

OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, CORK
COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATION 2012

BSc in Computer Science

CS4405: Multimedia Compression and Delivery

Professor Ian Gent
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Dr. John O'Mullane

The use of electronic calculators is permitted

Answer *ALL* questions

1½ Hours

1. **Topic: Images** (20 MARKS)

- a) The GIF (8-bit) format uses a colour lookup table to store up to 256 colours. Describe a scheme to select a representative set of 256 colours from the colours in the source image.
(7 marks)
- b) JPEG (baseline) is a standard for lossy compression of still images. Describe the steps performed by a JPEG encoder and explain the step where information is lost during the compression.
(7 marks)
- c) Compound images consist of a combination of text, graphics and natural pictures. Compressing these images with a single algorithm that simultaneously meets the requirements for this mixed content is difficult. Outline an approach for adaptively compressing these images.
(6 marks)

2. **Topic: Video** (20 MARKS)

- a) The majority of video codecs used in practice are *block-based* and employ *motion compensation*.
- Explain what is meant by the term block-based encoder and why the technique is used.
 - Explain how motion compensation improves codec performance.
- (4 marks)
- b) MPEG encoders have two encoding modes for individual video frames — intra (I-frames) and inter (P- and B- frames). In the former, a frame of video is encoded as an independent image without reference to other images in the sequence. In the latter, reference frames are used to predict the values.
- Describe using a diagram, the broad steps used in intra frame encoding.
 - Describe using a diagram, the key difference between encoding P- and B- frames.
- (10 marks)
- c) For chromakey content, explain why the presence of flesh colours in the foreground causes difficulties for extracting the uncomposed foreground colour. Describe a technique for overcoming this problem.
(6 marks)

3. Topic: Audio (20 MARKS)

- a) Audio signals are often sampled at different rates. CD quality audio is sampled at 44.1kHz rate while telephone quality audio sampled at 8kHz. What are the maximum frequencies in the input signal that can be fully recovered for these two sampling rates? (2 marks)
- b) Describe how Pulse Code Modulation (PCM) is used in the coding of audio data. (6 marks)
- c) Describe using a diagram the basic MPEG audio compression algorithm. (6 marks)
- d) Describe two psychological phenomena that have been exploited in MPEG audio compression. (6 marks)

4. Topic: Delivery (20 MARKS)

- a) Describe the essential elements of the HTTP Live Streaming Architecture. (6 marks)
- b) Jitter is the variation in the arrival rate of packets on a network connection. Explain how a playout buffer can overcome the effects of jitter. (4 marks)
- c) What is meant by the term *Forward Error Correction* (FEC)? Describe a simple FEC scheme. (4 marks)
- d) Explain what makes loss concealment techniques feasible for digital video. (6 marks)