SINGAPORE POLYTECHNIC

2021/2022 SEMESTER ONE TEST

DIPLOMA IN APPLIED AI & ANALYTICS
SECOND YEAR FULL TIME

DIPLOMA IN INFORMATION TECHNOLOGY
SECOND YEAR FULL TIME

DATA ENGINEERING Time allowed: 1.5 Hours

Instruction to Candidates

1. This paper comprises **4** questions.
2. This test paper consists of **6** pages (inclusive of cover page).
3. Answer **ALL** questions.
4. All answers should be written in the answer booklet.
5. Start each question on a new page.

1. The Member table shows the balance in a member's Ordinary, Special and Medisave accounts in his/her Central Provident Fund (CPF):

Member

NRIC	Name	DateofBirth	Sex	OrdAcc	SpeAcc	MedAcc
1234567A	Tan Wei Lian	11 Jul 1952	M	8500.50	NULL	3707.75
7612345B	Ang Lee Teng	20 Feb 1976	F	65345.20	25278.50	28888.88
8067890C	Loh Tein Qi	17 Jan 1980	F	12003.40	4666.66	5333.33
8412056D	Ang Lee Teng	9 Aug 1984	F	8112.90	3111.20	3555.56
8456789E	Mary Kang	13 Dec 1984	F	1035.10	NULL	500.00

Attribute	Description	Maximum Length
NRIC	Unique identifier for each member	8 characters
Name	Name of member	50 characters
DateofBirth	Date of birth of member	--
Sex	Sex of member	1 character
OrdAcc	Member's Ordinary Account	$9,999,999.99
SpeAcc	Member's Special Account	$9,999,999.99
MedAcc	Member's Medisave Account	$9,999,999.99

(a) How many rows will be updated in the Member table when the following SQL statement is executed:

```
Update Member
Set MedAcc = MedAcc * 1.20
Where Name Like '%Te%'
```

(2 marks)

(b) Write an SQL statement to remove all members whose last character in their NRIC is either A, B or D. (6 marks)

(c) Write an SQL statement to list the names of members and compute their age in the current year. Arrange their age from the oldest to the youngest.

(6 marks)

(d) Write an SQL statement to list **all** information on female members. You Should include only female members that **satisfy both** the following two conditions:

i) Were born between 01 Jan 1975 and 31 Dec 1980
ii) have no contribution in their Special account or with more than $5000 in their Medisave accounts.

(8 marks)

(e) Write an SQL statement to list total amount in all the 3 accounts for each **gender**. The total amount is calculated by adding the balances in the member's Ordinary, Special and Medisave accounts replacing NULL value with 0. Rename the total amount as 'Total Amount In CPF'.

Arrange the resulting table in descending order of the total amount. (8 marks)

2. A company stores information about books in a table called BookDetail. Below is the table with some sample data.

BookDetail

ISBN	Title	NoP	PubID	PubName	PubAddr	AuthorID	AuthorName
A001	Machine learning	850	P0003	Pearson Press	123 Hill Crescent Road	A00123	John Lai
						Al 1555	David Lim
						A03389	Alyssa Tan
E333	Database Systems	550	P0123	XYZ Print	80 Greenleaf Road	A00543	Justin Wee
						A00123	John Lai

Legend

ISBN:	Unique identifier of each book
Title:	Title of a book
NoP:	Number of pages in a book
PublD:	Unique identifier of each publisher
PubName:	Name of publisher
PubAddr:	Address of publisher
AuthorlD:	Unique identifier of each author
AuthorName:	Name of author

(a) Convert the BookDetail table in zero normal form (0NF). Express your 0NF table using relational heading format. (6 marks)

(b) Transform the 0NF table in question (2a) to first normal form (1NF) relation using relational heading format. (6 marks)

(c) Transform the 1NF table(s) in (2b) to a set of second normal form (2NF) relations using relational heading format. (6 marks)

(d) Transform the 2NF table(s) in (2c) to a set of third normal form (3NF) relations using relational heading format. (7 marks)

3. VINCAR is a local premier car dealership and parallel importer since 1989. VINCAR sells both new and used cars, and it operates a service workshop as well. VINCAR is planning to develop a database system to manage the sales and service operations with the following business rules:

- A salesperson writes a single sale invoice for each car that he sells, along with an invoice identifier and the date of invoicing. A salesperson may write many sale invoices, but each sale invoice is written by one salesperson. There are some salespersons who are new and have yet sold any cars.

- A customer gets a sales invoice for each car he purchased. A customer may have several sale invoices, but each invoice is given to only one customer.

- A salesperson is identified by a salesperson identifier, along with his first name and last name. While a customer is identified by a customer identifier. His first name, last name and phone number are kept.

- A customer may come in just to have his car serviced; that is, a customer needs not buy a car to be classified as a customer. The customer receives a service ticket for his car. The customer may bring in one or more cars for servicing at a time. A separate ticket will be issued to the customer for each car.

- A service ticket is identified by a ticket identifier, and the date of service is kept.

- A car brought in for service can be assigned to only 1 mechanic, and each mechanic may work on many cars. Sometimes, some mechanics may not have any assignments.

- A mechanic is identified by a mechanic identifier, his first name and last name are also kept.

- A car is identified by a car identifier, along with its chassis serial number. Other information like make, model, color and year are also stored. There is no distinction between a brand new car for sale and a car that comes in for service or repair.

Draw a single Entity Relationship Diagram (ERD) using the Crow's Foot notation to model the data requirements for the database system. You are to include the following in your diagram:

- Entity types, primary keys and other attributes mentioned above
- Relationships with proper cardinality and participation constraints

(25 marks)

4. (a) The following table holds the details of a table reservation system for a restaurant. The records are numbered as shown on the right.

Name	No_of_tables	No_of_persons	Date	Phone	Record Number
John Lim	2	12	13/09/20	9880055	1
Mary Oh	NULL	NULL	NULL	NULL	2
Justin Tan	4	TBC	22/04/20	8764412	3
Null	1	8	22/04/20	8764412	4
John Lim	2	12	13/09/20	9880055	5
John Lim	2	15	13/09/20	9880055	6
Justin Tan	3	22	12/10/20 13/10/20	8764412	7
John Lim	50	338	13/09/20	9880055	8

This table conflicts with three, out of the six required properties of a good relation. For each of these three conflicts, indicate the record number where the conflict is, and explain what property it violates in the space provided below.

Record Number	Reason for the conflict or violation

(6 marks)

(b) The following table stores students' records.

FirstName	LastName	DOB	Course	Phone
Aswin	Rai	13/05/99	DIT	8856777
Benny	Tan	02/07/98	DISM	9005316
Doreen	Sim	20/05/98	DAAA	9412223
Eve	Lim	10/10/99	DBIT	NULL
Evelyn	Ng	27/03/99	DIT	8002243
Tom	Fernandez	24/06/98	DIT	9555766
Sandy	Wei	01/12/97	DAAA	8576756
Zach	Rai	13/05/99	DAAA	9000213
Doreen	Sim	21/05/98	DISM	9987673

For each of the following attributes, explain whether it can serve as a primary key or not?

i) FirstName (2 marks)
ii) Phone (2 marks)

For each of following composite attributes explain whether it can serve as composite primary key or not?

iii) (FirstName, DOB) (2 marks)
iv) (LastName, DOB) (2 marks)
v) (Course, Phone) (2 marks)

(c) For each of the following statements indicate True or False.

i) Both a primary key, as well as a foreign key, cannot be set to null. (2 marks)

ii) A column that stores primary keys cannot contain duplicated values, however a column that stores foreign keys may contain duplicated values. (2 marks)

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