2016-DSE
ICT
PAPER 2A

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HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2016

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, 5 and 7.

(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.

Answer all questions.

1. A charity organisation launches a series of volunteer activities for members to take part in. Three database tables MEM, ACT and APP are used to store relevant information.

MEM

Field name	Type	Description	Example
MID	Character	Identity code of the member	10001
MNAME	Character	Name of the member	Rita Lam

ACT

Field name	Type	Description	Example
VID	Character	Identity code of the activity	V03
VNAME	Character	Name of the activity	ABC Hospital flag selling day
VDATE	Date	Date of launching the activity	25/11/2015
QUOTA	Integer	Number of volunteers needed	30

APP

Field name	Type	Description	Example
MID	Character	Identity code of the member	10001
VID	Character	Identity code of the activity that the member applies for	V03

Write SQL commands to complete tasks (a) to (d) below.

(a) List the identity codes of the activities whose names consist of 'flag selling'. The list should be in descending order of the date of launching the activity.

(2 marks)

(b) List the names of the activities which were held from January to March in 2016.

(3 marks)

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(c) List the names of the members who have not applied for any activity.

(3 marks)

(d) List the identity codes of the activities that the number of applications from members is less than the number of volunteers needed.

(3 marks)

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(e) Suppose that MEM has seven records, as shown below:

MID	MNAME
30005	Alice Li
20060	Ben Hung
30110	Clara Ng
20088	Greg Chan
10001	Rita Lam
40001	Tim Lee
40002	Yan Chan

Execute the following SQL command.

```
SELECT DISTINCT A.MNAME
FROM MEM A
WHERE 2 >= (SELECT COUNT(*)
  FROM MEM B
  WHERE A.MID > B.MID)
```

(i) What is the output?

(ii) The field MID also indicates the seniority of members. A smaller value in MID means that the member has been a member of the organisation for a longer time. What is the purpose of the SQL command above?

(3 marks)

(f) When the charity organisation rejects an application submitted by a member to take part in an activity, an explanatory note should be given to the member.

Suggest and describe **two** additional fields in APP and their data types that can support the requirement stated above.

(2 marks)

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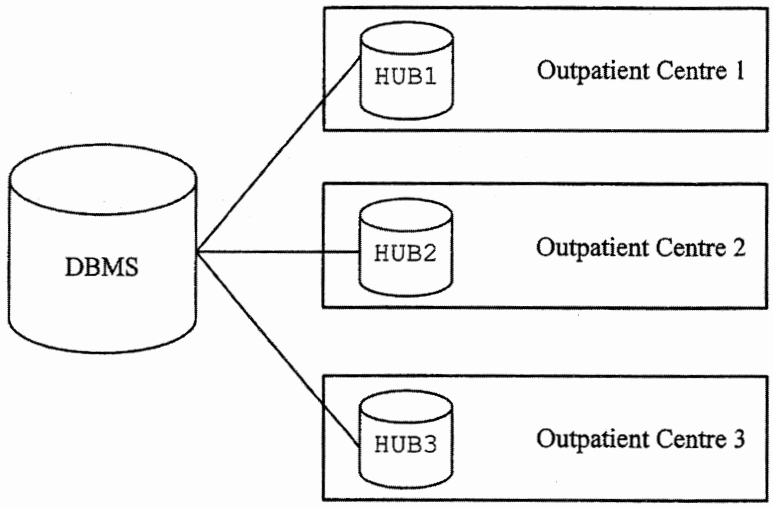
2. A hospital provides a device for its outpatients to carry. The device collects outpatients' health data, including heart beat rates. There are three outpatient centres with local databases. Outpatients can load the data stored in their devices onto the databases.



There is a database management system (DBMS) with three database tables `HUB1`, `HUB2` and `HUB3` for storing the health data from the three outpatient centres respectively. `HUB1`, `HUB2` and `HUB3` have the same structure and part of the structure is shown below.

Field name	Description
`PID`	Identity code of the outpatient
`HB`	Heart beat rate
`RDATE`	Date and time of taking the readings

(a) Some outpatients have visited all three outpatient centres and loaded their health data onto `HUB1`, `HUB2` and `HUB3`. Write a SQL command to list the identity codes of these outpatients.

(2 marks)

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(b) Amy manages the DBMS in the hospital. Doctors need to find for each outpatient, the highest heart beat rate and lowest heart beat rate stored in the DBMS.

(i) Describe the data in `HH` after executing the following SQL command.

```
CREATE VIEW HH AS
   SELECT * FROM HUB1
   UNION
   SELECT * FROM HUB2
   UNION
   SELECT * FROM HUB3
```

(ii) Complete the following SQL command to find the highest heart beat rate and lowest heart beat rate of each outpatient.

```
CREATE VIEW HIGHLOW AS
```

(iii) Explain why Amy should use `VIEW` in this situation.

(5 marks)

(c) Outpatients are required to take photos of what they eat and upload the photos to the DBMS. Amy has two solutions:

Solution 1: Add fields in `HUB1`, `HUB2` and `HUB3` that store the image objects.

Solution 2: Add fields in `HUB1`, `HUB2` and `HUB3` that store the file names of the images.

(i) Give one advantage of Solution 1 over Solution 2.

(ii) Give one advantage of Solution 2 over Solution 1.

(2 marks)

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(d) Amy decides to replace `HUB1`, `HUB2` and `HUB3` by merging them into one database table and to store the merged table on a centralised server with network support. Give one advantage and one disadvantage of Amy's decision.

(2 marks)

(e) Amy and her team have to uphold ethical principles when using the personal data stored in the DBMS. Give **two** examples of these ethical principles.

(2 marks)

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3. Peter plans to develop a web site for ABC food store so that customers can order sandwiches online. A basic sandwich costs $30 and includes a type of bread and at most three fillings. Customers can pay an extra $10 for an additional filling. Peter drafts the design of a database table to store customers' orders.

Field name	Description
ONO	Order number
BCODE	Bread code
BTYPE	Bread type
FCODE	Filling code
FTYPE	Filling type
PRICE	Price

Some sample data from the database table is shown below:

ONO	BCODE	BTYPE	FCODE	FTYPE	PRICE
1130	1	White	1	Ham	50
1130	1	White	2	Cheese	50
1130	1	White	3	Egg	50
1130	1	White	4	Salmon	50
1130	1	White	5	Onion	50
1131	1	White	1	Ham	30
1131	1	White	2	Cheese	30
1132	2	Rye	1	Ham	30
1132	2	Rye	3	Egg	30
1132	2	Rye	5	Onion	30

In the above sample data, the customer of the order number 1130 chooses white bread and 5 fillings and the sandwich costs $50.

(a) (i) The field PRICE is a derived attribute that is calculated from other attributes. Give **two** disadvantages of using this derived attribute.

(ii) Why does Peter still want to include PRICE in the table?

(3 marks)

(b) Give an example to illustrate the functional dependency in the database table. Describe your answer briefly.

(2 marks)

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(c) Peter considers creating a table to store customers' orders, as shown below:

```
CREATE TABLE ORDER_FOOD
       (ONO CHAR (4),
       BCODE CHAR (1),
       BTYPE CHAR (20),
       FCODE CHAR (3) UNIQUE,        ← Label 1
       FTYPE CHAR (20),
       PRICE INT,
       PRIMARY KEY (ONO))            ← Label 2
```

After creating ORDER_FOOD, what is the potential problem with the constraint indicated by each of the following labels?

(i) Label 1

_____

_____

(ii) Label 2

_____

_____

(2 marks)

(d) Peter normalises the design, as shown below:

ORDER_FOOD(ONO, BCODE, FCODE)

Primary key: _____

Foreign key: _____

FILLING(FCODE, FTYPE)
Primary key: FCODE
Foreign key: Nil

BREAD(BCODE, BTYPE)
Primary key: BCODE
Foreign key: Nil

(i) Fill in all primary and foreign keys in the spaces provided above.

(ii) Is this design in Third Normal Form (3NF)? Explain briefly.

_____

_____

_____

_____

(4 marks)

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(e) Peter needs to design an input form for customers to order sandwiches. Complete the draft of the layout of the input form below.

ABC Food Store Order Form

Name: _____ Mobile phone number: _____

Address: _____

(3 marks)

Answers written in the margins will not be marked.

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4. XYZ shopping mall is being renovated. The management office plans to set up a database management system to record and manage the transactions of each shop. Susan is the project manager and leads a team to complete this project.

(a) Suggest **two** types of database personnel needed in Susan's team.

_____

_____

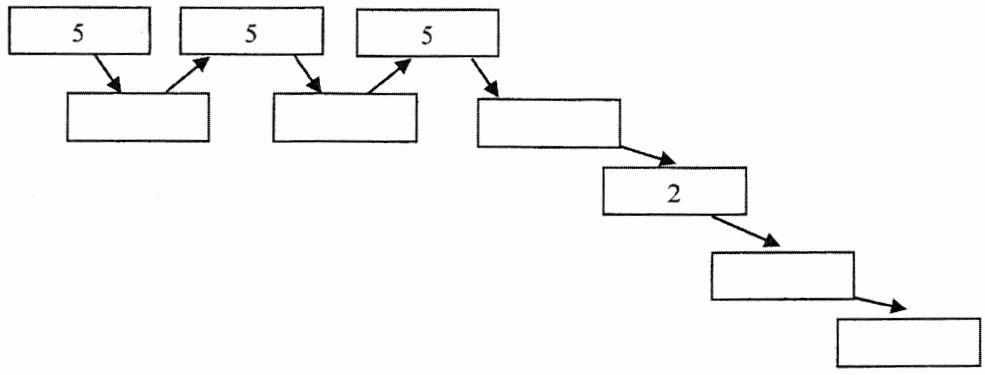
(2 marks)

Susan compiles the work breakdown of the project and lists some major tasks, as below:

1. Maintain the database management system
2. Implement the database
3. Design the database
4. Test the database management system
5. Investigate the data requirements

(b) During the development, Susan needs to repeat some tasks.

(i) Complete the workflow of the project below.



(ii) Give the major potential benefit of the iterations in the first six boxes in the workflow above.

_____

_____

_____

(4 marks)

(c) In which of the above tasks 1 to 5 do the following Computer Aided Software Engineering (CASE) tools need to be used?

Graphical modeling tools: _____

Query analysis tools: _____ , _____

(3 marks)

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(d) The management office gives the following requirements to Susan:

- Form several groups of customers. Each group represents a kind of buying habit.
- Customers are assigned to exactly one group.
- Shops can provide more than one kind of item.
- All items in the shopping mall may be provided by more than one shop.

Referring to the requirements, complete the draft of the ER diagram for Susan below. It is not necessary to draw attributes in the diagram.

(4 marks)

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(e) Susan writes a web page for promoting items. Below is a sample page:

XYZ Shopping Mall

Welcome, Chan Siu Ming! Customer number: A123789

Your preference: Computers

Item code	Description	Price from	Stocks left
1234	8-inch tablet	$1,500	30
2345	10-inch tablet	$2,900	12
1385	Notebook	$4,300	74

(i) Customer number and item code are the primary keys of the Customer and Item database tables. On which data field on the web page should Susan create an index? Explain briefly.

(ii) Describe how data mining techniques are used to select an item for promotion.

(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 ○