

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

Section 1: Databases

Question 1.

Answer the following three parts.

- a) SQL allows relations to have null values which indicates that the value exists but is missing. For example, the address or phone number of a person may be missing.

How should aggregate functions such as AVG and COUNT work in the presence of missing information. Use simple examples to illustrate your answer.

[11 Marks]

- b) Data modelling is a central activity in the process of database design and is independent of the actual database system used. Describe the components of a data model with reference to the relational data model.

[11 Marks]

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

- 1) the physical level of a database system
- 2) growth independence of the database
- 3) DML and DDL
- 4) DBA
- 5) Retrieval of information from the Web

[11 Marks]

[Total 33 Marks]

TURN OVER

Question 2.

Answer the following three parts.

- a) ISA relationships in an Entity Relationship Diagram can be used to model inheritance between entity types. Show how this can be done.

Multiple inheritance between entity types can cause naming conflicts. Show how the Universal Relation Schema Assumption (URSA) can disambiguate such conflicts.

[11 Marks]

- b) It is often desirable to construct an Entity Relationship Diagram (ERD) prior to the definition of the relational database schema. Show how an ERD can be translated into a relational database schema, illustrating your answer by a simple example.

[11 Marks]

- c) SQL does not remove duplicate rows unless explicitly asked to do so. What is the main reason for this approach?

Illustrate the syntax of duplicate removal in SQL.

[11 Marks]

[Total 33 Marks]

CONTINUE

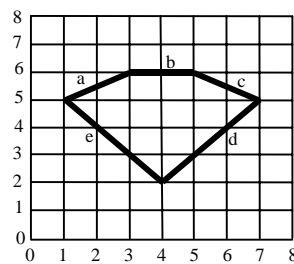
Section 2: Graphics

Question 3.

- a) Outline the two common points in polygon tests. Show, by the use of example figures, situations where the two tests generate similar results and situations where they generate different results.

[9 Marks]

- b) The following shape is to be scan-converted using the Active Edge Table method. Describe how the initial Edge Table data structure is constructed, and detail what happens as each scan line is processed.



[13 Marks]

- c) Write a short paragraph explaining each of the following concepts in rendering:

- alpha
- anti-aliasing
- super-sampling
- double buffering

[11 Marks]

[Total 33 Marks]

TURN OVER

Question 4.

- a) Describe, with the aid of pseudo-code, how a sharpening filter can be applied to an image.

[11 Marks]

- b) Explain the popularity and median-cut algorithms for selecting a set of colours for an indexed colour map.

[11 Marks]

- c) An image defined in 24bit RGB is to be converted to an image with an 8bit indexed colour map. A certain pixel had colour B before the conversion, and corresponds to colour B' in the indexed colour map after the conversion.

If the distance between two colours $C_1 = (R_1, G_1, B_1)$ and $C_2 = (R_2, G_2, B_2)$ is defined as $MAX(|R_1 - R_2|, MAX(|G_1 - G_2|, |B_1 - B_2|))$, what is the maximum distance between B and B' if the popularity algorithm was used to select the indexed colour map? What is the maximum distance between the B and B' if the median-cut algorithm was used to select the indexed colour map? Give examples where the maximum values occur for both algorithms.

[11 Marks]

[Total 33 Marks]

CONTINUE

Section 3: Human-Computer Interaction

Question 5.

A telecoms company is looking to expand its business into location-based information services. They want to create a system where local sensors detect a mobile device (phone, PDA) moving through the adjacent area, and can beam information about buildings, people, businesses, events etc. to the device. Information providers would pay to have their information transmitted to people passing through the adjacent area. The telecoms company commissions you to find out whether people would be interested in receiving such information, and in what form; they need the results within 3 months and are offering you enough money to employ 4 persons full-time.

- a) Write a plan for the User Study, clearly stating goals, scope, criteria, data to be collected and data collection/analysis methods to be used.

[22 Marks]

- b) State the purpose of piloting data collection/analysis methods, and explain how you would pilot one of the methods you have selected in answer a)

[11 Marks]

[Total 33 Marks]

TURN OVER

Question 6.

You are designing a bespoke system for discount travel agency, which sells cheap airplane tickets and holidays mostly over the phone, but also to people dropping into the shop. The shop is rather cramped, and due to rapid increase in turnover, 2 operators have to share a normal-size desk. The system interfaces to a search engine, and allows customer details and bookings to be recorded and invoices to be sent out.

- a) Identify the physical, task/situational and cultural factors that have to be addressed in the design of the system.

[22 marks]

- b) Which input devices and dialogue styles would you chose in view of the above factors.

[11 marks]

[Total 33 Marks]

END OF PAPER