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

Course Examination Second Term, 2011 - 2012

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) Jason is designing a webpage targeting for mobile phone users with 2G or lower telecommunication bandwidth. As his webpage contains multiple images, what image format he should adopt to store these images in order to facilitate the mobile phone users? Explain your answer. Be specific if the image standard contains multiple modes of representations. (**6 marks**)

(b) When we compress images with JPEG, human vision properties (inabilities or weaknesses) being exploited. Describe two such kinds of our human vision weaknesses that have been utilized in JPEG. (**6 marks**)

(c) Jack compressed an image with DCT-based JPEG. He believes by tunning the image quality factor to 100%, his image can be losslessly compressed. Is it true? Why? (**4 marks**)

(d) What his image will look like if he changes his mind to set the quality factor to 10%? (**3 marks**) Explain the reason behind. (**3 marks**)

(e) What his image will look like if he set the quality factor to 60% and his image is a cartoon image prepared with image software? (**3 marks**)

(2) (a) Why MP3 can reduce the data size so much without introducing annoying artefact to the audio data? Give me at least 3 human inabilities that have been utilized in designing MP3. (**6 marks**)

(b) It seems that some MP3 encoders can generate MP3 with better audio quality than others without scarifying the compression ratio. Why is it so difficult to develop a good MP3 encoder? What is the major difficulty? (**4 marks**)

(3) (a) What is the color matching experiment? And what is it for? Briefly describe it. (**6 marks**)

(b) While error diffusion can nicely reproduce grayscale image with black and white pixels, it is seldom used in printing industry. Why? (**3 marks**)

(c) The iphone is equipped with HDR photo capture. What exactly is HDR imaging? (**3 marks**)

(d) Can we observe the HDR image on the iphone display? (**3 marks**)

(4) (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. **(6 marks)**

天 地 地 地 人 人 地 人 地 天 地 人 天 天

(b) Consider the following text data:

(i) **A long long time ago, there is a temple** **(2 marks)**

(ii) **It is looooooooooooooooooooooooonnnnnnnnnnggggg** **(2 marks)**

Suppose you are given the choice to select between run-length encoding and LZW to compress the above two data. For each case, tell me your decision on the compression method and explain your answer.

(c) Consider the following data with the frequency of each alphabet as:

q	r	s	t	u
7	4	8	10	15

Compute the entropy of the above data **(3 marks)**.

(d) Construct the Huffman tree of data in (c) **(5 marks)** and compute the corresponding average bit length (up to 4 decimal places) **(2 marks)**.

(5) (a) Why Motion JPEG is not as effective in compression as MPEG? **(3 marks)**

(b) Why encoding a movie is more time consuming than playing (decoding) the same movie? **(4 marks)**

(c) For each of the following video shots, tell me whether it can be efficiently or not efficiently compress with MPEG? Briefly explain for each case

(i) A man walking alone a static background **(3 marks)**

(ii) A colourful CD spinning **(3 marks)**

(iii) An explosion shot **(3 marks)**

(d) What kind of visual artefact will appear if the above video shots are not effectively compressed? **(3 marks)**

(6) Given the following wavelet coefficient matrix:

-33	-18	7	0
10	-5	3	-1
-1	2	24	-9
-3	2	10	1

(a) What is the threshold T for the first EZW pass? (**3 marks**)

(b) For each pass below, draw the coefficient matrix in your answer book and label the coefficient using 5 labels: "ps" (positive significant), "ns" (negative significant), "iz" (isolated zero), "ztr" (zero-tree root), "X" coefficients that have been previously processed in previous passes, and left blank for those inside the zero trees.

(i) The first dominant pass (**4 marks**)

(ii) The second dominant pass (**4 marks**)

- END OF QUESTION PAPER -