SOLUTIONS

Module:	Interactive Media Design and Production		
Module Code	EBU5305	Paper	A
Time allowed	2hrs	Filename	Solutions_1617_EBU5305_A
Rubric	ANSWER ALL FOUR QUESTIONS		
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Question 3

a) Digitisation.

[10 marks]

   i)   What is the mathematical transformation that allows the extraction of the individual frequency components of a complex wave form?

(1 mark)

Solution: Fourier transform.

   ii)   In the digitisation process, what is the Nyquist theorem useful for?

(1 mark)

Solution: it is useful to avoid aliasing by choosing an appropriate sampling rate.

   iii)   Calculate the size <u>in bits</u> of a grayscale image file, which has the following characteristics: frame size is 150 pixels x 100 pixels.

(2 marks)

Solution: grayscale = 8 bits/pixel. Size = 150 x 100 x 8 = 120 000 bits.

   iv)   Calculate the size <u>in bytes</u> of a video file, which has the following characteristics: frame size is 300 pixels x 200 pixels, true colour encoding, frame rate is 30 frames/s, no audio track, duration is 2 minutes.

(3 marks)

Solution: true colour = 24 bits/pixel (or 3 bytes). Size = 300 x 200 x 3 x 30 x 120 = 648 Mbytes.

   v)   Calculate the size <u>in bytes</u> of an audio file, which has the following characteristics: CD quality, mono, duration is 1 minute.

(3 marks)

Solution: CD quality = 16 bits/sample and 44100 samples/s. Size = 44100 x 2 (bytes) x 60 = 5292 Kbytes.

b) Colour.

[6 marks]

   i)   What (R, G, B) values would you use to encode a light gray pixel? Justify your choice of values.

(3 marks)

Solution: in RGB, gray is represented with R=G=B. To achieve light gray, the values must be high, i.e. above 127. For example: (200, 200, 200) (other values possible ..)

ii)　What (C, M, Y, K) values would you use to encode a fully saturated dark red colour? Justify your choice of values.

(3 marks)

Solution: Saturated Red is a mixture of equal amounts of Magenta and Yellow. To make it dark, some amount of K must be added, e.g. (0, 255, 255, 100) (other values of K possible)

c) Image compression.

[4 marks]

i)　What image property is used in Huffman encoding to achieve compression?

(1 mark)

Solution: statistical properties (or the fact that some colours appear more often than others).

ii)　How much compression can be achieved using the Huffman encoding table provided in Table 1 for the following sequence of 16 symbols: AAAAEAABDBBCCABC? Assume that each symbol would normally be encoded using 8 bits.

symbol	probability	code
A	0.40	00
B	0.20	01
C	0.20	10
D	0.10	110
E	0.10	111

Table 1: Huffman encoding table

(3 marks)

Solution: uncompressed size = 8 bits x 16 symbols = 128 bits. Compressed size = 7 x 2 (A) + 4 x 2 (B) + 3 x 2 (C) + 3 x 1 (D) + 3 x 1 (E) = 34 bits. Compression rate is 64:17.

d) What can you say about the content of an MPEG video that contains very few I frames? Justify your answer.

[5 marks]

Solution: A video that contains very I frames has a lot of P and B frames. This means that the content is easily predictable, i.e. there is little change from one frame to the next. The video doesn't contain much action, it could be the video of an interview …