Feedback — Quiz #2

Help Center

You submitted this quiz on **Sun 25 Jan 2015 12:36 PM IST**. You got a score of **10.00** out of **10.00**.

Question 1

Suppose we have an image with 256 different gray levels. All the gray values appear an equal number of times. Will variable-length coding lead to any compression in this image without additional processing?

Your Answer		Score	Explanation
○ Yes			
◉ No	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

If all gray levels have equal probability then all the codes will have equal length and no compression is obtained.

Question 2

How can lossless image compression be achieved for the image in Question 1?

Your Answer		Score	Explanation
◉ Via predictive coding.	✔	1.00	
○ Erasing pixels.			
○ Performing a DCT.			

Lossless compression will never be achieved for such image.	
Total	1.00 / 1.00

Question Explanation

Predictive coding can exploit spatial redundancy, leading to non-uniform distributions of the prediction error and then compressing via variable length coding.

Question 3

How many unique sets of Huffman codes can you construct for an image with only 3 different pixel values (e.g., all the image is composed of 0s, 255s, and 128s)?

Your Answer		Score	Explanation
5			
2	✔	1.00	
Infinity			
3			
Total		1.00 / 1.00	

Question Explanation

The two codes are: (1) 0, 11, 10 and (2) 1, 00, 01. The codes are complements of one another. They are constructed by following the Huffman procedure for three symbols of arbitrary probability.

Question 4

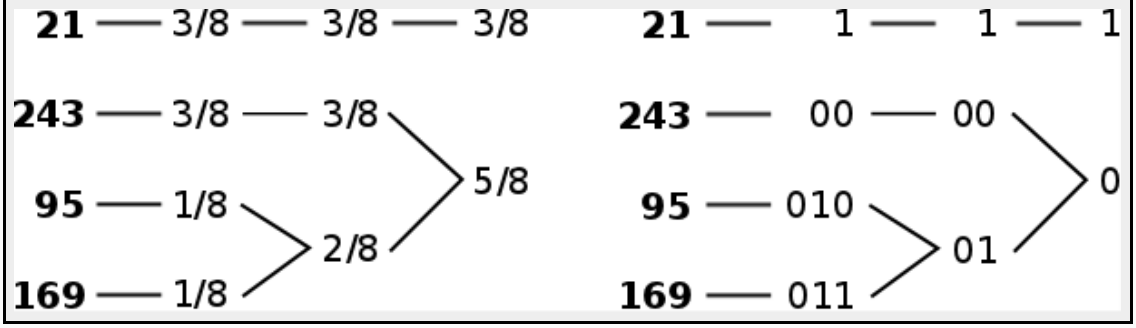
For an image with intensities 21, 95, 169 and 243; and respective probabilities 3/8, 1/8, 1/8, and 3/8; the length of the corresponding variable-length code created by the Huffman coding procedure

are

Your Answer		Score	Explanation
1, 2, 2, 1			
1, 4, 4, 1			
2, 2, 2, 2			
1, 3, 3, 2	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

A possible Huffman code is



Question 5

The main source of error (lossy compression) in JPEG is

Your Answer		Score	Explanation
The DCT.			
The variable-length (Huffman) coding.			
The quantization.	✔	1.00	
The division into 8x8 blocks.			
Total		1.00 / 1.00	

Question Explanation

While DCT might introduce minor rounding errors, the key source of errors in lossy compression is quantization.

Question 6

In lossless image compression, prediction can be based on any pixel in the image.

Your Answer		Score	Explanation
True			
False	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

Prediction can only be based on pixels already available to the decoder, meaning only on pixels that have already been encoded (this is the causal order of encoding).

Question 7

A reason for using DCT (instead of Fourier, for example) in JPEG is

Your Answer		Score	Explanation
It is simpler to compute			
Its favorable periodicity property	✔	1.00	
It is real while Fourier is complex			
No particular reason			
Total		1.00 / 1.00	

Question Explanation

Check the slide “Why DCT?” Its mirror/symmetry periodicity if favorable for working with blocks.

Question 8

Since we must encode all pixels in the image, JPEG needs at least a bit per pixel and therefore in a 256 levels image (8 bits), it can only achieve up to 8:1 compression.

Your Answer		Score	Explanation
○ True			
◉ False	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

Since after DCT and quantization many coefficients become 0, JPEG can encode all of them together (end of block), achieving higher compression ratios.

Question 9

In JPEG, if we double the quantization step, then we double the compression ratio.

Your Answer		Score	Explanation
◉ False	✔	1.00	
○ True			
Total		1.00 / 1.00	

Question Explanation

There are a number of reasons for this to be false, one of them being the presence of Huffman coding. Doubling the quantization means that each DCT coefficient will become a different symbol, and therefore will be coded differently. There is no way to know in advance the reduction in the number of bits resulting from this. An additional component is the presence of the end of block to code all the zeros.

Question 10

Without JPEG or a similar compression technique, digital cameras will no be as popular as they are today.

Your Answer		Score	Explanation
○ False			
◉ True	✔	1.00	
Total		1.00 / 1.00	

Question Explanation

Compression is an enabling technology and one of the most important contributions in image processing. You will be able to store many fewer images in your cameras and they will take so long to transfer them that their use will be significantly limited.

Question 11

(Optional programming exercises)

- Do a basic implementation of JPEG.
  - Divide the image into non-overlapping 8x8 blocks.
  - Compute the DCT (discrete cosine transform) of each block. This is implemented in popular packages such as Matlab.
  - Quantize each block. You can do this using the tables in the video or simply divide each coefficient by N, round the result to the nearest integer, and multiply back by N. Try for different values of N. You can also try preserving the 8 largest coefficients (out of the total of 8x8=64), and simply rounding them to the closest integer.
  - Visualize the results after you invert the quantization and the DCT.
- Repeat the above but instead of using the DCT, use the FFT (Fast Fourier Transform).
- Repeat the above JPEG-type compression but don't use any transform, simply perform quantization on the original image.
- Do JPEG now for color images. In Matlab, use the rgb2ycbcr command to convert the Red-Green-Blue image to a Lumina and Chroma one; then perform the JPEG-style compression on each one of the three channels independently. After inverting the compression, invert the color transform and visualize the result. While keeping the compression ratio constant for the Y channel, increase the compression of the two chrominance channels and observe the results.
- Compute the histogram of a given image and of its prediction errors. If the pixel being

processed is at coordinate (0,0), consider
  - predicting based on just the pixel at (-1,0);
  - predicting based on just the pixel at (0,1);
  - predicting based on the average of the pixels at (-1,0), (-1,1), and (0,1).
- Compute the entropy for each one of the predictors in the previous exercise. Which predictor will compress better?

Your Answer	Score	Explanation
Total	0.00 / 0.00	