# CARDIFF CARDIFF UNIVERSITY
# EXAMINATION PAPER

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| **Academic Year:** | 2001-2002 |
| **Examination Period:** | Autumn 2001 |
| **Examination Paper Number:** | CM0340 |
| **Examination Paper Title:** | Multimedia |
| **Duration:** | 2 hours |

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

**Structure of Examination Paper:**
There are three 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) Give a definition of *multimedia* and a *multimedia system*. [2]

   (b) What are the key distinctions between multimedia data and more conventional types of media? [4]

   (c) What key issues or problems does a multimedia system have to deal with when handling multimedia data? [7]

   (d) An analog signal has bandwidth that ranges from 15Hz to 10 KHz. What is the rate of sampler and the bandwidth of bandlimiting filter required if:

      (i) the signal is to be stored within computer memory. [3]
      (ii) the signal is to be transmitted over a network which has a bandwidth from 200Hz to 3.4 KHz. [4]

   (e) Assuming that each signal is sampled at 8 bits per sample what is the *quantisation noise* and the *signal to noise ratio* expected for the transmission of the signals in (d)(i) and (d)(ii).

   [7]

2. (a) Why is data compression necessary for Multimedia activities? [3]

   (b) What is the distinction between *lossless* and *lossy* compression? What broad types of multimedia data are each most suited to? [5]

   (c) Briefly explain the compression techniques of *zero length suppression* and *run length encoding*. Give one example of a real world application of each compression technique. [7]

   (d) Show how you would encode the following token stream using zero length suppression and run length encoding:

      ABC000AAB00000000DEFAB00000

   (i) What is the compression ratio for each method when applied to the above token stream?
   (ii) Explain why one has a better compression ratio than the other. What properties of the data lead to this result?

   [12]

3. (a) Briefly outline the basic principles of Inter-Frame Coding in Video Compression.

[8]

(b) What is the key difference between I-Frames, P-Frames and B-Frames? Why are I-frames inserted into the compressed output stream relatively frequently? [6]

(c) A multimedia presentation must be delivered over a network at a rate of 1.5 Mbits per second. The presentation consists of digitized audio and video. The audio has an average bit rate of 300 Kbits per second. The digitised video is in PAL format and is to be compressed using the MPEG-1 standard. Assuming a frame sequence of:

IBBPBBPBBPBBI…..

and average compression ratios of 10:1 and 20:1 for the I-frame and P-frame respectively, what is the compression ratio required for the B-frame to ensure the desired delivery rate?

You may assume that for PAL the luminance Signal is sampled at the spatial resolution of 352x288 and that the two chrominance signals are sampled at half this resolution. The refresh rate for PAL is 25Hz. You should also allow 15% overheads for the multiplexing and packetisation of the MPEG-1 video.

[13]

4. (a) What key features of Quicktime have led to its adoption and acceptance as an international multimedia format? [4]

(b) Briefly outline the Quicktime architecture and its key components.

[10]

(c) JPEG2000 is a new image compression standard. Outline how this new standard might be incorporated into the Quicktime architecture. Your answer need not consider the details of the actual compression methods used in JPEG2000; instead it should focus on how, given the compression format, you could extend Quicktime to support it.

[13]