

There are three sections to this paper. Answer ONE question from each section.

## **Section 1: Databases**

Question 1.

a) What are the main reasons that the relational model has become so successful ?

*[11 Marks]*

b) SQL by default does not remove duplicate rows. Discuss the main reason for this approach and illustrate your answer with an SQL query.

*[11 Marks]*

c) Briefly discuss the differences between finding information in a relational database using SQL and finding information in the World-Wide-Web using a search engine.

*[11 Marks]*

*[Total 33 Marks]*

TURN OVER

Question 2.

a) What is the Universal Relation Schema Assumption (URSA)? Discuss the importance of the URSA in the context of ISA relationships.

*[11 Marks]*

b) Why do multi-valued attributes in an Entity Relationship Diagram (ERD) violate First Normal Form? Show with the aid of an ERD fragment how you would express a multi-valued attribute such as a set of authors using only single-valued attributes.

*[11 Marks]*

c) Write a sentence or two on each of the following:

- 1) physical data independence
- 2) growth independence
- 3) optional and mandatory classification of relationships
- 4) COMMIT and ROLLBACK
- 5) precision and recall

*[11 Marks]*

*[Total 33 Marks]*

CONTINUE

## Section 2: Graphics

Question 3.

a) Given a polygon defined by the vertices  $p_1$  through  $p_n$ , describe a method to test whether another point  $q$  is inside that polygon.

*[9 Marks]*

b) Describe the basic operations of Constructive Area Geometry (CAG) and describe a method to test if a point  $q$  is inside a shape defined using CAG.

*[12 Marks]*

c) Describe and give psuedo-code for the recursive method to draw a bezier curve defined by four control points.

*[12 Marks]*

*[Total 33 Marks]*

TURN OVER

Question 4.

a) Give definitions of the following concepts and describe their use in building a scene graph:

- 1) World (or Logical) Coordinates
- 2) Screen Coordinates
- 3) Local Transformation Matrix
- 4) Rendering Traverse

*[10 Marks]*

b) A logical coordinate to screen coordinate mapping is set up so that a diagram which has an extent of  $(-5, -4)$  to  $(+5, +6)$  in logical coordinates is mapped onto a screen with pixel co-ordinates from 0,0 to 300, 400. The user clicks on pixel 200,300. What does this correspond to in the logical co-ordinates of the diagram?

*[5 Marks]*

c) A transformation is composed of the following operations: translate  $(2,3)$ , rotate by 90 degrees, scale by  $(4,1)$ . Where do the points  $(0,0)$  and  $(1,2)$  end up under this transformation?

*[9 Marks]*

d) Describe the steps involved in creating a transformation that rotates a shape about an arbitrary point and construct a single matrix that represents such a transformation.

*[9 Marks]*

*[Total 33 Marks]*

CONTINUE

### **Section 3: Human-Computer Interaction**

Question 5.

(a) Explain the concept of direct manipulation. Explain how you would apply DM to the design of a computer-controlled lectern panel from which a lecturer can control facilities such as lighting and audio in the room, plus a videoprojector, a laptop, a document camera, a videoplayer and a slide projector.

*[12 marks]*

(b) Direct manipulation systems - and most other systems today - employ icons. What do icons usually represent, and why they are so popular with user interface designers?

*[9 marks]*

(c) Text labels are often added to icons; explain why designers do this. What should a designer consider when mixing dialogue styles?

*[12 marks]*

*[Total 33 Marks]*

**TURN OVER**

Question 6.

Computers are operated in a variety of physical contexts (e.g. outdoors; in vehicles; in offices; in factories).

(a) Identify the main contextual factors that would influence the design and configuration of the user interface and workspace for ANY TWO of the following:

- (i) a word processing system with speech in a shared office;
- (ii) a hand-held computerised navigation aid for walkers and climbers;
- (iii) a computerised navigation aid for a car.

*[12 marks]*

(b) Which user study methods would you employ to identify contextual factors which may pose constraints for the design system?

*[9 marks]*

(c) Explain – in brief - the relationship between task analysis and dialogue styles.

*[12 marks]*

*[Total 33 Marks]*

END OF PAPER