Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

GX 1485

Semester 1 Examinations, 2003

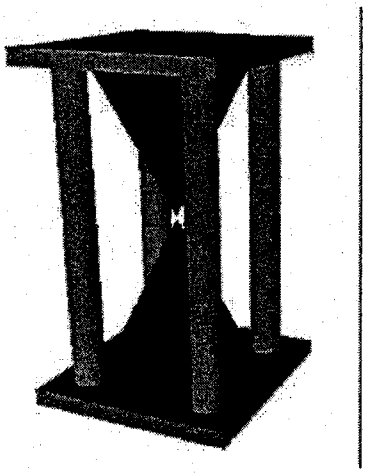
Exam Code(s)	4IF1, 4BP1, 1MF221
Exam(s)	4th Year B.Sc. (Information Technology) 4th Year B.E. (Electronic & Computer Engineering) 1st Year M.Sc. Software Design & Development (Stream 2)
Module Code(s)	CT404
Module(s)	GRAPHICS AND IMAGE PROCESSING
Paper No.	1
Repeat Paper	Special Paper
External Examiner(s)	Prof. P. Nixon Prof. D. Bell
Internal Examiner(s)	Prof. G. Lyons 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
Requirements:	
Handout	
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Other Material	
No. of Pages	6
Department(s)	Information Technology

Q.1.



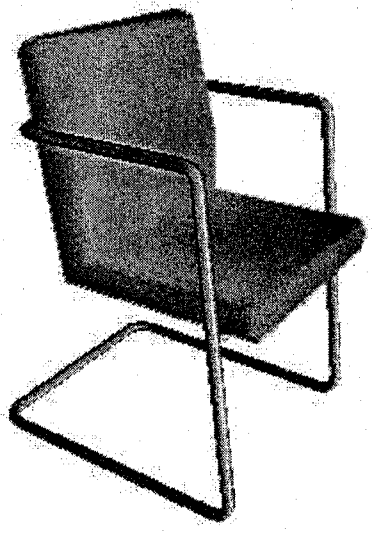
(a) Discuss the following techniques used in modern computer graphics: (i) back buffering (ii) hardware accelerated graphics adapters.

(b) Discuss the following concepts in computer animation: (i) nested co-ordinate systems; (ii) keyframe animation.

(c) The model pictured on the right is of an egg timer. Write VRML code to create an object similar to this. Note that the most useful VRML nodes are summarised on the final page of this exam paper.

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?

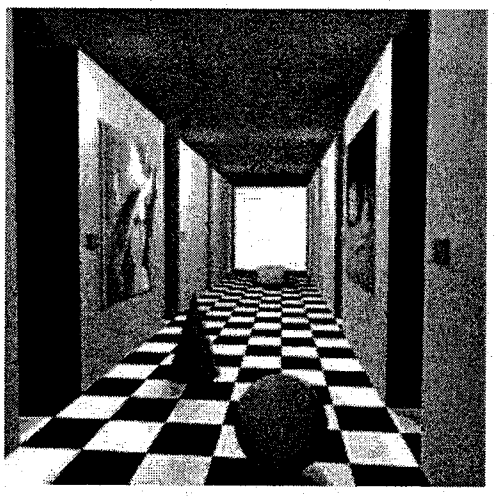


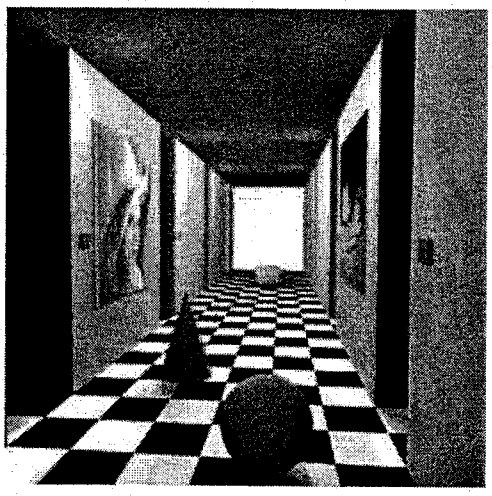
(b) Describe the raster graphics technique of "antialiasing", referring to both "weighted area sampling" and "unweighted area sampling" in your answer.

(c) The model pictured on the right is of an office chair. Write VRML code to create an object similar to this. Hint: the tubular component that makes up the legs and arms of the chair could be created by extruding a circular cross-section through a complex 3D path, applying rotations at the appropriate spine points. Note that the most useful VRML nodes are summarised on the final page of this exam paper.

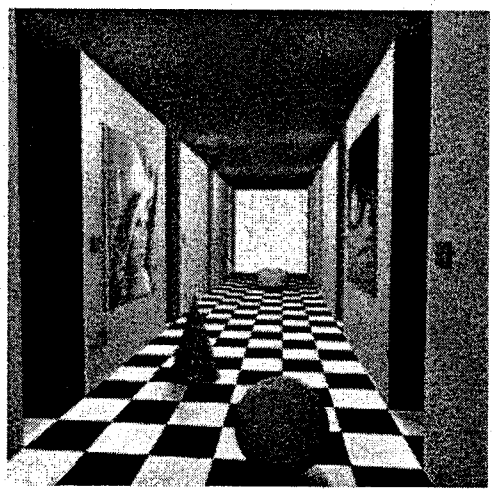
Q.3.

The first two images pictured below represent the left and right components of a stereo pair. Outline and discuss an algorithm for estimating the distance that each pixel in the left image is from the camera.





Explain how the algorithm you have outlined might be extended in order to robustly deal with noise (such as that present in the image below).



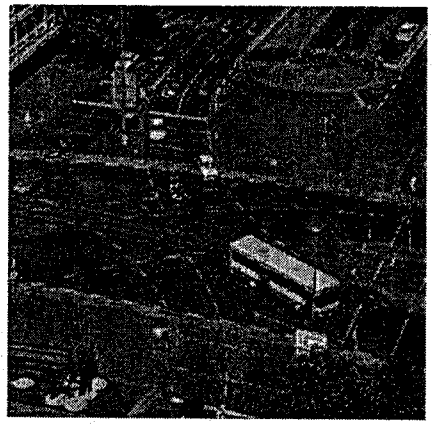
Q.4.

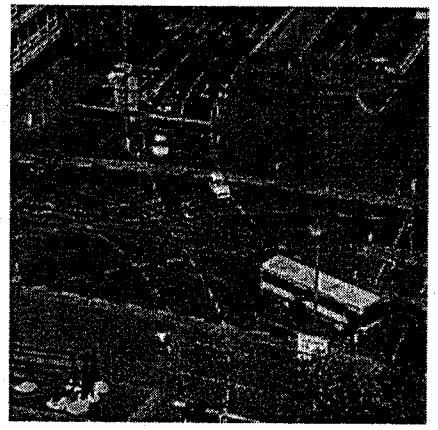
(a) Many automatic image analysis algorithms begin by smoothing an image, and then applying an edge extraction filter in order to ascertain the evidence for the edges of objects in the image. Discuss the use of smoothing and edge detection for these purposes. What approaches might be used to deal with problems such as fragmentary edges and occluded edges?

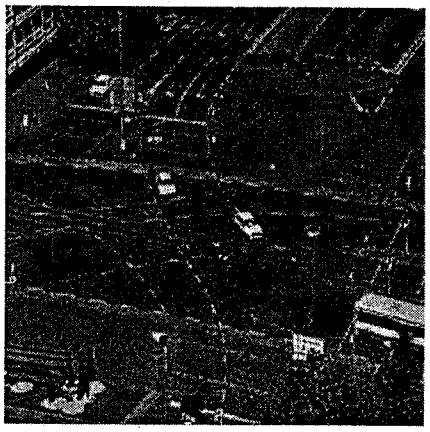
(b) The three images shown on the right have been taken from a larger sequence of images in which traffic flow is monitored.

Outline a suitable algorithm for counting the number of vehicles in a sequence of such images.

Assuming that there is a known period of time between subsequent images, and also that the approximate scale of the images (metres-per-pixel) is known, outline an algorithm for estimating the average speed of traffic flow.

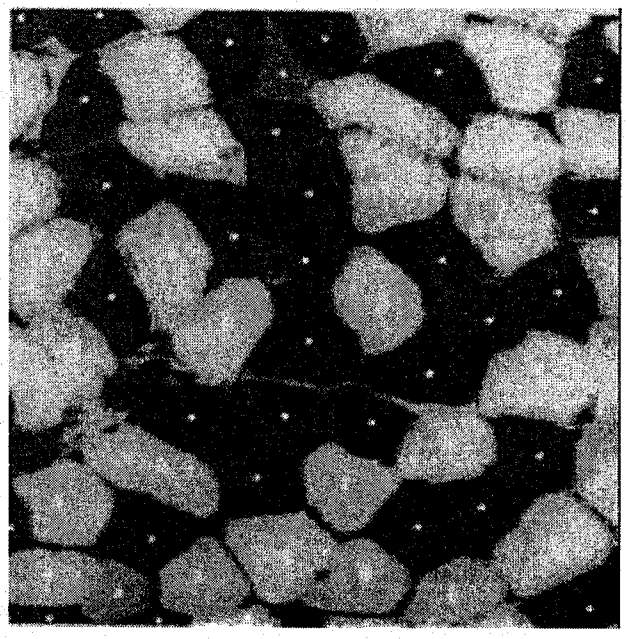






Q.5.

(a) The image pictured on the right contains numerous separate objects which are characterised by colour, texture, and the presence of reasonably strong contrast edges between them. The white spots in the centre of each object are initial 'seed' points that have been identified by a human user. Describe an algorithm that makes use of these seed points in order to robustly segment this image into its separate objects.



(b) The image on the right is of a satellite image containing regions of land (lighter) and regions of water (darker). The white lines depict the result of an algorithm for automatically segmenting the scene into regions of land and water. Outline and discuss an algorithm that could perform this operation.