Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Fundamentals of Databases

Date: Monday 19th May 2008
Time: 09:45 – 11:45

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

This Examination is split into TWO parts:

Part A is a set of 20 compulsory Multiple Choice Questions

Part B is a set of 2 conventional exam style questions
(you must answer 1 from 2 listed)

This is a CLOSED book examination

The use of electronic calculators is NOT permitted.
Part A

Section A comprises of multi-choice questions and therefore cannot be published.
Part B

Choose any ONE Questions from the TWO provided

1. a) Describe Relational Schemas in terms of Entity Relationship Diagrams, and show the flow and transitions between ER and Relational Schemas from design to implementation. Remember to include discussions of how you would specify keys, derived attributes, etc. You should also use examples to illustrate your points and assist your discussion. (6 marks)

b) Table 1 shows a set of Un-Normalised data that represents packing information for a DIY superstore. Explicitly state your assumptions regarding functional dependency, and in each case explain how and why you performed your conversions.

Convert the data to 1\textsuperscript{st} Normal form (1NF). (1 mark)
Convert the data to 2\textsuperscript{nd} Normal form (2NF). (3 marks)
Convert the data to 3\textsuperscript{rd} Normal form (3NF). (4 marks)

Table 1: Un-Normalised Data

<table>
<thead>
<tr>
<th>NoteNo</th>
<th>Packer</th>
<th>Name</th>
<th>Address</th>
<th>ItemNo</th>
<th>Qty</th>
<th>PartNo</th>
<th>Desc</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>JW</td>
<td>Bloggs</td>
<td>Northants</td>
<td>1</td>
<td>100</td>
<td>1234</td>
<td>Nuts</td>
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<td></td>
<td>2</td>
<td>200</td>
<td>2341</td>
<td>Nails</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>300</td>
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<td>3</td>
<td>500</td>
<td>4321</td>
<td>Washers</td>
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</tbody>
</table>

c) This question requires you to think across sections of the course or about information you have not been formally taught. There are 4 main ways of increasing the performance of a Database. What are these and how do any of them relate to normalisation? How could these performance increases relate to database block structure? From your experience of the real world when would you use hashing and indexing? (6 marks)
2. a) Explain the concept of Transactions and their importance as a Recovery Unit. You should list their ACID properties and describe how transactions relate to the Lost Update Problem. You should use examples to illustrate your points and assist your discussion.  (6 marks)

b) Write SQL statements to:

i) Create the student relation shown in Fragment 1. You should create keys and populate the table too.  (2 marks)

ii) Repeat (i) adding an integrity check to ensure that Module.academic-year is either 1, 2, or 3.  (3 marks)

iii) Why are aggregation operators not stored as SQL attributes, and why is there a problem modelling aggregation in conceptual models?  (3 marks)

```
| Staff(id, given-name, surname) |
| Student(id, given-name, surname, entry-year, {derived: academic-year}) |
| Module(code, name, academic-year) |
| TutorsOnModule(sta-id {fk:Staff.id}, stu-id {fk:Student.id}, mod-id {fk:Module.code}) |
```

Fragment 1: Relational Schema

c) This question requires you to think across sections of the course or about information you have not been formally taught. An Entity Relationship (ER) Diagram is the standard method of modelling entities and relationships for database creation. What other diagramming techniques could be used to model these entities and relationships? Are ER Diagrams suitable for modelling Object Oriented Databases? Justify your answer. Can you fully describe a database using ER modelling?  (6 marks)

END OF EXAMINATION

The Question Paper must be returned before you leave the examination