2013-DSE
ICT
PAPER 2A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2013

# 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

Please stick the barcode label here.

| Candidate Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

**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. A school sets up a reading club where students share their books. The club uses the following three database tables to store the borrowing records.

BOOK

| Field name | Type | Description |
|---|---|---|
| BID | Character | Identity code of the book |
| BTITLE | Character | Title of the book |
| SID | Character | Identity code of the student who shares the book |
| VB | Numeric | Value of the book |

BORROWING

| Field name | Type | Description |
|---|---|---|
| BID | Character | Identity code of the book |
| SID | Character | Identity code of the student who borrows the book |
| BDATE | Date | Date of borrowing |
| RET | Boolean | The return of the book<br>(Y – returned; N – not returned) |

STUDENT

| Field name | Type | Description |
|---|---|---|
| SID | Character | Identity code of the student |
| SNAME | Character | Student name |

Write SQL commands to complete the tasks in (a) to (d).

(a) List the titles of books. The list should be in descending order of the identity codes of students who share the books.

```
SELECT _____

FROM BOOK

ORDER BY _____
```

(2 marks)

(b) List the titles of the books starting with 'P' which have not been returned yet.

(3 marks)

(c) List the total value of the books shared by a student with the name 'MARY'.

(2 marks)



Answers written in the margins will not be marked.

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Please stick the barcode label here.

(d) List the names of the students who borrowed books more than 25 times in 2012.

(4 marks)

(e) (i) Explain the purpose of the following SQL command.

```
SELECT SNAME FROM STUDENT WHERE
SID NOT IN (SELECT SID FROM BOOK)
```

(ii) Write a SQL command with `OUTER JOIN` to generate the same result as in (e)(i).

(iii) Fill in the following box to complete the SQL command that can generate the same result as in (e)(i).

```
SELECT SNAME FROM STUDENT
[          ]

SELECT SNAME FROM STUDENT, BOOK
WHERE STUDENT.SID = BOOK.SID
```

(5 marks)



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2. Each employee of a company works on a project. The company wants to set up an instant messaging system (IMS) to improve communication between its employees. The information on the projects is stored in a table, EMPLOYEE, where EID represents the identity code of an employee. Part of EMPLOYEE is shown below.

EMPLOYEE

| EID | Employee name | Project name | Project number |
|---|---|---|---|
| A01 | Peter | ERP | 1 |
| A02 | Jenny | ERP | 1 |
| A03 | John | ERP | 1 |
| B01 | Sam | DSS | 2 |
| B07 | Susan | DSS | 2 |
| C04 | Jade | DSS | 2 |
| D18 | May | DSS | 2 |

(a) Normalise the table into third normalised form. Complete the database schema below and identify all primary and foreign keys if any.

EMPLOYEE(EID, _____)

Primary key: _____ Foreign key: _____

PROJECT(_____)

Primary key: _____ Foreign key: _____

(4 marks)

Employees can send short text messages through the IMS. The messages are stored in the table, MES.

MES

| Field name | Description |
|---|---|
| MID | Identity code of the message |
| EID | EID of the sender |
| SDATE | Date and time of sending the message |
| CONTENT | Content of the message |
| IMPORTANT | Y – important message; N – unimportant message |
| RECEIVER | EID of the receiver |

Primary key: MID

Foreign keys: EID, RECEIVER

(b) (i) Give a candidate key of MES that does not contain MID.

_____

(ii) Suggest a use of a data dictionary for MES.

_____

(2 marks)



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(c) The company uses the following three solutions to protect the data privacy.

T1: Only allow authorised users to access the database management system.
T2: Set up the access rights of users.
T3: Create SQL View.

(i) What action can be taken to achieve T1?

(ii) Other than 'Read' and 'Write', give an example of access rights in T2.

(iii) How can T3 protect the data privacy?

(3 marks)

(d) Susan has recently left the company. The company wants to prohibit other employees from accessing records about Susan.

(i) A database operator wants to delete all Susan's messages by executing the following SQL commands.

```
DELETE FROM EMPLOYEE WHERE EID = 'B07'
DELETE FROM MES WHERE EID = 'B07'
```

State and explain the integrity problem that will occur.

(ii) The company wants to keep all the messages. Suggest another approach the database operator can use to manage the records about Susan.

(4 marks)



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3. Ms Lam is the project manager of an annual tree donation campaign in a university. Donors can choose to plant trees in 7 areas of a new campus, Areas 1 to 7. Her colleague, Tom, designs an online donation form to collect donation information. A sample of the form is shown below.

**Donation Form**

Date: 20/3/2013

Name: Lo Sam

Email: slo@hkedcity.net

Area: ☑1 ☑ 2☐ 3 ☐ 4 ☐ 5 ☐ 6 ☑ 7 * Please choose three areas

Year of graduation: 2001

Type: ○ Student ○ Staff ◉ Alumni ○ Other

Amount: 888 Submit

(a) Tom suggests using a spreadsheet file instead of a database file to store the information of the donation. Give one advantage and one disadvantage of this suggestion.

_____

_____

_____

_____

(2 marks)

Ms Lam creates the following table, PLANT, to store the information on the donation form.

PLANT

| Field Name | Data Type | Description |
|---|---|---|
| DDATE | Date | Completion date of donation form |
| NAME | Character | Name of donor |
| EMAIL | Character | Email address |
| AR | Character | Numbers of three areas |
| GYEAR | Character | Year of graduation |
| TYPE | Character | Type of donor: S – Student, T – Staff, A – Alumni, O – Other |
| AMOUNT | Integer | Amount of the donation |

Primary key: NAME + DDATE

(b) Complete the following SQL command to store the data of the sample of the form in PLANT.

_____

```
PLANT(DDATE, NAME, EMAIL, AR, GYEAR, TYPE, AMOUNT)
  VALUES( _____ , _____
          'slo@hkedcity.net','127', _____ , _____ , _____ )
```

(3 marks)

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(c) Tom suggests using the field, AC, which stores a decimal value, to replace AR. When the value is converted into a 7-digit binary value, it represents 3 areas selected. For example, suppose AC stores an integer value 67,

$67_{10} = 1000011_2$

| AC | **1** | 0 | 0 | 0 | 0 | **1** | **1** |
|---|---|---|---|---|---|---|---|
| Area | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

This represents that Areas 1, 2 and 7 are selected.

(i) If Areas 4, 5 and 6 are selected, what should the decimal value in AC be? _____

(ii) Give one potential advantage of Tom's suggestion.

_____

_____

(iii) Give one potential disadvantage of Tom's suggestion.

_____

_____

(4 marks)

(d) In the database application development lifecycle, Tom is responsible for documentation and data migration.

(i) What kinds of information must be recorded in the project documentation? Give **two** examples.

_____

_____

(ii) Why is documentation so important in the development lifecycle? Give **two** reasons.

_____

_____

_____

_____



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(d) (iii) Ms Lam adopts the new design described in (c) and develops a new system. At the stage of data migration, what should Tom do?

_____

_____

_____

(6 marks)

4. Every year KK Association organises a charity auction. It invites the public to donate and bid for the items in the auction. This year KK Association is going to create an online system to replace the paper-based system for the auction. Bids for items will be traced throughout the auction. David and Mary work in the development team for this online system.

(a) David is responsible for designing the conceptual database schema. What is his job title?

_____

(1 mark)

David creates the following tables.

BUYER

| Field name | Type | Description |
|---|---|---|
| MID | Character | Identity code of the buyer |
| MNAME | Character | Name of the buyer |

DONOR

| Field name | Type | Description |
|---|---|---|
| MID | Character | Identity code of the donor |
| MNAME | Character | Name of the donor |

DITEM

| Field name | Type | Description |
|---|---|---|
| DID | Character | Identity code of the donated item |
| DES | Character | Description of the donated item |
| MID | Character | Identity code of the donor |

TRAN

| Field name | Type | Description |
|---|---|---|
| TID | Character | Identity code of the transaction |
| DID | Character | Identity code of the item sold |
| AMOUNT | Integer | Amount of the transaction |
| MID | Character | Identity code of the buyer |



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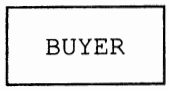
(b) Complete the following ER diagram. The drawing of attributes is not required.

(6 marks)




(c) Suppose that BUYER and DONOR are combined into one table. Give one advantage and one disadvantage of this combination.

_____

_____

_____

_____

(2 marks)



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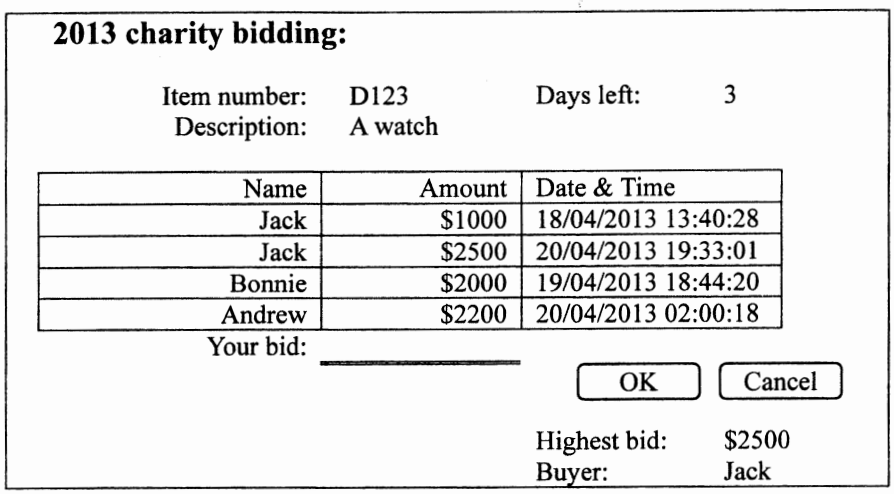
David designs the bidding page of the system as shown below:



**2013 charity bidding:**

Item number: D123 Days left: 3
Description: A watch

| Name | Amount | Date & Time |
|---|---|---|
| Jack | $1000 | 18/04/2013 13:40:28 |
| Jack | $2500 | 20/04/2013 19:33:01 |
| Bonnie | $2000 | 19/04/2013 18:44:20 |
| Andrew | $2200 | 20/04/2013 02:00:18 |

bidding list

Your bid: _____

OK Cancel

Highest bid: $2500
Buyer: Jack

A table, `BID`, is used to store the bidding history.

`BID`

| Field name | Type | Description | Example |
|---|---|---|---|
| `MID` | Character | Identity code of buyer | `A001` |
| `DID` | Character | Identity code of item | `D123` |
| `BDATE` | Date | Date and time of making bid | `18/04/2013 13:40:28` |
| `AMOUNT` | Numeric | Amount of bid | `1000` |

(d) Mary finds that the bidding list on the bidding page is difficult to read and there is a potential problem regarding data privacy.

(i) What is the potential problem?

_____

_____

(ii) Suggest a SQL command to provide proper information for displaying the bidding list in order.

(3 marks)

(e) Complete the following SQL command to find the name of the buyer who offers the highest bid on the item with identity code `D123`.

```
SELECT MNAME FROM BUYER, BID
WHERE BUYER.MID = BID.MID AND
AMOUNT
```

_____

_____

(2 marks)



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(f) Mary intends to implement a feature on the system which uses the technique of data mining to help the auction in the future. Suggest and describe an example of this feature.

_____

_____

_____

(2 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<br>ASC, AT, CHAR (CHR), CHAR_LENGTH (LEN), LOWER, TRIM, SPACE, SUBSTRING (SUBSTR/MID), UPPER, VALUE (VAL)<br>DATE, DAY, MONTH, YEAR<br>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:<br>Use \| on Mandatory side<br>Use ○ on Optional side | Relationship |