2012-DSE
ICT
PAPER 2A

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2012

Please stick the barcode label here.

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.

Answer all questions.

1. A school uses the following three tables to store the examination results of all students.

PER

Field name	Type	Description	Example
PID	Character	Student number	S001
NAME	Character	Student name	Peter
CLASS	Character	Class	1A
ENTRY	Date	Date of entry	20-02-2007

RES

Field name	Type	Description	Example
PID	Character	Student number	S001
SID	Character	Subject code	C01
MARK	Numeric	Exam mark	70

SUB

Field name	Type	Description	Example
SID	Character	Subject code	C01
SNAME	Character	Subject name	Computer

(a) State the primary keys and foreign keys of PER, RES and SUB. Write your answer in the following table and put 'N/A' if neither key is applicable.

	Primary key	Foreign key
PER		
RES		
SUB		

(4 marks)

(b) Write SQL commands to complete the tasks.

(i) List all the classes, without duplication. The list should be in descending order of the class.

(ii) List all the subject codes and the corresponding numbers of enrolled students. The output should be in two columns with headings 'Subj' and 'Num'.

Answers written in the margins will not be marked.

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(iii) List the student numbers of those students who have average marks in the enrolled subjects less than 50 and entered the school in 2007.

(7 marks)

(c) Suppose SUB and RES consist of the following records only.

RES

PID	SID	MARK
S001	C01	60
S001	B02	75
S002	C01	65
S003	D01	66

SUB

SID	SNAME
C01	Computer
B01	Biology
B02	Business
D01	History

The school administrative officer discovers that some subject codes do not match.

(i) Which type of integrity does the database violate? _____

(ii) The officer uses the following SQL command to check the integrity stated in (c)(i). How does the command help?

```
select RES.SID
from RES left outer join SUB
         on SUB.SID = RES.SID
where SNAME is null
```

(iii) Write a SQL command with a subquery to produce the same result as the SQL command in (c)(ii).

(6 marks)

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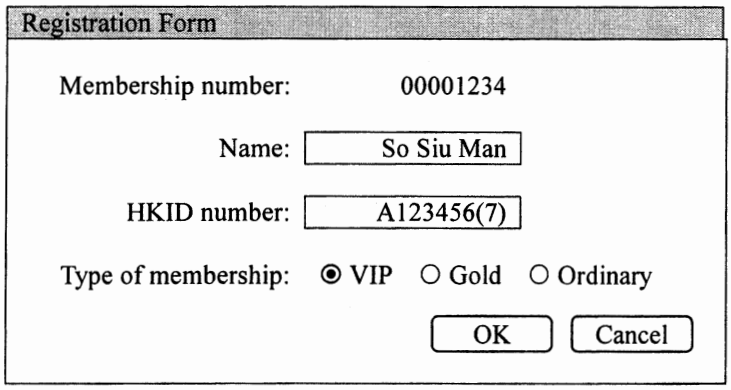
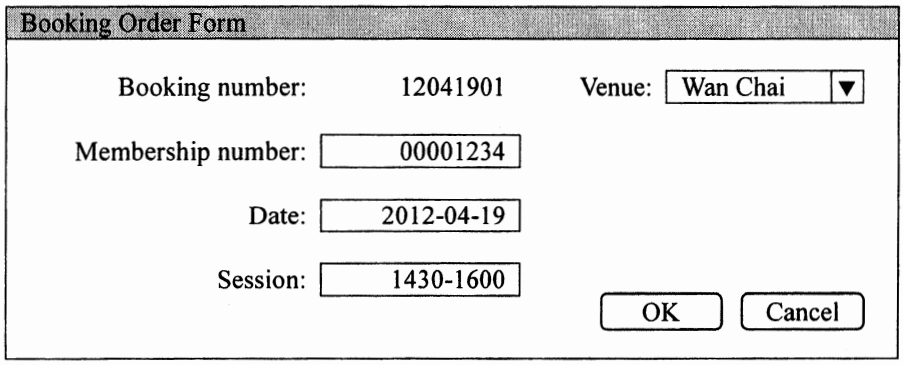
2. Ms Li and David set up an online booking system for a recreation centre. The centre offers three types of membership: VIP, Gold and Ordinary. Members can book three venues located in Wan Chai, Shatin and Mongkok online. The online registration and booking order forms are illustrated below.





The following tables, `MINFO` and `BOOKING`, store membership information and booking information.

`MINFO`

Field Name	Data Type	Description
MNO	Character	Membership number
NAME	Character	Member name
HKID	Character	Identity card number
VIP	Boolean	VIP member
GOLD	Boolean	Gold member
ORD	Boolean	Ordinary member

Primary key: MNO

`BOOKING`

Field Name	Data Type	Description
BNO	Character	Booking number
MNO	Character	Membership number
VENUE	Character	Venue of the booking
BDATE	Date	Date of the booking
SESSION	Integer	Session of the booking

Primary key: BNO

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(a) Ms Li decides to use character instead of integer as the data type of `MNO` in `MINFO`. Why?

_____

_____

(1 mark)

(b) Ms Li would like to design a form of e-ticket to be sent to members. An e-ticket contains the information about a booking, including the type of membership, so that members can present e-tickets at the venues for entry.

Write the SQL command used to retrieve the data of the e-ticket in the given example for the booking number 12041901.

(2 marks)

(c) Ms Li asks David to implement a validation rule that the venue in Wan Chai can no longer be booked by Gold members and Ordinary members. He writes the following SQL command.

```
SELECT BOOKING.*
FROM MINFO, BOOKING
WHERE (GOLD = TRUE OR ORD = TRUE)
AND VENUE = 'WAN CHAI'
AND MINFO.MNO = BOOKING.MNO
```

(i) How can this SQL command help David validate the relevant data?

_____

_____

(ii) The SQL command can be simplified. Indicate the simplification.

_____

_____

(3 marks)

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Ms Li wants to provide a search function for checking bookings.

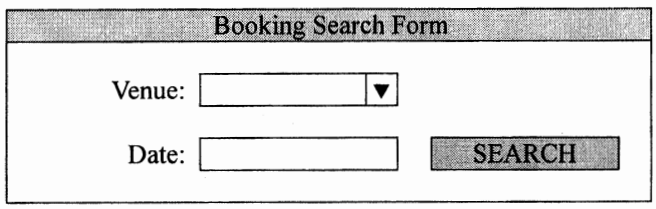
(d) David proposes that each venue should store a copy of `BOOKING` for daily operations.

(i) Give **two** benefits of this proposal to the centre.

(ii) What is the major issue to be considered when maintaining a consistent database in the booking system?

(3 marks)

(e) David designs an online booking search form shown below. When members press the SEARCH button, all records in `MINFO` and `BOOKING` related to the input data will be shown.



(i) What indexes in `BOOKING` and `MINFO` should be created to facilitate searching?

(ii) Ms Li discovers that this search function might lead to unethical use by members. Why?

(4 marks)

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3. Mark and Lily are the members of the committee of a fund-raising organisation. They use a table, MEM, to store member information.

MEM

Field name	Description
MCODE	Identity code of member
MNAME	Name of the member

(a) Some members take charge of fund-raising activities, so the activity code (ACODE) and activity name (ANAME) should be stored.

Mark proposes changing MEM into MYMEM.

MYMEM

ACODE	ANAME	MCODE	MNAME
A01	Famine Weekend	M01	Mark
A03	Child Sponsorship	M01	Mark
A02	Charity Sale	M01	Mark
A02	Charity Sale	L02	Lily
A02	Charity Sale	V03	Vera
⋮	⋮	⋮	⋮
A10	Lucky Draw	T08	Tim

Lily proposes to keep MEM and add a new table, ACT, as shown below:

ACT

ACODE	ANAME	MCODE
A01	Famine Weekend	M01
A03	Child Sponsorship	M01
A02	Charity Sale	M01
A02	Charity Sale	L02
A02	Charity Sale	V03
⋮	⋮	⋮
A10	Lucky Draw	T08

MEM

MCODE	MNAME
M01	Mark
L02	Lily
V03	Vera
⋮	⋮
T08	Tim

(i) Describe **two** major problems with Mark's proposal.

(ii) To improve the design, Lily changes her proposal to include three tables. What tables would you suggest?

(6 marks)

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Every member of the organisation belongs to a group with a group number, GNO. Only one member of each group is the group leader.

(b) Mark proposes some changes to MEM, as shown below. MCODE includes a suffix character where Y and N represent a group leader and an ordinary group member respectively.

MEM

MCODE	MNAME	GNO
M01Y	Mark	1
L02Y	Lily	2
V03N	Vera	1
:	:	:
T08N	Tim	18

(i) Mark writes a SELECT SQL command to find group leaders. Because of the handling of the suffix characters, what SQL reserved word(s) in the SELECT command should Mark use?

(ii) It is desired to keep the original design of MCODE. Without creating extra tables, suggest another design of MEM.

(3 marks)

(c) Lily proposes a table, LEADER, for storing the identity codes of group leaders, as shown below.

MEM

MCODE	MNAME	GNO
M01	Mark	1
L02	Lily	2
V03	Vera	1
:	:	:
T08	Tim	18

LEADER

MCODE	GNO
M01	1
L02	2
F12	20
:	:
T22	18

Suppose that there are 1000 members and 500 groups. Lily's proposal is not better than Mark's. Why not?

(3 marks)

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(d) After integrating Lily's proposals in (a) and (c), a new design with four tables is created.

ACT

Field name
ACODE
ANAME

MEM

Field name
MCODE
MNAME
GNO

LEADER

Field name
MCODE
GNO

INV

Field name
ACODE
MCODE

Draft an E-R diagram for the new design.

(4 marks)

4. HAPPY ice-cream company is going to computerise its current paper-based system. Ms Tam is a database administrator and the project manager of this computerisation project.

(a) Describe **two** common methods that Ms Tam can use during the requirements collection stage.

(2 marks)

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(b) The company says that it needs the following monthly report.

HAPPY Ice-cream Company
Sales Report on January 2012

Staff code	Category	Shop	Quantity	Unit price	Sub-total
A001	Gelato	Wan Chai	2000	30	60 000
A001	Yogurt	Wan Chai	8000	25	200 000
A002	Sorbet	Shatin	4000	35	140 000
A002	Custard	Shatin	2000	42	84 000
A002	Gelato	Shatin	6000	30	180 000
⋮	⋮	⋮	⋮	⋮	⋮
A380	Sorbet	Wan Chai	1000	30	30 000

In the above report, there is a column containing data which are not usually stored in a database. Which column is this? Justify your answer.

(2 marks)

(c) Ms Tam creates the following table, `MAIN`, with primary key `CAT+FLAV`.

`MAIN`

Field Name	**Description**	**Example**
CAT	Category	Gelato
FLAV	Flavour	Vanilla
ING	Main ingredient	Goat milk
PRICE	Unit price	30
MANU	Manufacturer	YY company
TEMP	Storage temperature	-10

The following dependencies exist among the fields:

- `ING` and `TEMP` depend on `CAT`
- `PRICE` depends on `FLAV+CAT`
- `MANU` depends on `ING`

(i) Is `MAIN` in second normal form? Explain briefly.

(ii) Ms Tam wants to change the design of MAIN into third normal form, as shown in the schema below. Complete the schema and underline the primary keys.

CAT	TEMP	ING

FLAV+CAT	

ING	

(5 marks)

(d) Tim is an assistant to Ms Tam. He enters some incorrect data in TEMP of MAIN. In order to delete the incorrect data, he has executed the following SQL command before re-entry.

```
alter table MAIN
drop column TEMP
```

Comment on his action.

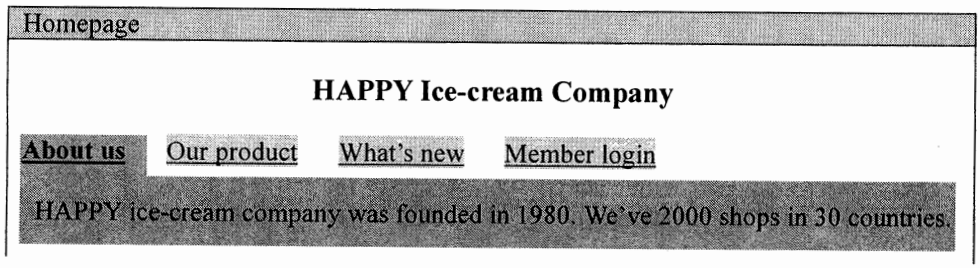
_____

_____

_____

(2 marks)

(e) The homepage of the company includes four hyperlinks to different web pages, as shown below:



Ms Tam sets up a database management system (DBMS) so that data can be dynamically extracted from or stored in the database through the web pages. She wants to insert a web page 'Membership' so that customers can become members of the shop. Give examples of the data exchange between the web page and the DBMS and describe the data interaction briefly.

_____

_____

_____

_____

_____

(3 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