

UNIVERSITY OF LONDON
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1998

BEng Honours Degree in Computing Part III
BEng Honours Degree in Information Systems Engineering Part III
MEng Honours Degree in Information Systems Engineering Part III
MSc Degree in Computing Science
for Internal Students of the Imperial College of Science, Technology and Medicine

*This paper is also taken for the relevant examinations for the
Diploma of Membership of Imperial College
Associateship of the City and Guilds of London Institute*

PAPER 3.46 / I3.12

MULTIMEDIA SYSTEMS
Tuesday, May 5th 1998, 10.00 - 12.00

Answer THREE questions

For admin. only: paper contains 4
questions

- 1 The image sensor in a digital still camera captures frames of 320x240 pixels with 8-bit resolution in each of red, green and blue. The camera outputs JPEG images to a PC through a serial port operating at 19,200 bits per second.
 - a Briefly list the main processing steps to convert the captured image into JPEG format.
 - b For each step, explain how the step contributes to the overall compression achieved and estimate the compression ratio achieved by the step.
 - c Estimate the overall compression ratio by multiplying the compression ratio of each step together.
 - d How long will it take to transfer the image to a PC?
 - e If the camera were used to produce and transfer to the PC a sequence of still frames, of the same aspect ratio, at 25 frames per second, what image resolution would be achievable? How would you suggest improving this? What improved resolution could be achieved?

The five parts carry, respectively, 25%, 25%, 10%, 10%, 30%, of the marks

- 2a Carefully explaining your assumptions, estimate the compression ratio of the Fractal Transform applied to a still grey-scale image with resolution of 256x256 16-bit pixels.
- b How does the compression ratio change if the image resolution on both axes is successively doubled?
- c How does the quality of the decompressed image change in comparison with the quality of the original image if an original image of twice the resolution (on both axes) is used?
- d How is the quality of the decompressed image likely to compare with one encoded using JPEG? Why?
- e Part of a simple music synthesizer converts incoming MIDI note information into the frequency of the corresponding musical note. Derive a formula to do this. (MIDI note 60 is middle C). The A above middle C (i.e. A4) is 440Hz. Check your formula by calculating the pitch of the A sounded by MIDI note 81.
- f What does the formula $2410 \log((1.6/1000)f + 1)$ measure? Which note sounds half as high in pitch as A5 (880Hz) to a typical (unmusical) member of the public?
- g Using your inventive initiative, give a brief example of a multimedia system in which you could apply the answer you calculated in part (f).

The seven parts carry, respectively, 20%, 10%, 10%, 10%, 20%, 20%, 10%, of the marks

Turn over ...

3 SGML, HTML, Javascript

- a Define an SGML document type 'Journal Article'. The main components of a journal article are: publisher, journal, volume, issue, title, authors, abstract, keywords, text.
- b Write this page (the page you are looking at right now) as an html document
- c Write an html/JavaScript page where you can input an arithmetic expression and display the value of this expression.

The three parts carry, respectively, 30%, 30%, 40% of the marks

4 Protocols and Standards

- a Describe how the three protocols IP (Internet Protocol), TCP (Transmission Control Protocol) and HTTP (Hypertext Transfer Protocol) are related with each other.
- b The standard internet protocols provide a point to point connection between two computers. For an application like video conferencing with a few active and may passive participants this is not a suitable architecture.
 - i) Why is this not a suitable architecture?
 - ii) What is the bandwidth needed to service 1000 passive participants with an (uncompressed) stream of video signals where each frame has a resolution of 500×400 pixels and a colour depths of 8 bits. Assume a standard TV frame rate.
 - iii) How would you improve the architecture to reduce the bandwidth? Describe your solution in sufficient detail.
- c Describe the difference between the HTML link and addressing scheme and the HyTime link and addressing scheme.

The three parts carry, respectively 30%, 40% and 30% of the marks.

End of Paper