CSI 2132 Lab #5

- Advanced SQL Queries

10 Feb 2020

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Outline

- Restore the database as it should be after done the queries of Lab 03
- Review advanced queries that involve:
- ➢ Join of Multiple Tables
- ➢ Group By and Having keywords
- ➢ Nested queries and IN keyword
- ➢ Aggregate functions
- ➢ GROUP BY and HAVING clauses
- ➢ NOT EXISTS keyword
- ➢ Using temporary tables in queries

Restore the Database

- Delete all the tables within “laboratories” schema
- Download from the course website the following file:

➢ EndLab03.backup

This file contains the backup of the database as it should be after done all the queries presented in Lab 03

- Restore the database (explained during previous lab).

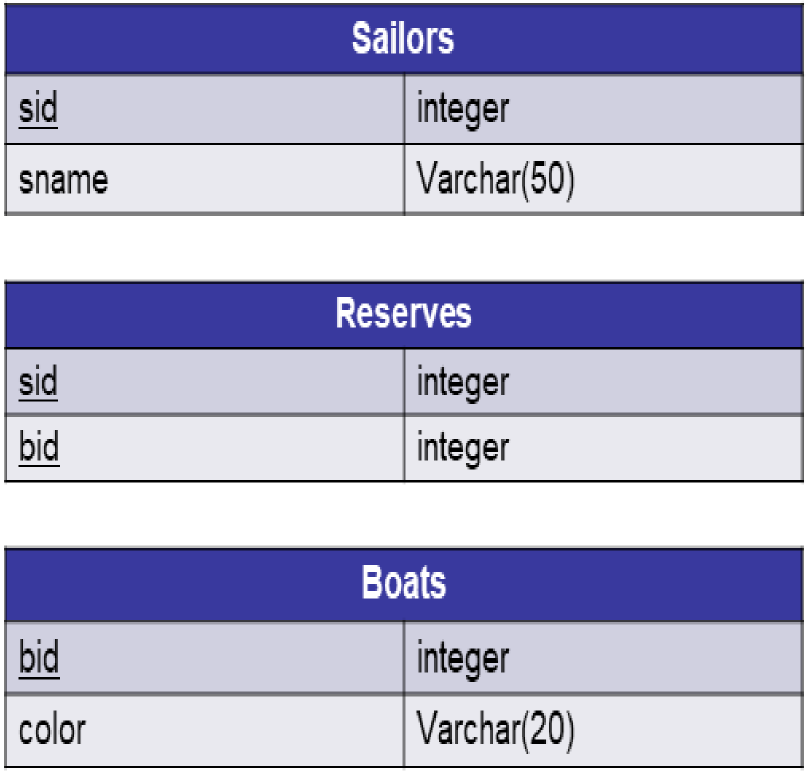
Write the SQL Queries for the following

- Note that these queries involve more than one table

1. List the names and customer ids of all customers who like Picasso

2. List the names of all customers who like Artists from the Cubism style and having an amount larger than 30000.

SAILORS Database PART A



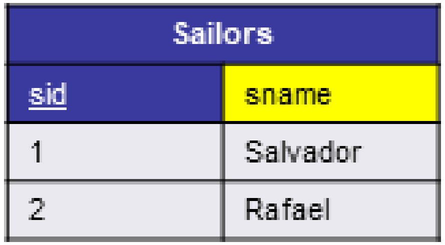
Sailors	
sid	integer
sname	Varchar(50)

Reserves	
sid	integer
bid	integer

Boats	
bid	integer
color	Varchar(20)

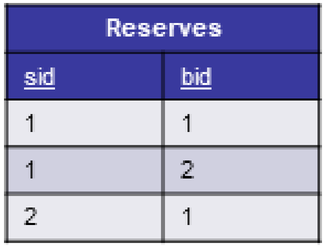
A nested Query using IN keyword in SAILORS DB

- Find the names of sailors who have reserved both a red and a green boat



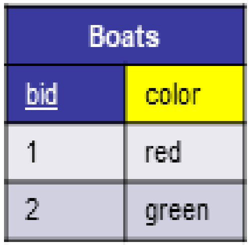
Sailors

sid	sname
1	Salvador
2	Rafael



Reserves

sid	bid
1	1
1	2
2	1

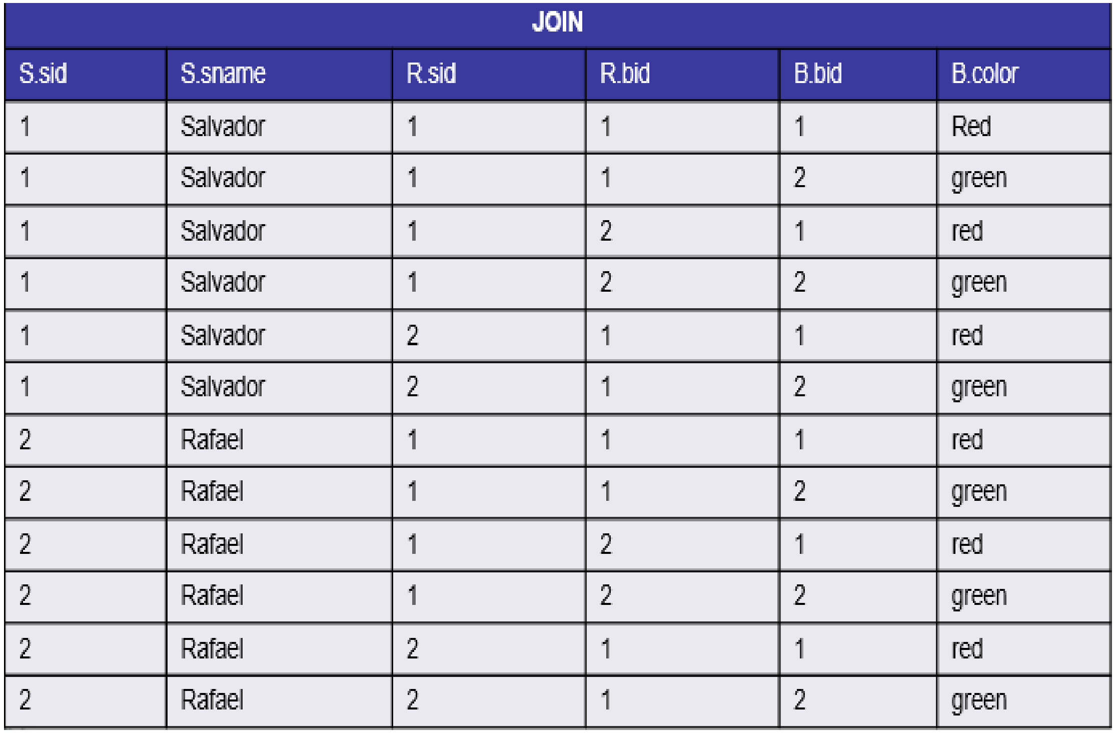


Boats

bid	color
1	red
2	green

```
SELECT * FROM Sailors S, Reserves R, Boats B
```

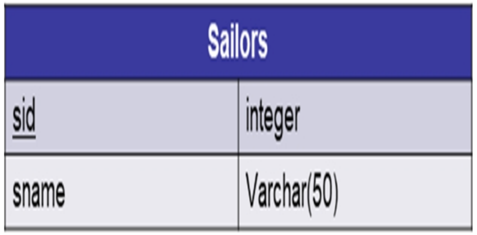
Output of above Query



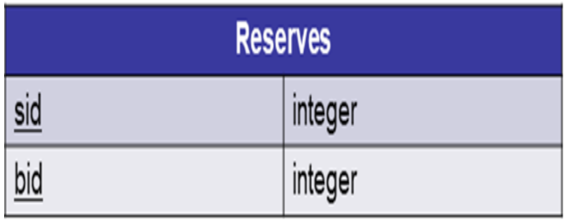
JOIN					
S.sid	S.sname	R.sid	R.bid	B.bid	B.color
1	Salvador	1	1	1	Red
1	Salvador	1	1	2	green
1	Salvador	1	2	1	red
1	Salvador	1	2	2	green
1	Salvador	2	1	1	red
1	Salvador	2	1	2	green
2	Rafael	1	1	1	red
2	Rafael	1	1	2	green
2	Rafael	1	2	1	red
2	Rafael	1	2	2	green
2	Rafael	2	1	1	red
2	Rafael	2	1	2	green

Using IN keyword in SAILORS DB

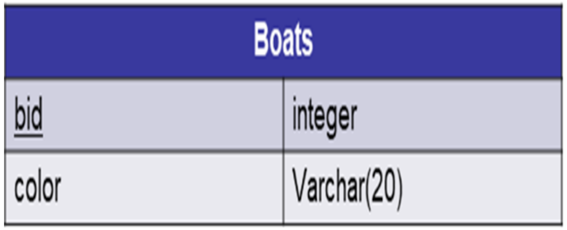
- Find the names of sailors who have reserved both a red and a green boat.



Sailors	
sid	integer
sname	Varchar(50)



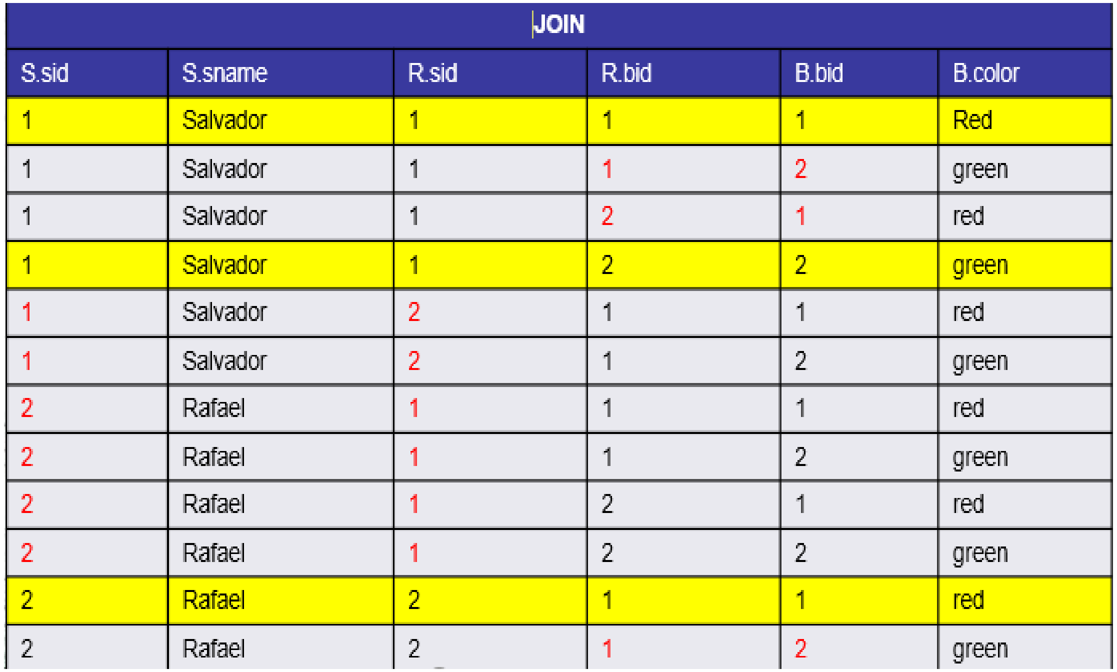
Reserves	
sid	integer
bid	integer



Boats	
bid	integer
color	Varchar(20)

SELECT * FROM Sailors S, Reserves R, Boats B WHERE S.sid = R.sid AND R.bid = B.bid;

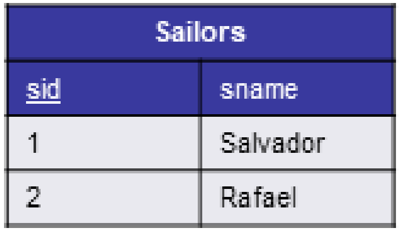
OUTPUT OF above Query



JOIN					
S.sid	S.sname	R.sid	R.bid	B.bid	B.color
1	Salvador	1	1	1	Red
1	Salvador	1	1	2	green
1	Salvador	1	2	1	red
1	Salvador	1	2	2	green
1	Salvador	2	1	1	red
1	Salvador	2	1	2	green
2	Rafael	1	1	1	red
2	Rafael	1	1	2	green
2	Rafael	1	2	1	red
2	Rafael	1	2	2	green
2	Rafael	2	1	1	red
2	Rafael	2	1	2	green

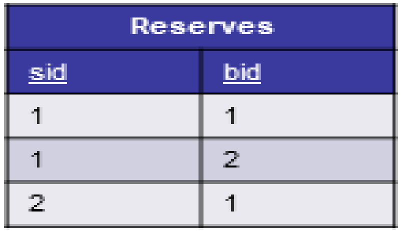
A nested Query using IN keyword in SAILORS Database

- Find the names of sailors who have reserved both a red and a green boat



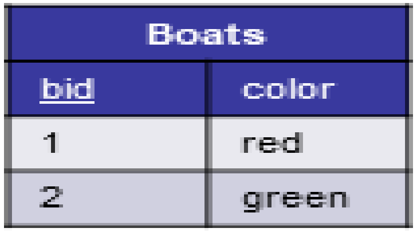
Sailors

sid	sname
1	Salvador
2	Rafael



Reserves

sid	bid
1	1
1	2
2	1

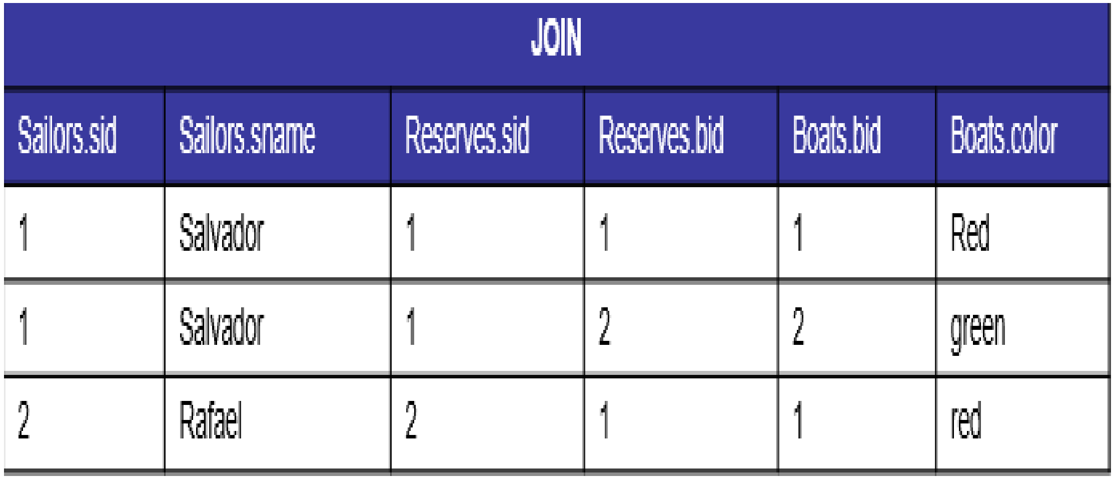


Boats

bid	color
1	red
2	green

SELECT * FROM Sailors, Reserves, Boats WHERE
Sailors.sid = Reserves.sid AND Reserves.bid =
Boats.bid AND….

Output of above Query



JOIN					
Sailors.sid	Sailors.sname	Reserves.sid	Reserves.bid	Boats.bid	Boats.color
1	Salvador	1	1	1	Red
1	Salvador	1	2	2	green
2	Rafael	2	1	1	red

Query using IN keyword in SAILORS DB

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

```
SELECT S.sname FROM Sailors S, Reserves R, Boats B
WHERE S.sid = R.sid AND R.bid = B.bid AND B.color = ‘red’  AND S.sid IN
(SELECT S2.sid FROM Sailors S2,Boats B2, Reserves R2  WHERE S2.sid =
R2.sid AND R2.bid = B2.bid AND  B2.color = ‘green’ );
```

Analysis of above Query

- The query between () will return the sailor IDs who have reserved a green boat.
- First three lines of the query will find sailors who reserved a red boat.
- Thus, in the 4th line, we will have the ID of a sailor who reserved a red boat, and check if this same sailor also reserved a green boat by IN keyword

Your turn

- Using our Artist database, find names of Customers who likes both an artist born in Malaga and an artist born in Florence.
- You need the data that we inserted in Lab2 and Lab3.
- Answer this question by writing a similar query that is described in previous slides.

SAILORS Database PART-B

Sailors	
sid	integer
sname	Varchar(50)
age	integer
rating	Varchar(20) {good,fair,poor}

Reserves	
sid	integer
bid	integer

Boats	
bid	integer
color	Varchar(20)

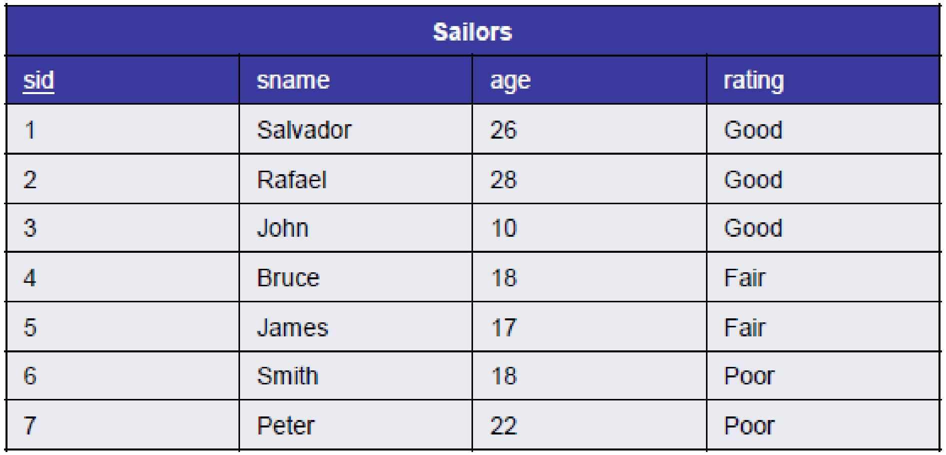
More on Select statements

- Remember (previous lab) the order and the syntax for GROUP BY and HAVING clauses

SELECT select-list FROM from-list WHERE record-qualification GROUP BY grouping-list HAVING group-qualification

A Query using aggregate function AVG, and GROUP BY and Having clauses in Sailors DB

- Find the average age of sailors who are at least 18 years old, for each rating level that has at least two such sailors.



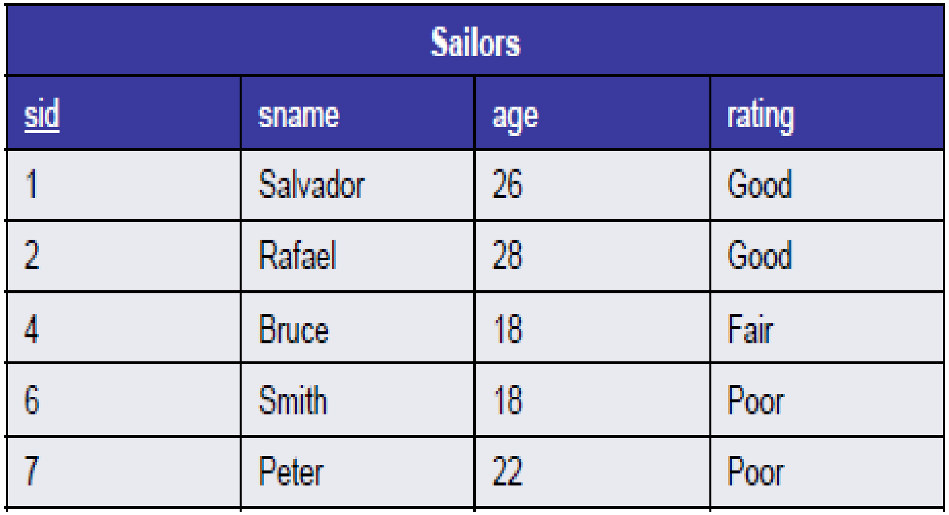
Sailors

sid	sname	age	rating
1	Salvador	26	Good
2	Rafael	28	Good
3	John	10	Good
4	Bruce	18	Fair
5	James	17	Fair
6	Smith	18	Poor
7	Peter	22	Poor

```
SELECT * FROM Sailors S
WHERE S.age >= 18
```

WHERE clause eliminates all the sailors whose age is lesser than 18.

Output of above Query

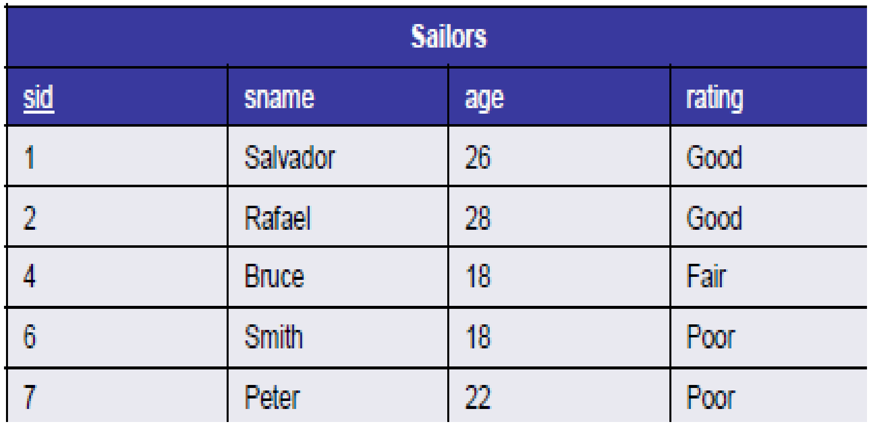


Sailors			
sid	sname	age	rating
1	Salvador	26	Good
2	Rafael	28	Good
4	Bruce	18	Fair
6	Smith	18	Poor
7	Peter	22	Poor

A Query using aggregate function AVG, and GROUP BY and Having clauses in Sailors DB

- Find the average age of sailors who are at least 18 years old, for each rating level that has at least two such sailors.

➢ SELECT S.rating, AVG(S.age) AS avgage, COUNT(*) numsailors FROM Sailors S WHERE S.age >= 18 GROUP BY S.rating

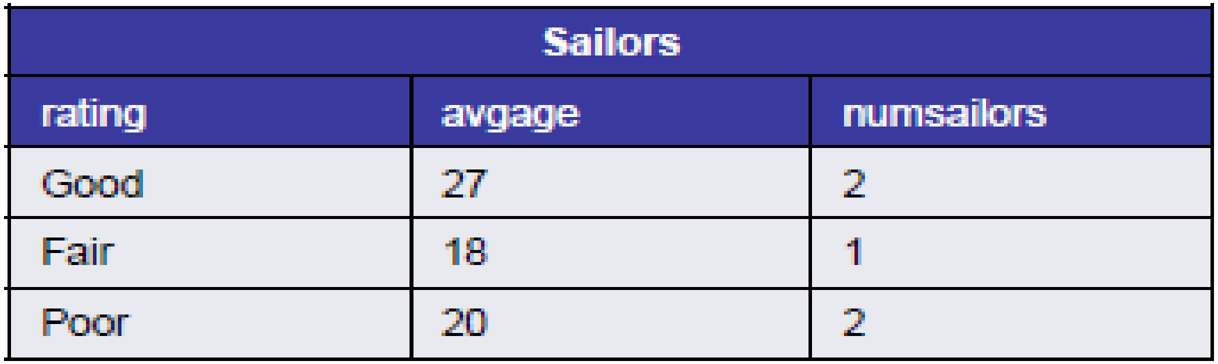


Sailors			
sid	sname	age	rating
1	Salvador	26	Good
2	Rafael	28	Good
4	Bruce	18	Fair
6	Smith	18	Poor
7	Peter	22	Poor

Output of above query

- The remaining rows will be grouped by their rating using GROUP BY clause and we also obtain the average age and the number of sailors in each group.

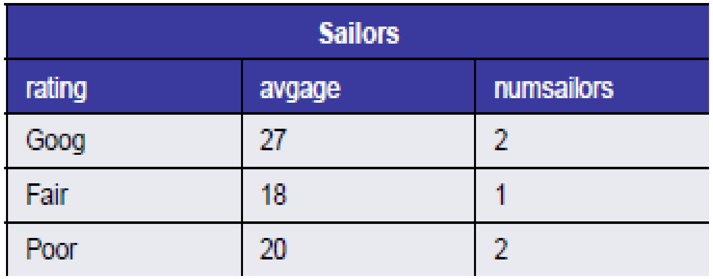
- Up to now, we have sailors who are older than 17 grouped by their rating.



Sailors		
rating	avgage	numsailors
Good	27	2
Fair	18	1
Poor	20	2

A Query using aggregate function AVG, and GROUP BY and Having clauses in Sailors DB

- Find the average age of sailors who are at least 18 years old, for each rating level that has at least two such sailors.

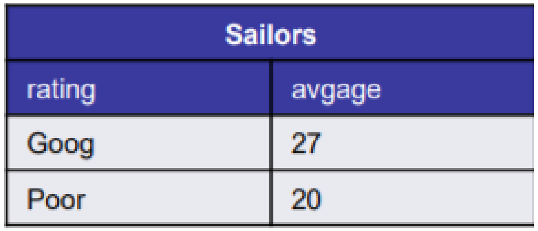


Sailors		
rating	avgage	numsailors
Goog	27	2
Fair	18	1
Poor	20	2

Solution

- SELECT S.rating, AVG(S.age) AS avgage FROM Sailors S WHERE S.age >= 18 GROUP BY S.rating HAVING COUNT(*) > 1

- HAVING clause allows us to specify a qualification (filter) for each group.
- COUNT(*) >1 in the HAVING clause eliminates all the rating groups which do not have at least two sailors.



Sailors	
rating	avgage
Goog	27
Poor	20

TIP: WHERE -> SELECT
HAVING -> GROUP BY

Another Query similar to previous one

Find the age of the youngest sailor with age > 18, for each rating level with at least 2 sailors (of any age)

- SELECT S.rating, MIN(S.age) AS minage FROM Sailors S WHERE S.age >= 18 GROUP BY S.rating HAVING (SELECT COUNT (*) FROM Sailors S2 WHERE S.rating=S2.rating) >= 2

- All clauses except HAVING clause are similar to the previous query

• This time, since group qualification is having 2 sailors of any age, we get the total number of rows for that rating group with the query inside HAVING clause, and check if this number is at least 2.

Your turn

- You need to insert following rows to Artwork table.

- ('Saints', 1470, 'Renaissance', 30000.00, 'Leonardo’)
- ('Hand of god', 1510, 'Renaissance', 52000.00, 'Michelangelo’)
- ('Murder', 1600, 'Baroque', 15000.00, 'Caravaggio’)
- ('Green', 1950, 'Modern', 5000.00, 'John’)

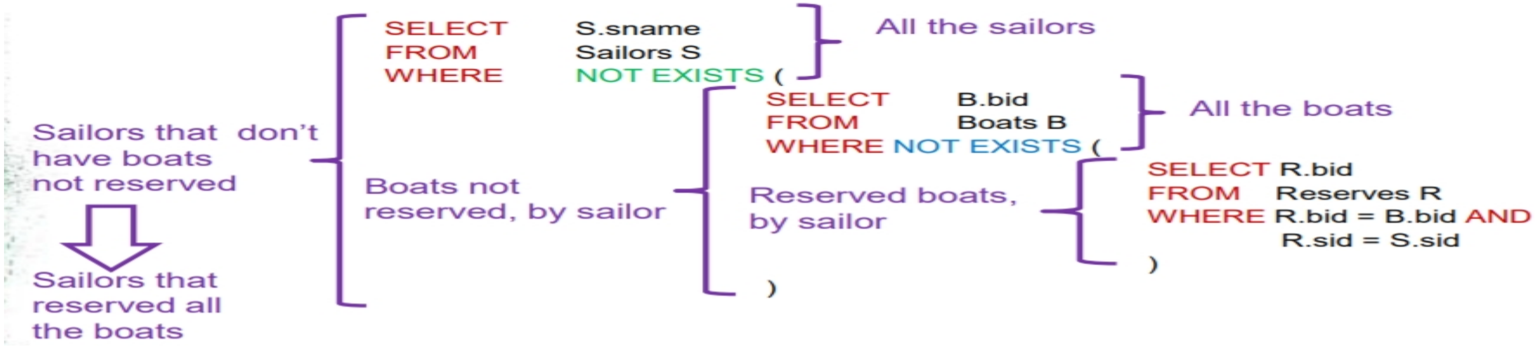
- Find the average price of artworks which are painted after 1490, for each artwork type that has at least two such artworks.
- And find the average price of artworks which are painted after 1490, for each artwork type that has at least two artworks (painted in any year)
- Write a query similar to what is described in previous slides to answer the question.

A nested Query using NOT Exists

- Find name of the sailors who reserved all the boats.

The intuition behind this query is:

- Find name of the sailors such that; there is no boat that he/she did not reserve.
- Logically equivalent to 'Find name of the sailors who reserved all the boats' .



```
SELECT      S.sname
FROM        Sailors S
WHERE       NOT EXISTS (
                SELECT      B.bid
                FROM        Boats B
                WHERE NOT EXISTS (
                    SELECT R.bid
                    FROM     Reserves R
                    WHERE R.bid = B.bid AND
                             R.sid = S.sid
                    )
                )
```

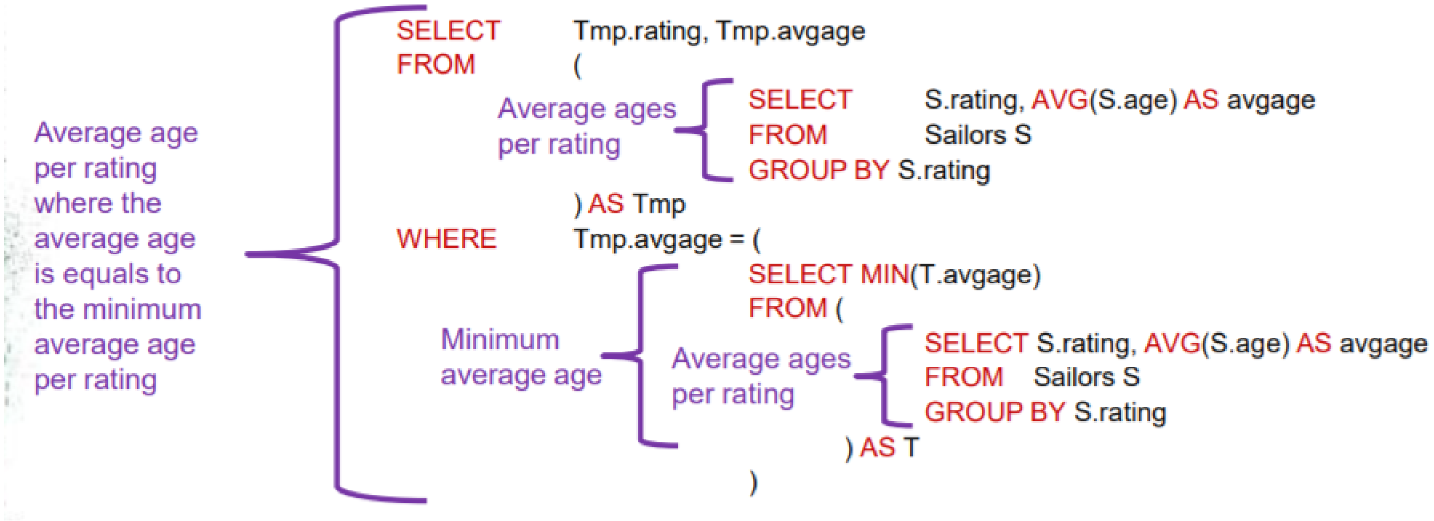
All the sailors
All the boats
Sailors that don't have boats not reserved
Sailors that reserved all the boats
Boats not reserved, by sailor
Reserved boats, by sailor

Your turn

- You need the following values inserted into LikeArtist table first.
- (2,'Caravaggio’)
- (2,'Hans Hofmann’)
- (2,'John’)
- (2,'Josefa’)
- (2,'Michelangelo’)
- Find names of customers who like all the artists. You can answer this query using what you have learned in previous slide.

Using Temporary tables in queries

- We can generate temporary tables and refer to their rows in our queries
- Find those ratings for which the average age is minimum over all ratings.



```
SELECT      Tmp.rating, Tmp.avgage
FROM        (
                 SELECT      S.rating, AVG(S.age) AS avgage
                 FROM        Sailors S
                 GROUP BY S.rating
            ) AS Tmp
WHERE       Tmp.avgage = (
                 SELECT MIN(T.avgage)
                 FROM (
                      SELECT S.rating, AVG(S.age) AS avgage
                      FROM    Sailors S
                      GROUP BY S.rating
                 ) AS T
            )
```

Average age per rating where the average age is equals to the minimum average age per rating
Average ages per rating
Minimum average age
Average ages per rating

Analysis of above Query

- Table Tmp and T will store average ages for all the ratings.

- Query in WHERE clause will return a single value, which is the minimum of all the average ages.

- WHERE clause selects the rows where avgage equals to minimum average age.

Your turn

- First, delete a row that we have inserted in previous lab

➢ DELETE FROM Artwork WHERE price = 4000.00;

- Find those painting types for which the average price is the minimum over all types.