

C11-R3: MULTIMEDIA TECHNOLOGY AND VIRTUAL REALITY

NOTE:

1. Answer question 1 and any FOUR from questions 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours

Total Marks: 100

1.

- a) Describe significant differences between vector and bitmapped graphics.
- b) Explain how Huffman Tree is developed and used in text compression?
- c) What are the benefits and drawbacks of using 8-bit instead of 16-bit quantisation? Suggest an application that would use 8-bit quantisation.
- d) Videos are sometimes referred to as “moving pictures.” Explain this in terms of the perceptual features exploited by video coding.
- e) Briefly explain the concept of Aliasing.
- f) Explain how MPEG-1 and MPEG-2 exploit masking frequencies to increase the audio compression rates.
- g) Briefly explain what is meant by the terms ‘visual realism’ and ‘latency’ when describing a VR system. Also explain how these two terms are related.

(7x4)

2.

- a) A digitized video is compressed using MPEG-1 with an IBBPBBPBBPBBI . . . frame sequence and average compression ratios of 10:1, 20:1 and 50:1 for the I, P and B frames respectively. What is the average compression ratio? Derive the average bitrate for the PAL (352x288, 25fps, 4:2:2) format, with and without compression.
- b) Describe the Spatial Compression techniques for JPEG. In your answer you should demonstrate an understanding of the Discrete Cosine Transform and the advantages that it has for Spatial Picture Compression.

(9+9)

3.

- a) Why does the MPEG-4 Simple Profile omit B-Frames?
- b) What is RAID technology and what advantages does it offer as a medium for the storage and delivery of large data? Briefly explain the eight levels of RAID functionality.
- c) A digital video file is 40 Mb in size. The disk subsystem has four drives and the controller is designed to support read and write onto each drive, concurrently. The digital video is stored using the *disk striping* concept. A blocksize of 8 Kb is used for each I/O operation.
 - i) What is the performance improvement in *sequentially* reading the complete file when compared to a single drive subsystem in terms of the number of operations performed?
 - ii) What is the percentage performance improvement for this system compared to a single drive system?

(4+8+6)

4.

- a) Suppose an MPEG encoder uses the nine frame sequence IBBPBBPBB as a GOP. Draw a diagram showing the dependencies between the first 18 frames of a compressed clip produced by this encoder. Show how the pictures would be reordered into bitstream order. Explain briefly why the pattern of I, P and B pictures in the bitstream order of the first nine frames is different from that of the second nine frames. Explain why might it be beneficial to vary specification for a Group of Pictures during a clip?
- b) Define multicasting within the context of computer networks. Why is multicasting relevant to multimedia applications? At what level of the network stack might you find multicast functionality and why?

(9+9)

5.

- a) What is the difference between end-to-end delay and packet jitter? What are the causes of packet jitter? Outline ways in which a buffer may be used to eliminate jitter. Why might it be desirable to use an adaptive play out delay? How might such a scheme work?
- b) The Real Time Transport Protocol (RTP) is designed for use by time sensitive traffic.
- i) What facilities does RTP provide?
 - ii) Why is it important that the rate at which RTP generates packets is limited to a proportion of the data rate?

(10+8)

6.

- a) Describe two real-world applications of virtual reality technology, one which demands high visual realism and one which demands low latency, explaining why in each case.
- b) Describe the following interpolators: Position interpolator, Colour interpolators. What is the difference between interpolator and script?
- c) Briefly explain the differences between the following three forms of virtual reality: Immersive; Window-on-world; and Augmented Reality.

(8+6+4)

7.

- a) In multimedia there are a number of general guidelines to help assist designer to develop effective presentations and applications. Such guidelines include: Thematic congruence; Information loading; User compatibility; Viewpoints Consistency and Reinforcement.
- Explain what is meant by each of the guideline, and in each case describe how the directive assists in multimedia design, together with an example.
- b) One of the main considerations with multimedia design is the possibility of multiple concurrent media and the affect on user understanding. Describe what media types, when presented concurrently, are readily comprehensible and which types are difficult for the user to manage.

(10+8)