CSE 490 GZ
Assignment 6
March 1, 2002

In the problems below you will compare the performance of the discrete cosine transform and the Haar wavelet transform on some small but interesting data sets. The idea is that both the transforms attempt to "compact" the data into a few coefficients. In both cases we will quantize the data using more bits for the most important coefficients. If we have a vector of coefficients $[c_0, c_1, c_2, c_3]^T$ that we quantize with the vector $[q_0, q_1, q_2, q_3]^T$ we mean construct the labels $L_i = \lfloor c_i/q_i + 0.5 \rfloor$ for $0 \le i \le 3$. Decoding the labels consists of computing $c'_i = L_i q_i$.

1. Consider the discrete cosine transform D of order 4.
   (a) Compute the transform of the vector $x = [10, 10, 10, 10]^T$. Use the quantization table $[1, 2, 4, 4]^T$ to quantize the coefficients. Decode the quantized coefficients and apply the inverse transform to reconstruct a vector x'. Compute the distortion of x' from x.
   (b) Compute the transform of the vector $[10, 10, -10, -10]^T$. Use the quantization table $[1, 2, 4, 4]^T$ to quantize the coefficients. Decode the quantized coefficients and apply the inverse transform to reconstruct a vector x'. Compute the distortion of x' from x.
2. Consider the Haar wavelet transform, where two levels are performed on vectors of length 4.
   (a) Compute the transform of the vector $x = [10, 10, 10, 10]^T$. Use the quantization table $[1, 2, 4, 4]^T$ to quantize the coefficients. Decode the quantized coefficients and apply the inverse transform to reconstruct a vector x'. Compute the distortion of x' from x.
   (b) Compute the transform of the vector $[10, 10, -10, -10]^T$. Use the quantization table $[1, 2, 4, 4]^T$ to quantize the coefficients. Decode the quantized coefficients and apply the inverse transform to reconstruct a vector x'. Compute the distortion of x' from x.