Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Fundamentals of Databases

Date: Monday 1st June 2009
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 – use a separate answerbook)

This is a CLOSED book examination

The Examination Mark is out of a total possible of 35

Part A Questions 1-10 achieve 0.5 marks each
Part A Question 11-20 achieve 1.0 marks each
Part B Questions achieve 20 marks each

Incorrect answers achieve 0 marks

The use of electronic calculators is NOT permitted.
Part A

Part A comprises of multi-choice questions and there cannot be published.

The Question Paper must be returned before you leave the examination
Part B

Choose 1 Question from the 2 provided

1. a) Describe the following in terms of File Organisation and Indexes:
   
i) The properties of UnOrdered and Ordered files. (2 marks)
   
ii) The properties of Open Addressing and Chaining. (2 marks)
   
b) Describe File Organisation in terms of Indexing and Access Paths. Make sure include the discussions on the different types, levels, and densities of indexes. You should also use examples to illustrate your points and assist your discussion. (6 marks)
   
c) Figure 1 shows a completed Entity Relationship Diagram that represents banking information. Each bank can have multiple branches, and each branch can have multiple accounts and loans.

![ER Diagram](image)

Figure 1: BANK ER Diagram

(Question 1 continues on the following page)

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(Question 1 continues from the previous page)

i) List the (nonweak) entity types in the ER diagram. (1 mark)

ii) Is there a weak entity type? If so, give its name, its partial key, and its identifying relationship. (1 mark)

iii) What constraints do the partial key and the identifying relationship of the weak entity type specify in this diagram? (2 mark)

iv) List concisely the user requirements that led to this ER schema design. (2 marks)

d) Use standard methods to build a Relational Schema for the completed ER diagram from question 1.c above. Include all Entities and Relationships including those you added to complete the diagram (you need not normalize your Schemas beyond the implicit normalization suggested in the entity relationship diagram). (4 marks)

2. a) With regard to Transaction Management:

i) Describe Locking and Time Outs. (2 marks)

ii) Describe Wound-Wait and Wait-Die with regard to Deadlock. (2 marks)

b) Explain the concept of Transactions and their importance as a Recovery Unit, listing and describing the three main recovery techniques and explaining the concepts of roll-forward and check-pointing. You should use examples to illustrate your points and assist your discussion. (6 marks)

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

i) Describe why the table shown below is not in first normal form (1NF). (1 mark)

ii) The table shown below is susceptible to update anomalies. Provide examples of how insertion, deletion, and modification anomalies could occur on this table. (1 mark)

(Question 2 continues on the following page)

The Question Paper must be returned before you leave the examination
iii) Identify the functional dependencies represented by the table shown below. State any assumptions you make about the data shown in this table (if necessary). Use any method you wish to accomplish this, however use the arrow style from the lectures if you are unsure. You may also combine this question with the one below if you prefer. (2 marks)

iv) Using the functional dependencies identified in part (iii), describe and illustrate the process of normalization by converting the table shown in Table 1 to Third Normal Form (3NF). (2 marks)

Table 1: Un-Normalised Data

<table>
<thead>
<tr>
<th>filmNo</th>
<th>fTitle</th>
<th>dirNo</th>
<th>director</th>
<th>actorNo</th>
<th>aName</th>
<th>role</th>
<th>timeOnScreen</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1100</td>
<td>Happy Days</td>
<td>D101</td>
<td>Jim Alan</td>
<td>A1020</td>
<td>Sheila Toner</td>
<td>Jean</td>
<td>15.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D101</td>
<td>Jim Alan</td>
<td>A1222</td>
<td>Peter Watt</td>
<td>Simson</td>
<td>25.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D101</td>
<td>Jim Alan</td>
<td>A1020</td>
<td>Sheila Toner</td>
<td>Kinder</td>
<td>22.56</td>
</tr>
<tr>
<td>F1109</td>
<td>Snake Bite</td>
<td>D076</td>
<td>Sue Ramsay</td>
<td>A1567</td>
<td>Steven</td>
<td>Tim</td>
<td>19.56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D076</td>
<td>Sue Ramsay</td>
<td>A1222</td>
<td>McDonald</td>
<td>Rosey</td>
<td>10.44</td>
</tr>
</tbody>
</table>

d) Sketch an Entity–Relationship model for the data shown in table above. (4 marks)

END OF EXAMINATION

The Question Paper must be returned before you leave the examination