

**CARDIFF UNIVERSITY  
EXAMINATION PAPER**

<b>Academic Year:</b>	2003-2004
<b>Examination Period:</b>	Autumn 2003
<b>Examination Paper Number:</b>	CM0340
<b>Examination Paper Title:</b>	Multimedia
<b>Duration:</b>	2 hours

**Do not turn this page over until instructed to do so by the Senior Invigilator.**

**Structure of Examination Paper:**

There are **FOUR** pages.  
There are **FOUR** questions in total.

There are no appendices.

The maximum mark for the examination paper is 100% and the mark obtainable for a question or part of a question is shown in brackets alongside the question.

**Students to be provided with:**

The following items of stationery are to be provided:  
One answer book.

**Instructions to Students:**

Answer **THREE** questions.

The use of translation dictionaries between English or Welsh and a foreign language bearing an appropriate departmental stamp is permitted in this examination.

1. (a) What does *Nyquist's Sampling Theorem* state?

[2]

- (b) What are the implications of *Nyquist's Sampling Theorem* for multimedia data?

[4]

- (c) For each of the following media types, *graphics, images, audio* and *video*, briefly discuss how *Nyquist's Sampling Theorem* affects the quality of the data and the form in which sampling effects manifest themselves in the actual data.

[12]

- (d) Calculate the uncompressed digital output, i.e. data rate, if a video signal is sampled using the following values:

25 frames per second  
160 x 120 pixels  
True (Full) colour depth

[4]

- (e) If a suitable stereo CD quality audio signal is included with the video signal in part d what compression ratio would be needed to be able to transmit the signal on a 128 kbps channel?

[5]

2. (a) What characteristics of the human visual system can be exploited for the compression of colour images and video?

[5]

- (b) What is the *YIQ color model* and why is this an appropriate color model used in conjunction with compression methods such as JPEG and MPEG?

[4]

- (c) Given the following YIQ image values:

128	126	127	129
124	123	124	124
130	136	132	132
154	143	132	132

**Y**

55	66	54	54
56	57	56	56
45	56	58	49
34	36	39	37

**I**

44	44	55	55
44	44	55	55
34	34	36	35
35	35	34	34

**Q**

What are the corresponding *chroma subsampled* values for a

- (i) 4:2:2 subsampling scheme
- (ii) 4:1:1 subsampling scheme
- (iii) 4:2:0 subsampling scheme

[18]

3. (a) What is the distinction between *lossy* and *lossless* data compression?

[4]

- (b) Briefly describe two repetitive suppression algorithms and give one practical use of each algorithm.

[10]

- (c) Briefly state the LZW compression algorithm and show how you would use it to encode the following stream of characters:

MYMEMYMO

You may assume that single character tokens are coded by their ASCII codes, as per the original LZW algorithm. However, for the purpose of the solution you may simply output the character rather than the ASCII value.

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[13]

4. (a) What is the basic format of an *MHEG application*?

[2]

- (b) Briefly describe *the MHEG Client-Server interaction* and the role that the *MHEG Engine* plays in this process.

[10]

- (c) Using suitable *fragments* of MHEG code, illustrate how you would code the following presentation in MHEG:

**Scene 1****Scene 2**

The above presentation consists of two scenes. **Scene 1** plays some Video and is overlayed by some text information and a next button is provided so that the user may elect to jump to **Scene 2**. **Scene 2** plays some video and is overlayed by a visual prompt which when selected displays some further text information.

**Note** that the precise MHEG syntax and object attributes and attribute values is not absolutely required in your solutions. Rather you should concentrate on giving indicative object attributes values. In essence the *structure* of the code is more important than *precise* syntax.

[15]