Answer all questions.

1. A company provides a service which allows members to rent and view videos online during a 7-day rental period. The company uses three database tables `MEMBER`, `VIDEO` and `RENTAL` to store information on members, videos and rental respectively.

`MEMBER`

Field name	Type	Description	Example
`MID`	Character	Identity code of member	M0023
`MNAME`	Character	Name	Susan Li
`MTYPE`	Character	Type of member: G – Gold member O – Ordinary member	G
`CREDIT`	Integer	Credit points	580
`JDATE`	Date	Date joined	31/01/2012

Primary key: `MID`

`VIDEO`

Field name	Type	Description	Example
`VID`	Character	Identity code of video	V08
`VTITLE`	Character	Title of video	Nice Face
`RFEE`	Integer	Rental fee for video	20

Primary key: `VID`

`RENTAL`

Field name	Type	Description	Example
`MID`	Character	Identity code of member	M0023
`VID`	Character	Identity code of video	V08
`RDATE`	Date	Date of rental	18/10/2019

(a) What is the primary key for `RENTAL`? _____

(2 marks)

Write SQL statements to complete the following tasks from (b) to (e) below.

(b) List the names and identity codes of the Ordinary members who have fewer than 100 credits.

(2 marks)

(c) Find the total rental fee earned by the video 'Nice Face'.

(3 marks)

(d) List the titles of the videos which have never been rented.

(3 marks)

(e) The company celebrates its anniversary and gives 50 extra credit points to members who joined before 2017.

(3 marks)

(f) What is the purpose of the following SQL statement?

```
SELECT MID FROM MEMBER
WHERE MTYPE = "G" AND
   JDATE < ALL
           (SELECT JDATE FROM MEMBER
            WHERE MTYPE = "O")
```

(2 marks)

2. Peter works in a food delivery company. There are two database tables D1 and D2 that store information on the food items offered by two restaurants respectively.

D1

Field name	Type	Description
ACODE	Character	Identity code of food
ANAME	Character	Food name
PRICE	Real	Price of food

Primary key: ACODE

Sample data:

ACODE	ANAME	PRICE
K01	Banana pancake	48.5
K08	Strawberry pancake	48.5
L62	Brownie	39.9

D2

Field name	Type	Description
BCODE	Character	Identity code of food
BNAME	Character	Food name
PRICE	Integer	Price of food

Primary key: BCODE

Sample data:

BCODE	BNAME	PRICE
K01	Chicken rice	90
K08	Beef noodle	70
GP5	Fried vegetable	58

(a) Peter is going to set up an online platform for ordering food from various restaurants. He needs to migrate the data in D1 and D2 to one database table. Give two problems that he will encounter during data migration and suggest an appropriate solution for each problem.

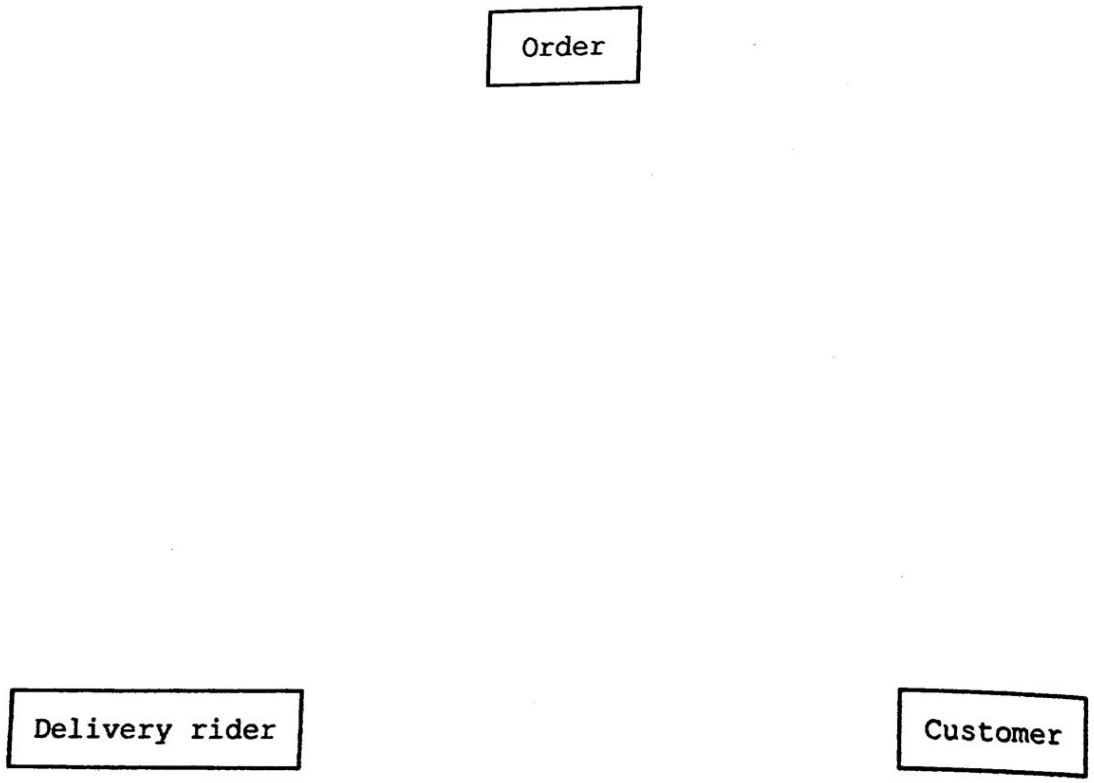
(4 marks)

Answers written in the margins will not be marked.

(b) Peter designs a database to store information on delivery riders, customers and orders. The requirements of the database are described below:

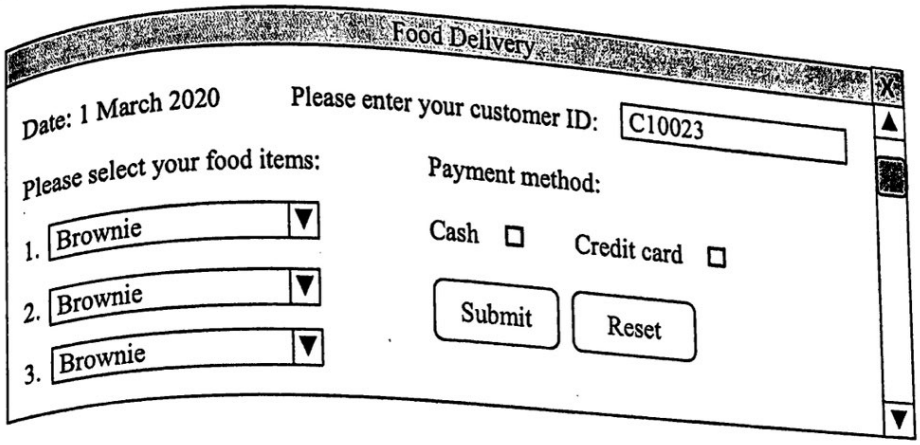
The company hires a lot of delivery riders to deliver food to customers. Each customer places one order or multiple orders. Each delivery rider delivers zero or multiple orders. Each order must be delivered by one delivery rider only.

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



(4 marks)

Peter drafts the following order form for customers:



(c) Describe how the company can use data mining techniques on the data collected using the order form to improve its business.

(3 marks)

(d) Peter plans to design a monthly report on the delivery service, based on the following data.

Rider ID	District	Date	Number of orders
R1211	Wan Chai	1/3/2020	21
R1004	North Point	1/3/2020	18
R0804	Mong Kok	1/3/2020	43
R1211	Wan Chai	2/3/2020	28
R1004	North Point	2/3/2020	5
R0804	Mong Kok	2/3/2020	50
⋮			

He wants to find data with a specific date range and a specific district.

Create an interface with multiple search functions to generate the report that meet Peter's needs. Annotate your design, where appropriate.

(4 marks)

3. A school plans to set up a registration system and Ms Lam is responsible for developing the system. She designs a database table `STUDENT` to store the student records for the school year 2019-2020.

`STUDENT`

Field name	Description	Example
SID	Student identity code (a leading character 'S' followed by 6 digits)	S117001
NAME	Name	Chan Tai Man
SEX	Sex M – Male F – Female	M
CL	Class name (1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, 5B, 6A, 6B)	3A
CLNO	Class number (1 – 36)	20

Primary key: `SID`

(a) Complete the following SQL statement to create `STUDENT` according to the design above.

```
CREATE TABLE STUDENT (

  SID  _____________________________________,
  NAME   char(50) not null,
  SEX    char(1),
  CL     char(2),

  CLNO _____________________________________)
```

(2 marks)

(b) (i) Is `SID + CLNO` a candidate key for `STUDENT`? Explain briefly.

_____

_____

_____

_____

(2 marks)

(ii) Suggest a candidate key that does not include `SID`. Explain why it would not be selected as a primary key for `STUDENT`.

_____

_____

_____

_____

(2 marks)

Answers written in the margins will not be marked.

(c) *Ms Lam executes the following* `INSERT` *statement but it fails due to some data items in the statement. Identify these data items and justify your answer.*

```
INSERT INTO STUDENT(SID, NAME, SEX, CL, CLNO)
VALUES('S170001', '', 'Male', '8A', 30)
```

(4 marks)

Extra-curricular activities in the school are classified into different types. The first three types are:

1 Music
2 Sports
3 Visits

Students receive a summary report on the activities they have attended, as shown in the following sample report:

Extra-curricular Activities Report

Name: Chan Tai Man Sex: M Student ID: S117001 Class: 3A Class number: 20

Date: 22/09/2019
Activity: Basketball practice
Type: 2

Date: 22/09/2019
Activity: Volleyball team meeting
Type: 2

Date: 28/01/2020
Activity: Ocean Park visit
Type: 3

(d) Based on the information in the sample report above, create a database schema including `STUDENT` in Third Normal Form. Identify the corresponding primary keys and foreign keys, or write 'N/A' if not applicable.

(5 m

4. Tom develops a project on membership applications for two shopping malls. The project is divided into the following stages:

1. Investigate the need
2. Define the system
3. Design the database
4. Testing
5. Maintenance

(a) (i) The project uses two Computer Aided Software Engineering (CASE) tools, namely a query editor and a graphical tool. State which stage each tool is used in and describe how the feature(s) of the tool can help complete the corresponding work.

Query editor: _____

_____

_____

_____

Graphical tool: _____

_____

_____

_____

(4 marks)

(ii) Describe two deliverables for Stage 4 (testing).

_____

_____

_____

_____

(2 marks)

(b) Tom installs two standalone computers to collect members' spending in the two shopping malls and store the data separately in database tables `S1` and `S2`.

`S1` and `S2` are of the same structure, as shown below:

Field name	Description
MID	Identity code of member
SDATE	Date of spending
AMT	Total amount of spending on that day

Tom considers SQL1 and SQL2 below:

SQL1	`SELECT * FROM S1`
	`UNION`
	`SELECT * FROM S2`

SQL2	`SELECT * FROM S1`
	`UNION ALL`
	`SELECT * FROM S2`

(i) Tom finds that SQL1 and SQL2 produce different results. State one difference.

(2 marks)

(ii) After executing SQL1, Tom needs to clear all the records in `S1` and `S2`. Which command, `DELETE` or `DROP`, should he use? Explain briefly.

(2 marks)

Tom considers SQL3 and the sample data in S1 and S2 below:

SQL3	SELECT S1.MID, S1.SDATE, S1.AMT, S2.MID, S2.SDATE, S2.AMT FROM S1 FULL OUTER JOIN S2 ON S1.MID = S2.MID ORDER BY S1.MID, S1.SDATE, S2.SDATE

S1

MID	SDATE	AMT
T12345	21/10/2019	850
H10040	21/10/2019	500
P12011	21/10/2019	400
P98765	22/10/2019	900

S2

MID	SDATE	AMT
P12011	21/10/2019	300
R08040	21/10/2019	500
H10040	22/10/2019	680

(iii) Fill in the information on the results of SQL1 and SQL3.

	Number of records (rows)	Number of attributes (columns)
SQL1		3
SQL3		

(3 marks)

(iv) Give two benefits of using SQL3.

(2 marks)

END OF PAPER

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 — ○