Relational Algebra

CASE STUDY I

Consider the following schema:

Suppliers (***sid: integer***, sname: string, address: string)
Parts (***pid: integer***, pname: string, color: string)
Catalog (***sid: integer***, *pid: integer*, cost: real)

The primary key and the composite key attributes of each schema are underlined. The datatype of each field is listed after the field name.

sid is the key for Suppliers
pid is the key for Parts
sid and pid are key for Catalog

The supplier relation enlists the details of the supplier providing parts. The parts relation enlists the details of the spare parts. The Catalog relation lists the cost price of parts sold by Suppliers.
Write the following queries in relational algebra.

1. Find the names of suppliers who supply *'yellow'* part.
2. Find *'sid'* of suppliers who supply *'blue'* or *'yellow'* part.
3. Find *'sid'* of suppliers who supply *'yellow'* part or are at *'SVNIT'*.
4. Find *'sid'* of suppliers who supply *'yellow'* part and *'green'* part.
5. Find *'sid'* of suppliers who supply every part.
6. Find *'sid'* of suppliers who supply every '*red'* part.
7. Find *'sid'* of suppliers who supply every *'blue'* or *'yellow'* part.
8. Find *'sid'* of suppliers who supply every red part or supply every green part.
9. Find pairs of *'sid'* such that the supplier with the first *'sid'* charges more for some part than the supplier with the second *'sid'*.
10. Find the *'pid'* of parts supplied by at least two different suppliers.
11. Find the '*pid'* of the most expensive parts supplied by suppliers named *'Raj Patel'*.
12. Find the Supplier names of the suppliers who supply a red part that costs less than INR 100.
13. This Relational Algebra statement does not return anything because of the sequence of projection operators. Once the sid is projected, it is the only field in the set. Therefore, projecting on sname will not return anything.

14. Find the Supplier names of the suppliers who supply a red part that costs less than INR 100 and a green part that costs less than INR 100.

15. Find the Supplier ids of the suppliers who supply a red part that costs less than 100 INR and a green part that costs less than 100 INR.

16. Find the Supplier names of the suppliers who supply a red part that costs less than 100 INR and a green part that costs less than 100 INR.

CASE STUDY II

Consider the following relations containing airline flight information:

Flights(***fl_no***: integer, from: string, to: string, distance: integer, departs: time, arrives: time)

Aircraft(***a_id****:* integer, aname: string, cruising_range: integer)

Certified(***e_id:*** integer, aid: integer)

Employees(***e_id:*** integer, ename: string, salary: integer)

Important insights for the schema:

- The Employees relation describes pilots and other kinds of employees as well.
- Every pilot is certified for some aircraft (otherwise, he or she would not qualify as a pilot).
- Only pilots are certified to fly.

Write the following queries in relational algebra.

1. Find the *e_ids* of pilots certified for some Boeing aircraft.
2. Find the names of pilots certified for some Boeing aircraft.
3. Find the aids of all aircraft that can be used on non-stop flights from *Surat* to *Delhi*.
4. Identify the flights that can be piloted by every pilot whose salary is more than INR 100,000.
5. Find the names of pilots who can operate planes with a range greater than 3,000 km but are not certified on any Boeing aircraft.
6. Find the e_ids of employees who make the highest salary.
7. Find the e_ids of employees who make the second highest salary.
8. Find the e_ids of employees who are certified for exactly three aircraft.