Database Management System Assignment

Sub Code: CSE-224

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CSE - 3

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DBMS Assignment

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- Exercise-1:
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)

Write the following queries in relational algebra.

1) Find the names of suppliers who supply some red part

$$\Pi_{sname}\left(\Pi_{sid}\left(\Pi_{pid}\left(\sigma_{color='red'}(Parts)\right) \bowtie Catalog\right) \bowtie Suppliers\right)$$

2) Find the sids of suppliers who supply some red or green part.

$$\Pi_{sid}\left(\Pi_{pid}\left(\sigma_{color='red' \text{ OR } color='green'}(Parts)\right) \bowtie Catalog\right)$$

3) Find the sids of suppliers who supply some red part or are at 221 Packer street.

$$T_1 \leftarrow \Pi_{sid}\left(\Pi_{pid}\left(\sigma_{color='red'}(Parts)\right) \bowtie Catalog\right)$$
$$T_2 \leftarrow \Pi_{sid}\left(\sigma_{address='221\ Packer\ street'}(Suppliers)\right)$$
$$\underline{Result \leftarrow T_1 \cup T_2}$$

4) Find the sids of suppliers who supply some red part and some green part.

$T_1 \leftarrow \Pi_{sid}(\Pi_{pid}(\sigma_{color='red'}(Parts)) \bowtie Catalog)$

$T_2 \leftarrow \Pi_{sid}(\Pi_{pid}(\sigma_{color='green'}(Parts)) \bowtie Catalog)$

$Result \leftarrow T_1 \cap T_2$

5) Find the sids of suppliers who supply every part.

$\Pi_{sid,pid}(Catalog) \div \Pi_{pid}(Parts)$

6) Find the sids of suppliers who supply every red part

$\Pi_{sid,pid}(Catalog) \div \Pi_{pid}(\sigma_{color='red'}(Parts))$

7) Find the sids of suppliers who supply every red part or supply every green part

$T_1 \leftarrow \Pi_{sid,pid}(Catalog) \div \Pi_{pid}(\sigma_{color='red'}(Parts))$

$T_2 \leftarrow \Pi_{sid,pid}(Catalog) \div \Pi_{pid}(\sigma_{color='green'}(Parts))$

$Result \leftarrow T_1 \cup T_2$

8) Find the pairs of sid such that the supplier with the first sid charges more for some part than the supplier with the second sid.

$$\rho_{R_1}(\text{Catalog}) \qquad \rho_{R_2}(\text{Catalog})$$

$$\Pi_{R1.sid,\, R2.sid}\left(\sigma_{\substack{R1.pid = R2.pid \\ \wedge\ R1.sid \neq R2.sid \\ \wedge\ R1.cost > R2.cost}}(R_1 \times R_2)\right)$$

9) Find the pids of parts supplied by atleast two different suppliers.

$$\rho_{R_1}(\text{Catalog}) \qquad \rho_{R_2}(\text{Catalog})$$

$$\Pi_{R1.pid}\left(\sigma_{\substack{R1.pid = R2.pid \\ \wedge \\ R1.sid \neq R2.sid}}(R_1 \times R_2)\right)$$

10) Find the pids of the most expensive parts supplied by suppliers named Yosemite Sham.

$$R_1 \leftarrow \Pi_{\substack{\text{catalog.sid}, \\ \text{pid, cost}}}\left(\sigma_{sname = \text{'Yosemite Sham'}}(\text{Suppliers} \bowtie \text{Catalog})\right)$$

$$R_2 \leftarrow R_1$$

$$R_3 \leftarrow \Pi_{\substack{R_1.sid, \\ R_2.pid, R_1.cost}}\left(\sigma_{R_1.cost < R_2.cost}(R_1 \times R_2)\right)$$

$$\underline{\text{Result} \leftarrow R_2 - R_3}$$

11) Find the pids of parts supplied by every supplier at less than (If any supplier either does not supply the part or charges more than $200 for it, the part is not selected).

$\Pi_{pid,sid}(\sigma_{cost<200}(Catalog)) \div \Pi_{sid}(Suppliers)$

- Exercise 2 :-

Flights (flno: integer, from: string, to: string, distance: integer, departs: time, arrives: time, aid: integer)

Aircraft (aid: integer, aname: string, cruisingrange: integer)

Certified (eid: integer, aid: integer)

Employees (eid: integer, ename: string, salary: integer)

Write relational algebra queries:-

1. Find the eids of pilots certified for some Boeing aircraft.

$\Pi_{eid}(\sigma_{aname='Boeing'}(Aircraft \bowtie Certified))$

2) Find the names of pilots certified for some boeing aircraft.

$\Pi_{ename}(\sigma_{aname='Boeing'}(Aircraft \bowtie Certified) \bowtie Employee)$

3. Find the aids of all aircrafts that can be used on non-stop flights from Bonn to Madras.

$R_1 \leftarrow \sigma_{from = 'Bonn' \wedge to = 'Madrid'}(Flights)$

$Result \leftarrow \Pi_{aid}(\sigma_{cruisingrange > distance}(Aircraft \times R_1))$

4. Identify the flights that can be piloted by every pilot whose salary is more than $100000

$R_1 \leftarrow \sigma_{distance \leq cruisingrange}(Flights \bowtie Aircraft)$

$R_2 \leftarrow R_1 \bowtie Certified$

$Result \leftarrow \Pi_{flno}(\sigma_{salary > 100000}(R_2 \bowtie Employee))$

5. Find the names of pilots who can operate planes with a range > 3000 miles but are not certified on any Boeing aircraft.

$R_1 \leftarrow \Pi_{ename}(\sigma_{cruisingrange > 3000}(Aircraft \bowtie Certified \bowtie Employees))$

$R_2 \leftarrow \Pi_{ename}(\sigma_{aname = 'Boeing'}(Aircraft \bowtie Certified \bowtie Employees))$

$Result \leftarrow R_1 - R_2$

6. Find the eids of employees who make the highest salary
C_{R_1} (Employees) C_{R_2} (Employees)

$$T_1 \leftarrow \Pi_{R1.eid}\left(\sigma_{R1.salary < R2.salary}(R_1 \times R_2)\right)$$

$$\text{Result} \leftarrow \Pi_{eid}(R_1) - T_1$$

7. Find the eids of employees who are certified for largest no. of aircraft.

$$R(eid, count\_aid) \leftarrow {}_{eid}\mathcal{F}_{COUNT(aid)}(Certified)$$

$$\text{Result} \leftarrow \mathcal{F}_{MAX(count\_aid)}(R)$$

Result $\leftarrow \sigma_{count\_aid = m}(R)$

8. Find the eids of employees who are certified for exactly three aircraft.
C_{R_1} (Certified) C_{R_2} (Certified) C_{R_3} (Certified) C_{R_4} (Certified)

$$T_1 \leftarrow \Pi_{eid}\left(\sigma_{R1.eid=R2.eid=R3.eid \wedge R1.aid \neq R2.aid \neq R3.aid}(R_1 \times R_2 \times R_3)\right)$$

$$T_2 \leftarrow \Pi_{eid}\left(\sigma_{R1.eid=R2.eid=R3.eid=R4.eid \wedge R1.aid \neq R.aid \neq R3.aid \neq R4.aid}(R_1 \times R_2 \times R_3 \times R_4)\right)$$

$$\text{Result} \leftarrow T_1 - T_2$$

9. Find the total amount paid to employees as salaries

$$\mathcal{F}_{sum(salary)}(Employees)$$

Exercise 3:-

Consider the sailor boat schema:-

Sailors (sid, sname, rating, age)
Boat (bid, bname color)
Reserved (sid, bid, day)

1. Find the names of sailors who have reserved boat 103

$$\Pi_{sname}\left(\left(\sigma_{bid=103}(Reserved)\right) \bowtie Sailors\right)$$

2. Find the name of the sailors who has reserved Red boat.?

$$\Pi_{sname}\left(\left(\sigma_{color='red'}(Boats)\right) \bowtie Reserved \bowtie Sailors\right)$$

3. Find the color of the boat reserved by Lubek?

$$\Pi_{color}\left(\left(\sigma_{sname='Lubek'}(Sailors)\right) \bowtie Reserved \bowtie Boats\right)$$

4. Find the name of the sailors who have reserved allleast one boat?

$$\Pi_{sname}\left(Sailors \bowtie Reserved\right)$$

5. Find the names of sailors who have reserved a red and a green boat.

$$R_1 \leftarrow \left(\sigma_{color='Red'}(Boats)\right) \cap \left(\sigma_{color='green'}(Boats)\right)$$

$$Result \leftarrow \Pi_{sname}\left(R_1 \bowtie Reserved \bowtie Sailors\right)$$

6. Find the names of sailors who have reserved a red or a green boat.

$R_1 \leftarrow \sigma_{color = 'red'\ OR\ (V)\ color = 'green'}(Boats)$

$Result \leftarrow \Pi_{sname}(R_1 \bowtie Reserved \bowtie Sailors)$

7. Find SID of sailor with age greater then to who have not reserved a red boat.

$R_1 \leftarrow \left((\sigma_{color \neq 'red'}(Boat)) \bowtie Reserved \bowtie Sailors\right)$

$Result \leftarrow \Pi_{sailors.sid}\left(\sigma_{sailors.age > R_1.age}(Sailors \times R_1)\right)$

8. Find the name of the sailor who reserved all boat?

$R_1 \leftarrow \Pi_{sid,bid}(Reserved) \div \Pi_{bid}(Boats)$

$Result \leftarrow \Pi_{sname}(Sailors \bowtie R_1)$

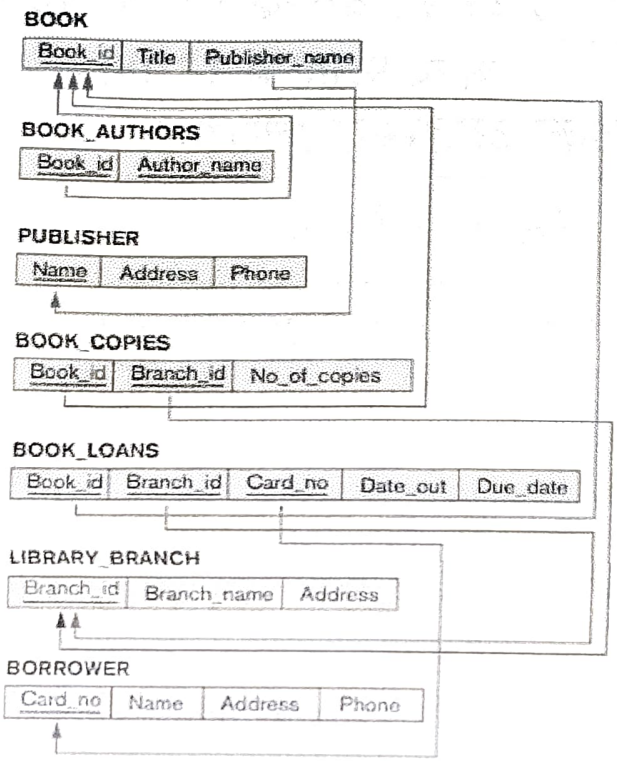
9. Find the names of sailors who have reserved at least two boats.

$R_1 \leftarrow \Pi_{sid,sname,bid}(Sailors \bowtie Reserved)$

$R_2 \leftarrow R_1$

$Result \leftarrow \Pi_{R_1.sname}\left(\sigma_{R_1.sid = R_2.sid \wedge R_1.bid \neq R_2.bid}(R_1 \times R_2)\right)$

Exercise 4:-
Consider the following library schema:-



1. How many copies of the book titled The Lost Tribe are owned by the library branch whose name is 'Sharpstown'?

$$\Pi_{\text{no\_of\_copies}}\left(\sigma_{\text{Branch\_name}='\text{Sharpstown}'\ \wedge\ \text{Title}='\text{The Lost Tribe}'}\left(\text{BOOK\_COPIES} \bowtie \text{LIBRARY\_BRANCH} \bowtie \text{BOOK}\right)\right)$$

2. How many copies of the book titled The Lost Tribe are owned by each library branch?

$$\Pi_{\text{BranchID, No\_of\_Copies}}\left(\left(\sigma_{\text{Title}='\text{The Lost Tribe}'}(\text{BOOK})\right) \bowtie \text{BOOK\_COPIES}\right)$$

3. Retrieve names of all borrowers who do not have any books checked out

$$R_1 \leftarrow \left(\Pi_{Card\text{-}no}(BORROWER) - \Pi_{Card\text{-}no}(BOOK\text{-}LOANS) \right)$$

$$Result \leftarrow \Pi_{Name}(BORROWER \ltimes R_1)$$

4. For each book that is loaned out from the Shorpstown branch and whose Due_date is today, retrieve the book title, the borower's name, and the borrower's address.

$$R_1 \leftarrow \Pi_{Branch\text{-}id}(\sigma_{Branch\_Name='Shorpstown'}(LIBRARY\text{-}BRANCH))$$

$$R_2 \leftarrow \Pi_{Book\text{-}id,\,Card\_no}((\sigma_{DueDate='2020\text{-}02\text{-}06'}(BOOK\text{-}LOANS)) \ltimes R_1)$$

$$Result \leftarrow \Pi_{Title,\,Name,\,Address}(BOOK \ltimes BORROWER \ltimes R_2)$$

5. For each library branch, retrive the branch name and total number of books loaned out from that branch

$$R(branch\_id, Total) \leftarrow {}_{<Branch\text{-}id>}\mathcal{F}_{COUNT(Book\text{-}id)}(BOOK\text{-}LOANS)$$

$$Result \leftarrow \Pi_{Branch\_name,\,Total}(R \ltimes LIBRARY\text{-}BRANCH)$$

6. Retrieve names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

$$B(\text{Card\_no}, \text{Total\_Checkout}) \leftarrow {}_{\langle \text{Card\_no} \rangle}\mathcal{F}_{\text{COUNT}(\text{Book\_id})}(\text{BOOK\_LOANS})$$

$$BS \leftarrow \sigma_{\text{Total\_Checkout} > 5}(B)$$

$$\text{Result} \leftarrow \pi_{\text{Name, Address, Total\_Checkout}}(BS \bowtie \text{BORROWER})$$

7. For each book authored (or coauthored) by Stephen King, retrieve the title and the number of copies owned by the library branch whose name is Central.

$$SK \leftarrow \left(\left(\sigma_{\text{Author\_name} = \text{'Stephen King'}} (\text{BOOK\_AUTHORS}) \right) \bowtie \text{BOOK} \right)$$

$$C \leftarrow \sigma_{\text{Branch\_name} = \text{'Central'}} (\text{LIBRARY\_BRANCH})$$

$$\text{Result} \leftarrow \pi_{\text{Title, No\_of\_copies}} (SK \bowtie \text{BOOK\_COPIES} \bowtie C)$$