Advanced Database System (Lab)

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Problem Statement 1:

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

Description :

Create Book Store database using below schema and insert at least 5-7 tuples in each table.

Table Name	Field	Data Type	Key	FK Reference
Author	author_id	varchar (10)	PK	
	name	Structured type (fname and lname)		
	Phone_no	Varray(4)		
Book	ISBN	integer	PK	
	title	varchar (30)		
	author_id	vArray [10]		
	category	varchar (20)		
	publisher	Structured type (pub_id, Pub_name, branch)		
	keywords	multiset		
	price	Number (10,2)		
Customer	customer_id	varchar (10)	PK	
	name	Structured type (fname and lname)		
	phone	multiset		
Book_Sale	sale_id	varchar (10)	PK	
	customer_id	varchar (10)	FK	Customer.customer_id
	ISBN	integer	FK	Book.ISBN

Creating Author Table:

```
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
)
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;
```

Creating Book Table:

```
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;
```

Creating Customer Table:

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

INSERT INTO Customer VALUES ('C01', Name('Sujay', 'Gangan'),phone_no('9403377600'));

INSERT INTO Customer VALUES ('C02', Name('Aryan', 'Mangrule'),phone_no('9825345670'));

INSERT INTO Customer VALUES ('C03', Name('Shivraj', 'Patil'),phone_no('9823477781'));

INSERT INTO Customer VALUES ('C04', Name('Tanmay', 'Sathe'),phone_no('9831267892'));

INSERT INTO Customer VALUES ('C05', Name('Pavan', 'Rajmane'),phone_no('9845645903'));

INSERT INTO Customer VALUES ('C06', Name('Aditya', 'Belkude'), phone_no('9855289014'));

INSERT INTO Customer VALUES ('C07', Name('Sumit', 'More'),phone_no('9867874125'));

INSERT INTO Customer VALUES ('C08', Name('Aniket', 'Gavali'), phone_no('9338901236'));

INSERT INTO Customer VALUES ('C09', Name('Pranav', 'Chavan'),phone_no('9889112347'));

INSERT INTO Customer VALUES ('C10', Name('Ritesh', 'Bakare'),phone_no('9890443458'));

select * from Customer;
```

Creating Book_Sale Table:

```
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;
```

Queries:

```sql
-- Question 1

-- 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;

-- 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;
```

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)

A. Define the above schema in SQL, with appropriate types for each attribute.

```
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 (
    '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;
```

B. Using the above schema, write the following queries in SQL.

i. Find the names of all employees who have a child born on or after January 1, 2000.

ii. Find those employees who took an examination for the skill type “typing” in the city “Dayton”.

iii. List all skill types in the relation 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;
```