

Assignment-1

A120BTECH11015.

Relational Algebra:-SCHEMA:-

Sailors (sid: integer, sname: string, rating: integer, age: real)

Boats (bid: integer, bname: string, color: string)

Reserves (sid: integer, bid: integer, day: date)

1. $\pi_{\text{sname}}(\pi_{\text{sid}}((\pi_{\text{bid}}(\sigma_{\text{color}=\text{'red'}} \text{Boats}) \bowtie \text{Reserves}) \bowtie \text{Sailors}))$

Ans:- Query: Names of sailors who have reserved a red boat.

Step wise explanation:-

(i) $\sigma_{\text{color}=\text{'red'}} \text{Boats}$

→ Select all rows in Boats in which color = 'red'.

It means select all rows associated with red boats in Boats

Now attributes present are,

bid	bname	color
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(ii) $\pi_{\text{bid}}(\sigma_{\text{color}=\text{'red'}} \text{Boats})$

→ Project bid attribute from (i). It means, bid of ~~sailors~~ red boats.

Now attributes are,

bid

(iii) $\Pi_{\text{bid}} \sigma_{\text{color}=\text{'red'}} \text{Boats} \bowtie \text{Reserves}$

⇒ This natural joins the projection in (ii) with Reserves on keeping equality specified on bid attribute. (common attribute)

Now, the attributes are

sid	bid	day
-----	-----	-----

⇒ It means details of red boats that are reserved.

(iv) $\Pi_{\text{sid}} (\Pi_{\text{bid}} \sigma_{\text{color}=\text{'red'}} \text{Boats} \bowtie \text{Reserves})$

⇒ This projects the sid attribute from the (iii).

It means sid of the red boats that are reserved.

Now the attributes are,

sid

(v) $(\Pi_{\text{sid}} (\Pi_{\text{bid}} \sigma_{\text{color}=\text{'red'}} \text{Boats} \bowtie \text{Reserves}) \bowtie \text{Sailors})$

⇒ This natural joins the projection in (iv) with Sailors by specifying equality on sid attribute. (common)

⇒ It means details of sailors who reserved a red boat.

Now attributes are,

sid	sname	rating	age
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(vi) $\Pi_{\text{Sname}}(\Pi_{\text{sid}}((\Pi_{\text{bid}}[\text{color} = \text{'red'}] \text{Boats}) \bowtie \text{Reserves}) \bowtie \text{Sailors})$

⇒ This projects the sname attribute from(v).

It means names of the sailors who have reserved a red boat.

Now attributes are,

s name.

∴ Final Query :-

Names of sailors who have reserved a
red boatish | big rajah

2. ρ (Tempboats, ($O_{color='red' \vee color='green'}Boats$))

II snare (Temp boats Reserves & Sailors)

Ans:- Query: Names of sailors who have reserved
a red boat or a green boat.

Stepwise explanation:

(i) $\sigma_{\text{color} = \text{'red'}} \vee \sigma_{\text{color} = \text{'green'}}$ Boats .

⇒ Select all rows in Boats in which color = 'red'
or color = 'green'.

It means select all rows associated with
or color = green.

It means some red or green boats, in Boats.

Now attributes present are,

bid	bname	color
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(ii) $f(Tempboats, (O_{color='red' \vee color='green'} Boats))$

⇒ This renames the above thing in (i) to Tempboats.

(iii) Tempboats \bowtie Reserves.

⇒ This natural joins Tempboats with Reserves by specifying equality on bid attribute. (common attribute).

It means details of red or green boats that are reserved.

Now attributes present are,

bid	bname	color	sid	day
-----	-------	-------	-----	-----

(iv) Tempboats \bowtie Reserves \bowtie Sailors

⇒ This natural joins (iii) and Sailors with equality specified on sid attribute. (common)

It means details of Sailors who reserved a red or green boat. (with details about boat).

Now attributes present are,

sid	sname	rating	age	bid	bname	color	day
-----	-------	--------	-----	-----	-------	-------	-----

(v) $\Pi_{sname} (\text{Tempboats} \bowtie \text{Reserves} \bowtie \text{Sailors})$

→ This projects sname attribute from (iv).

It means names of the sailors who have reserved a red or green boat.

Now attributes are

sname

Final Query:-

Names of sailors who have reserved a red or a green boat.

3. $\rho (\text{Temp1}, \Pi_{sid} ((\sigma_{color='red'} \text{Boats}) \bowtie \text{Reserves}))$
 $\rho (\text{Temp2}, \Pi_{sid} ((\sigma_{color='green'} \text{Boats}) \bowtie \text{Reserves}))$
 $\Pi_{sname} ((\text{Temp1} \cap \text{Temp2}) \bowtie \text{Sailors})$.

Ans:- Query:- Names of sailors who reserved both red and a green boats.

Stepwise explanation:-

(i) $\sigma_{color='red'} \text{Boats}$.

→ Select all rows in Boats in which color='red'.

It means select all rows associated with red boats in Boats.

Now attributes present are,

bid	bname	color
-----	-------	-------

(ii) $\sigma_{\text{color}=\text{'red'}}$ Boats \bowtie Reserves
⇒ This natural joins (i) with Reserves by specifying equality on bid attribute. (common attribute).

It means details of red boats that are reserved.

Now attributes present are,

bid	bname	color	sid	day
-----	-------	-------	-----	-----

(iii) $\Pi_{\text{sid}}(\sigma_{\text{color}=\text{'red'}} \text{Boats} \bowtie \text{Reserves})$

⇒ This projects sid attribute from (ii).

It means sid of sailors who reserved red boats.

Now attributes present are,

sid

(iv) $\rho(\text{Temp1}, \Pi_{\text{sid}}(\sigma_{\text{color}=\text{'red'}} \text{Boats} \bowtie \text{Reserves}))$

⇒ This renames the above (iii) as.

Temp1.

∴ Temp1 consists sid of sailors who reserved a red boat.

(v) $\sigma_{\text{color}=\text{'green'}} \text{Boats}$

⇒ Select all rows in Boats in which color = 'green'.

It means select all rows associated with green ~~red~~ boats in Boats.

Now attributes present are

bid	bname	color
-----	-------	-------

(vi) $\Pi_{\text{color}=\text{'green'}}(\text{Boats}) \bowtie \text{Reserves}$

→ This natural joins (v) with Reserves, by specifying equality on bid attribute. (common attribute).

It means details of green boats that are reserved.

Now attributes present are,

bid	bname	color	sid	day
-----	-------	-------	-----	-----

(vii) $\Pi_{\text{sid}}((\text{Boats}) \bowtie \text{Reserves})$

→ This projects sid attribute from (vi).

It means sid of sailors who reserved green boats.

Now attributes present are,

sid

(viii) $f(\text{Temp}2, \Pi_{\text{sid}}((\text{Boats}) \bowtie \text{Reserves}))$

→ This renames the above (vii) as

Temp2.

∴ Temp2 consists of sid of sailors who

reserved a green boat.

(ix) $\text{Temp1} \cap \text{Temp2}$.

⇒ This results into sid of sailors who reserved both red and green boats.
Now, attributes present are,

sid

(x) $(\text{Temp1} \cap \text{Temp2}) \bowtie \text{Sailors}$

⇒ This natural joins (ix) with Sailors by specifying equality on sid attribute (common attribute).

It means details of sailors who reserved both red and green boats.

Now attributes present are,

sid	sname	rating	age
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(xi) $\Pi_{\text{sname}}((\text{Temp1} \cap \text{Temp2}) \bowtie \text{Sailors})$

⇒ This projects sname attribute from (x).

It means names of the sailors who reserved both red and green boats.

Now attributes are,

sname

Final Query:-

Names of sailors who reserved both red and green boats.

4. $\Pi_{sid, sname, bid} (Sailors \bowtie Reserves)$
 $\sigma_{(1 \rightarrow sid1, 2 \rightarrow sname1, 3 \rightarrow bid1, 4 \rightarrow sid2, 5 \rightarrow sname2, 6 \rightarrow bid2)}$, Reservations \bowtie Reservations).

$\Pi_{sname1} \sigma_{(sid1 = sid2) \wedge (bid1 \neq bid2)}$ Reservation pairs.

Ans:-

Query:- Names of sailors who have reserved atleast two boats. (More than 1 boat)

Stepwise explanation:-

(i) Sailors \bowtie Reserves.

\Rightarrow This natural joins the Sailors with Reserves by specifying equality on sid attribute (common attribute).

It means details of sailor who have reserved atleast one boat.

Now attributes present are;

sid	sname	rating	age	bid	day
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(ii) $\Pi_{sid, sname, bid} (Sailors \bowtie Reserves)$

\Rightarrow This projects sid, sname, bid attributes from (i).

It means sid, sname, bid of sailor who reserved atleast one boat.

Now attributes present are,
sid | sname | bid

(iii) $f(\text{Reservations}, \Pi_{\text{sid}, \text{sname}, \text{bid}})$ (Sailors X Reserves).

⇒ This renames the above thing in (ii) as

• Reservations.

∴ Reservations consists of sid, sname, bid

of sailors who have reserved atleast
one boat.

(iv) Reservations X Reservations

⇒ This gives cartesian product of Reservations
with itself.

Now attributes present are,

• sid | sname | bid | sid | sname | bid

(v) $f(\text{Reservation Pairs} (1 \rightarrow \text{sid1}, 2 \rightarrow \text{sname1}, 3 \rightarrow \text{bid1},$
 $4 \rightarrow \text{sid2}, 5 \rightarrow \text{sname2}, 6 \rightarrow \text{bid2}), \text{Reservations} \times$
 $\text{Reservations})$.

⇒ This, First renames the attributes
as sid1, sname1, bid1 | sid2, sname2, bid2.

And then renames entire relation as
ReservationPairs.

Now attributes present are,

sid1 | sname1 | bid1 | sid2 | sname2 | bid2

(vi) $\Pi_{\{sid1=sid2\} \wedge \{bid1 \neq bid2\}}$ Reservation pairs.

→ This selects all rows in which $sid1 = sid2$ and $bid1 \neq bid2$ in ReservationPairs.
It means select all rows associated with sailors who reserved atleast two boats.

Now attributes present are,

sid1	sname1	bid1	sid2	sname2	bid2
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(vii) $\Pi_{sname1} (\Pi_{\{sid1=sid2\} \wedge \{bid1 \neq bid2\}})$ Reservation pairs

⇒ This projects $sname1$ attribute from (vi).

It means Names of sailors who have reserved atleast two boats.

Now attributes present are,

sname1

Final Query:-

Names of sailors who have reserved atleast two boats. (More than 1 boat).

5. $\Pi_{\text{sid}}(\sigma_{\text{age} > 20} \text{ Sailors}) - \Pi_{\text{sid}}(\sigma_{\text{color} = \text{'red'}} \text{ Boats})$ Δ
Reserved Δ Sailors

Ans:-

Query:- sid of sailors with age over 20,
who have not reserved a red boat.
Stepwise explanation:-

(i) $\sigma_{\text{age} > 20}$ Sailors

\Rightarrow Select all rows in Sailors in which age
of sailor is greater than 20.

Now attributes present are,

sid	sname	rating	age
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(ii) $\Pi_{\text{sid}}(\sigma_{\text{age} > 20} \text{ Sailors})$

\Rightarrow This projects sid attribute from (i).
It means sid of the sailors with

age over 20.

Now attributes present are,

sid

(iii) $\sigma_{\text{color} = \text{'red'}} \text{ Boats}$

\Rightarrow Select all rows in Boats in which color = 'red'.
It means select all rows associated with
red boats in Boats.

Now attributes present are,

bid	bname	color
-----	-------	-------

(iv) $\Pi_{\text{color}=\text{'red'}}(\text{Boats}) \bowtie \text{Reserves}$

⇒ This natural joins (iii) with Reserves by specifying equality on bid attribute. (common attribute).

It means details of red boats that are reserved.

Now attributes present are

bid	bname	color	sid	day
-----	-------	-------	-----	-----

(v) $\Pi_{\text{color}=\text{'red'}}(\text{Boats}) \bowtie \text{Reserves} \bowtie \text{Sailors}$

⇒ This natural joins (iv) with Sailors by specifying equality on sid attribute. (common attribute).

It means details of sailors who reserved a red boat. (with details about boat).

Now attributes present are,

bid	bname	color	sid	sname	rating	age	day
-----	-------	-------	-----	-------	--------	-----	-----

(vi) $\Pi_{\text{sid}}(\Pi_{\text{color}=\text{'red'}}(\text{Boats}) \bowtie \text{Reserves} \bowtie \text{Sailors})$

⇒ This projects sid attribute from (v).

It means sid of sailors who reserved a red boat.

Now attributes present are,

sid

(vii) $\pi_{sid}(\sigma_{age > 20} \text{ Sailors}) - \pi_{sid}(\sigma_{color = 'red'} \text{ Boats}) \bowtie \text{Reserves}$
 $\bowtie \text{Sailors}$

→ This is the set difference between (ii) and (vi).

It means the sid of sailors whose age is over 20 and did not reserve a red boat.

Here the set difference excludes the sailors ~~with~~ age over 20 and reserved with a red boat from the sailors with age over 20.

∴ It means the sid of sailors whose age is over 20, who have not reserved a red boat.

Final Query: sid of sailors with age

over 20, who have not reserved a red boat.