

Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 281

Semester 1 Examinations, 2005

Exam Code(s)	1SD1, 4BS2, 4CS2, 1EM1
Exam(s)	Higher Diploma in Applied Science (Software Design & Development) 4 th Year BSc 4 th Year BSc Computing Studies/Mathematical Science Erasmus
Module Code(s)	CT336
Module(s)	GRAPHICS AND IMAGE PROCESSING
Paper No.	1
Repeat Paper	Special Paper
External Examiner(s)	Prof. S. McClean.
Internal Examiner(s)	Dr. M. Madden Dr. S. Redfern

Instructions:

Time allowed: 2 hours
Answer any 3 questions

All questions carry equal marks.

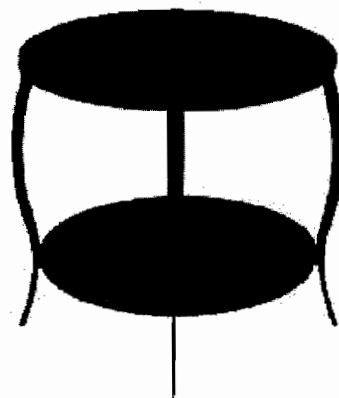
Duration	2 hrs
No. of Answer books	1
<u>Requirements:</u>	
Handout	
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	
No. of Pages	4
Department(s)	Information Technology

Q.1.

Real-time 3D graphics programmers use a variety of techniques to improve the realism of their virtual worlds while keeping the number of polygons actually being rendered to a minimum. Discuss the techniques that are currently used. (20 marks).

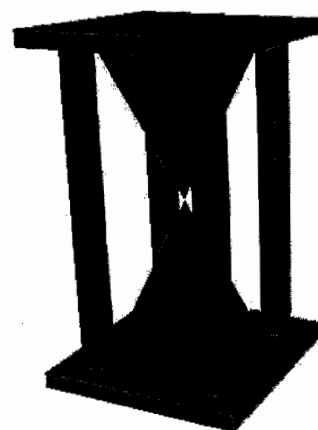
Q.2.

- (a) With respect to the digital storage of raster (bitmapped) graphics, explain the differences between “lossless” compression and “lossy” compression. Briefly outline the dictionary-based compression algorithm used in GIF image files. What characteristics would you expect to see in an image that is highly suitable for GIF compression? (5 marks).
- (b) Describe the raster graphics technique of “antialiasing”, referring to both “weighted area sampling” and “unweighted area sampling” in your answer. (5 marks).
- (c) Write VRML code to create an object similar to the table shown on the right.
Note that the most useful VRML nodes are summarised on the final page of this exam paper. (10 marks).



Q.3.

- (a) Discuss the following techniques used in modern computer graphics: (i) back buffering (ii) hardware accelerated graphics adapters. (5 marks).
- (b) Discuss the following concepts in computer animation: (i) nested co-ordinate systems; (ii) keyframe animation. (5 marks).
- (c) The model pictured on the right is of an egg timer. Write VRML code to create an object similar to this. You should approximate the materials as well as the geometry.
Note that the most useful VRML nodes are summarised on the final page of this exam paper. (10 marks).



Q.4.

(a) (i) Discuss the image processing technique called 'active contours'. (ii) Present a suitable set of optimisation constraints (sometimes called energy factors) for accurately tracing the outline of a hand in an image such as the one shown below, using active contours. (10 marks).



(b) Outline and discuss an algorithm for accurately counting the number of bubbles in image such as the one shown below. Your approach should address the presence of noise as well as the fact that the bubbles may be overlapping (10 marks).



Q.5.

(a) Describe the morphological techniques of erosion and dilation. Compare the four operations (i) opening, (ii) closing, (iii) thinning and (iv) thickening. In what circumstances might each of these four operations be used? (10 marks).

(b) The image on the right is of a printed circuit board (PCB), thousands of which are manufactured every hour in a particular factory. It is required as part of the quality control of this factory to produce an automatic machine vision system, which extracts the traces (straight bits), end points (places at which a trace terminates), and pads (circular bits) in the image. **Present and discuss** a suitable and robust set of image processing algorithms for this task (10 marks).

