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Experiment No. 1
Create Complex Data Types and Perform SQL Operations

SQL Schema and Data

```
-- Create Object Type for Name
CREATE TYPE Name_Type AS OBJECT (
    fname VARCHAR2(30),
    lname VARCHAR2(30)
);

-- Create VARRAY Type for Phone Numbers
CREATE TYPE Phone_Varray AS VARRAY(4) OF VARCHAR2(15);

-- Create Structured Type for Publisher
CREATE TYPE Publisher_Type AS OBJECT (
    pub_id VARCHAR2(10),
    pub_name VARCHAR2(30),
    branch VARCHAR2(30)
);

-- Create VARRAY Type for Author IDs
CREATE TYPE Author_Varray AS VARRAY(10) OF VARCHAR2(10);

-- Create Nested Table Type for Keywords
CREATE TYPE Keywords_Table AS TABLE OF VARCHAR2(100);

-- Create Nested Table Type for Phone Numbers in Customer Table
CREATE TYPE Phone_Table AS TABLE OF VARCHAR2(15);

-- Create Table Author
CREATE TABLE Author (
    author_id VARCHAR2(10) PRIMARY KEY,
    name Name_Type,
    phone_no Phone_Varray
);

-- Create Table Book
CREATE TABLE Book (
```

```
    ISBN NUMBER PRIMARY KEY,
    title VARCHAR2(30),
    author_id Author_Varray,
    category VARCHAR2(20),
    publisher Publisher_Type,
    keywords Keywords_Table,
    price NUMBER(10, 2)
)
NESTED TABLE keywords STORE AS keywords_store_table;

-- Create Table Customer
CREATE TABLE Customer (
    customer_id VARCHAR2(10) PRIMARY KEY,
    name Name_Type,
    phone Phone_Table
)
NESTED TABLE phone STORE AS phone_store_table;

-- Create Table Book_Sale
CREATE TABLE Book_Sale (
    sale_id VARCHAR2(10) PRIMARY KEY,
    customer_id VARCHAR2(10),
    ISBN NUMBER,
    FOREIGN KEY (customer_id) REFERENCES Customer(customer_id),
    FOREIGN KEY (ISBN) REFERENCES Book(ISBN)
);
```

Insert Sample Data

```
-- Insert Data into Author
INSERT INTO Author VALUES (
    'A001',
    Name_Type('John', 'Doe'),
    Phone_Varray('1234567890', '0987654321')
);
INSERT INTO Author VALUES (
    'A004',
    Name_Type('David', 'Copperfield'),
    Phone_Varray('1234567890', '9876543210')
);
```

```
INSERT INTO Author VALUES (
    'A005',
    Name_Type('Oliver', 'Twist'),
    Phone_Varray('0123456789', '9876543210')
);
INSERT INTO Author VALUES (
    'A002',
    Name_Type('Jane', 'Smith'),
    Phone_Varray('1234509876', '0987612345')
);

-- Insert Data into Book
INSERT INTO Book VALUES (
    1001,
    'Database Systems',
    Author_Varray('A001', 'A002'),
    'Education',
    Publisher_Type('P001', 'Tata MaGraw Hill', 'India'),
    Keywords_Table('SQL', 'NoSQL'),
    499.99
);
INSERT INTO Book VALUES (
    1004,
    'The Great Gatsby',
    Author_Varray('A004'),
    'Literature',
    Publisher_Type('P004', 'Penguin Random House', 'US'),
    Keywords_Table('Novel', 'American Literature', 'Jazz Age'),
    299.99
);
INSERT INTO Book VALUES (
    1005,
    'Pride and Prejudice',
    Author_Varray('A005'),
    'Literature',
    Publisher_Type('P005', 'HarperCollins', 'UK'),
    Keywords_Table('Novel', 'Romance', 'Historical Fiction'),
    349.99
);
INSERT INTO Book VALUES (
    1002,
```

```
    'Advanced Databases',
    Author_Varray('A001'),
    'Technology',
    Publisher_Type('P002', 'O''Reilly Media', 'US'),
    Keywords_Table('Database', 'Advanced'),
    599.99
);

-- Insert Data into Customer
INSERT INTO Customer VALUES (
    'C001',
    Name_Type('Alice', 'Wonderland'),
    Phone_Table('1234987654')
);
INSERT INTO Customer VALUES (
    'C002',
    Name_Type('Bob', 'Builder'),
    Phone_Table('1234765432')
);
INSERT INTO Customer VALUES (
    'C004',
    Name_Type('Sherlock', 'Holmes'),
    Phone_Table('1234567890')
);
INSERT INTO Customer VALUES (
    'C005',
    Name_Type('Dr. Watson', 'Watson'),
    Phone_Table('0123456789')
);

-- Insert Data into Book_Sale
INSERT INTO Book_Sale VALUES (
    'S001',
    'C001',
    1001
);
INSERT INTO Book_Sale VALUES (
    'S002',
    'C002',
    1002
);
```

```
INSERT INTO Book_Sale VALUES (
    'S004',
    'C004',
    1004
);
INSERT INTO Book_Sale VALUES (
    'S005',
    'C005',
    1005
);
```

Queries

```
-- Q1: List all titles in “Book” and include ISBN, author name (as
combined from author.fname and author.lname)
SELECT
    b.ISBN,
    b.title,
    a.name.fname || ' ' || a.name.lname AS author_name
FROM
    Book b,
    TABLE(b.author_id) aid,
    Author a
WHERE
    a.author_id = aid.COLUMN_VALUE;
```

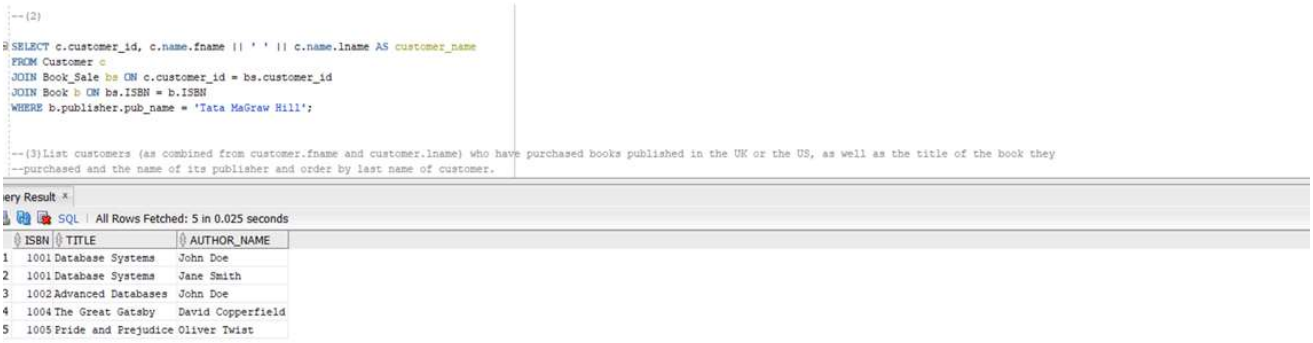
```
--Q1

--(1)

SELECT b.ISBN, b.title, a.name.fname || ' ' || a.name.lname AS author_name
FROM Book b
JOIN LATERAL (SELECT * FROM TABLE(b.author_id)) author_id_table ON 1 = 1
JOIN Author a ON a.author_id = author_id_table.COLUMN_VALUE;

--(2)
```

Query Result

SQL | All Rows Fetched: 5 in 0.025 seconds

	ISBN	TITLE	AUTHOR_NAME
1	1001	Database Systems	John Doe
2	1001	Database Systems	Jane Smith
3	1002	Advanced Databases	John Doe
4	1004	The Great Gatsby	David Copperfield
5	1005	Pride and Prejudice	Oliver Twist

```
-- Q2: List all customers who have purchased books published with
'Tata MaGraw Hill'
SELECT
    c.customer_id,
    c.name.fname || ' ' || c.name.lname AS customer_name
FROM
    Book b,
    Book_Sale bs,
    Customer c
WHERE
    b.publisher.pub_name = 'Tata MaGraw Hill'
    AND b.ISBN = bs.ISBN
    AND bs.customer_id = c.customer_id;
```



```
--(2)

SELECT c.customer_id, c.name.fname || ' ' || c.name.lname AS customer_name
FROM Customer c
JOIN Book_Sale bs ON c.customer_id = bs.customer_id
JOIN Book b ON bs.ISBN = b.ISBN
WHERE b.publisher.pub_name = 'Tata MaGraw Hill';

--(3)List customers (as combined from customer.fname and customer.lname) who have purchased books published in the UK or the US, as well as the title of the book they
--purchased and the name of its publisher and order by last name of customer.
```

ery Result

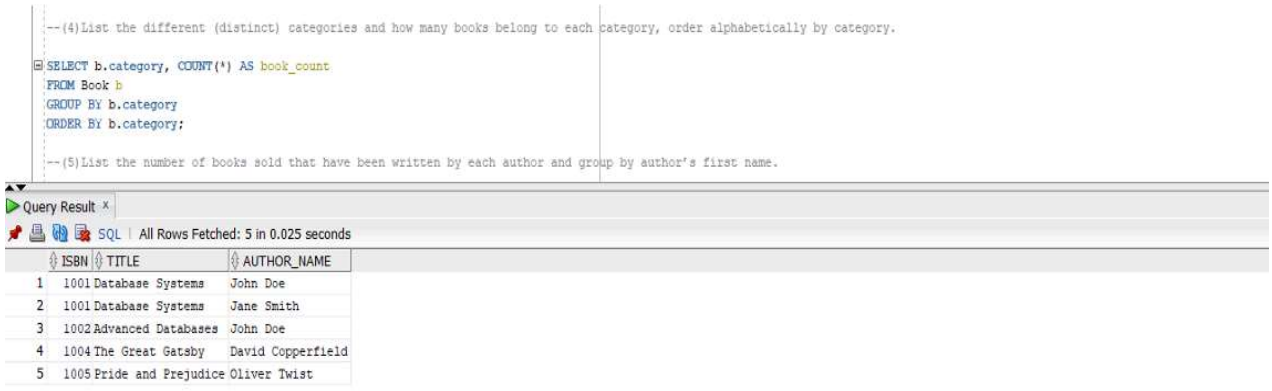
SQL | All Rows Fetched: 5 in 0.025 seconds

	ISBN	TITLE	AUTHOR_NAME
1	1001	Database Systems	John Doe
2	1001	Database Systems	Jane Smith
3	1002	Advanced Databases	John Doe
4	1004	The Great Gatsby	David Copperfield
5	1005	Pride and Prejudice	Oliver Twist

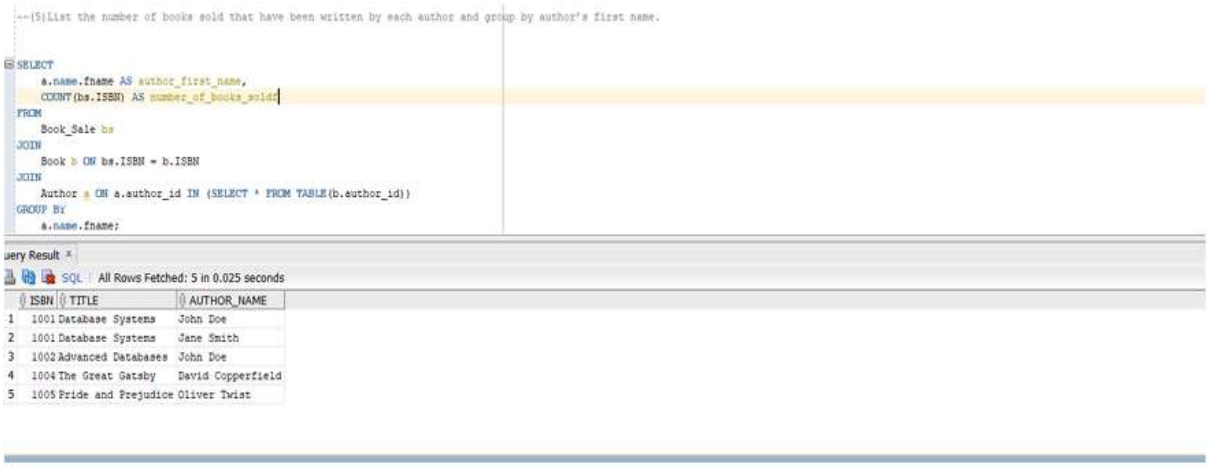
```
-- Q3: List customers (as combined from customer.fname and
customer.lname) who have purchased books published in the UK or the
US,
--      as well as the title of the book they purchased, and the
name of its publisher, ordered by last name of customer.
SELECT
    c.name.fname || ' ' || c.name.lname AS customer_name,
    b.title AS book_title,
    b.publisher.pub_name AS publisher_name
FROM
    Book b,
    Book_Sale bs,
    Customer c
WHERE
```

```
    b.publisher.branch IN ('UK', 'US')
    AND b.ISBN = bs.ISBN
    AND bs.customer_id = c.customer_id
ORDER BY
    c.name.lname;
```


```
-- Q4: List the different (distinct) categories and how many books
belong to each category, ordered alphabetically by category.
SELECT
    b.category,
    COUNT(*) AS num_books
FROM
    Book b
GROUP BY
    b.category
ORDER BY
    B.category;
```



```sql
-- Q5: List the number of books sold that have been written by each
author and group by author's first name.
SELECT
    a.name.fname AS author_first_name,
    COUNT(*) AS books_sold
FROM
    Book b,
    TABLE(b.author_id) aid,
    Author a,
    Book_Sale bs
WHERE
    a.author_id = aid.COLUMN_VALUE
    AND b.ISBN = bs.ISBN
GROUP BY
    a.name.fname;
```



```
--(5)List the number of books sold that have been written by each author and group by author's first name.

SELECT
    a.name.fname AS author_first_name,
    COUNT(bs.ISBN) AS number_of_books_sold
FROM
    Book_Sale bs
JOIN
    Book b ON bs.ISBN = b.ISBN
JOIN
    Author a ON a.author_id IN (SELECT * FROM TABLE(b.author_id))
GROUP BY
    a.name.fname;
```

uery Result

SQL | All Rows Fetched: 5 in 0.025 seconds

	ISBN	TITLE	AUTHOR_NAME
1	1001	Database Systems	John Doe
2	1001	Database Systems	Jane Smith
3	1002	Advanced Databases	John Doe
4	1004	The Great Gatsby	David Copperfield
5	1005	Pride and Prejudice	Oliver Twist