# Normalization and Database Design

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**03/22/2023**

# PART A

**Question 1**
(a, b)

**Second Normal Form (2NF)**

| BAGEL ORDER | |
|---|---|
| PK | Bagel Order ID |
| | Order Date |
| | First Name |
| | Last Name |
| | Address 1 |
| | Address 2 |
| | City |
| | State |
| | Zip Code |
| | Mobile Phone |
| | Delivery Fee |
| | Special Notes |

1:M

| BAGEL ORDER LINE ITEM | |
|---|---|
| PK / FK | Bagel Order ID |
| PK / FK | Bagel ID |
| | Bagel Quantity |

M:1

| BAGEL | |
|---|---|
| PK | Bagel ID |
| | Bagel Name |
| | Bagel Description |
| | Bagel Price |

(c)

I assigned attributes based on their relevance to each of the newly created tables' titles. To achieve second normal form all non-key attributes were assigned to be dependent on the minimal super key. The first table contains the title 'BAGEL ORDER, so the related attributes would be those related to an order placed by a customer such as Order Date, First Name, Last Name, Address q, Address 2, Coty, State, Zip Code, Mobile Phone, Delivery Fee, and Special Notes (assuming this referred to special instructions when preparing the bagels). The second table, 'BAGEL ORDER LINE ITEM', must contain items related to the specific quantity of a particular bagel purchased for each order. The table furthest to the right 'BAGEL', represents information for each specific type of bagel, so therefore it must refer to the Bagel Name, Bagel Description, and Bagel Price. The PK of Bagel Order must be Bagel Order ID since it is unique, simple, and correlates to that specific table identifying each specific bagel order placed. The table titled 'BAGEL' must have a PK of Bagel ID since it is a unique identifier for each specific bagel. With cardinalities, each bagel order can have many bagel order line items, so the relationship is that of one to many (1:M). Similarly, each distinct bagel may have many bagel order line items, so the relationship between bagel order line item and bagel is many to one (M:1).

**Question 2**
(a, b, c, d)

**Third Normal Form (3NF)**

| BAGEL ORDER | |
|---|---|
| PK | Bagel Order ID |
| FK | Customer ID |
| | Order Date |
| | Delivery Fees |
| | Special Notes |

1:M

| BAGEL ORDER LINE ITEM | |
|---|---|
| PK / FK | Bagel Order ID |
| PK / FK | Bagel ID |
| | Bagel Quantity |

M:1

| BAGEL | |
|---|---|
| PK | Bagel ID |
| | Bagel Name |
| | Bagel Description |
| | Bagel Price |

M:1

| CUSTOMER | |
|---|---|
| PK | Customer ID |
| | First Name |
| | Last Name |
| | Address 1 |
| | Address 2 |
| | City |
| | State |
| | Zip Code |
| | Mobile Phone |

(e)

Redundancy can still be formed when the same customer creates multiple orders which cause each order they place to have their credentials repeated throughout the ‘BAGEL ORDER’ table. So, a new table is created labeled ‘CUSTOMER’ that separates customer attributes from order attributes to account for these repeated values. All of the attributes relating to customers go in the new ‘CUSTOMER’ table. As to cardinalities, each bagel order only has one customer, and each customer can place many bagel orders, so the relationship is that of many to one (M:1).

## Question 3

(a, b)

**Final Physical Database Model**

| BAGEL ORDER | | |
|---|---|---|
| PK | bagel_order_id | INT |
| FK | customer_id | INT |
| | order_date | TIMESTAMP |
| | delivery_fees | NUMERIC(4,2) |
| | special_notes | VARCHAR(100) |

1:M

| BAGEL ORDER LINE ITEM | | |
|---|---|---|
| PK / FK | bagel_order_id | INT |
| PK / FK | bagel_id | CHAR(2) |
| | bagel_quanitity | INT |

M:1

| BAGEL | | |
|---|---|---|
| PK | bagel_id | CHAR(2) |
| | bagel_name | VARCHAR(30) |
| | bagel_description | VARCHAR(100) |
| | bagel_price | NUMERIC(4,2) |

M:1

| CUSTOMER | | |
|---|---|---|
| PK | customer_id | INT |
| | first_name | VARCHAR(20) |
| | last_name | VARCHAR(20) |
| | address_01 | VARCHAR (50) |
| | address_02 | VARCHAR (50) |
| | city | VARCHAR (30) |
| | state | CHAR(2) |
| | zip_code | CHAR(5) |
| | mobile_phone | CHAR(10) |

# PART B

**Question 1**
(a, b)

```sql
CREATE TABLE COFFEE_SHOP(
    shop_id INTEGER,
    shop_name   VARCHAR(50),
    city    VARCHAR(50),
    state CHAR(2),
    PRIMARY KEY (shop_id)
);
```

```sql
CREATE TABLE SUPPLIER(
    supplier_id INTEGER,
    company_name    VARCHAR(50),
    country     VARCHAR(30),
    sales_contact_name  VARCHAR(60),
    email   VARCHAR(50) NOT NULL,
    PRIMARY KEY (supplier_id)
    );
```

```sql
CREATE TABLE COFFEE(
    coffee_id INTEGER,
    shop_id INTEGER,
    supplier_id INTEGER,
    coffee_name VARCHAR(30),
    price_per_pound NUMERIC(5,2),
    PRIMARY KEY (coffee_id),
    FOREIGN KEY (shop_id) REFERENCES COFFEE_SHOP(shop_id),
    FOREIGN KEY (supplier_id) REFERENCES SUPPLIER(supplier_id)
);
```

```sql
CREATE TABLE EMPLOYEE (
    employee_id INTEGER,
    first_name  VARCHAR(30),
    last_name   VARCHAR(30),
    hire_date   DATE,
    job_title   VARCHAR(30),
    shop_id     INTEGER,
    PRIMARY KEY (employee_id),
    FOREIGN KEY (shop_id) REFERENCES Coffee_Shop(shop_id)

    );
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 16:42:18 | CREATE TABLE COFFEE_SHOP( shop_id INTEGER, shop_name VARCHAR(50),... | 0 row(s) affected | 0.0086 sec |
| 2 | 16:43:35 | CREATE TABLE SUPPLIER( supplier_id INTEGER, company_name VARCHAR(50),... | 0 row(s) affected | 0.012 sec |
| 3 | 16:43:53 | CREATE TABLE EMPLOYEE ( employee_id INTEGER, first_name VARCHAR(30), l... | 0 row(s) affected | 0.011 sec |
| 4 | 16:44:08 | CREATE TABLE COFFEE( coffee_id INTEGER, shop_id INTEGER, supplier_id INT... | 0 row(s) affected | 0.011 sec |

## Question 2

(a, b)

```
1     -- ROW 1 FOR ALL TABLES
2     INSERT INTO SUPPLIER
3     VALUES (51, 'We Supply', 'USA', 'John', 'john32@wesupply.com');
4
5     INSERT INTO COFFEE_SHOP
6     VALUES (1001, 'Starbucks','San Diego', 'CA');
7
8     INSERT INTO COFFEE
9     VALUES (101, 1001,51, 'Grande', 1.23);
10
11    INSERT INTO EMPLOYEE
12    VALUES (1,'Samuel','Diaz','2000-01-30','Software Engineer',1001);
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 18:11:41 | INSERT INTO SUPPLIER VALUES (51, 'We Supply', 'USA', 'John', 'john32@wesupply.c... | 1 row(s) affected | 0.0016 sec |
| 2 | 18:11:41 | INSERT INTO COFFEE_SHOP VALUES (1001, 'Starbucks','San Diego', 'CA') | 1 row(s) affected | 0.0013 sec |
| 3 | 18:11:41 | INSERT INTO COFFEE VALUES (101, 1001,51, 'Grande', 1.23) | 1 row(s) affected | 0.0011 sec |
| 4 | 18:11:41 | INSERT INTO EMPLOYEE VALUES (1,'Samuel','Diaz','2000-01-30','Software Engineer',... | 1 row(s) affected | 0.0017 sec |

```
1     -- ROW 2 FOR ALL TABLES
2     INSERT INTO SUPPLIER
3     VALUES (52, 'Supply Now', 'Africa', 'Matt', 'matt83@supplynow.com');
4
5     INSERT INTO COFFEE_SHOP
6     VALUES (1002, 'Dunkin','Oceanside', 'CA');
7
8     INSERT INTO COFFEE
9     VALUES (102, 1002, 52, 'Venti', 2.50);
10
11    INSERT INTO EMPLOYEE
12    VALUES (2,'Pearl','Buchanon','2002-05-21','Environmental Scientist',1002);
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 18:13:48 | INSERT INTO SUPPLIER VALUES (52, 'Supply Now', 'Africa', 'Matt', 'matt83@supplyn... | 1 row(s) affected | 0.0012 sec |
| 2 | 18:13:48 | INSERT INTO COFFEE_SHOP VALUES (1002, 'Dunkin','Oceanside', 'CA') | 1 row(s) affected | 0.00044 sec |
| 3 | 18:13:48 | INSERT INTO COFFEE VALUES (102, 1002, 52, 'Venti', 2.50) | 1 row(s) affected | 0.00044 sec |
| 4 | 18:13:48 | INSERT INTO EMPLOYEE VALUES (2,'Pearl','Buchanon','2002-05-21','Environmental S... | 1 row(s) affected | 0.00040 sec |

```
1     -- ROW 3 FOR ALL TABLES
2     INSERT INTO SUPPLIER
3     VALUES (53, 'The Supply', 'Europe', 'James', 'james_hustone23@thesupply.com');
4
5     INSERT INTO COFFEE_SHOP
6     VALUES (1003, 'Krispie Kreme','Imperial Beach', 'CA');
7
8     INSERT INTO COFFEE
9     VALUES (103, 1003,53, 'Tall', 3.73);
10
11    INSERT INTO EMPLOYEE
12    VALUES (3,'Deandre','Owens','2001-12-24','Supply Chain Manager',1003);
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 18:14:10 | INSERT INTO SUPPLIER VALUES (53, 'The Supply', 'Europe', 'James', 'james_hustone... | 1 row(s) affected | 0.0015 sec |
| 2 | 18:14:10 | INSERT INTO COFFEE_SHOP VALUES (1003, 'Krispie Kreme','Imperial Beach', 'CA') | 1 row(s) affected | 0.00076 sec |
| 3 | 18:14:10 | INSERT INTO COFFEE VALUES (103, 1003,53, 'Tall', 3.73) | 1 row(s) affected | 0.00068 sec |
| 4 | 18:14:10 | INSERT INTO EMPLOYEE VALUES (3,'Deandre','Owens','2001-12-24','Supply Chain M... | 1 row(s) affected | 0.00040 sec |

## Question 3

(a, b)

```
1     CREATE VIEW EMPLOYEE_VIEW
2     AS SELECT employee_id, CONCAT (first_name, ' ', last_name) as employee_full_name,
3     hire_date,
4     job_title,
5     shop_id
6     FROM EMPLOYEE;
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 18:14:10 | INSERT INTO SUPPLIER VALUES (53, 'The Supply', 'Europe', 'James', 'james_hustone... | 1 row(s) affected | 0.0015 sec |
| 2 | 18:14:10 | INSERT INTO COFFEE_SHOP VALUES (1003, 'Krispie Kreme','Imperial Beach', 'CA') | 1 row(s) affected | 0.00076 sec |
| 3 | 18:14:10 | INSERT INTO COFFEE VALUES (103, 1003,53, 'Tall', 3.73) | 1 row(s) affected | 0.00068 sec |
| 4 | 18:14:10 | INSERT INTO EMPLOYEE VALUES (3,'Deandre','Owens','2001-12-24','Supply Chain M... | 1 row(s) affected | 0.00040 sec |
| 5 | 18:23:11 | CREATE VIEW EMPLOYEE_VIEW AS SELECT employee_id, CONCAT (first_name, ' ', la... | 0 row(s) affected | 0.012 sec |

**Question 4**
(a, b)

```
1 •   CREATE INDEX COFFEE_INDEX
2     ON COFFEE(coffee_name);
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 18:37:36 | CREATE INDEX COFFEE_INDEX ON COFFEE(coffee_name) | 0 row(s) affected Records: 0 Duplicates: 0 Warnin... | 0.031 sec |

**Question 5**
(a, b)

```
1 •   SELECT job_title
2     FROM EMPLOYEE
3     WHERE employee_id = 1;
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 20:37:06 | SELECT job_title FROM EMPLOYEE WHERE employee_id = 1 LIMIT 0, 1000 | 1 row(s) returned | 0.00053 sec / 0.0000... |

**Question 6**
(a, b)

```
1 •   SELECT
2         E.employee_id,
3         E.first_name,
4         E.last_name,
5         E.hire_date,
6         E.job_title,
7         CS.shop_name,
8         CS.city,
9         CS.state,
10        C.coffee_id,
11        C.supplier_id,
12        C.coffee_name,
13        C.price_per_pound
14    FROM EMPLOYEE AS E
15    INNER JOIN COFFEE_SHOP AS CS ON E.shop_id = CS.shop_id
16    INNER JOIN COFFEE AS C ON CS.shop_id = C.shop_id;
17
```

Action Output

| | Time | Action | Response | Duration / Fetch Time |
|---|---|---|---|---|
| 1 | 19:37:45 | SELECT E.employee_id, E.first_name, E.last_name, E.hire_date, E.job_tit... | 3 row(s) returned | 0.0011 sec / 0.00001... |