discretised function in blue, the noisy function in red (shifted down).
- The reconstructed function after forward transform, thresholding and backward transform.
- The error: original signal minus reconstructed signal.
- The absolute value wavelet coefficients in log scale. The blue line indicates the threshold level. Red crosses are coefficients that are left after thresholding.

Try some different wavelets. You will observe an error in the order of the machine precision. It seems that the signal is perfectly reconstructed.
To see if you can reconstruct using a smaller number of coefficients you can set the threshold. Compare the Haar and Daubechies wavelets for different thresholds, what do you notice?
Now add a little noise, say `delta=0.1`. What happens to the wavelet coefficients? Set the threshold to 0.08 and try different Daubechies wavelets. Can you explain what happens?
Is there a difference between smooth and non smooth functions? Compare for example `Func3` and `Func5`.