Giving a database schema:

* Sailors(sid: *integer*, sname: *string*, rating: *integer*, age:*real*)
* Boats(bid:*integer* , bname: *string*, color: *string*)
* Reserves(sid: *integer*, bid: *integer* , day: *date* )

|  |  |  |  |
| --- | --- | --- | --- |
| ***Sid*** | ***Sname*** | ***Rating*** | ***Age*** |
| 22 | Dustin | 7 | 45.0 |
| 29 | Brutus | 1 | 33.0 |
| 31 | Lubber | 8 | 55.5 |
| 32 | Andy | 8 | 25.5 |
| 58 | Rusty | 10 | 35.0 |
| 64 | Horatio | 7 | 35.0 |
| 71 | Zorba | 10 | 16.0 |
| 74 | Horatio | 9 | 35.0 |
| 85 | Art | 3 | 25.5 |
| 95 | Bob | 3 | 63.5 |

|  |  |  |
| --- | --- | --- |
| ***Sid*** | ***Bid*** | ***Day*** |
| 22 | 101 | 10/10/08 |
| 22 | 102 | 10/10/08 |
| 22 | 103 | 10/08/08 |
| 22 | 104 | 10/07/08 |
| 31 | 102 | 11/10/08 |
| 31 | 103 | 11/06/08 |
| 31 | 104 | 11/12/08 |
| 64 | 101 | 9/05/08 |
| 64 | 102 | 9/08/08 |
| 74 | 103 | 9/08/08 |

|  |  |  |
| --- | --- | --- |
| ***Bid*** | ***Bname*** | ***Color*** |
| 101 | Interlake | Blue |
| 102 | Interlake | Red |
| 103 | Clipper | Green |
| 104 | Marine | Red |

**Sailors**

**Reserves**

**Boats**

**Using relational algebra expression to answer below queries**

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

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (σ\_bid = 103(Reserves)))

1. ***Find the names of sailors who have reserved a red boat***

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_color = 'Red'(Boats))))

1. ***Find the colors of boats reserved by Lubber.***

π\_color(Boats ⨝ Boats.bid = Reserves.bid (Reserves ⨝ Reserves.sid = Sailors.sid (σ\_sname = 'Lubber'(Sailors))))

1. ***Find the names of sailors who have reserved at least one boat.***

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves))

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

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_color = 'Red' ∨ color = 'Green'(Boats))))

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

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_color = 'Red'(Boats))))

∩

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_color = 'Green'(Boats))))

1. ***Find the sids of sailors with age over 20 who have not reserved a red boat***

π\_sid(σ\_age > 20(Sailors)) − π\_sid(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_color = 'Red'(Boats))))

1. ***Find the names of sailors who have reserved all boats***

π\_sname(Sailors) − π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_bid NOT IN (π\_bid(Boats)))))

1. ***Find the names of sailors who have reserved all boats called Interlake***

π\_sname(Sailors) − π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (Reserves ⨝ Reserves.bid = Boats.bid (σ\_bname = 'Interlake'(Boats) ∧ bid NOT IN (π\_bid(Boats)))))

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

π\_sname(Sailors ⨝ Sailors.sid = Reserves.sid (γ\_sid; COUNT(bid) AS num\_reserves (Reserves) ⨝ num\_reserves ≥ 2))