OLLSCOIL NA hÉIREANN GAILLIMH

NATIONAL UNIVERSITY OF IRELAND GALWAY

SUMMER EXAMINATIONS 2003

The Third University Examination for the Degree of B.Sc. in Biomedical Science

Biomedical Systems (CT323)

Professor D. Bell
Professor G. Lyons
Dr. A. Golden

Time allowed: **Two hours**
Answer three questions, with at least one question from each Section.
Please use seperate answerbooks for each Section.

Section A

1. Three typical laboratory models include a Research and Development model, a Quality Control Model, and an Analytical Control model. Outline the differences between the three, and specific LIMS related needs that must be considered for each.

2. You have just started work for a medium sized biomedical business that will shortly commence performing blood tests for hospitals in the Western Health Board region. The managing director has asked you to outline the case for and against purchasing a LIMS system - what would be your report to her?

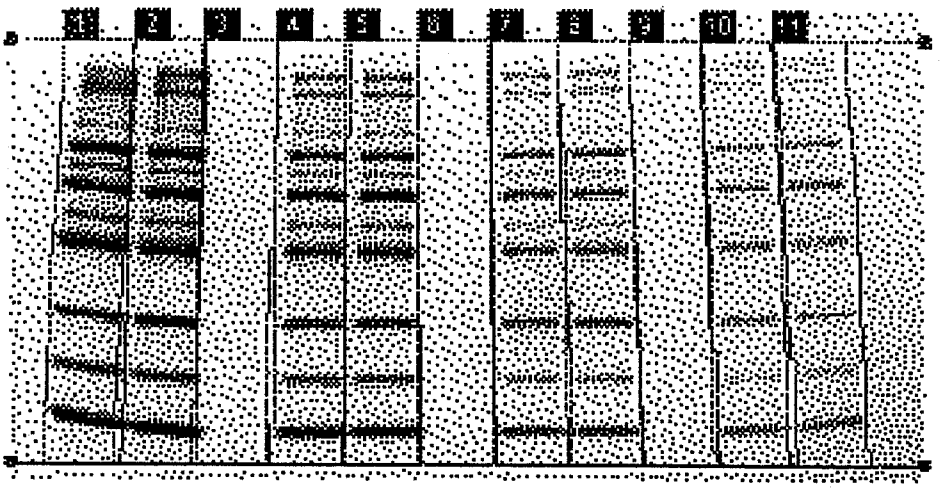
3. What role do both operations and systems analysis have in the eventual design of a specific LIMS solution?

Section B

4. (a) Explain the difference between global (point) and local image processing operations - give examples of each 'class' of operation.

   (b) What is meant by convolution in image processing? Describe what role the kernel plays in this process. Can you explain what is meant by a deconvolution process?

5. The following figure is that of a gel electrophoresis experiment, showing the isolation of DNA 'markers'. This image is what typically be acquired via an automated CCD system - outline the algorithmic steps that could be carried out to (i) clean the images (ii) correct for the apparent geometric distortion (i.e. deviation away from 'parallel' gel lines caused by the camera optics) (iii) accurate isolation of the 'marker' regions, and (iv) measurement of each 'marker"s gel line position and intensity.



6. Discuss the effectiveness of using parameter space in the processing of images - illustrate your answer with appropriate examples.

Section C

7. Write notes on the following: Homology; Substitutions; Insertions & Deletions.
   How are these issues relevant to the problem of sequence alignment?

8. Given two simple, sample sequences x = TTGTCAGACGA and y = TCGGAGTTG, outline four possible 'algorithms' that might be used to optimally align the sequences. If one scores a +1 for a match, -1 for a mismatch and -2 for a gap, which 'algorithm' is the best?

9. Discuss the need for sequence alignment analysis in contemporary biological research. In your answer indicate precisely why understanding the sequencing itself is so important.