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Calculators may be used in this examination but must not be used to store text. Calculators with the ability to store text should have their memories deleted prior to the start of the examination.

THE UNIVERSITY OF BIRMINGHAM

Degree of B.Sc. with Honours
Artificial Intelligence and Computer Science. Second Examination
Computer Science/Software Engineering. Second Examination
Computer Science/Software Engineering with Business Studies. Second Examination

Joint Honours Degree of B.Sc. with Honours
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Joint Degree of BEng/MEng with Honours
Electronic and Software Engineering. Third Year

MSc in Computer Science

06 02381

(SEM 222)
Introduction to Databases

Tuesday 18th January 2000 9.30 am - 11.30 am

[Answer ALL Questions]

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Any Calculator

1. Consider the following database (where FILMS.DirectorNumber and ROLES.ActorNumber are both foreign keys into PEOPLE.PersonNumber):

    FILMS(FilmNumber, Title, DirectorNumber, Year, ProductionCost)

    PEOPLE(PersonNumber, Surname, Firstname, Gender, BirthDate, Nationality)

    ROLES(FilmNumber, ActorNumber, Character)

    a) Give the relational algebra query that finds the titles of films in which the director is also an actor in that film. [10%]

    b) Give the relational algebra query that finds the actors who have played two different characters in the same film. The result of the query should contain the title of the film, the first name and surname of the actor and the two characters he or she played in the film. [10%]

2. Consider the following database that contains the weekly flight schedule for airports around the world:

    AIRPORT(City, Country, NumberOfRunways)

    FLIGHT(FlightID, Day, DepartCity, DepartTime, ArriveCity, ArriveTime)

    a) Give the SQL query that finds the cities from which international flights leave.

    [10%]

    b) Give the SQL query that finds the French cities from which more than 20 direct flights to Germany leave each week. [10%]

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3. We wish to automate the management of loans in a library. The specification of the application, acquired through an interview with the librarian, is as follows:

A reader who uses the library has an identity card on which is written his or her code, name and address. The users make requests for the loan of books catalogued in the library. Each book has a title and a list of authors and there can be many copies of any book. Each book in the library is identified by a code. Following a request, the archive of available books is first consulted (that is, those not out on loan at present). If the book is available, we look for the books on the shelves. Once the book is found, it is given to the reader. The text is then classified as one on loan. When the reader has finished, the book is returned, put back on the shelves and re-classified as available. For each loan, the times and date of borrowing and returning are recorded.

Analyse the specification, filter the ambiguities, paying particular attention to the distinction between the concept of a *"book"* and a *"copy of a book"*, and then

a) Produce a glossary. [5%]

b) Produce a list of phrases of the specification, grouped according to type [10%]

c) Draw an Entity-Relationship model diagram for the specification, paying particular attention to relationship cardinalities and attributes. [15%]

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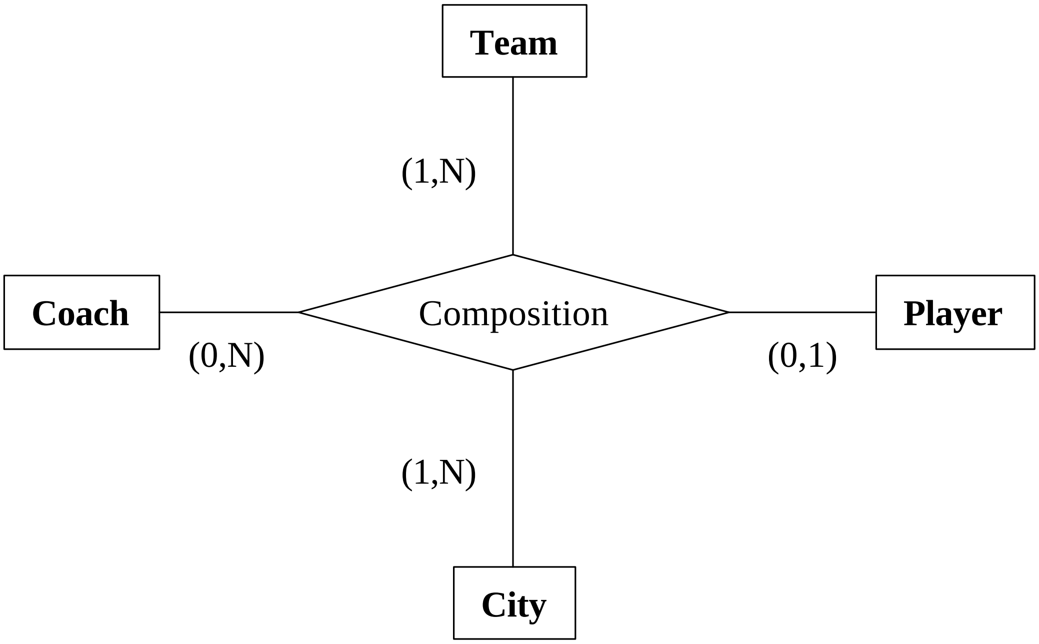
Any Calculator

4. Consider the following Entity-Relationship schema:



Assume that the following properties apply:

- A player can play for at most one team (but might not play for any).
- A trainer can train at most one team (but might not train any).
- A team belongs to exactly one city (but a city can have more than one team).

a) Identify the functional dependencies in this schema [10%]

b) Identify the key for relationship *"Composition"*. [5%]

c) Restructure the schema so that it respects Boyce-Codd normal form. [15%]