

Answer all questions.

1. A university uses a computer system to record the entry of rooms. The system uses three database tables STAFF, ROOM and TRAN to store information on staff, rooms and entry records respectively. When a staff member enters a room using a smart card, an entry record will be created.

STAFF

Field name	Description	Example
SID	Identity code of staff member	AA000001
HKID	Identity card number	Z683365(5)
SNAME	Staff name	Chan Tai Man
DEPT	Department	Physics

Primary key: SID

ROOM

Field name	Description	Example
RID	Identity code of room	L502
RTYPE	Room type	Lab
RNAME	Room name	Science Lab
AREA	Area of room	Eastern

Primary Key: RID

TRAN

Field name	Description	Example
TID	Identity code of entry record	20230728000001
SID	Identity code of staff member	AA000001
RID	Identity code of room	L502
TDATE	Entry date	28/7/2023

Primary key: TID

Foreign Key: SID references SID of STAFF
RID references RID of ROOM

(a) State a candidate key in STAFF, other than SID. SNAME (1 mark)

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

- (b) List the identity codes of staff members who have entered the room with the identity code 'L502' in ascending order of TDATE.

Select ~~SID~~ ' where RID = L502 '
ORDER BY 'TDATE USC'!

(2 marks)

Answers written in the margins will not be marked.

- (c) List the names of staff members who have entered rooms with names containing 'Lab'.

Select SNAME Where 'RNAME' like "Lab"
SNAME from STAFF

(2 marks)

- (d) List the names of staff members who have not entered any rooms.

SELECT SNAME FROM STAFF LEFT JOIN T10
ON _____
WHERE 'TID' is Null

(3 marks)

- (e) Some rooms have more than 100 entry records in TRAN. List the room types of these rooms.

SELECT RTYPE From Room Where TID > 100

(3 marks)

- (f) Complete the following SQL statement to add a field, MOB , to STAFF to store the mobile phone numbers of staff.

Field name	Data type	Length
MOB	Character	8

Select _____ STAFF
ADD _____ MOB

(2 marks)

- (g) What is the purpose of the SQL statement below?

```
SELECT SID FROM STAFF S
WHERE DEPT = 'Physics'
AND EXISTS (SELECT S.SID FROM TRAN T
WHERE S.SID = T.SID)
MINUS
SELECT SID FROM TRAN
WHERE TDATE = '28/7/2023'
```

Check who has entered the physics Dept
on the 28/7/2023,

(2 marks)

2. Ms Chan is a manager of a computer training centre. She uses a database table ENROL to store information about students' enrolment on the courses at the centre. Each course will be offered once a year and taught by one teacher only. Students may enroll on the same course in different years.

ENROL

Field name	Description
CCODE	Identity code of course
CNAME	Name of course
CYEAR	School year
TEACHER	Teacher-in-charge
SID	Identity code of student
SNAME	Name of student
MOBILE	Contact number of student

Some sample records are shown below:

ENROL

CCODE	CNAME	CYEAR	TEACHER	SID	SNAME	MOBILE
CS1001	Basic Programming	2022	Mr Lee	S00121	Ben	69871234
CS1001	Basic Programming	2023	Mr Chan	S00121	Ben	69871234
CS1001	Basic Programming	2022	Mr Lee	S00203	Tom	95543210
CS1003	Advanced Programming	2023	Ms Lam	S00121	Ben	69871234
CS2001	Artificial Intelligence	2023	Ms Lo	S00089	Mary	90065489
CS4001	Databases (I)	2023	Mr Chan	S00332	Peter	91139888
CS1003	Advanced Programming	2022	Mr Lee	S00089	Mary	90065489

(a) (i) Suggest a primary key of ENROL. CCODE (2 marks)

(ii) State two fields that are functionally dependent on SID only.

CCODE depends on SID.

CNAME depends on SID.

(2 marks)

(iii) Describe an example of data redundancy in ENROL.

CNAME are being repeated for different people.

(1 mark)

- (b) To convert ENROL into Third Normal Form, Ms Chan suggests the following database schema. COURSE, COURSEDETAIL, STUDENT and EINFO store information on courses, students and enrolment respectively.

Complete the following database schema in Third Normal Form.

COURSE (CCODE, CNAME)

Primary key: CCODE

Foreign key: N/A

COURSEDETAIL (TIME , VENUE , TEACHER)

Primary key: TIME

Foreign key: N/A

STUDENT (SID, SNAME, MOBILE)

Primary key: SID

Foreign key: N/A

EINFO (Seat , Date , Center)

Primary key: Seat

Foreign key: _____ references _____ of _____

_____ references _____ of _____

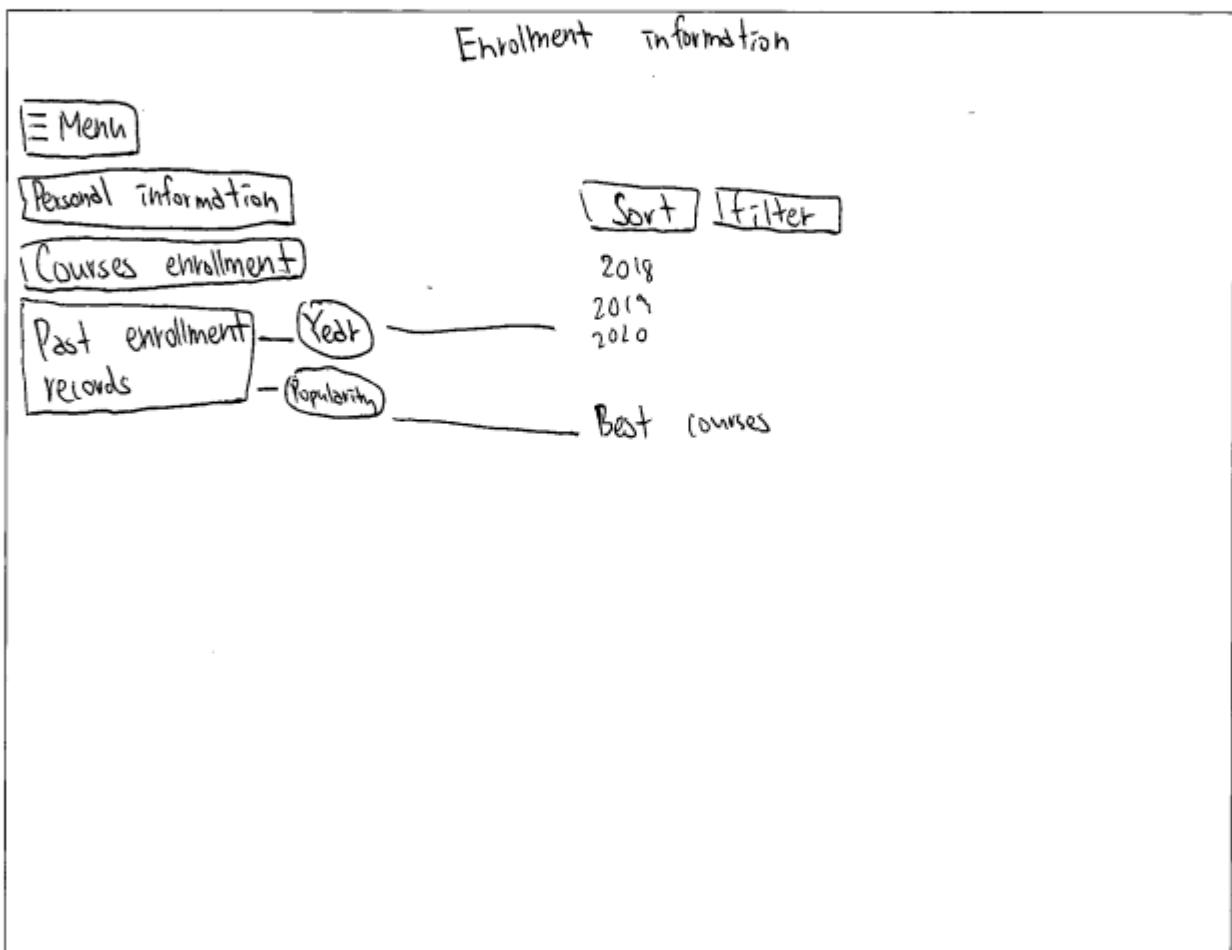
_____ references _____ of _____

(6 marks)

(c) Design an interface of a form for students to view and add new enrolment information. The requirements of the interface are shown below:

- Students can view their own personal information.
- Students can enrol on the courses for the current year.
- Students can view the past enrolment records in a particular year and find out the popularity of the courses by filtering or sorting functions.

Annotate your design, where appropriate.



The interface is made simple for it to be user-friendly, all options are under the menu so that users can simply find everything without have to further search.

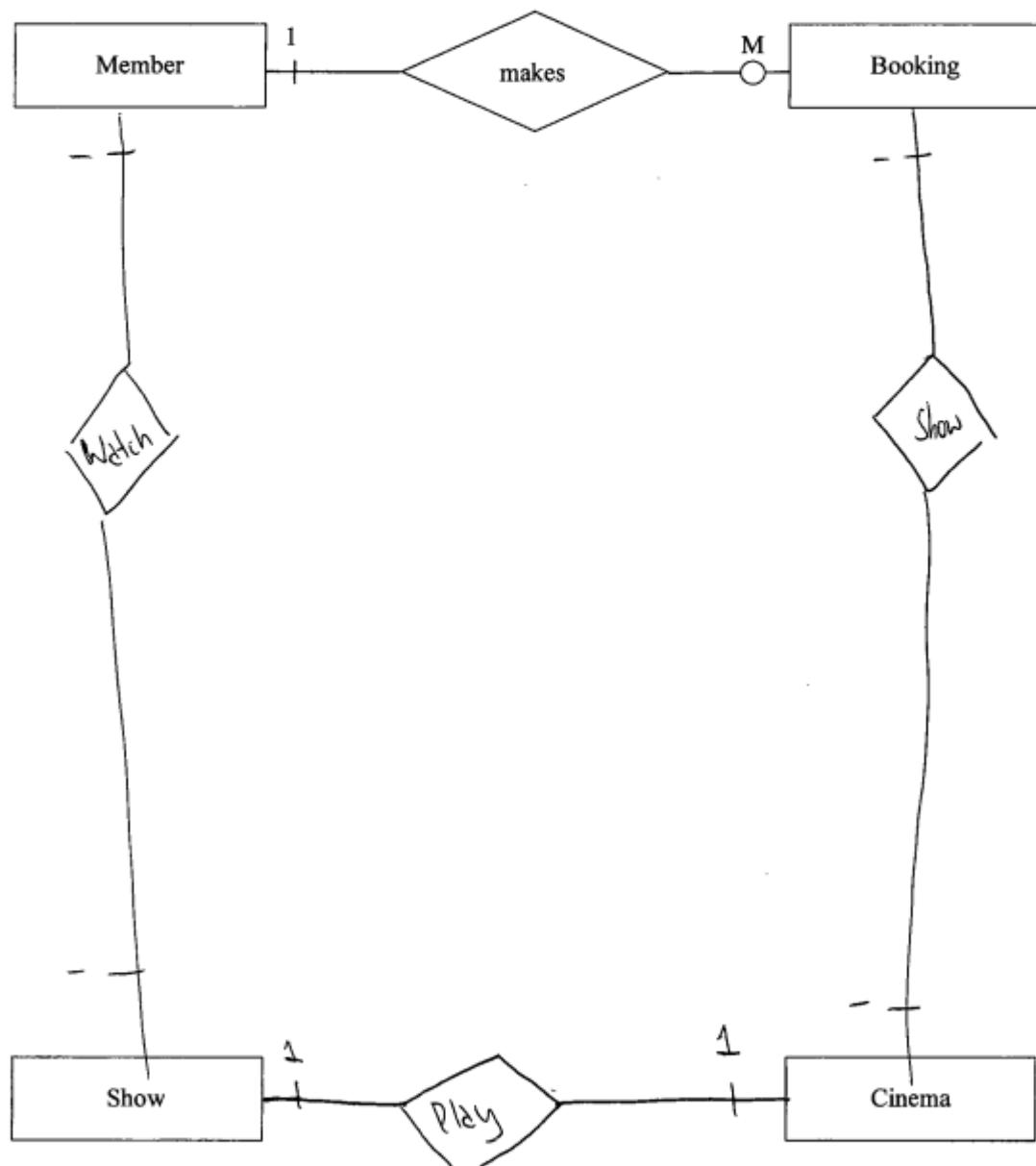
(4 marks)

3. A company owns a number of cinemas. There are several shows in each cinema every day. The company plans to develop a database to store information on members, bookings, shows and cinemas.

(a) The requirements of the database are described below:

- Each booking is for one show.
- Each show may or may not have bookings.
- Each cinema must have at least one show.

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



Answers written in the margins will not be marked.

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- (b) Select one deliverable and one staff member involved in the database design stage in the database application development lifecycle.

Stage	Deliverable	Staff member
Database design	<input type="checkbox"/> Flowchart <input type="checkbox"/> Data dictionary <input checked="" type="checkbox"/> User manual	<input type="checkbox"/> System analyst <input type="checkbox"/> Data entry operator <input checked="" type="checkbox"/> Database engineer

(2 marks)

The database table MEMBER stores information on members and part of the records are shown below.

MEMBER

MID	MNAME	SEX	DOB	EMAIL	ADDRESS
00083	CHAN TM	F	12/4/1990	ctm@abc.com	120 Sea Street, Kowloon
10389	WONG SS	M	8/3/1988	wss@fly.com	23 High Road, Hong Kong
10931	TAM MM	F	2/12/1985	tmm@sea.com	343 Land Street, N.T.
20456	TO SM	M	3/5/1992	tsm@abc.com	98 King Street, Hong Kong
40888	LAM SM	M	8/3/1988	lsm@mat.org	21 Queen Road, Kowloon

- (c) (i) SQL1 is a SQL statement.

SQL1	<pre>SELECT MNAME, SEX, DOB FROM MEMBER WHERE DOB > '1/1/1988' ORDER BY MNAME</pre>
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An index, MINDEX, is created to improve the performance of SQL1. Select two fields in the box below to complete the following SQL statement, which will lead to the best performance of SQL1.

MNAME	SEX	DOB
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CREATE INDEX MINDEX

ON MEMBER(DOB, MNAME)

MNAME

DOB

(2 marks)

- (ii) SQL2 and SQL3 are SQL statements that can modify MNAME with MID '00083' to 'Chan Tai Man'.

SQL2	DELETE FROM MEMBER WHERE MID = '00083' INSERT INTO MEMBER VALUES ('00083', 'Chan Tai Man', 'F', '12/4/1990', 'ctm@abc.com', '120 Sea Street, Kowloon')
SQL3	UPDATE MEMBER WHERE MID = 00083 SET Values = ('00083', 'Chan Tai Man', F) WHERE MID = '00083'

Complete SQL3 above.

(2 marks)

- (iii) Suppose that MID is indexed. SQL2 will rebuild the index. Explain briefly.

(2 marks)

- (d) The company plans to share member information in MEMBER to an advertising company to promote other businesses. What is the potential problem with this plan? How can this problem be solved?

Problem: The private information such as address might get leaked

Solution: Do not send the address

(2 marks)

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4. A charity organisation recruits students to organise social service groups in each district. Each student can join different districts using the same identity code. A student may have a leader in each district. The organisation uses a separate database for each district to store student information. The same structure of a database table is used for all districts, as shown below:

Field name	Description	Data type	Example
SID	Identity code of student	x	012345
RDATE	Date of registration	Date	1/10/2020
SNO	Number of services participated in	Integer	6
LEADER	Identity code of leader	x	098765

Primary key: SID

- (a) State the data type, x, for SID. Explain briefly.

Number because the SID is 012345 which are numbers

(2 marks)

Suppose that D1 and D2 are database tables used for two different districts.

D1

SID	RDATE	SNO	LEADER
012345	1/10/2020	6	098765
010040	2/9/2023	2	098765
011564	8/8/2018	7	012011
012011	15/8/2022	4	
098765	2/2/2017	4	

D2

SID	RDATE	SNO	LEADER
088906	3/3/2020	3	013988
010040	2/1/2023	5	013988
098765	2/12/2019	1	013988
012011	2/8/2020	4	013988
013988	20/2/2017	3	

- (b) Based on the given records in D1 and D2, how many records will appear in the results when executing SQL1 and SQL2 below?

SQL1	SELECT SID FROM D1 UNION SELECT SID FROM D2
SQL2	SELECT SID FROM D1 UNION ALL SELECT SID FROM D2

SQL1: _____

SQL2: _____

(2 marks)

- (c) In each of the following parts, there is a new record to be inserted into D1, but it will cause an integrity problem (such as entity integrity, referential integrity and domain integrity). State the integrity problem and explain your answer briefly.

(i)

SID	RDATE	SNO	LEADER
012345	12/9/2022	3	098765

Entity integrity

(2 marks)

(ii)

SID	RDATE	SNO	LEADER
012033	30/2/2022	5	098765

Domain integrity

(2 marks)

(iii)

SID	RDATE	SNO	LEADER
012066	10/6/2022	3	023456

Referential integrity

(2 marks)

- (d) (i) The IT manager suggests merging the databases from all districts. Give a benefit of this suggestion and explain your answer briefly.

The database will show for all districts, so time would save as you would not need to go through each one separately.

(2 marks)

- (ii) D1 and D2 should be redesigned before merging. The districts should be distinguished in the new design. Complete the following new database table for merging.

D1 (SID, RDATE, SNO, LEADER, Mobile)

Primary key: LEADER

Description of the new field name:

Mobile number of the students participating.

(2 marks)

- (e) Describe how data mining can be applied to enhance social services.

More information can found like what kind of social issues there are can be solved.

(2 marks)

END OF PAPER