

**INFORMATION AND COMMUNICATION  
TECHNOLOGY  
PAPER 2A  
Databases  
(Sample Paper)  
Question-Answer Book**

Time allowed: 1 hour 30 minutes  
This paper must be answered in English.

**INSTRUCTIONS**

- (1) Write your Candidate Number in the space provided on Page 1.
- (2) Stick barcode labels in the spaces provided on Pages 1, 3 and 5.
- (3) Answer **ALL** questions.
- (4) Write your answers to Section B in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.
- (5) Supplementary answer sheets will be provided on request. Write your candidate number, fill in the question number and stick a barcode label on each sheet. Tie them loosely but securely with a string **INSIDE** this Question-Answer Book.

Please stick the barcode label here.

Candidate Number									
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	Marker's Use Only	Examiner's Use Only
	Marker No.	Examiner No.
Question No.	Marks	Marks
1		
2		
3		
4		
Total		

Answer all questions. Write your answers in this question-answer book.

(Modified from 2004 ASCA1 Q.1)

1. A database is created with the following SQL commands to store the subject scores of a class of students in an examination. REG\_NO and SUBJ\_CODE represent the registration number of a student and the code of a subject respectively.

```
CREATE TABLE EXAM (  
    REG_NO CHAR(6),  
    SUBJ_CODE CHAR(3),  
    SCORE NUMERIC(5,1))
```

```
CREATE TABLE STUDENT (  
    REG_NO CHAR(6),  
    STUD_NAME CHAR(20))
```

```
CREATE TABLE SUBJECT (  
    SUBJ_CODE CHAR(3),  
    SUBJ_NAME CHAR(15))
```

- (a) Modify the first SQL command to ensure that no records in EXAM contain empty values in REG\_NO and SUBJ\_CODE.

(1 mark)

- (b) Identify the primary key(s) and foreign key(s) in the database.

(4 marks)

- (c) Write an SQL command to insert the following record into SUBJECT.

SUBJ_CODE :	ENG
SUBJ_NAME :	ENGLISH

(2 marks)

Answers written in the margins will not be marked.

Please stick the barcode label here.

- (d) Because of a modification in the examination paper of the subject code ENG, all students will be awarded two additional scores. Write an SQL command to increase the value of SCORE by 2 in each relevant record.

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(2 marks)

- (e) Describe the purpose of the following SQL command.

```
DELETE FROM STUDENT WHERE LEN(TRIM(STUD_NAME)) = 0
```

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(2 marks)

- (f) A student withdrew from the school after the examination. In order to maintain the referential integrity constraint of the database, it has been suggested that his record in STUDENT should not be removed. Do you agree? Explain briefly.

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(2 marks)

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(New Question)

2. In a secondary school library, a database `LIBRARY` stores the transactions in which students borrow and return books. Each student can borrow at most 5 books at a time. Each copy of book can be borrowed by one student only at a time. The field names of `LIBRARY` are described below:

Field name	Description
StudID	Unique student ID code
Stud_Name	Name of student
Class	Class attended
BookID	Unique book ID code
Book_Title	Title of book
Author	Author of book
Publisher	Publisher of book
Borrow_Date	Date on which the book is borrowed
Return_Date	Date on which the book is returned

- (a) Explain briefly how this design leads to data redundancy.

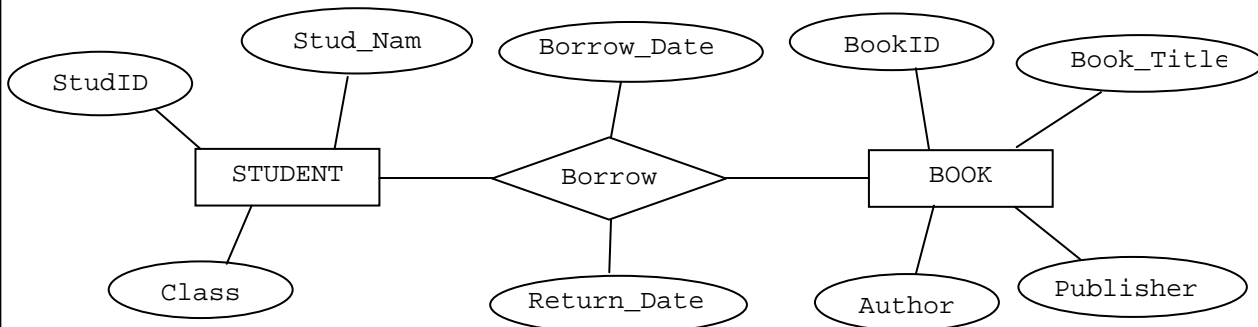
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(2 marks)

- (b) To fix the problem of data redundancy, a librarian re-designs the database and draws an E-R diagram as follows. However, the key attributes of entity, maximum cardinality, mandatory cardinality, optional cardinality are missing in the diagram. Complete the E-R diagram for the librarian.



(2 marks)

Answers written in the margins will not be marked.

Please stick the barcode label here.

- (c) Transform the E-R diagram in (b) into database using the following schema.

STUDENT (\_\_\_\_\_)

BOOK (\_\_\_\_\_)

BORROW (\_\_\_\_\_)

(6 marks)

- (d) The librarian wants to include the company name, address and phone number of publishers in the diagram. It is assumed that a publisher publishes many books and a book is published by one publisher only. Add an entity in the E-R diagram in (b).

(3 marks)

- (e) Suggest a modification to the design of LIBRARY to ensure that each student can borrow 5 books at any time. The total number of books borrowed by a student is not greater than 5 at a time.

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(3 marks)

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(Modified from 2004 ASCA1 Q.10)

3. A recreation centre provides several leisure facilities such as tennis courts and barbecue sites for its members. The centre is open daily from 9 a.m. to 11 p.m. The following database files are used to store the information of members, facilities and reservations by members.

**MEM**

	Field name	Type	Width	Description	Example of data
1	MEMID	Character	6	Member identity number	123456
2	MNAME	Character	20	Name of the member	Chan Po Po

**FAC**

	Field name	Type	Width	Description	Example of data
1	FCODE	Character	3	Facility code	T02
2	FTYPE	Character	30	Type of facility	Tennis Court
3	RATE	Numeric	3	Charge per hour	40

**RES**

	Field name	Type	Width	Description	Example of data <i>A member with member identity number '123456' reserves the facility with Code 'T02' from 11 a.m. to 2 p.m. on 31st December 2003.</i>
1	MEMID	Character	6	Member identity number	123456
2	FCODE	Character	3	Facility code	T02
3	UDATE	Date	8	Date of use	31/12/03
4	START	Numeric	2	The start time	11
5	END	Numeric	2	The end time	14

**RES** stores the information of the reservations by members in 2003.

Write SQL commands to complete the following tasks:

- (a) List the names of members, without duplicates, who have reserved one or more of the facilities on 21/09/03.

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(3 marks)

Answers written in the margins will not be marked.

- (b) Output the names of members who have **not** reserved any of the facilities of the centre.

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(3 marks)

- (c) The members will be billed monthly for reserving the facilities in the centre. The charge for each facility is calculated using the following formula:

$$\text{Charge} = (\text{END} - \text{START}) \times \text{RATE}$$

Where    **START**    represents the start time  
              **END**       represents the end time  
              **RATE**    represents the charge per hour

List the names of members, and the total amount of the charges in September for those members who are billed for more than \$1000 in this month. The records in the list should be arranged in descending order of the total amount.

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(5 marks)

- (d) There are two soccer pitches with facility codes, 'S01' and 'S02', in the centre. Output the dates on which the two soccer pitches are both reserved.

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(4 marks)

- (e) There are many barbecue sites in the centre. The first character of the facility code of all barbecue sites is 'Q'. Output the facility codes of the barbecue sites which are **not** reserved during the time period from 6 p.m. to 9 p.m. on 21/09/03.

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(5 marks)

Answers written in the margins will not be marked.

(Modified from 2007 ALCS1 Sample Paper Q.2)

4. Kenneth is the administrator of the database system in a school. TEACHER is one of tables in the database with the following structure:

Field	Description of the teacher
ID	HKID number
Name	Name
Salary	Salary
Address	Address

- (a) Kenneth wants Mary, a clerk in the school, to verify the personal information of the teachers. However, the Principal wants to keep the salary information confidential from the clerk.

Suggest a database measure which can be used to implement the above security requirement. Explain briefly how the measure can allow the clerk to verify information without any violation of confidentiality.

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(2 marks)

- (b) The principal asks Kenneth to create accounts for all 60 teachers in the school so that the teachers can access the school database to check students' information. To protect the data privacy, teachers can be only allowed to view data in the tables containing student information, but not the teacher information in TEACHER.

There are two common approaches to assigning account privileges: account-level and table-level. Which one is more suitable? Justify your answer.

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(3 marks)

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In the extracurricular activities, each club is led by at least one chairperson. Each student is allowed to lead at most one club. The information on chairpersons of all clubs is stored in the following table CLUB:

CLUB(ClubID, ClubName, Chairperson, SID, Class)

In the above schema, ClubID, ClubName, Chairperson, SID and Class represent the code of the club, the name of the club, the name of the chairperson, the student ID code of the chairperson and the class of the chairperson respectively.

(c) (i) Is CLUB in first normal form (1NF)? Explain briefly.

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(ii) Is CLUB in second normal form (2NF)? Explain briefly.

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(iii) CLUB is not in third normal form (3NF). Why not?

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(iv) Normalize CLUB to become third normal form.

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(6 marks)

**END OF PAPER**

Answers written in the margins will not be marked.