ECE503 Homework Assignment Number 3

Due by 8:50pm on Monday 06-Feb-2012

IMPORTANT: Please place your ECE mailbox number on all homework assignments. Your ECE mailbox number can be found on the course web page.

Make sure your reasoning and work are clear to receive full credit for each problem. Points will be deducted for a disorderly presentation of your solution. Please also refer to the course academic honesty policies regarding collaboration on homework assignments.

1. 4 points. Mitra 5.12.
2. 3 points. Mitra 5.20.
3. 3 points. Mitra 5.67
4. 4 points. Mitra 5.76
5. 4 points. Use Matlab to plot a spectrogram of the .wav file on the course web page and determine the phone number entered by comparing the frequencies present in the signal to the frequencies of DTMF tones.
6. 7 points. Use the Matlab functions `fft2` and `dct2` to do the following image compression experiments:

   - Load the image "post512.tif" from the course website using the `imread` command. This will result in a 512×512 matrix of values from 0 to 255. You can make Matlab plot this original uncompressed image with the `imshow` command.
   - Perform a two-dimensional DCT on this image, resulting in a 512×512 real-valued matrix.
   - Set all but the N largest magnitude values of this DCT matrix equal to zero.
   - Perform an inverse two-dimensional DCT and plot the resulting image using `imshow`.
   - Repeat the above with the two-dimensional FFT.
   - You should generate three plots: original uncompressed image, DCT compressed image, FFT compressed image.

   Experiment with different values of N to see if you can find cases where the DCT compression looks better to you than the FFT compression. For small values of N, the compressed images will probably not look very good. Note that the FFT will be complex, and after zeroing out some of the values, the inverse FFT may not be real anymore. You should come up with a good way of handling that. Also note when $N = 512 \times 512$, both techniques should produce an image identical to the original image (you aren't throwing away any information).