

NATIONAL UNIVERSITY OF IRELAND, GALWAY
OLLSCOIL NA hÉIREANN, GAILLIMH

SEMESTER II, SPRING 2001 EXAMINATION

MSc Degree in Biomedical Science – 1MV131

CT513 BIOMEDICAL SYSTEMS (INFORMATION TECHNOLOGY)

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Time allowed: TWO hours

Answer THREE questions: ONE must be from Section A and ONE must be from Section B
All questions carry equal marks

SECTION A

- Q.1.** You have just started work for a medium sized biomedical business that will shortly commence the manufacture of a range of intravenous drip solutions for the US healthcare industry. The managing director has asked you to outline the case for and against purchasing a LIMS system – what would be your report to her?
- Q.2.** Describe the role of operations and systems analysis in the process of preparing a specific LIMS solution for a particular laboratory environment.
- Q.3.** In the implementation of a LIMS solution, the specific sequence of steps in this process include planning around the proposed LIMS solution, and a validation phase. Describe in some detail these two critical steps.

SECTION B

- Q.4.** (a) Briefly describe, with sketches, three different projection methods used in 3D graphics.
- (b) Compare the operation and functionality of modern graphics adapters to traditional graphics adapters. Describe one way in which improved graphics adapters have benefitted biomedical science.
- (c) Describe and compare the operation of computerized tomography (CT-scan) and Magnetic Resonance Imaging (MRI) apparatus in hospitals. Briefly describe another application of CT in the biological sciences.

Q.5. (a) Discuss geometric image processing operations, and describe three different applications of this class of technique. Explain the term "interpolation" in your answer, making use of a diagram to explain one method of interpolation.

(b) Explain what is meant by the term "power spectrum", and describe the process of frequency clipping. Name three methods for de-noising a medical X-ray. What are the advantages and disadvantages of these methods, relative to each other?

Q.6 (a) Describe three size measurements and three shape measurements commonly used in the feature extraction stage of object classification. Describe four characteristics which are desirable in a selected feature. Briefly describe how classification normally proceeds after feature extraction.

(b) A number of objects are to be extracted from the biomedical image below. The objects are magnified cells, approximately circular in shape and of radius 10 to 25 pixels; we are particularly interested in those whose interiors appear darker after staining. There are also much smaller cells, of radius 2–4 pixels and tending to cluster into dense groups, visible on the same slide. The image is of reasonable signal-to-noise ratio (i.e. all the cells have edges of reasonable contrast). Describe the key steps that could be carried out to segment this image and to classify its cellular content in as robust a manner as possible. The final classification should maximise the information which can be gleaned about the three main cellular populations.

