CSci 5708, Spring 19: Homework 4

Team No.: 

### Table of Participation

<table>
<thead>
<tr>
<th>Question ID</th>
<th>Answer drafted by</th>
<th>Answer reviewed by</th>
</tr>
</thead>
<tbody>
<tr>
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</table>
Question 1. Consider the AIRPORT database Entity Relationship (ER) schema as shown in Figure 1. Define the data-types for the following objects, **Employee, Pilot, Corporation, Person and Owner** using SQL-3 ‘CREATE TYPE’ statements. Further, define tables for **Employee, Pilot, Corporation, Person and Owner** using SQL-3 ‘CREATE TABLE’ statements. Provide SQL-3 ‘INSERT’ statements to insert a single row in each of these tables.

Briefly, justify your answers particularly for the **OWNER** entity. Note that, the SQL UNION operation requires union compatibility, i.e. operand tables should have identical set of columns. (Hint: One may add columns and integrity constraints not shown in the extended ER diagram.)

![Figure 1. AIRPORT database ER schema](image-url)

Figure 1. AIRPORT database ER schema
CREATE TYPE PERSON_TYPE AS (  
    OWNER_ID CHAR(20),  
    SSN CHAR(11),  
    Name VARCHAR(35),  
    Address VARCHAR(100),  
    Phone VARCHAR(11)  
INSTANTIABLE  
NOT FINAL;
)

CREATE TYPE CORPORATION_TYPE AS (  
    OWNER_ID CHAR(20)  
Name VARCHAR(35),  
Address VARCHAR(100),  
Phone VARCHAR(11)  
INSTANTIABLE  
NOT FINAL;
)

CREATE TYPE OWNER_TYPE AS(  
    OWNER_ID CHAR(20)  
OWNER_TYPE CHAR(1)  
INSTANTIABLE  
NOT FINAL  
METHOD OWNS() RETURNS AIRPLANE_TYPE ARRAY[N];
)

CREATE TYPE EMPLOYEE_TYPE UNDER PERSON_TYPE AS (  
    Salary FLOAT,  
    Shift CHAR(10)  
INSTANTIABLE  
NOT FINAL  
METHOD WORKS_ON() RETURNS PLANE_TYPE_TYPE ARRAY[M]  
MAINTAIN() RETURNS SERVICE_TYPE ARRAY[M];
)

CREATE TYPE PILOT_TYPE UNDER PERSON_TYPE AS(  
    Restr CHAR(10)  
Lic_num CHAR(10)  
INSTANTIABLE FINAL METHOD FLIES() RETURNS PLANE_TYPE_TYPE ARRAY[M];
);
CREATE TABLE PERSON OF PERSON_TYPE(
    PRIMARY_KEY(SSN)
);

CREATE TABLE CORPORATION OF CORPORATION_TYPE ( 
    PRIMARY_KEY(Name)
);

CREATE TABLE OWNER OF OWNER_TYPE(
    PRIMARY_KEY(OWNER_ID, OWNER_TYPE)
);

CREATE TABLE EMPLOYEE OF EMPLOYEE_TYPE UNDER PERSON;

CREATE TABLE PILOT OF PILOT_TYPE UNDER PERSON;

**Question 2.** Consider the following transactions. The set of items is \{milk, bread, cookies, eggs, butter, coffee, juice\}.

<table>
<thead>
<tr>
<th>Trans_id</th>
<th>Items_purchased</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk, Bread, Eggs</td>
</tr>
<tr>
<td>2</td>
<td>Butter, Juice</td>
</tr>
<tr>
<td>3</td>
<td>Juice, Milk</td>
</tr>
<tr>
<td>4</td>
<td>Milk, Bread, Eggs</td>
</tr>
<tr>
<td>5</td>
<td>Coffee, Eggs</td>
</tr>
<tr>
<td>6</td>
<td>Coffee</td>
</tr>
<tr>
<td>7</td>
<td>Bread, Cookies, Eggs, Milk</td>
</tr>
<tr>
<td>8</td>
<td>Juice, Coffee</td>
</tr>
<tr>
<td>9</td>
<td>Butter, Cookies</td>
</tr>
<tr>
<td>10</td>
<td>Milk, Bread, Eggs</td>
</tr>
<tr>
<td>11</td>
<td>Milk, Butter, Bread</td>
</tr>
<tr>
<td>12</td>
<td>Juice, Eggs</td>
</tr>
</tbody>
</table>

**Q2a)** Execution trace the apriori algorithm to the above transactions and fill the results of each iteration in Table 2. Use 0.2. for the minimum support value. (Answers may not fill all the rows.)

<table>
<thead>
<tr>
<th>Iteration</th>
<th>Itemset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>{Milk}, {Bread}, {Eggs}, {Juice}, {Coffee}</td>
</tr>
<tr>
<td>2</td>
<td>{Milk, Bread}, {Eggs}, {Bread, Eggs}</td>
</tr>
<tr>
<td>3</td>
<td>{Milk, Bread, Eggs}</td>
</tr>
</tbody>
</table>
Q2b) Show two rules that have a confidence of 0.6 or greater for an itemset containing three items.

\{\text{Milk, Eggs}\} \rightarrow \text{Bread}
\{\text{Bread, Eggs}\} \rightarrow \text{Milk}
\{\text{Milk, Bread}\} \rightarrow \text{Eggs}

Question 3. Trace execution of K-Means algorithm with K=2 for a set of data points in Figure 2 and for the given 3 sets of initial seeds shown in Table 2. The coordinates of the 16 data points are: 1-(1, 4), 2-(2, 4), 3-(3, 4), 4-(4, 4), 5-(1, 3), 6-(2, 3), 7-(3, 3), 8-(4, 3), 9-(1, 2), 10-(2, 2), 11-(3, 2), 12-(4, 2), 13-(1, 1), 14-(2, 1), 15-(4, 1). Fill out Table 3, 4 and 5 to show the results. (Answers may not fill all the rows.)

Figure 2. Distribution of data points

Table 2. Initial seeds of K-Means

<table>
<thead>
<tr>
<th>Set</th>
<th>Seed 1</th>
<th>Seed 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>(2, 4)</td>
<td>(2, 1)</td>
</tr>
<tr>
<td>B</td>
<td>(1, 5)</td>
<td>(4, 3)</td>
</tr>
<tr>
<td>C</td>
<td>(1, 1)</td>
<td>(10, 1)</td>
</tr>
</tbody>
</table>

Table 3. K-Means result using seed set A

<table>
<thead>
<tr>
<th>Iteration ID</th>
<th>Points (\in) Class-1</th>
<th>Center of Class 1</th>
<th>Points (\in) Class-2</th>
<th>Center of Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1, 2, 3, 4, 5, 6, 7, 8</td>
<td>(2.5, 3.5)</td>
<td>9, 10, 11, 12, 13, 14, 15, 16</td>
<td>(2.5, 1.5)</td>
</tr>
<tr>
<td>2</td>
<td>1, 2, 3, 4, 5, 6, 7, 8</td>
<td>(2.5, 3.5)</td>
<td>9, 10, 11, 12, 13, 14, 15, 16</td>
<td>(2.5, 1.5)</td>
</tr>
</tbody>
</table>

Table 4. K-Means result using seed set B

<table>
<thead>
<tr>
<th>Iteration ID</th>
<th>Points (\in) Class-1</th>
<th>Center of Class 1</th>
<th>Points (\in) Class-2</th>
<th>Center of Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1, 2, 5, 9</td>
<td>(1.25, 3.25)</td>
<td>3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16</td>
<td>(2.92, 2.25)</td>
</tr>
<tr>
<td>2</td>
<td>1, 2, 5, 6, 9, 13</td>
<td>(1.33, 2.83)</td>
<td>3, 4, 7, 8, 10, 11, 12, 14, 15, 16</td>
<td>(3.2, 2.3)</td>
</tr>
<tr>
<td>3</td>
<td>1, 2, 5, 6, 9, 10, 13</td>
<td>(1.43, 2.71)</td>
<td>3, 4, 7, 8, 11, 12, 14, 15, 16</td>
<td>(3.33, 2.33)</td>
</tr>
<tr>
<td>4</td>
<td>1, 2, 5, 6, 9, 10, 13, 14</td>
<td>(1.5, 2.5)</td>
<td>3, 4, 7, 8, 11, 12, 15, 16</td>
<td>(3.5, 2.5)</td>
</tr>
<tr>
<td>5</td>
<td>1, 2, 5, 6, 9, 10, 13, 14</td>
<td>(1.5, 2.5)</td>
<td>3, 4, 7, 8, 11, 12, 15, 16</td>
<td>(3.5, 2.5)</td>
</tr>
</tbody>
</table>
Question 4. Consider the relational database schema in Figure 2. Suppose that all the relations were created by (and hence are owned by) user X, who wants to grant the following privileges to user accounts A, B, C, and D. Write SQL statements to grant these privileges. Use views where appropriate.

**Q4a**) Account A can retrieve or update any relation except LEG_INSTANCE and can grant any of these privileges to other users.

```
GRANT SELECT, UPDATE ON AIRPORT, FLIGHT, LEG_INSTANCE, FARE, AIRPLANE_TYPE, CAN_LAND, AIRPLANE, SEATERVATION TO A WITH GRANT OPTION;
```

**Q4b**) Account B can retrieve all the attributes of FLIGHT_LEG, LEG_INSTANCE and FARE except for Amount, Restrictions, and Airplane_id.

```
CREATE VIEW LEG_INSTANCE_VIEW AS SELECT Flight_number, Leg_number, Date, Number_of_available_seats, Departure_airport_code, Departure_time, Arrival_airport_code, Arrival_time FROM LEG_INSTANCE;
CREATE VIEW FARE_VIEW AS SELECT Flight_number, Fare_code FROM FARE;
GRANT SELECT ON FLIGHT, FLIGHT_LEG, LEG_INSTANCE_VIEW, FARE_VIEW TO B;
```

**Q4c**) Account C can retrieve or update LEG_INSTANCE but can only retrieve the Flight_number and Leg_number attributes of FLIGHT_LEG and the Flight_number and Amount attributes of FARE.

```
CREATE VIEW C_FLIGHT_LEG AS SELECT Flight_number, Leg_number FROM FLIGHT_LEG;
CREATE VIEW C_FARE AS SELECT Flight_number, Amount FROM FARE;
GRANT SELECT, UPDATE ON LEG_INSTANCE TO C;
GRANT SELECT ON C_FLIGHT_LEG, C_FARE TO C;
```

**Q4d**) Account D can retrieve any attribute of AIRPLANE_TYPE but only for AIRPLANE_TYPE tuples that have Company = “Boeing”.

```
CREATE VIEW D_FLIGHT AS SELECT Airplane_type_name, Max_seats, Company FROM AIRPLANE_TYPE WHERE Company = “Boeing”;
GRANT SELECT ON D_FLIGHT TO D;
```
Question 5. Suppose that privilege (Q4b) is to be given with GRANT OPTION but only so that account B can grant it to at most ten accounts, and each of these accounts can propagate the privilege to other accounts but without the GRANT OPTION privilege. What would the horizontal and vertical propagation limits be in this case?

The horizontal propagation limits 10.
The vertical propagation limit: 2.
Question 6. Refer to google timeline (https://www.google.com/maps/timeline). Review your own timeline. Explain, how can one store the data in SQL-3. Note, the data has timestamp along with GPS co-ordinates

CREATE TYPE LOCATION AS(
    ID VARCHAR(10),
    LATITUDE VARCHAR(10),
    LONGITUDE VARCHAR(10),
)
FINAL

CREATE TYPE DAILY_USER_TRAJECTORY AS (LOC LOCATION ARRAY[86400], TIMESTAMP DATETIME ARRAY[86400],)
FINAL
INSTANTIABLE