

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
Diploma

SYSTEMS DESIGN

25th April 2006, 2.30 p.m.-4.30 p.m.

Answer FOUR questions out of SIX. All questions carry equal marks.

Time: TWO hours

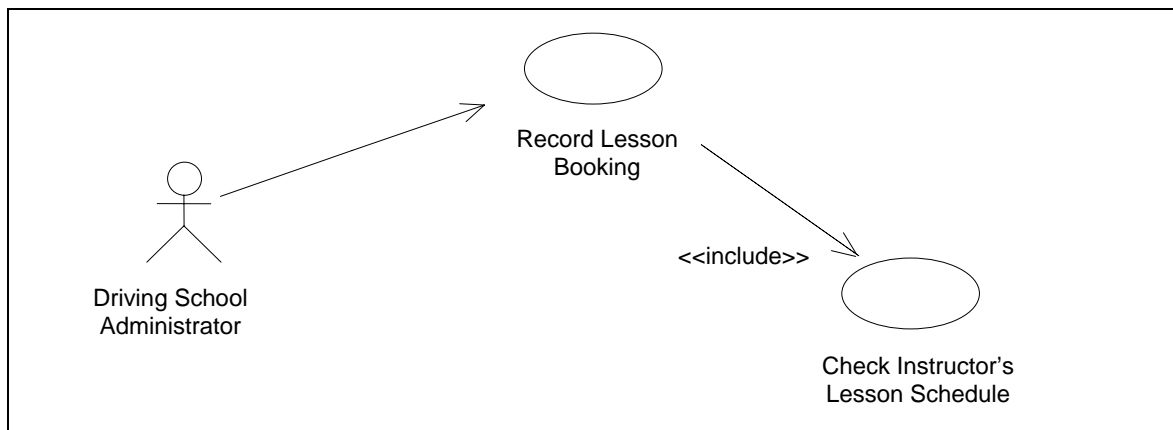
*The marks given in brackets are **indicative** of the weight given to each part of the question.*

1. a) Write a BRIEF explanation of the purpose of TWO of the following UML diagrams as used in Object-Oriented systems design. You should illustrate your answer with a labelled diagram:

- i) *design* class diagram,
- ii) sequence diagram,
- iii) statechart (state diagram).

(2 x 5 marks)

- b) The following fragment of a Use Case diagram and entry from the Use Case Catalogue (**Figure 1**) are taken from a driving school system. Draw a labelled Sequence Diagram for the Use Case *Record Lesson Booking* to illustrate how objects will interact during the execution of the Use Case. (15 marks)



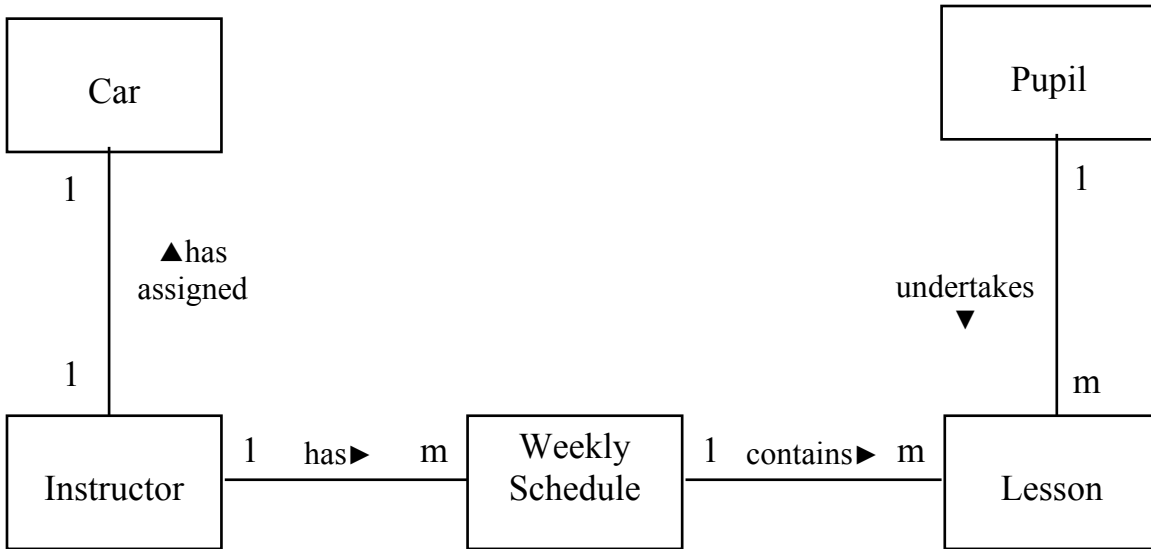
Use Case: *Record Lesson Booking*
Primary Actor: *Driving School Administrator*
Goal: *To facilitate the recording of a lesson booking for an existing pupil with their allocated instructor*
Preconditions: *Instructor is available for lesson and pupil is already registered*
Success Condition: *A specific driving lesson is recorded for a specific registered pupil with their allocated instructor.*

Main Sequence:

1. The driving school administrator inputs the pupil's driver number
2. The screen displays the pupil's details and presents the name of their instructor
3. The driving school administrator checks the instructor's lesson schedule for a suitable date and time
4. The system displays the lesson slot time and date and confirms instructor's availability for the lesson
5. The driving school administrator approves lesson booking
6. The system displays a confirmation that the booking is made and updates the instructor's schedule

Figure 1

2. The following Entity-Relationship diagram and set of normalized tables form part of a design for a driving school system. They are to be used for the physical design of a relational database system (RDBMS).



INSTRUCTOR (Instructor-ID, Instructor-Name, Grade, Registration-Number)
 PUPIL (Pupil-ID, Pupil-Name, Pupil-Address, Pupil-Tel, Test-Date, Licence-Number)
 LESSON (Lesson-Number, Pupil-ID, Lesson-Date, Lesson-Time, Lesson-Duration, Schedule-ID)
 WEEKLY SCHEDULE (Schedule-ID, Instructor-ID, Week-Number, Total-Hours)
 CAR (Registration-Number, Make, Model, Mileage)

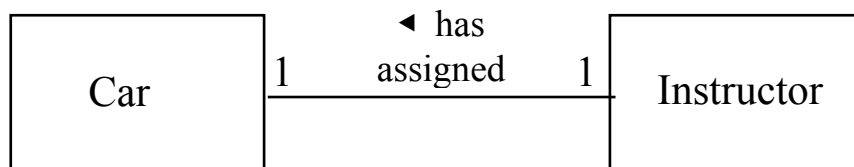
a) *Using examples* taken from the above ERD and tables, briefly explain the design decisions that should be considered during the physical design of the relational database for each of the following activities:

- i) choosing data types
- ii) dealing with derived (calculated) attributes
- iii) controlling referential integrity
- iv) dealing with null values.

(4 x 3 marks)

b) When designing the physical tables it may be necessary to denormalize the given normalized tables in order to optimise for efficient data processing.

- i) Explain what is meant by the term denormalization and state TWO disadvantages of denormalizing tables. (9 marks)
- ii) Produce the denormalized table(s) for the following one-to-one relationship. (4 marks)



CAR (Registration-Number, Make, Model, Mileage)
 INSTRUCTOR (Instructor-ID, Instructor-Name, Grade, Registration-Number)

3. a) Local Area Networks (LANs) are an important feature of today's computer systems within most organizations. With reference to the design of these distributed environments explain what is meant by the following terms:
- i) File Server Architecture
 - ii) Client/Server Architecture. (2 x 6 marks)
- b) Discuss the advantages and disadvantages of each of the above architectures when choosing between them for a LAN implementation. (13 marks)
4. It is common to find a **single computer application** has been developed using several different languages.
- a) Write notes describing the different features and roles of EACH of the following languages and their contribution to the development of a single computer application:
- i) HTML
 - ii) C++
 - iii) XML
 - iv) SQL
 - v) Java (5 x 4 marks)
- b) Explain why you might need a mixture of the above languages for the development of a single application. (5 marks)
5. a) Describe the main features of Rapid Application Development (RAD), with particular reference to the **design** phase. (10 marks)
- b) List FIVE advantages and FIVE disadvantages of the RAD approach. (10 marks)
- c) What design strategies could you employ to overcome the disadvantages you have described? (5 marks)
6. A company Help Desk operates for its computer users as follows:
 A user has a need or a problem: for example they have forgotten their password, or their mouse has stopped working, or they want a new report produced by the company financial software. They ring the Help Desk, and describe what they need. The Help Desk operator assigns the request to an appropriate team of technicians, one of whom then deals with the request.
- The company has decided to install a new Help Desk software system to automate and administer this process, receiving requests direct from the users.
- The following information will be held once a request has been received by the help desk:
- Category of request (from dropdown)
 - Title (one line) and Summary (a few lines describing what is being requested)
 - Name, Userid, Email address of user
 - Date submitted, Date required, Priority or severity
 - Hardware ID or Software version
 - Attachments (eg screen dump or exact specification of requirement)
 - Name of team and individual assigned to work on the problem
- List the functions required of the system by each of the following:
- a) The End User (5 marks)
 - b) The Help Desk Manager (5 marks)
 - c) The Technician assigned the problem (6 marks)
- AND discuss the interface style appropriate to each. (3 x 3 marks)