



THE UNIVERSITY
of LIVERPOOL

JANUARY 2002 EXAMINATIONS

Master of Science : Year 1

APPLICATION OF INFORMATION TECHNOLOGY

TIME ALLOWED : Two Hours

INSTRUCTIONS TO CANDIDATES

Answer ALL questions from Section A
And TWO questions form Section B

If you attempt to answer more than the required number of questions, the mark awarded for the excess question (i.e. the one with the lowest mark) will be discarded.



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SECTION A

Attempt ALL questions from this section. Each question carries 10 marks.

1. Describe the process of conceptualisation of a spreadsheet. (10 marks)
2. Describe what is meant by logical data independence and physical data independence, and why they are desirable properties of a database. (10 marks)
3. (a) Describe what is meant by *data integrity* of a database. (4 marks)
(b) Describe the functionality and purpose of the following relational database features:
 - i. Enforce Referential Integrity (2 marks)
 - ii. Cascade Delete (2 marks)
 - iii. Cascade Update (2 marks)
4. Describe the following Entity-Relationship (ER) modelling concepts, and demonstrate the conventions used to represent each of these concepts in the ER notation:
 - (a) weak entity (4 marks)
 - (b) multivalued attributes (3 marks)
 - (c) derived attributes. (3 marks)



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SECTION B

Attempt TWO questions from this section. Each question carries 30 marks. Credit will be given for the best two answers only.

1. The table below lists car rental data. A client rents a given car from a specific branch on a specific period at a specific daily rent. The combination ClientNo + CarNo + RentStart is the primary key for the table.

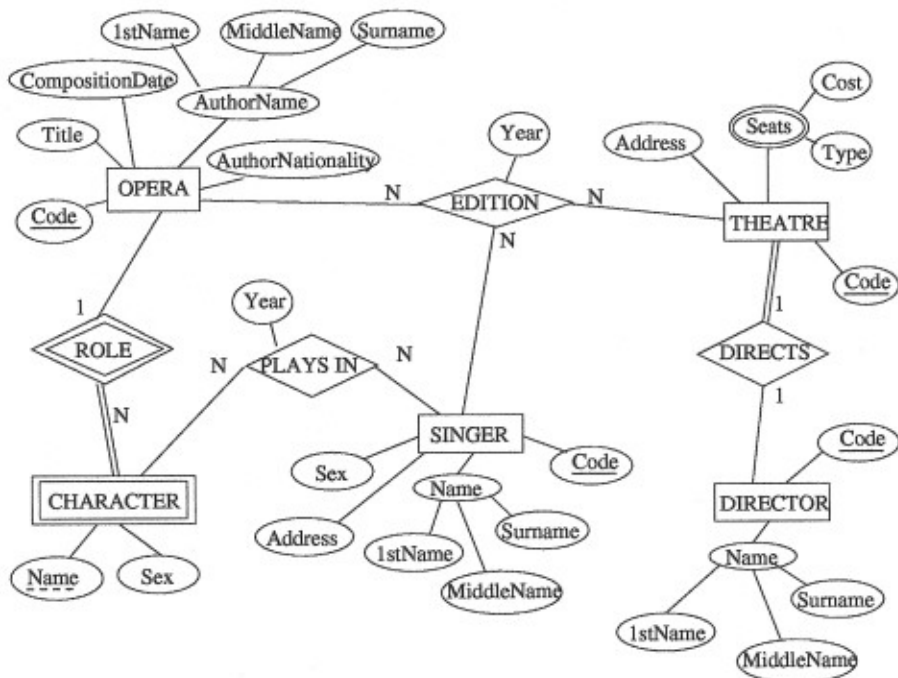
ClientNo	ClientName	CarNo	CarType	RentStart	RentFinish	Rent	BranchNo	BranchAddress
S1011	Tony Smith	P100	Ford	12-Sept-01	15-Sept-01	45	S15	6 Lawrence St, Glasgow
S1011	Tony Smith	P105	Rover	12-Dec-01	15-Dec-01	50	S15	6 Lawrence St, Glasgow
S1024	Helen Pearson	P108	Fiat	12-Sep-01	14-Sept-01	43	S10	5 Novar St, London
S1024	Helen Pearson	P108	Fiat	14-Nov-01	20-Nov-01	43	S10	5 Novar St, London
S1032	Robin Plevin	P105	Rover	14-Sept-01	15-Sept-01	50	S15	6 Lawrence St, Glasgow
S1032	Robin Plevin	P110	Toyota	15-Sept-01	22-Sept-01	70	S13	2 Manor Rd, York

- (a) Why is ClientNo + CarNo + RentStart a good primary key? (3 marks)
- (b) The table above is susceptible to update anomalies. Provide examples of insertion, deletion and update anomalies. (6 marks)
- (c) Describe and illustrate the process of normalising the table above to Third Normal Form. State any assumption you make about the data shown in the table. (15 marks)
- (d) What are the benefits and the limitations of normalisation? (6 marks)



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2. The Entity-Relationship model in the figure below represents the conceptualisation of an Opera database.



Map the ER model to a relational database schema.

(30 marks)



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3. A relational database for an estate agency contains information about the branches of the agency, with the staff and the properties for rent at each branch, the owner of each property, the staff member who handles the property, the clients of the agency, and the appointments each client has booked to view a property with a staff member. The database has the following definition:

- table BRANCH(BranchNo, street, city, postcode)
- table STAFF(StaffNo, Name, Surname, Position, DateBirth, Salary, BranchNo)
- table PROPERTIES-FOR-RENT(PropertyNo, street, city, postcode, type, rooms, rent, OwnerNo, StaffNo, BranchNo)
- table CLIENT(ClientNo, Name, Surname, telNo, maxRent)
- table OWNER(OwnerNo, Name, Surname, telNo, address)
- table VIEWING-APPOINTMENT(ClientNo, PropertyNo, viewDate)

The following referential constraints hold in the database:

- PROPERTIES-FOR-RENT.OwnerNo **references** OWNER.OwnerNo
- PROPERTIES-FOR-RENT.StaffNo **references** STAFF.StaffNo
- PROPERTIES-FOR-RENT.BranchNo **references** BRANCH.BranchNo
- VIEWING-APPOINTMENT.ClientNo **references** CLIENT.ClientNo
- VIEWING-APPOINTMENT.StaffNo **references** STAFF.StaffNo

(a) Express the following queries in SQL:

- How many properties cost more than £ 350 per month to rent? (2 marks)
- For each branch, find the number of staff members working in it and the average of their salary. (2 marks)
- List the names of all clients who have viewed a property, with the property number and postcode. (2 marks)

(b) Express the following queries **both** in relational algebra **and** in SQL:

- List the property number and address of all the properties that have been viewed. (6 marks)
- List the addresses of all branch offices in London or Glasgow. (6 marks)
- List all fields of the properties that are handled by staff who work in Liverpool. (6 marks)
- List all the cities where there is either a branch office or a property. (6 marks)