SINGAPORE POLYTECHNIC

2021/2022 SEMESTER TWO TEST

DIPLOMA IN INFORMATION TECHNOLOGY
SECOND YEAR FULL TIME

**DATA ENGINEERING** Time allowed: 1.5 Hours

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Instruction to Candidates

1. This paper comprises **4** questions.
2. This test paper consists of 7 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. Best Tuition Pte Ltd provides one-to-one tuition classes to primary and secondary school students in Singapore. The following relation lists the information of the students.

**Student**

| StID | StName | Level | Branch | Subject | TutorID |
|---|---|---|---|---|---|
| 121 | Chloe Wong | Sec 3 | Thomson | Physics | 10055 |
| 122 | Louis Tan | Sec 3 | Orchard | EMath | 10056 |
| 123 | Tom Chan | Sec 4 | Thomson | Physics | 10055 |

| Attribute | Description |
|---|---|
| StID | Student ID: a unique identifier assigned to a registered student |
| StName | The name of a student |
| Level | The level of the student |
| Branch | The branch that the student is registered at |
| Subject | The subject that the student is taking |
| TutorID | The ID of the tutor who conducts the lesson |

Using the above relation, answer the following questions:

a) Which attribute or combination of attributes would you use as the primary key? Explain your choice. (2 marks)

b) Which attribute is likely to be a foreign key and name the Rule that governs it? (2 marks)

c) In setting which cell to NULL will violate the Entity Integrity Rule? Explain your answer. (2 marks)

d) Which rule would you violate if you choose Subject as a primary key? Explain your answer. (2 marks)

e) An admin officer tries to create the following entry in the table:

| StID | StName | Level | Branch | Subject | TutorID |
|---|---|---|---|---|---|
| 124 | Louis Tan | Sec 3 | Orchard | EMath | 10056 |

Would the insertion succeed or fail? Explain your answer. (2 marks)

**(Total 10 marks)**

2. The following tables show the details of HDB properties handled by SecureEstates:

**Property**

| PropertyID | Area | Type | Age | Valuation | HighestOffer | AgentID |
|---|---|---|---|---|---|---|
| P100 | Ang Mo Kio | 5-room Improved | 12 | 324 | NULL | E01 |
| P100 | Bishan | 5-room | 10 | 395 | 480 | E02 |
| P100 | Hougang | Exec Maisonette | 10 | 352 | 380 | E02 |
| P100 | Jurong | 5-room | 5 | 280 | NULL | E03 |
| P104 | Jurong | 3-room | 8 | 132 | 150 | E04 |
| P100 | Yishun | 3-room | 9 | 168 | 200 | E01 |
| P100 | Queenstown | Exec Apartment | 6 | 550 | 628 | E08 |
| P105 | Queenstown | Exec Maisonette | 6 | 580 | 600 | E04 |

| Attribute | Description |
|---|---|
| PropertyID | Identifier of a property; unique only within the area in which the property is located. |
| Area | Name of area in which property is located. |
| Type | Type of HDB property. |
| Age | Age of the property. |
| Valuation | Valued price of the property; price quoted in thousands. |
| HighestOffer | Highest offer received for the property, price quoted in thousands. |
| AgentID | Unique identifier of the agent handling the property. |

a) The following CREATE TABLE statement has **four different errors**.

```
Create Table Property                                    ①
( PropertyID    Char(4)       Null,                      ②
Area            Varchar(30)   Not Null,                  ③
Type            Varchar(30)   Not Null,                  ④
Age             Integer(3)    Not Null,                  ⑤
Agent           Char(3)       Not Null,                  ⑥
Valuation       Integer(3)    Not Null,                  ⑦
HighestOffer    Integer(3)    Not Null,                  ⑧
Primary Key ( PropertyID and Area)      )                ⑨
```

Correct the errors by filling in the table given below:

| Error Number | Line Number | Corrected Statement |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

(6 marks)

b) Write an SQL statement to increase the valuation of all properties in Queenstown and Jurong by 2%. (6 marks)

c) Write an SQL statement to list the property identification, area and amount above valuation for all properties from 6 to 10 years in age inclusive. The amount above valuation is calculated by subtracting the valuation price from the highest offer. Assume that the highest offer is equal to the valuation price if the property does not have any highest offer yet. Rename the column for amount above valuation as 'Amount Above Valuation'. Arrange the resulting table in descending order of amount above valuation within ascending order of area (12 marks)

d) Write an SQL statement to list **all** information on properties handled by agents E02, E03 or E08. You should include only properties that satisfy **both** the following two conditions:

- received at least one offer (ie. highest offer has a value);
- valuation is less than $200,000 or more than $500,000

(10 marks)

e) Write an SQL statement to list the average valuation and the number of all properties for each type of HDB flat. (6 marks)

**(Total 40 marks)**

3. My Grandma's Place Restaurant owns a chain of food courts in Singapore. Each food court is identified by its name. There are many stalls in a food court. A stall has a unique stall number which is unique only within a food court. This means the stall number can be the same across different food courts.

Stalls can be classified into a few categories. There are the drink and Halal food categories. There are other categories as well. No Halal food stall can sell drinks and a drink stall is never classified as a Halal food stall. A Halal food stall must be Halal-certified by Muis. The Halal-certification number must be recorded. The total sale must be kept for drink stall.

A drink stall must be manned by at least one or more staff of My Grandma's Place Restaurant. A staff may be assigned to man a drink stall. Not all staff is assigned to man the drink stall.

A staff is identified by a unique staff number. A staff is assigned to work in at least one or more food courts. A food court must have at least one staff assigned to it. The date a staff is assigned to a particular food court is kept.

A food court must be managed by a staff who is a supervisor. A staff, as a supervisor, may manage only one food court. Not all staff manages food courts. A staff may supervise a few staff. Not all staff supervises other staff. A staff is supervised by one staff. Not all staff has a supervisor.

Draw the Entity Relationship Diagram (ERD) to model the above data requirements. You are to include the following in your ERD:

- entity types, including weak entity types, and their primary key attributes (underline the primary keys);
- relationships, including identifying relationships, with cardinality and participation constraints;
- generalization hierarchies, including disjointness and completeness constraints, if applicable;
- attribute(s) of subtypes or relationships, if applicable.

You do not need to include **non-key attributes** except for those required above.

**(Total 25 marks)**

4. The following table shows the booking details for ABC Karaoke.

**Booking**

| Room No | Type | Capacity | Price | Date | Start Time | Duration | Member No | Name | NoOf Guest |
|---|---|---|---|---|---|---|---|---|---|
| 100 | Small | 4 | 20.00 | 12/5/2021 | 1400 | 2 | M123 | Jack Tan | 4 |
| 200 | Medium | 8 | 30.00 | 12/5/2021 | 1400 | 1 | M456 | Sue Ong | 6 |
| 100 | Small | 4 | 20.00 | 12/5/2021 | 1800 | 3 | M789 | Jack Tan | 3 |
| 300 | Large | 12 | 40.00 | 13/7/2021 | 1500 | 2 | M123 | Jack Tan | 9 |
| 500 | Large | 12 | 40.00 | 13/7/2021 | 1500 | 4 | M321 | Neil Lee | 11 |
| 600 | Large | 12 | 40.00 | 13/7/2021 | 1500 | 1 | M321 | Neil Lee | 10 |
| 100 | Small | 4 | 20.00 | 20/9/2021 | 1400 | 2 | M123 | Jack Tan | 4 |
| 100 | Small | 4 | 20.00 | 20/9/2021 | 2100 | 2 | Ml23 | Jack Tan | 4 |
| ... | | | | | | | | | |

Legend:

| | |
|---|---|
| RoomNo | Unique number that identifies a room. |
| Type | Type of room (eg Large, Medium, Small). |
| Capacity | Maximum number of guests that a room can accommodate. The capacity of a room is based on the type of room. |
| Price | Price per hour charged for a room booking. Price is dependent on the type of the room. |
| Date | Date booked for a room. |
| StartTime | Time booked for a room. |
| Duration | Number of hours booked for a room. |
| MemberNo | Unique number that identifies each member. |
| Name | Name of a member. |
| NoOfGuest | Number of guests accompanying a member for a roombooked on a specific date and time. |

Assumptions:

- A room can only be booked by one member at any specific date and time.
- A member can book the same room on different dates.
- A member can book the same room on the same date more than once but at different start times.

a) The *incomplete* first normal form (INF) relation for the Booking table is given below:

**Booking** ( RoomNo, Type, Capacity, Price, Date, StartTime,Duration, MemberNo, Name, NoOfGuest )

Complete the given INF relation by identifying the primary key of the INF relation. (3 marks)

b) List any functional dependencies and derive the second normal form (2NF) relation(s) from the INF relation obtained in (a). Use relational heading format in your answer. (12 marks)

c) List any transitive dependencies and derive the third normal form (3NF) relation(s) from the 2NF relation(s) obtained in (b). Use relational heading format in your answer. You have to identify the foreign key(s) in the 3NF relation(s) by underlining with dotted lines. (10 marks)

**(Total 25 marks)**

**--End of Paper--**