香 港 中 文 大 學
The Chinese University of Hong Kong

Course Examinations, 2nd term, 2010 – 2011

Course Code & Title : CSCI3280 Introduction to Multimedia Systems

Time allowed : 2 hours minutes

Student I.D. No. : Seat No. :

Full Marks: 100
ANSWER ALL QUESTIONS

(1) (a) Consider the following input data. Draw the LZW tree in order to encode it. Denote the root node with **R**, and the numeric labelling of the nodes starts from **1**. Assume there are only 3 distinct alphabets. (**8 marks**)

`x y y z y y x x y y z y z`

(b) Consider the following data stream of 16 bits:

`1 1 1 0 0 0 1 1 1 1 0 1 1 1 1 1`

What are the entropies of the above "data" if we consider each alphabet contains

(i) 1 bit (**3 marks**)
(ii) 2 bits (**3 marks**)
(iii) 4 bits (**3 marks**)

If you don't have a calculator with you, you can just put down the expression instead.

(c) Suppose you are now implementing a LZ78 decoder and you receive the following encoded data. Decode the data and draw the LZ78 tree. (**9 marks**)

`R, a, 1, a, R, b, 2, a, R, c, 5, b, 4, c`

Assume **R** is the root node and the labelling starts with **1**.

(2) Consider the following wavelet coefficient matrix.

56	**0**	**-28**	**-3**
1	**33**	**0**	**-2**
28	**-1**	**-3**	**1**
-3	**3**	**-1**	**0**

(a) What is the threshold in the first pass? (**3 marks**)

(b) Write down the coefficients in the subordinate list after the first pass of EZW scanning. Make sure to write in order. (**4 marks**)

(c) Draw the coefficient matrix above in your answer book and label the coefficients using the 5 labels, "ps" (positive significant), "ns" (negative significant), "iz" (isolated zero), "ztr" (zero-tree root), "X" coefficients that have been handled in the previous pass, left blank for those inside the zero trees.

(i) For the first dominant pass (**5 marks**).

(ii) For the second dominant pass (**5 marks**).

(3) (a) For each of the following motion sequence content, explain whether it can be very effectively compressed with MPEG. Justify your answer for each case.

(i) A sequence showing a car driving from left to right (**4 marks**)

(ii) A zoom-in sequence (**4 marks**)

(iii) A sequence showing a squid changes its color (**4 marks**)

(b) What is your answer if I encoded the same sequence in (3)(a)(iii) with H.261? Again, with justification. (**4 marks**)

(c) Suppose you are asked to implement a motion compensation module in MPEG. Suggest three ways to accelerate it. (**6 marks**)

(4) (a) Simon wants to convert an interlaced video to a progressive one. Will there be any problem? Explain your answer. (**4 marks**)

(b) Jack said, "our LCD TV can reproduce all colors in natural world perceptually, not physically." Do you agree? Explain your answer (**5 marks**)

(c) If you are asked to encode an image, what color model you will choose? Why? (**4 marks**)

(d) Consider the following 4x4 dithering threshold matrix. How many pixel will be converted to black if all image pixels are 0.25 in gray value. Assume the pixel range is [0,1] and a pixel is turned black if its pixel value is larger than the threshold. (**4 marks**)

1/32	**17/32**	**5/32**	**23/32**
19/32	**3/32**	**21/32**	**7/32**
9/32	**25/32**	**13/32**	**31/32**
27/32	**11/32**	**29/32**	**15/32**

(5) (a) If you are implementing the OS of a cell phone and you are asked to choose the way to realize the font display, either bitmap font or outline font. What is your decision if your cell phone is equipped with a slow CPU? Explain your answer. (**4 marks**)

(b) In Google street view, one can jump from one panorama node to another. But the visual quality is too bad. How will you suggest to improve such visual quality? Any drawback with your suggestion? (**4 marks**)

(c) Suppose you are a film director and your famous actor is not available to take a shoot in Venice but he/she is available to take the shoot in your studio in Hong Kong. Can you find a technology to ensure the lighting cast on this actor confirms to the real lighting in Venice? Identify it. (**5 marks**)

(d) You are implementing an image-based representation similar to *Apple QuickTime VR object* that allows the user to rotate an object clockwisely or anti-clockwisely. One problem you are facing is how to store it in a compact format. You don't want to invent a new encoding method. Can you suggest one *common encoding standard* to store the data? Explain your answer. (**5 marks**)

- END OF QUESTION PAPER -