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Subject: Advanced Database Systems Labs

Experiment No.: 1

Problem Statement 1:

Create Book Store database using complex data types such as structure, array and set. Solve the queries on that database.

Problem Statement 2:

Consider a database schema with a relation Emp whose attributes are as shown below, with types specified for multivalued attributes.

Emp= (ename, ChildrenSet multiset(Children), SkillSet multiset(Skills))

Children = (name, birthday)

Skills = (type, ExamSet setof(Exams))

Exams = (year, city)

Create this database and solve queries on it.

Q1

```
create type Name as OBJECT (
    fName varchar(20),
    lName varchar(20)
)

create type phone_no is varray(4) of varchar(20);

create type Publisher as OBJECT (
    pub_id varchar(20),
    pub_name varchar(20),
    branch varchar(20)
)

create type keywords is varray(5) of varchar(20);
create type author_id is varray(10) of varchar(20);

create table Author (
    author_id varchar(20) primary key,
    name Name,
    phone_nos phone_no
)

create table Book (
    isbn integer primary key,
    title varchar(30),
    author_ids author_id,
    category_ varchar(20),
    publisher_info Publisher,
    keyword keywords,
    price number(10, 2)
)

INSERT INTO Book VALUES (101, 'Compiler Construction', author_id('A01','A02'),
'Education', Publisher('P02', 'TATA McGraw Hill', 'US'), keywords('Compiler',
'Parsing'), 120);
INSERT INTO Book VALUES (102, 'Data Structures', author_id('A03','A04'), 'Education',
Publisher('P03', 'Pearson', 'India'), keywords('Data', 'Algorithms'), 150);
INSERT INTO Book VALUES (103, 'Operating Systems', author_id('A05'), 'Technology',
Publisher('P04', 'Wiley', 'US'), keywords('OS', 'Kernel'), 180);
INSERT INTO Book VALUES (104, 'Database Engineering', author_id('A06','A07'),
'Education', Publisher('P05', 'Addison Wesley', 'US'), keywords('SQL', 'NoSQL'),
200);
INSERT INTO Book VALUES (105, 'Artificial Intelligence', author_id('A08'),
'Technology', Publisher('P06', 'Reilly', 'US'), keywords('AI', 'Machine Learning'),
220);
INSERT INTO Book VALUES (106, 'Web Development', author_id('A09','A10'),
'Technology', Publisher('P07', 'Packt Publishing', 'UK'), keywords('HTML', 'CSS'),
130);
```

```
INSERT INTO Book VALUES (107, 'Software Engineering', author_id('A01'), 'Education',
Publisher('P08', 'McGraw Hill', 'US'), keywords('SDLC', 'Agile'), 160);
INSERT INTO Book VALUES (108, 'Cloud Computing', author_id('A02','A03'),
'Technology', Publisher('P09', 'Springer', 'US'), keywords('Cloud', 'AWS'), 190);
INSERT INTO Book VALUES (109, 'Cyber Security Handbook', author_id('A04'),
'Technology', Publisher('P10', 'Wiley', 'UK'), keywords('Security', 'Encryption'),
170);
INSERT INTO Book VALUES (110, 'Big Data Analytics', author_id('A05','A06'),
'Technology', Publisher('P11', 'Cambridge Press', 'UK'), keywords('Data',
'Analytics'), 210);
select * from Book;

INSERT INTO Author VALUES ('A01', Name('Dham', 'Dhere'),
phone_no('8804127374','9422847374'));
INSERT INTO Author VALUES ('A02', Name('Narasimha', 'Karumanchi'),
phone_no('9876543210','9123456789'));
INSERT INTO Author VALUES ('A03', Name('William', 'Stallings'),
phone_no('9812345678','9412345678'));
INSERT INTO Author VALUES ('A04', Name('Shamkant', 'Navate'),
phone_no('9823456789','9123456780'));
INSERT INTO Author VALUES ('A05', Name('Peter', 'Norvig'),
phone_no('9900112233','9800112233'));
INSERT INTO Author VALUES ('A06', Name('Angela', 'Yu'),
phone_no('9811223344','9911223344'));
INSERT INTO Author VALUES ('A07', Name('Neal', 'Ford'),
phone_no('9833445566','9933445566'));
INSERT INTO Author VALUES ('A08', Name('Thomas', 'Erl'),
phone_no('9844556677','9944556677'));
INSERT INTO Author VALUES ('A09', Name('Kevin', 'Mitnik'),
phone_no('9855667788','9955667788'));
INSERT INTO Author VALUES ('A10', Name('Venkat', 'Ankam'),
phone_no('9866778899','9966778899'));
select * from Author;

create table Customer (
    customer_id varchar(10) primary key,
    name Name,
    phone phone_no
)

INSERT INTO Customer VALUES ('C01', Name('Pushkaraj', 'Yadav'),
phone_no('9403365600'));
INSERT INTO Customer VALUES ('C02', Name('Aryan', 'Mangrule'),
phone_no('9812345670'));
INSERT INTO Customer VALUES ('C03', Name('Shivraj', 'Patil'),
phone_no('9823456781'));
INSERT INTO Customer VALUES ('C04', Name('Kartikeya', 'Yadav'),
phone_no('9834567892'));
INSERT INTO Customer VALUES ('C05', Name('Aishwarya', 'Pavane'),
phone_no('9845678903'));
INSERT INTO Customer VALUES ('C06', Name('Prachi', 'Patil'), phone_no('9856789014'));
INSERT INTO Customer VALUES ('C07', Name('Kedar', 'Salunkhe'),
phone_no('9867890125'));
```

```
INSERT INTO Customer VALUES ('C08', Name('Ankita', 'Desai'), phone_no('9878901236'));
INSERT INTO Customer VALUES ('C09', Name('Avdhut', 'Pailwan'),
phone_no('9889012347'));
INSERT INTO Customer VALUES ('C10', Name('Ritesh', 'Bakare'),
phone_no('9890123458'));
select * from Customer;

create table Book_Sale (
    sale_id varchar(10) primary key,
    customer_id varchar(10),
    isbn integer,
    FOREIGN key(customer_id) references Customer(customer_id),
    foreign key(isbn) references Book(isbn)
)

INSERT INTO Book_Sale VALUES ('S01', 'C01', 101);
INSERT INTO Book_Sale VALUES ('S02', 'C02', 102);
INSERT INTO Book_Sale VALUES ('S03', 'C03', 103);
INSERT INTO Book_Sale VALUES ('S04', 'C04', 104);
INSERT INTO Book_Sale VALUES ('S05', 'C05', 105);
INSERT INTO Book_Sale VALUES ('S06', 'C06', 106);
INSERT INTO Book_Sale VALUES ('S07', 'C07', 107);
INSERT INTO Book_Sale VALUES ('S08', 'C08', 108);
INSERT INTO Book_Sale VALUES ('S09', 'C09', 109);
INSERT INTO Book_Sale VALUES ('S10', 'C10', 110);
select * from Book_Sale;



-- 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_ids) AID, author A
    WHERE A.author_id = AID.COLUMN_VALUE;

-- List all customers who have purchased books published with ‘Tata MaGraw Hill’
SELECT DISTINCT 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_info.pub_name = 'TATA McGraw Hill';

-- 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.
SELECT C.name.fName || ' ' || C.name.lName AS customer_name, B.title,
B.publisher_info.pub_name AS publisher_name, C.name.lName
    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_info.branch IN ('UK', 'US')
    ORDER BY C.name.lName;
```

```sql
-- List the different (distinct) categories and how many books belong to each
category,
-- order alphabetically by category.
SELECT B.category_ AS category, COUNT(*) AS book_count
    FROM book B
    GROUP BY B.category_
    ORDER BY B.category_;

-- List the number of books sold that have been written by each author and group by
author's first name.
SELECT A.name.fName, COUNT(BS.sale_id) AS books_sold
    FROM book B
    JOIN TABLE(B.author_ids) AID ON 1 = 1
    JOIN author A ON A.author_id = AID.COLUMN_VALUE
    JOIN book_sale BS ON B.isbn = BS.isbn
    GROUP BY A.name.fName;
```

Q2

```
create type Exam as object (
    year number,
    city varchar2(50)
);

create type Child as object (
    name varchar2(50),
    birthday date
);

create type ExamSet as varray(10) of Exam;

create type Skill as object (
    type varchar(50),
    exams ExamSet
);
create type SkillSet as varray(10) of Skill;

create type ChildrenSet as varray(10) of Child;

create table EMP (
    ename varchar2(50),
    children ChildrenSet,
    skills SkillSet
);

insert into EMP VALUES (
        'Pushkaraj Yadav',
        ChildrenSet(Child('Anil', TO_DATE('2001-05-15', 'YYYY-MM-DD')),
Child('Supriya', TO_DATE('1998-03-22', 'YYYY-MM-DD'))),
        SkillSet(Skill('typing', ExamSet(Exam(2023, 'Dayton'), Exam(2021,
'Cleveland'))),
        Skill('programming', ExamSet(Exam(2020, 'New York'))))
    );
insert into EMP VALUES (
        'Satej Patil',
        ChildrenSet(Child('Ashish', TO_DATE('1999-07-30', 'YYYY-MM-DD'))),
        SkillSet(Skill('accounting', ExamSet(Exam(2019, 'Columbus'))),
        Skill('typing', ExamSet(Exam(2022, 'Dayton')))));
insert into EMP VALUES (
        'Arya Patil',
        ChildrenSet(Child('Samrudhi', TO_DATE('2003-09-05', 'YYYY-MM-DD')),
Child('Sarthak', TO_DATE('2005-11-13', 'YYYY-MM-DD'))),
        SkillSet(Skill('management', ExamSet(Exam(2018, 'Chicago'))),
        Skill('programming', ExamSet(Exam(2021, 'Boston'))))
    );
insert into EMP VALUES (
        'Pratik Patil',
```

```
        ChildrenSet(Child('Samir', TO_DATE('2000-12-25', 'YYYY-MM-DD'))),
        SkillSet(Skill('typing', ExamSet(Exam(2023, 'Dayton'))),
        Skill('design', ExamSet(Exam(2020, 'San Francisco'))))
    );
insert into EMP VALUES (
        'Anand Kulkarni',
        ChildrenSet(Child('Abhinav', TO_DATE('2002-02-14', 'YYYY-MM-DD')),
Child('Akansha', TO_DATE('1997-10-19', 'YYYY-MM-DD'))),
        SkillSet(Skill('data analysis', ExamSet(Exam(2022, 'Seattle'))),
        Skill('typing', ExamSet(Exam(2020, 'Dayton'))))
    );
insert into EMP VALUES (
        'Sandip Kharade',
        ChildrenSet(Child('Nina', TO_DATE('2004-04-22', 'YYYY-MM-DD'))),
        SkillSet(Skill('programming', ExamSet(Exam(2019, 'Boston'))),
        Skill('typing', ExamSet(Exam(2021, 'Dayton'))))
    );
insert into EMP VALUES (
        'Saurabh Desai',
        ChildrenSet(Child('Samarjeet', TO_DATE('2000-08-07', 'YYYY-MM-DD'))),
        SkillSet(Skill('typing', ExamSet(Exam(2023, 'Dayton'))),
        Skill('management', ExamSet(Exam(2022, 'Chicago'))))
    );
insert into EMP VALUES (
        'Aruna Gaikwad',
        ChildrenSet(Child('Amar', TO_DATE('1996-01-17', 'YYYY-MM-DD')), Child('Arun',
TO_DATE('2003-12-29', 'YYYY-MM-DD'))),
        SkillSet(Skill('data analysis', ExamSet(Exam(2021, 'Los Angeles'))),
        Skill('typing', ExamSet(Exam(2022, 'Dayton'))))
    );
insert into EMP VALUES (
        'Ajay Kulkarni',
        ChildrenSet(Child('Prashant', TO_DATE('2001-03-03', 'YYYY-MM-DD'))),
        SkillSet(Skill('design', ExamSet(Exam(2020, 'New York'))),
        Skill('typing', ExamSet(Exam(2021, 'Dayton'))))
    );
insert into EMP VALUES (
        'Ananya Suryavanshi',
        ChildrenSet(Child('Olivia', TO_DATE('2005-06-12', 'YYYY-MM-DD'))),
        SkillSet(Skill('typing', ExamSet(Exam(2023, 'Dayton'))),
        Skill('programming', ExamSet(Exam(2019, 'San Francisco'))))
    );
select * from emp;

select ename from EMP E
where exists (
    select 1
    from table(E.children) C
    where C.birthday > TO_DATE('2000-01-01', 'YYYY-MM-DD')
);

select ename from EMP E
where exists (
```

```
    select 1
    from table(E.Skills) S, table(S.exams) EX
    where S.type = 'typing'
    AND EX.city = 'Dayton'
);

SELECT DISTINCT(S.TYPE) AS SKILLTYPES
FROM EMP E, TABLE(E.SKILLS) S;
```