

Answer all questions.

1. A park hires an IT project team to develop a system to monitor plants in the park. Members of the team include Mary, Peter and Eva. They are involved in various stages of the database application development lifecycle for the project.

- (a) Mary is a database administrator, Peter is a database developer and Eva is a data entry operator. Identify the person-in-charge of each of the following stages.

Stage of the development lifecycle	Person-in-charge
Application and database design	
Data migration	
Operational maintenance	

(3 marks)

- (b) (i) Suggest a deliverable for each of the following stages.

Application and database design stage: _____

Prototyping stage: _____

Testing stage: _____

(3 marks)

- (ii) In what situation will data migration be carried out?

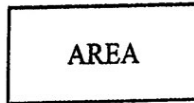
(1 mark)

- (iii) Give another stage that should be carried out before the 'Database Management System (DBMS) selection', other than the stages in (a).

(1 mark)

- (c) The park has several areas. The database in the system stores information on the areas, plants and diseases. The requirements of the database are described below:
- Some areas do not have any plants while other areas have only one kind of plant.
 - The plants in an area may be very healthy, or may be infected with one or more diseases.
 - Some diseases recorded in the database are not found in the park.

Complete the ER diagram for the database design below. It is not necessary to draw attributes.

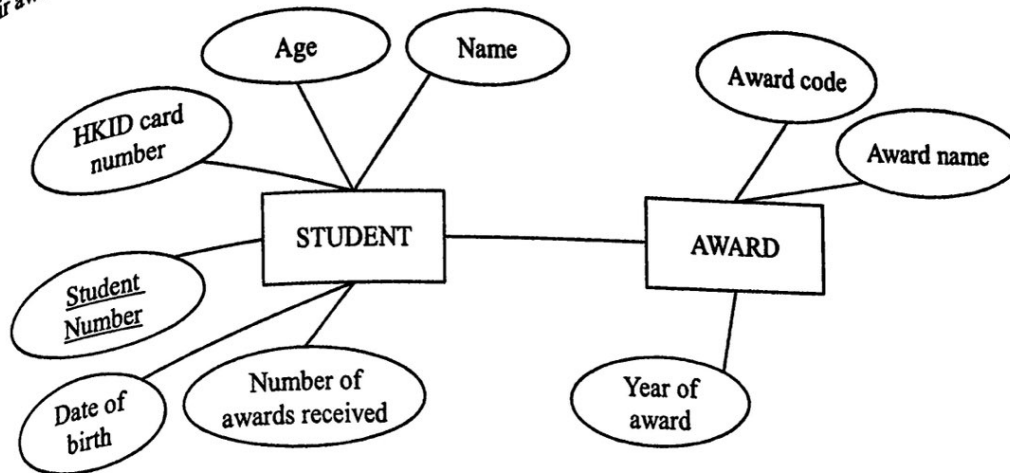


(6 marks)

- (d) Peter intends to use the system and the data collected in this project for his personal research. What should he do to avoid violating ethical principles?

(2 marks)

Mr Li works in an international school. He plans to use a database to store information on students and their awards. He drafts an ER diagram below:



- (a) Why does Mr Li use 'Student number' instead of 'HKID card number' as the primary key?

(1 mark)

- (b) Some attributes in the ER diagram are derived attributes as they can be derived from other attributes. Give **two** derived attributes in the ER diagram.

(2 marks)

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(ii) Based on the draft of the ER diagram, create a database schema in Third Normal Form without derived attributes. Identify the corresponding primary keys and foreign keys. Write 'N/A' if not applicable.

This image shows a single page from a notebook or ledger. It features approximately 20 horizontal ruling lines spaced evenly down the page. The lines are dark and slightly curved, following the shape of the paper. There is no handwriting or other markings on the page.

Answers written in blue

Provided by dse.life

A company installs storage boxes in some public places including airports and shopping centres. Customers can rent the storage boxes on an hourly basis. The company creates a database table SBOX to store information on storage boxes.

SBOX	
Field name	Description
SID	Identity code of the storage box
LOC	Location
FEE	Hourly rental fee (no decimal places)
OUTOFSER	Out of service true - Under maintenance false - Available for use

- (a) (i) Complete the following SQL command to create SBOX with appropriate data types.

```
CREATE TABLE SBOX (
  SID char(10),
  LOC char(50),
```

```
  FEE _____,
```

```
  OUTOFSER _____)
```

(2 marks)

- (ii) Suggest **three** types of constraints that can be included in the command in (a)(i). For each type of constraint, indicate a field to be applied.

(3 marks)

Answer must be in the margin will not be marked

The company creates another database table RENTAL to store information on rental transactions.

RENTAL	
Field name	Description
SID	Identity code of the storage box
CID	Identity code of the customer
STIME	Start time of the rental
ETIME	End time of the rental

Below are sample records of RENTAL:

SID	CID	STIME	ETIME
P1122	A1234	21/03/2019 15:02	22/03/2019 15:52
P1333	B2222	20/03/2019 15:03	20/03/2019 15:13
P1566	C5656	21/03/2019 15:04	
P1122	D6467	20/03/2019 16:06	20/03/2019 16:41
P1445	B2222	21/03/2019 16:30	22/03/2019 17:10

If a storage box has never been rented, there is no record of the storage box in RENTAL.

- (b) Some storage boxes are under maintenance and some are rented. When the number of storage boxes in a location that are now available for rent is smaller than 10, the company will post an online message about this.

Write a SQL command to list the locations and the corresponding numbers of storage boxes available for rent that the company will post online.

(4 marks)

The company creates an online system to monitor the rental of the storage boxes. A sample interface for generating a rental report is shown below:

Rental Information			
Month:	<input type="text" value="3"/>	Year:	<input type="text" value="2019"/>
Location	Identity code of storage box	Rental duration (hour)	Percentage rented out
Airport	P1122	280	
Central MTR	P1333	700	38%
Airport	P1445	400	94%
			54%

- (c) (i) With reference to the above design, which field in the database should be indexed so as to generate a rental report faster? Explain briefly.

(2 marks)

- (ii) Briefly describe how to calculate the values in the column 'Percentage rented out'.

(1 mark)

Answers written in the margins will not be marked.

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- (d) There are 5000 storage boxes in 10 locations. Give **three** modifications to the design of the interface to improve the monitoring of the usage of storage boxes. Annotate your design, where appropriate.

Rental Information

(3 marks)

A bus company uses three database tables BROUTE, EMPLOYEE and DRIVER to store information on buses, employees and drivers. DRIVER only stores information on the drivers and the bus routes they can drive.

BROUTE			
Field name	Type	Description	Example
BID	Character	The bus route	1A
BNO	Integer	Number of buses on this bus route	20

Primary Key: BID

EMPLOYEE			
Field name	Type	Description	Example
EID	Character	Identity code of the employee	A00038
ENAME	Character	Name of the employee	John Li
SALARY	Integer	Salary of the employee	20000
DSER	Date	First day of work	21/3/2010

Primary Key: EID

DRIVER			
Field name	Type	Description	Example
EID	Character	Identity code of the employee	A00038
BID	Character	The bus route that the employee can drive	1A

Primary key: EID + BID

Foreign key: EID , BID

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

- (a) List the names and identity codes of the employees who can drive bus route '1A' in descending order of their salary.

(2 marks)

- (b) List the highest salary for those who joined the company in 2009.

(2 marks)

Answers written in the margins will not be marked.

(c) List the names and identity codes of the employees who cannot drive any bus route.

(d) For some bus routes, the number of drivers is smaller than the number of buses. List those bus routes.

(e) Consider the following views:

```
CREATE VIEW V1 AS
SELECT AVG(SALARY) AS AVG1 FROM EMPLOYEE
WHERE EID IN
  (SELECT DRIVER.EID FROM DRIVER
   WHERE DSER < '1/1/2005')
```

```
CREATE VIEW V2 AS
SELECT AVG(SALARY) AS AVG2 FROM EMPLOYEE
WHERE EID IN
  (SELECT DRIVER.EID FROM DRIVER
   WHERE DSER >= '1/1/2005')
```

(i) What is the purpose of V1?

(2 marks)

(ii) Write a SQL command to find (AVG1 - AVG2).

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(i) The company introduces a new overnight bus route 'N1A' and assigns it to drivers who can drive bus route '1A' and joined the company before '15/3/2000'. The company will execute the following SQL commands: (2 marks)

	SQL command
(1)	INSERT INTO BROUTE VALUES ('N1A', 10)
(2)	CREATE VIEW DRIVERN1A AS SELECT EMPLOYEE.EID, 'N1A' AS BID FROM EMPLOYEE, DRIVER WHERE EMPLOYEE.EID = DRIVER.EID AND DSER < '15/3/2000'
(3)	INSERT INTO DRIVER SELECT EID, BID FROM DRIVERN1A

Describe the potential problem if the sequence of executing the SQL commands is:

(i) (1) → (3) → (2)

(ii) (2) → (3) → (1)

(1 mark)

(2 marks)

END OF PAPER

Answers written in the margins will not be marked.