CS 5420 **Topics in Image Processing and Multimedia**
Assignment # 1 Due Date: February 18, 2015

Important: Please do all assignments on `hoare`

Wavelets and multiresolution processing

1. Write functions to perform wavelet analysis and synthesis, using Haar wavelet and Daubechies 9/7 wavelets. The Daubechies coefficients are given by

k	Analysis Lowpass	Analysis Highpass	Synthesis Lowpass	Synthesis Highpass
-4	0.026748757411	0	0	0.026748757411
-3	-0.016864118443	0.091271763114	-0.091271763114	-0.016864118443
-2	-0.078223266529	-0.057543526229	-0.057543526229	-0.078223266529
-1	0.266864118443	-0.591271763114	0.591271763114	-0.266864118443
0	0.602949018236	1.11508705	1.11508705	0.602949018236
1	0.266864118443	-0.591271763114	0.591271763114	-0.266864118443
2	-0.078223266529	-0.057543526229	-0.057543526229	-0.078223266529
3	-0.016864118443	0.091271763114	-0.091271763114	-0.016864118443
4	0.026748757411	0	0	0.026748757411

   Make sure that your input image is $2^n \times 2^n$ pixels. If an image is not $2^n \times 2^n$ pixels, change it into one by padding with 0s.

   Save your analyzed output in the form where the scaled component is in the top left corner and the difference components are in the other three corners. Use binary file write to save your analyzed image, and render it (or save it as an image) as well.

   Your code will be invoked by

```
wavelet -w hd [-a|-s] -d depth image_file [outputfile]
```

   where `-w` specifies the wavelet; `hd` can be 0 (for Haar) or 1 (for Daubechies), with Daubechies being the default; `-a` for analysis and `-s` for synthesis (one of those must be specified, or you can use the file extension to decide that). `depth` is a positive number to decide how many times you want to apply the wavelet analysis or how many times you synthesize during reconstruction. The analyzed file should be saved with the extension `.wl` (you can use this extension to decide whether to apply synthesis). The default synthesized output will be as JPEG.

   The analysis file should have a header with a magic number to indicate that it is an analyzed file which will also indicate the type of wavelet used for analysis. When you have to synthesize the image back, make sure to check this magic number to apply the appropriate filters. The header should also contain the depth of analysis.

   You will be better off applying the filters using convolution and downsampling on rows and columns separately as discussed in class.

What to handin

Handin an electronic copy of all the sources, README, Makefile(s), and results. Create your programs in a directory called *username*.1 where *username* is your login name on hoare. Once you are done with everything, *remove the executables and object files*, and issue the following commands:

```
% cd
% ~sanjiv/bin/handin cs6420 1
```