University of Stirling

Department of Computing Science & Mathematics

Computing Science Examination
Spring Semester 2001

IT82 : Multimedia

Monday 28th May 2001   **0900-1100 hours**

Attempt **FOUR** questions.

You must attempt **Question1** from the **Sound** section of the paper.

All questions carry equal marks.

The approximate distribution of marks among the parts of each question is indicated.

You may use an electronic calculator.

IMPORTANT NOTE

It is essential that you write your registration number on the front of each answer book.

Also, when you have completed the examination, the number of answer books which you have used must be prominently written on the front of one book.

Sound

Question 1

a) Describe both the *physical* and *perceptual* characteristics of sound, highlighting any apparent anomalies between the two descriptions. **[6]**

b) For sound to be captured from the outside world so it can be replayed or manipulated by computer software, it must be *transduced* and *digitised*. Describe the processes of transduction and digitisation of sound, detailing the two key parameters in digitisation (a diagram may be helpful). **[6]**

c) Describe the features of human sound perception that could form the basis of compression techniques for digitised sound data. Include the phenomenon of *masking* in your answer. **[6]**

d) Consider the following scenario. Computer-based multimedia presentations must display text and graphics within the confines of a computer screen. However, consider such a presentation that uses a very large virtual screen (much bigger than an actual computer screen) upon which all the presentation media have a physical location. The virtual screen is too large to be seen on the computer screen in its entirety. The user can scroll the virtual screen (using arrow keys or the mouse) to make different parts visible on the physical computer screen, and navigational buttons may also move the physical view to different sections of the virtual screen. It is desired to use binaural sound, delivered through headphones, to give the user feedback at all times as to where they are on the virtual screen relative to the virtual screen centre.

How might this be achieved, given that the user can be either above, below, to the left, or to the right of the centre? No technical details are required, just a description of how your system would work. **[7]**

Graphics

Question 2
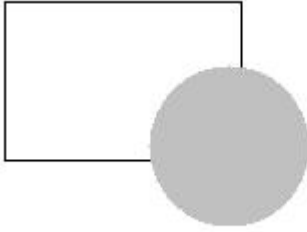
a) The above picture, consisting of a square and an overlapping circle, was drawn using a basic bitmapped-based paint package. Imagine you are editing this image with the basic paint package. Describe the steps involved in repositioning the circle to the right of the square, so that it no longer overlaps the square. **[6]**

b) Now suppose that the original picture, as shown above, was drawn using a vector-based drawing package. How could the circle be repositioned to the right of the square in this case, assuming you are editing it using the vector-based package? **[6]**

c) On the basis of your answers to a) and b), which is the most appropriate form of graphics representation for this simple drawing? **[1]**

d) Would the use of multiple layers with the bitmapped image, such as is possible with *Adobe Photoshop*, change your answer in a)? Justify your answer. **[4]**

e) Both bitmapped and vector-based images have advantages and disadvantages, depending on the nature of the graphic images being produced and how they are to be used. Discuss the characteristics of both bitmapped and vector-based images in the context of today's Web-based society. **[8]**

Question 3

Rendering an image using finite-sized pixels, such as on a computer screen, can result in jagged looking edges on objects in the image.

    a) Explain the term *rendering*. **[2]**

    b) Describe why a rendered object may have a jagged appearance. Use one or more diagrams to aid your explanation. **[5]**

    c) What is *anti-aliasing,* and how might it help relieve the jagged appearance? Again, use one or more diagrams to illustrate your answer. **[5]**

    d) Give an example of when *anti-aliasing* is NOT a good technique to use. Also use diagrams to illustrate. **[5]**

The representation of colours in graphical images can be handled using a number of different colour models. Which model is most appropriate depends on the likely medium for display of an image e.g. computer screen, laser printer etc. Two of the most common are the RGB and CMY models.

    e) When are each of these colour models most appropriate? **[2]**

    f) RGB is an *additive* colour model, whereas CMY is *subtractive*. What does this mean and how are the two colour models related to each other? **[5]**

    g) What does 24-bit colour mean in relation to the RGB model? **[1]**

Question 4

Huffman coding and *Lempel-Ziv Welch (LZW)* compression schemes both make use of dictionaries to compress a graphical image.

    a) In general terms, describe how a *dictionary* can be used to achieve compression of graphical images. **[4]**

    b) How is the dictionary used in *Huffman coding* constructed, and what does it contain? **[4]**

    c) How is the dictionary used in *LZW* compression constructed, and what does it contain? **[4]**

    d) For both *Huffman coding* and *LZW* compression, why is it NOT necessary to store the dictionary in the same file as the compressed image? **[3]**

Compression of video data can make use of both *spatial* and *temporal* compression.

    e) Explain the terms *spatial* and *temporal* compression. **[2]**

    f) Describe a basic temporal compression scheme that makes use of *key frames*. **[5]**

    g) *Motion compensation* may be used to improve temporal compression. What is motion compensation, and how is it used? **[3]**

Multimedia

Question 5

    a) *Storyboards* and *Nav Maps* are both very useful in the multimedia design process. Briefly describe what they are and how they are used. **[6]**

    b) The three main approaches to the design and authoring of multimedia are:

- Card / Page Based
- Icon / Event Based
- Time-line Based

       Describe the main features of each of these approaches. **[6]**

You have the following brief to develop a multimedia presentation:

"The Computer Science Department at the University of Stirling wishes to produce a comprehensive multimedia presentation of the department that can be distributed world-wide on CD-ROM to attract overseas students. The presentation will include video interviews with members of staff, an interactive tour of departmental facilities and excerpts of course content in the form of on-line tutorials."

    c) Briefly outline how *ONE* of the approaches listed in b) may be applied to the development of this brief. **[5]**

    d) What technical constraints can you forsee with this project, given the required contents and the delivery medium? **[4]**

    e) How would these constraints change if it was decided also to make the presentation available on-line via the World Wide Web? **[4]**

Question 6

a) What is *task analysis,* and how is it used in the design and testing phases, respectively, during the development of a multimedia presentation? **[4]**

b) Carry out a *task analysis* decomposition of "organising a dinner party" (this need not include specific details of the food and the recipes used). **[6]**

c) Testing is a vital part in developing multimedia presentations. What is the difference between *functional testing* and *usability testing* and how are they used in the testing of a multimedia presentation? In your answer include a description for two methods for *functional testing* and two methods for *usability testing.* **[8]**

d) Another crucial part of the development cycle in multimedia is building a *prototype.* Describe what this is, what its key features are, and how it differs from the final production presentation. **[7]**

END OF EXAMINATION