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THE UNIVERSITY
of LIVERPOOL

JANUARY 2003 EXAMINATIONS

Flexible Degree: Year 2

Information Systems

TIME ALLOWED : Two Hours

INSTRUCTIONS TO CANDIDATES

Answer **all** questions in Section A
Answer **two** questions in Section B

If you attempt to answer more questions than the required number of questions (in any section), the marks awarded for the excess questions will be discarded (starting with your lowest mark).

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SECTION A

Answer **ALL** Questions in this section.

1. In the context of databases, give brief answers to the following questions:

   (a) Define what a Database is. **3 marks**

   (b) What is a Data Base Management System? **3 marks**

   (c) Describe how the mathematical concept of a relation is represented in relational databases? **4 marks**

   (d) What is a Data Type? **2 marks**

   (e) Define the following concepts:

      i. superkey, **2 marks**

      ii. candidate key, **2 marks**

      iii. primary key, **2 marks**

      iv. foreign key. **2 marks**

2. Answer the following questions on entities and relationships:

   (a) What is the multiplicity of a relationship and how is it described in an entity-relationship diagram? **5 marks**

   (b) Specify the multiplicity for the following relationships:

   A member of staff manages a branch. **2 marks**

   A branch has a member of staff. **2 marks**

   Newspapers advertise properties for rent. **2 marks**

   (c) Explain the difference between composite and multi-valued attributes. Give examples of such attributes. **4 marks**

   (d) What is a referential integrity constraint? **5 marks**

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SECTION B Answer TWO of Questions 3, 4 or 5.

3.   (a) Give the definition of the First Normal Form.   **2 marks**

   (b) Give an example showing a table that is not in the First Normal Form.   **3 marks**

   (c) Consider the following table with the *composite primary key* {staffNo, branchNo}:

staffNo	sName	position	salary	branchNo	branchAddress
SL21	John White	Manager	30000	B005	22 Deer Rd, London
SG37	Ann Beech	Assistant	12000	B003	163 Main St, Glasgow
SG14	David Ford	Supervisor	18000	B003	163 Main St, Glasgow
SA9	Mary Howe	Assistant	9000	B007	16 Argyll St, Aberdeen
SG5	Susan Brand	Manager	24000	B003	163 Main St, Glasgow
SL41	Julie Lee	Assistant	9000	B005	22 Deer Rd, London

   — Why is the table not in Second Normal Form, assuming appropriate dependencies between columns?   **5 marks**

   — Convert the table to an equivalent collection of tables that are in Second Normal Form.   **10 marks**

4. A training company needs a database to hold information on the courses it provides. The following statements have resulted from an initial analysis of the requirements:

   • The company delivers a number of training courses (identified by a unique course number).

   • Each course is delivered by one lecturer at some location.

   • The course can be attended by a limited number of students.

   • Each student should be registered for a course.

   (a) Suggest entities for this application area.   **3 marks**

   (b) Identify relationships between the entities.   **5 marks**

   (c) Suggest possible attributes and choose primary keys.   **5 marks**

   (d) Draw an Entity-Relationship model describing the above showing the primary keys and multiplicity constraints   **7 marks**

5. Consider the following tables from a database on renting a property:

branch

branchNo	street	city	postcode
B0002	14 Deer Rd	Glasgow	G11 7QX
B0003	146 Alexandra Rd	Bristol	BS99 1NZ
B0004	34 Mayfield St	London	SW1 6EN
B0005	15 Argyll St	Aberdeen	AB2 9SU
B0007	286 Oxford Rd	London	NW8 6EU

staff

staffNo	fName	lName	position	salary	branchNo
SA11	David	Smith	Assistant	8,000.00	B005
SL7	Simon	Ford	Supervisor	20,000.00	B007
SL23	Mary	Chin	Assistant	14,000.00	B004
SL17	John	Brooks	Manager	25,000.00	B004
SG28	Susan	Stern	Manager	35,000.00	B002
SB32	Ann	Ley	Assistant	1000.00	B003

propertyforRent

propertyNo	city	street	rent	branchNo
PA18	Aberdeen	8 Suffolk St	630	B005
PG24	Glasgow	18 Dale Rd	400	B002
PL92	London	6 Argyll St	700	B007
PB16	Bristol	20 Manor Rd	375	B003
PL87	London	6 Lawry St	800	B004

Using the three tables above, give the expected results of the following queries:

```
SELECT propertyForRent.propertyNo, propertyForRent.city,
propertyForRent.rent
FROM propertyForRent
WHERE propertyForRent.city="London" AND
propertyForRent.rent Between 500 And 750;
```

4 marks

```
SELECT staff.fname, staff.lname, staff.branchNo,
branch.street, branch.city
FROM branch INNER JOIN staff ON branch.branchNo=staff.branchNo
WHERE staff.fname="David" And staff.lname="Smith";
```

5 marks

```
SELECT staff.staffNo, staff.fname, staff.lname, branch.city
FROM branch INNER JOIN staff ON branch.branchNo = staff.branchNo
WHERE branch.city="Glasgow";
```

5 marks

```
SELECT staff.fname, staff.lname, staff.salary, branch.city
FROM branch INNER JOIN staff ON branch.branchNo = staff.branchNo
WHERE staff.salary<20000 AND
(branch.city="London" Or branch.city="Bristol");
```

6 marks