

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.

Please stick the barcode label here.

Candidate Number

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Answer all questions.

1. A club uses a database with two tables ROUTE and SPOT to store information on routes and sightseeing spots in country parks. Members can access the database to acquire information.

SPOT

Field name	Type	Description
SID	Character	Identity code of the sightseeing spot
SNAME	Character	Name of the sightseeing spot

ROUTE

Field name	Type	Description
RID	Character	Identity code of the route
RNAME	Character	Name of the route
SID	Character	Identity code of the sightseeing spot
SN	Integer	Sequence number of the sightseeing spot on this route. '0' represents the starting point.
DIFF	Integer	Difficulty level of the route
NUM	Integer	Number of sightseeing spots

Some sample data is shown below:

SPOT

SID	SNAME
S02	Aberdeen Reservoir
S08	Lion Pavilion
S10	Police Museum
S25	Victoria Gap
S30	Wan Fong Pavilion
S40	Old Wan Chai Post Office

ROUTE

RID	RNAME	SID	SN	DIFF	NUM
R02	The South	S40	0	2	4
R02	The South	S30	1	2	4
R02	The South	S10	2	2	4
R02	The South	S02	3	2	4
R08	Peak	S08	0	1	3
R08	Peak	S40	1	1	3
R08	Peak	S10	2	1	3

- (a) Complete the following table to identify the primary keys and foreign keys for ROUTE and SPOT, if any. Write 'N/A' if not applicable.

	Primary key	Foreign key
ROUTE		
SPOT	SID	

(3 marks)

Answers written in the margins will not be marked.

Please stick the barcode label here.

(b) (i) Briefly explain why NUM is a derived attribute.

(ii) What is the major benefit of using NUM in the database?

(2 marks)

(c) (i) Give an example of redundant data, other than NUM, in the database and explain your answer briefly.

(ii) Normalise the database into third normal form and give the new database schema.

(5 marks)

Answers written in the margins will not be marked.

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- (d) The club uses a design tool to create a user interface which allows members to create new routes using the existing sightseeing spots.

(i) Should the interface created by the design tool be a form or a report? Explain briefly.

(ii) Complete the draft of the user interface below.

Create a new route

(5 marks)

Answers written in the margins will not be marked.

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2. The management office of a shopping mall creates a mobile phone application as an electronic wallet (e-wallet). Customers can use the e-wallets in their mobile phones to store small amounts of money and make payments in the shops in the mall. The management office uses a relational database with database tables EW and TRANS to store relevant information.

EW

Field name	Size (bytes)	Description
ENO	16	e-wallet number
AMT	4	Amount that the e-wallet has

Primary key: ENO

TRANS

Field name	Size (bytes)	Description
TNO	32	Transaction number
ENO	16	e-wallet number
SID	8	Identity code of the shop
ADDM	4	Amount of money transferred
DT	8	Date and time of the transfer

Primary key: TNO

The management office launches a promotion and gives a rebate of \$100 to e-wallets which have transactions with transaction numbers between 1 and 1000 inclusively.

- (a) Write an SQL command to add the rebate to the corresponding e-wallets.

(3 marks)

- (b) The mobile phone application uses 1 MB memory in a customer's mobile phone to store a copy of relevant transaction history in TRANS. Estimate the maximum number of records that can be stored in the mobile phone. Show your calculation.

(2 marks)

Answers written in the margins will not be marked.

(c) (i) Dry run the following DELETE commands on EW and TRANS with the sample records, as shown below. Put a 'X' in the 'Deleted?' columns to indicate the deletion.

DELETE FROM TRANS WHERE ENO = 'E2'

DELETE FROM EW WHERE ENO = 'E2'

EW

ENO	AMT	Deleted?
E1	800	<input type="checkbox"/>
E2	1200	<input type="checkbox"/>

TRANS

TNO	ENO	SID	ADDM	DT	Deleted?
88	E1	S8	-200	2017/1/1 14:40	<input type="checkbox"/>
410	E2	S3	-150	2017/2/8 12:10	<input type="checkbox"/>
999	E2	S8	-300	2017/2/8 13:00	<input type="checkbox"/>
1001	E2	S2	-400	2017/2/8 14:15	<input type="checkbox"/>

(ii) It is found that the database management system does not allow users to execute the following DELETE commands on EW and TRANS in (c)(i) because the execution of the commands will result in an integrity problem.

DELETE FROM EW WHERE ENO = 'E2'

DELETE FROM TRANS WHERE ENO = 'E2'

Describe the integrity problem briefly.

(4 marks)

(d) What is the major difference between the following two SQL commands?

- (1) DELETE FROM TRANS
- (2) DROP TABLE TRANS

(2 marks)

- (e) The promotion is now finished. Describe how the management office uses data mining techniques to determine sales strategies.

(3 marks)

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3. ABC school launches a programming competition. Any three students can form a team to join the competition. Each team is required to solve several programming tasks. Three database tables TEAM, PTASK and RESULT are used to store information relating to the competition.

TEAM

Field name	Type	Description	Example
TID	Character	Identity code of the team	T1
TNAME	Character	Name of the team	Happy
MIDC	Character	Identity code of the captain	S001
MID1	Character	Identity code of the first member	S005
MID2	Character	Identity code of the second member	S008

Primary key: TID

PTASK

Field name	Type	Description	Example
PID	Character	Identity code of the programming task	P1
TITLE	Character	Title of the programming task	Bubble sort
FAST	Character	Identity code of the fastest team to solve the programming task	T1

Primary key: PID

RESULT

Field name	Type	Description	Example
PID	Character	Identity code of the programming task	P1
TID	Character	Identity code of the team	T1
MARK	Integer	Mark obtained (from 0 to 100)	100

Primary key: PID + TID

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

- (a) PTASK indicates the fastest team at solving each programming task. List the titles of the programming tasks and the names of the corresponding fastest teams.

(2 marks)

- (b) List the total number of programming tasks whose titles contain the string 'sort'.

(2 marks)

Answers written in the margins will not be marked.

- (c) List the results of all programming tasks including the titles of the programming tasks, the names of the teams and the corresponding marks obtained which should be larger than 50. The list should be in ascending order of the title of the programming task and then in descending order according to the mark obtained.

(4 marks)

- (d) List the names of the teams that are the fastest teams at solving more than one programming task.

(4 marks)

- (e) Suppose that TEAM contains 5 records and ABC school uses a SQL command for checking, as shown below:

```
SELECT MIDC FROM TEAM T WHERE EXISTS
(SELECT E.MIDC FROM TEAM E
WHERE T.MIDC = E.MID1 OR T.MIDC =E.MID2)
```

TID	TNAME	MIDC	MID1	MID2
T1	Happy	S001	S005	S008
T2	Love	S010	S002	S007
T3	Winner	S111	S010	S006
T4	Grace	S008	S003	S011
T5	Song	S009	S012	S016

- (i) List the result produced by the SQL command.

- (ii) What is the purpose of the SQL command?

(3 marks)

Answers written in the margins will not be marked.

4. An information system is to be developed for a school exhibition. Its project team use CASE tools to develop the system. This team has three team members:

Name	Title
Peter	Project manager
Charles	Data entry operator
Eva	Database designer

- (a) (i) For each of the following features of the CASE tools, suggest a project team member who would use it frequently.

(1) ER diagram templates _____

(2) Time scheduling _____

- (ii) There are different stages in the database application development lifecycle. For each of the following features of the CASE tools, give the stage of the database application development lifecycle that the project team would use frequently.

(1) ER diagram templates _____

(2) Bug tracking _____

(4 marks)

- (b) The project team produce two types of manuals. Complete the following table to indicate the specifications of the manuals.

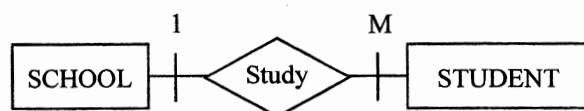
Manual	Readers of the manual	Purpose of the manual
User manual	End users	
System manual		

(3 marks)

- (c) The database in the information system stores information on schools, students, exhibits and exhibition areas. The requirements of the database are described below:

Students create exhibits for the exhibition. Some students create more than one exhibit while some exhibits are created by several students. Each exhibit will only be placed in one exhibition area. Due to some limitations, exhibition areas cannot display all exhibits. Each exhibition area has a theme.

- (i) Complete the ER diagram for the database design below. It is not necessary to draw attributes in the diagram.



- (ii) The project team want to transform the 'exhibition area' into a database table. Give **two** attributes that must be included in the database table.

(6 marks)

- (d) The project team want to store all digital exhibits in a database system. Give **three** technical challenges they may encounter when planning for the development of the database system.

(3 marks)

END OF PAPER

Answers written in the margins will not be marked.

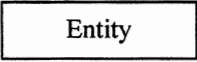

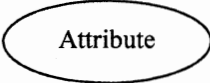

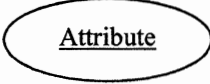


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Database (SQL commands - based on SQL-92 Standard)

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		One-to-One Relationship	
Attribute		One-to-Many Relationship	
Key Attribute		Many-to-Many Relationship	
Relationship		Participation constraints: Use on Mandatory side Use ○ on Optional side	