2014-DSE
ICT
PAPER 2A

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2014

Candidate Number									

INFORMATION AND COMMUNICATION TECHNOLOGY

PAPER 2A

Databases

Question-Answer Book

11.15 am – 12.45 pm (1 hour 30 minutes)
This paper must be answered in English

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3 and 5.

(2) **ANSWER ALL QUESTIONS.** Write your answers in the spaces provided in this Question-Answer book. Do not write in the margins. Answers written in the margins will not be marked.

(3) Supplementary answer sheets will be supplied on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this book.

(4) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

(5) The last page of this Question-Answer book contains SQL commands and symbols used in entity-relationship diagrams which you may find useful.

* A 2 0 0 E 0 2 A *

Answer all questions.

1. In a book fair, a bookshop puts books on different shelves. Each book has an International Standard Book Number (ISBN). Customers can only buy one book in each transaction. The shop uses the following database tables to store the books' information and sales records. All copies of a book are located on the same shelf.

BOOKS

Field name	Description
ISBN	ISBN
TITLE	Title
AUTHOR	Author name
PRICE	Price
CAT	Category (e.g. FICTION, TOURISM, etc.)
PUBLISHER	Publisher
SCODE	Identity code of the shelf

SHELF

Field name	Description
SCODE	Identity code of the shelf
SNAME	Shelf name
LOC	Location of the shelf

SALES

Field name	Description
TNO	Transaction number
ISBN	ISBN
SDATE	Date of the sales

(a) Write SQL commands to complete the following tasks.

(i) List the titles and prices of the books written by the author 'CHARLES DICKENS' in ascending order of the titles.

(ii) List the titles of the books that belong to the category 'TOURISM'. The titles should contain 'AUST'.

Answers written in the margins will not be marked.

(iii) List the shelf names without books belonging to the category 'FICTION'.

(iv) List the total sales of books for each category.

(10 marks)

(b) Once the copies of a book with a particular ISBN are sold out, the corresponding record in BOOKS will be deleted. State and explain the integrity problem that will occur.

(2 marks)

(c) The bookshop plans to allow customers to buy several books in one transaction. How should the database design be changed?

(2 marks)

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2. An organisation manages a professional examination which includes several subjects. Candidates enroll in the examination through training centres. Each candidate enrolls in at least one subject. Markers can mark one subject only. The organisation uses the following database tables to store the information on the examination.

TCENTRE

Field name	Type	Description
TNO	Integer	Identity number of the training centre
TNAME	Character	Name of the training centre

CAND

Field name	Type	Description
CNO	Integer	Identity number of the candidate
CNAME	Character	Candidate name
SEX	Boolean	Sex
CDOB	Date	Date of birth
TNO	Integer	Identity number of the training centre
SBJCODE	Integer	Identity number of the subject that the candidate enrolls in
SBJNAME	Character	Name of the subject that the candidate enrolls in

MARKER

Field name	Type	Description
MNO	Integer	Identity number of the marker
MNAME	Character	Name of the marker
TNO	Integer	Identity number of the training centre that the marker works in
SBJCODE	Integer	Identity number of the subject that the marker serves

In the examination, there are about 400 training centres, 70,000 candidates and 1,500 markers.

(a) Suppose that only one database table will be indexed.

(i) What is the advantage of indexing?

(ii) Write a SQL command to create an index file named `IND` with the primary key of `CAND`.

(iii) A simple SQL command has the three parts, SELECT, FROM and WHERE. Which part will the index file facilitate? Explain briefly.

(4 marks)

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(b) (i) What criterion will you use to choose another field for indexing?

(ii) Usually not all fields in a database table are indexed. Why not?

(2 marks)

(c) Candidates who were born in or before 1990 are called adult candidates. Write a SQL command to list the identity numbers and candidate names of all adult candidates.

(2 marks)

(d) Identify the foreign key of `MARKER`.

(1 mark)

(e) What is the main purpose of the following SQL command?

```
SELECT MNO, CNO FROM MARKER, CAND
WHERE MARKER.TNO = CAND.TNO
```

(1 mark)

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(f) (i) Normalise the tables, TCENTRE, CAND and MARKER, into third normal form. The structure of CAND should be modified and another table SBJ should be created to store subject information. Complete the new database schema below.

CAND (_____)

Primary key: CNO

SBJ (_____)

Primary key: _____

(ii) What is the benefit of the modification in (f)(i)?

_____

_____

(iii) The modification in (f)(i) may slow down the querying process. Why?

_____

_____

_____

(4 marks)

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3. Mr Chan is a project manager in a mobile phone company. He is going to re-develop the online store so that customers can download mobile applications. The following database design is used.

CUST

Field name	Description
CNUM	Identity code of the customer
CNAME	Name of the customer
EMAIL	Email address of the customer
CC	Credit card number of the customer

APPS

Field name	Description
ANUM	Identity code of the mobile application
ANAME	Name of the mobile application
COST	Cost of installation

TRAN

Field name	Description
CNUM	Identity code of the customer
ANUM	Identity code of the mobile application
DATE	Date of installation

(a) Draft an ER diagram for the design. The drawing of attributes is not required.

CUST

(6 marks)

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(b) Mr Chan develops a prototype of the online store. What is a prototype? Give a benefit of prototyping.

(2 marks)

(c) After the implementation stage, Mr Chan does the data conversion before testing.

(i) Why should Mr Chan do the data conversion?

(ii) If Mr Chan did the testing before the data conversion, what difficulty would he encounter? Explain briefly.

(3 marks)

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(d) The new online store includes dynamic web pages to enhance user interaction. When it is launched, many users complain that they have to wait for a long time to complete the transactions in the store and sometimes some transactions are not successful.

(i) Mr Chan finds that this problem occurs when more than 50 dynamic web pages are accessing the database at the same time. Why?

(ii) Suggest **two** possible solutions to the problem, other than rewriting the web pages.

(4 marks)

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4. A multi-campus university wants to set up an online video-sharing platform which students can use to upload video clips. The following database tables store information about the video clips.

VID

Field name	Description
ID	The identity code of the video clip
TITLE	Video title
UDATE	Date of upload
PUB	The video clip is either private or public
URL	URL of the video clip
CAT	Category
AVER	The average rating given by viewers
CCODE	The code of campus which the video clip is uploaded

RAT

Field name	Description
VIEWER	Viewer's identity code
ID	The identity code of the video clip
RATING	The rating given by a viewer (an integer from 0 to 10)

(a) (i) Other than character and integer types, suggest a suitable data type for PUB.

(ii) Which field is redundant? Explain briefly.

(iii) Which field mostly needs strict enforcement of domain integrity? Explain briefly.

(5 marks)

Mr Li is the database administrator of the university.

(b) (i) Give his **two** main duties.

(ii) Other than 'SELECT' and 'CREATE', give **two** access privileges to the database tables that should be granted to him.

(4 marks)

Answers written in the margins will not be marked.

(c) `ID` is a candidate key of `VID`.

(i) What is a candidate key?

_____

_____

(ii) Give another candidate key of `VID`. _____

(2 marks)

Mr Li considers two database models, a distributed database model and a parallel database model.

(d) Describe the major design consideration of each model.

Distributed database model: _____

_____

Parallel database model: _____

_____

(2 marks)

(e) The monthly equipment rental cost and the average query cost of the two models are shown below.

	Distributed database	Parallel database
Monthly equipment rental cost ($)	300,000	900,000
Average query cost ($)	5	2

(i) If there are 100,000 queries per month, which model has a lower cost? Show your calculation.

_____

_____

_____

_____

(ii) In how many queries per month will the parallel database model have a lower cost? Show your calculation.

_____

_____

_____

_____

(4 marks)

END OF PAPER

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Database (SQL commands - based on SQL-92 Standard)

Constants	FALSE, TRUE
Operators	+, –, *, /, >, <, =, >=, <=, <>, %, _ , ' , AND, NOT, OR
SQL	ABSOLUTE (ABS), AVG, INT, MAX, MIN, SUM, COUNT ASC, AT, CHAR (CHR), CHAR_LENGTH (LEN), LOWER, TRIM, SPACE, SUBSTRING (SUBSTR/MID), UPPER, VALUE (VAL) DATE, DAY, MONTH, YEAR ADD, ALL, ALTER, ANY, AS, ASC, BETWEEN, BY, CREATE, DELETE, DESC, DISTINCT, DROP, EXISTS, FROM, GROUP, HAVING, IN, INDEX, INNER JOIN, INSERT, INTEGER, INTERSECT, INTO, LEFT [OUTER] JOIN, LIKE, MINUS, NULL, RIGHT [OUTER] JOIN, FULL [OUTER] JOIN, ON, ORDER, SELECT, SET, TABLE, TO, UNION, UNIQUE, UPDATE, VALUES, VIEW, WHERE

Symbols Used in Entity-Relationship Diagrams

Meaning	Symbol	Meaning	Symbol
Entity	Entity	One-to-One Relationship	1 Relationship 1
Attribute	Attribute	One-to-Many Relationship	1 Relationship M
Key Attribute	Attribute	Many-to-Many Relationship	M Relationship N
Relationship	Relationship	Participation constraints: Use | on Mandatory side Use ○ on Optional side	Relationship