OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLÁISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SAMPLE Examination 2013

BSc in Computer Science

CS4405: Multimedia Compression and Delivery

Professor Ian Gent
Professor Barry O'Sullivan
Dr. John O'Mullane

The use of electronic calculators is permitted

Answer ALL questions

$1\frac{1}{2}$ Hours

1. **Topic: Image Coding** (24 MARKS)

   a) An image compressed using JPEG is intended to be viewed by a human observer.

      i. Describe how the JPEG algorithm exploits the features of the human visual system to achieve high levels of compression while minimising visual distortion. (*6 marks*)

      ii. Explain what is meant by the term "JPEG ghosts" and describe how they can be used to detect tampered images. (*4 marks*)

   b) The JPEG File Interchange Format (JFIF) is an image file format for exchanging JPEG encoded files compliant with the JPEG Interchange Format (JIF) standard.

      i. Explain why JFIF is needed. (*4 marks*)

      ii. Suggest a JFIF extension that allows for transparent JPEG images. (*4 marks*)

      iii. Outline an implementation of this extension that could be used for displaying transparent JPEG images on a web page. (*6 marks*)

2. **Topic: Audio and Video Coding** (28 MARKS)

   a) Describe the advantages and disadvantages of *pixel-based* and *block-based* motion representation. (*4 marks*)

   b) MPEG-1 video compression uses I-, P- and B- pictures.

      i. Explain the advantages of a mixture of picture types. (*2 marks*)

      ii. Describe a situation where video compression would not be as effective without B-pictures. (*6 marks*)

   c) In telephony, the usable voice frequency band ranges from approximately 300Hz to 3400Hz. When implementing a voice codec

      i. Explain why a band-pass filter would be applied to the input audio signal. (*2 marks*)

      ii. Describe how the discrete cosine transform could be used to compress the speech signal. (*5 marks*)

      iii. Comment on the effectiveness of this approach. (*3 marks*)

   d) Describe the main steps in MPEG-1 Layer 3 audio coding. (*4 marks*)

3. **Topic: Media Delivery and Presentation** (28 MARKS)

   a) ISO/IEC developed the MPEG-DASH standard allowing for dynamic adaptive streaming over HTTP.

      - Describe the main elements of an MPEG-DASH player. (*6 marks*)
      - Describe a typical deployment architecture for MPEG-DASH. (*6 marks*)

   b) Explain how Forward error correction (FEC) can be used to combat errors in wired and wireless links. Describe the conditions in which the scheme will not be effective. (*4 marks*)

   c) Explain how a decoder can conceal the loss of texture data. (*4 marks*)

   d) In a media streaming system

      - Explain why a client playout buffer is a key component. (*2 marks*)
      - In MPEG-DASH the client controls the delivery of data. Describe an approach that an MPEG-DASH player could use to schedule media data from the server to ensure smooth playback. (*6 marks*)