ECE 6354/5354 Fall 2016 HW 7, due 10/25

Problem 1.
Encode the following binary image using 1-D facsimile encoding on the top line and 2-D on the bottom line.

11110 11110 01101 01011 00001
11101 00011 11101 11000 00010

Problem 2.
Decode the following 2-line binary image using 1-D facsimile encoding on the top line and 2-D on the bottom line.
0000 0000 0001 0011 0101 0100 1111 1100 0111 0011 0110 0011 1000 0000 0000 1000 1000 1010 1001 1000 0110 0010 0000 0000 0010 0000 0000 0010 0000 0000 0010 0000 0000 0010 0000 0000 0010 0000 0000 001

0000 0000 0001 0011 0101 0100 1111 1100 0111 0011 0110 0011 1000 0000 0000 1000 1000 1010 1001 1000 0110 0010 0000 0000 0010 0000 0000 0010 0000 0000 0010 0000 0000 0010 0000 0000 0010 0000 0000 001

Problem 3. JPEG
a) Given an 8x8 block of luminance pixels, compute the maximum and minimum possible values for the DC or (0,0)th coefficient of the 2-D DCT transform of the **level-shifted** image block.

b) Compute the maximum and minimum possible values for the DPCM of the DC or (0,0)th coefficient of the 2-D DCT transform of the **level-shifted** image block.

Problem 4. JPEG
Consider the 8x8 DCT-coefficients below, from a 2-D 8x8 DCT of luminance values with **no level shifting**.
Quantize the 8x8 DCT coefficients using the appropriate default JPEG tables.

a) Assume that this is the 1st block, and encode the DC-coeff using DPCM according to the JPEG standard.
b) Encode the quantized AC coefficients using (RL, Size) codewords and bits according to the JPEG standard. Include an end-of-block EOB codeword.

997	980	3	5	11	12	17	23
4	26	3	9	8	21	10	19
-122	2	1	6	9	2	1	21
2	4	284	1	4	7	11	23
2	8	11	9	21	30	21	4
7	3	-110	23	29	41	12	9
1	12	9	7	33	33	10	3
21	19	-189	33	10	9	11	12

Problem 5. JPEG
From decoding the previous luminance block, the quantized DC-value of the previous 8x8 block is 18. A luminance block is coded with baseline/sequential JPEG using the default tables and produces the following bit-stream for the DC and AC coefficients of the block: 10010100111010010101010. Decode the 8x8 set of "de-quantized" 2-D DCT coefficients.