Two hours

Please note that an OMR Sheet is attached for use with Section A:
full instructions for their use are given in Section A

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Fundamentals of Databases

Date: Wednesday 25th January 2012

Time: 09:45 - 11:45

The Paper is in THREE Sections

Section A is compulsory set of 20 Multiple Choice Questions

Section A Questions 1-10 achieve 0.5 marks each
Section A Questions 11-20 achieve 1.0 marks each
Incorrect answers achieve 0 marks

Please answer ONE further question (worth 20 marks)
from either SECTION B or SECTION C

Please use separate Answerbooks for EACH SECTION

The total examination mark is out of a possible 35

This is a CLOSED book examination

The use of electronic calculators is NOT permitted

Section A is restricted and cannot be published

Section B

B. a) Figure 1 shows a partially completed entity relationship (ER) diagram that represents packing information for a DIY superstore. Orders are composed of order-parts, and order-parts must consist of a quantity of catalogue_items.

i) Complete the diagram; state clearly any assumptions you make.

(2 marks)

ii) Use standard methods to build a relational schema for the completed ER diagram. 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).

(6 marks)

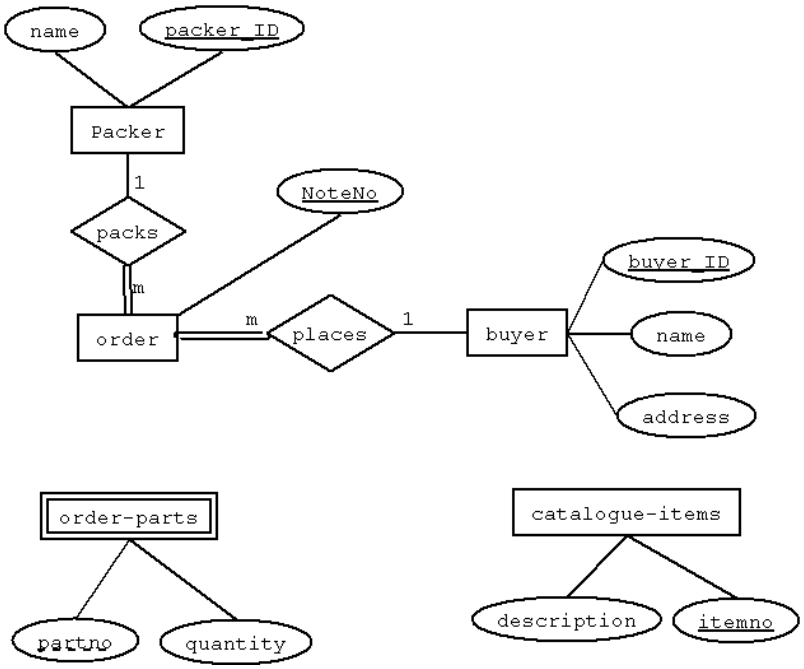

Figure 1: DIY ER Diagram

b) Table 1 shows a set of un-normalised data that represents packing information for a DIY superstore.

i) List the general inference rules for functional dependencies
(3 marks)

ii) Convert the data to 1st normal form (1NF). Briefly explain your answer.
(1 mark)

iii) Convert the data to 2nd normal form (2NF). Briefly explain your answer.
(2 marks)

iv) Convert the data to 3rd normal form (3NF). Briefly explain your answer.
(2 marks)

Explicitly state your assumptions regarding functional dependency, and in each case explain how and why you performed your conversions.

Table 1: Un-normalised Data

NoteNo	**Packer**	**Name**	**Address**	**ItemNo**	**Qty**	**PartNo**	**Desc**
300	JW	Bloggs	Northants	1	100	1234	Nuts
				2	200	2341	Nails
				3	300	3412	Bolts
200	GK	Smith	Manchester	1	300	2341	Nails
				2	400	1234	Nuts
				3	500	4321	Washers

c) Describe relational schemas in terms of ER diagrams, and show the flow and transitions between ER diagrams and relational schemas from design to implementation. Remember to include discussions of how you would specify keys, derived attributes etc. Use examples and diagrams to illustrate your points and assist your discussion.
(4 marks)

[PTO]

The Question Paper must be returned before you leave the examination

Section C

C. a) Select the most appropriate File Organisation for each of the following situations, and explain your choice in each case.

i) Situation 1: The relation to be stored in disk has an index key as additional access structure.
(2 marks)

ii) Situation 2: The relation to be stored in disk is always accessed as a whole, i.e., every tuple in the relation is retrieved every time the relation is accessed.
(2 marks)

iii) Situation 3: The access order of the individual tuples of the relation to be stored in disk is random and it is always based on the same field.
(2 marks)

b) Describe the following:

i) What an index is and what it is used for. (1 mark)
ii) Each of three different types of single-level index. (2 marks)
iii) An example for one of the types of single-level index (by illustration clearly specifying the index type you are illustrating). (2 marks)
iv) What a multi-level index is, in which circumstances it should be used, and how it reduces the search effort for a tuple. (2 marks)
v) An example of a multi-level index (by illustration). (1 mark)

c) 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)

END OF EXAMINATION

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