ECE 6354/5354 Fall 2016 HW 3. Due 9/15

Problem 1. Given the run-length encoding rules for binary row-ordered images

(a) Let the first run-length denotes a run of zeros.

(b) Let the number-of-bits used to store a codeword (denoting a run-length) be denoted N. Choose for example N=3, or 4, or 5, etc.

(c) Let the codeword value $2^N - 1$ indicate a run-length of $2^N - 1$ that is then continued by the next codeword until a codeword less than $2^N - 1$ is encountered (the next codeword can be 0).

RL encode the image $\underline{\mathbf{X}}$ based upon row-ordering with N=4.

$$\underline{\mathbf{X}} = \begin{bmatrix} [0] & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix}.$$

Problem 2. Given the run-length encoding rules for binary row-ordered images as in Problem 1 above, decode the following bit-stream using N=3 to obtain a row-ordered 7x4 binary image.

0 0 0 1 0 1 1 1 1 1 1 1 0 1 0 1 0 0 0 1 1

What is the compression ratio of the encoded image?

Problem 3. Row-order and encode the image $\underline{\mathbf{X}}$ below using RLE7. Use an arbitrary 13-byte header at the beginning of the file, perhaps use all 0's.

$$\underline{\mathbf{X}} = \begin{bmatrix} [255] & 0 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 0 & 0 \\ 16 & 16 & 16 & 16 & 99 & 99 & 99 & 99 & 99 & 2 & 2 \\ 2 & 2 & 48 & 80 & 80 & 80 & 80 & 80 & 80 & 56 & 56 \end{bmatrix}$$

Problem 4. A row-ordered 4x3 greyscale image is encoded in the following RLE7 encoded byte sequence, listed below in decimal-values 0-255. Decode the image.

4, 129, 133, 3, 77, 2, 99, 8, 3, 0

Problem 5. Find the Huffman code table for the following 8x8 image.

0	0	1	1	1	1	2	2
2	2	2	2	3	3	3	3
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
4	4	5	5	5	5	5	5
6	6	6	6	6	6	6	6
6	6	6	6	6	6	6	6
6	6	7	7	7	7	7	7