CSI2132 Lab #4

Advanced SQL queries

Presented by: Rana Khalil, 5 Feb 2018

Outline

- 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 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.

Example: Sailors DB 1

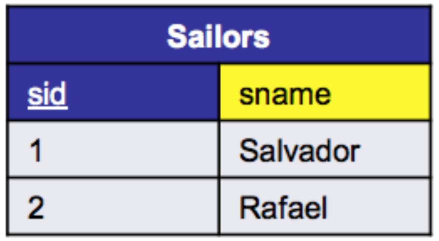
Sailors	
sid	integer
sname	Varchar(50)

Reserves	
sid	integer
bid	integer

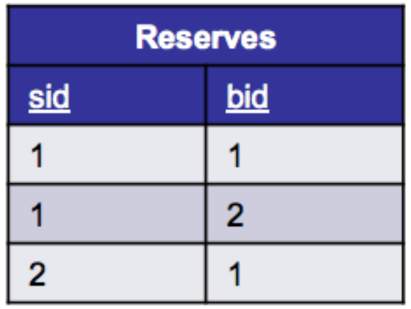
Boats	
bid	integer
color	Varchar(20)

A nested query using IN keyword in Sailors DB

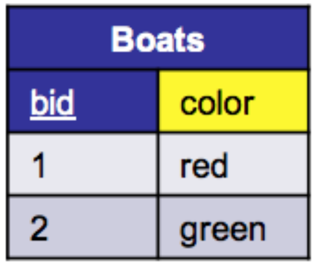
- Find the names of sailors who have reserved both a red and a green boat



Sailors	
sid	sname
1	Salvador
2	Rafael

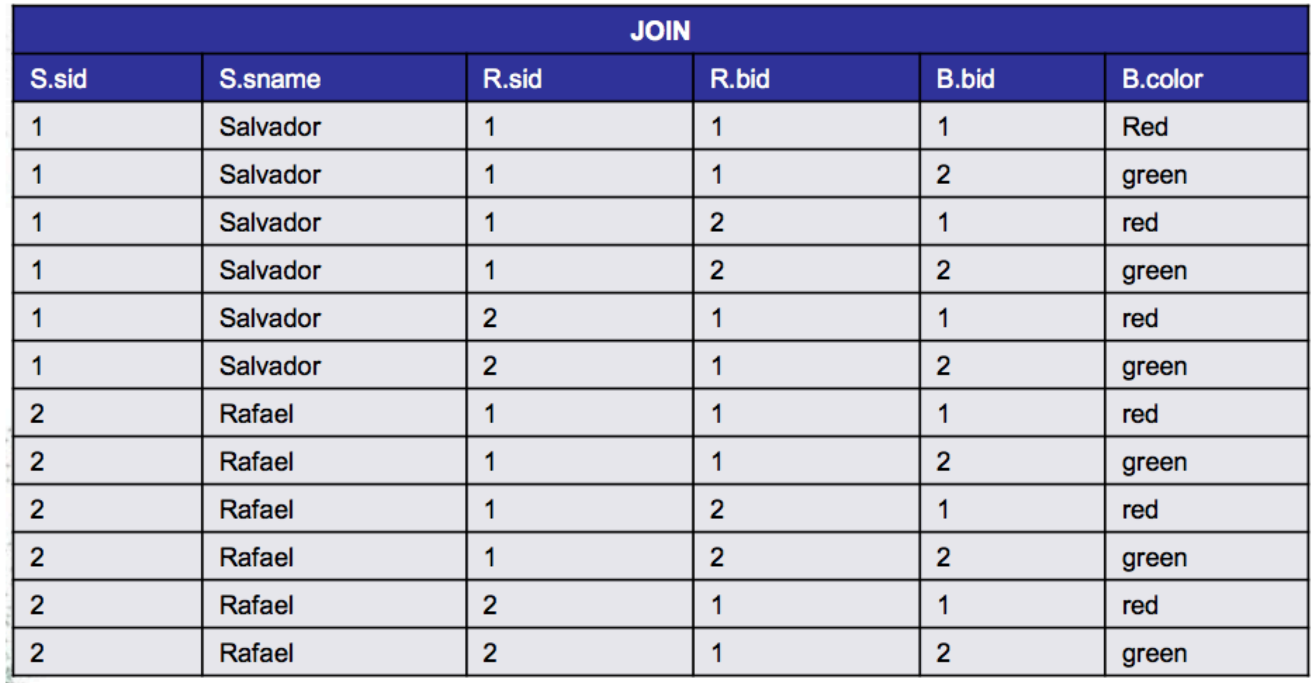


Reserves	
sid	bid
1	1
1	2
2	1



Boats	
bid	color
1	red
2	green

- Query: `SELECT * FROM Sailors S, Reserves R, Boats B`



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 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

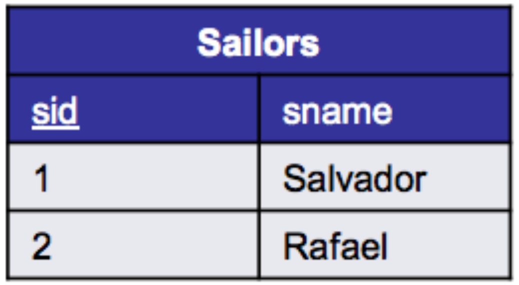
- Query:

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

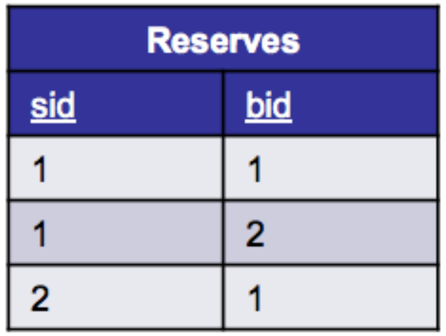
JOIN					
S.sid	S.sname	R.sid	R.bid	B.bid	B.color
1	Salvador	1	1	1	Red
1	Salvador	1	1	2	green
1	Salvador	1	2	1	red
1	Salvador	1	2	2	green
1	Salvador	2	1	1	red
1	Salvador	2	1	2	green
2	Rafael	1	1	1	red
2	Rafael	1	1	2	green
2	Rafael	1	2	1	red
2	Rafael	1	2	2	green
2	Rafael	2	1	1	red
2	Rafael	2	1	2	green

A nested query using IN keyword in Sailors DB

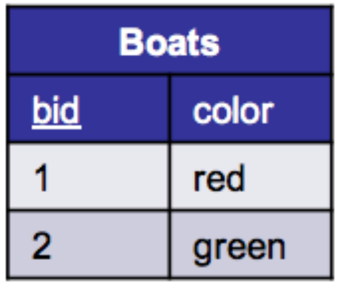
- Find the names of sailors who have reserved both a red and a green boat.



Sailors	
sid	sname
1	Salvador
2	Rafael



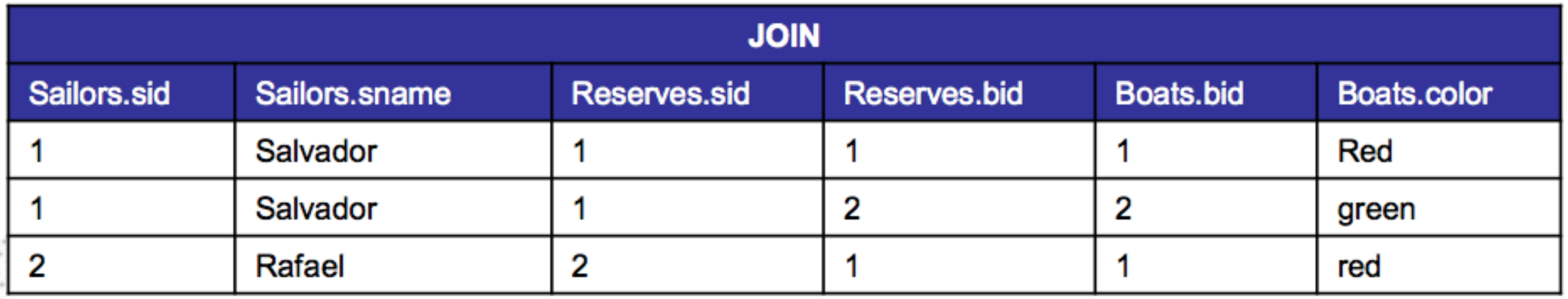
Reserves	
sid	bid
1	1
1	2
2	1



Boats	
bid	color
1	red
2	green

- Query: `SELECT * FROM Sailors S, Reserves R, Boats B`

```
WHERE S.sid = R.sid AND R.bid = B.bid
AND ……
```



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

A nested 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’ );
```

- 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

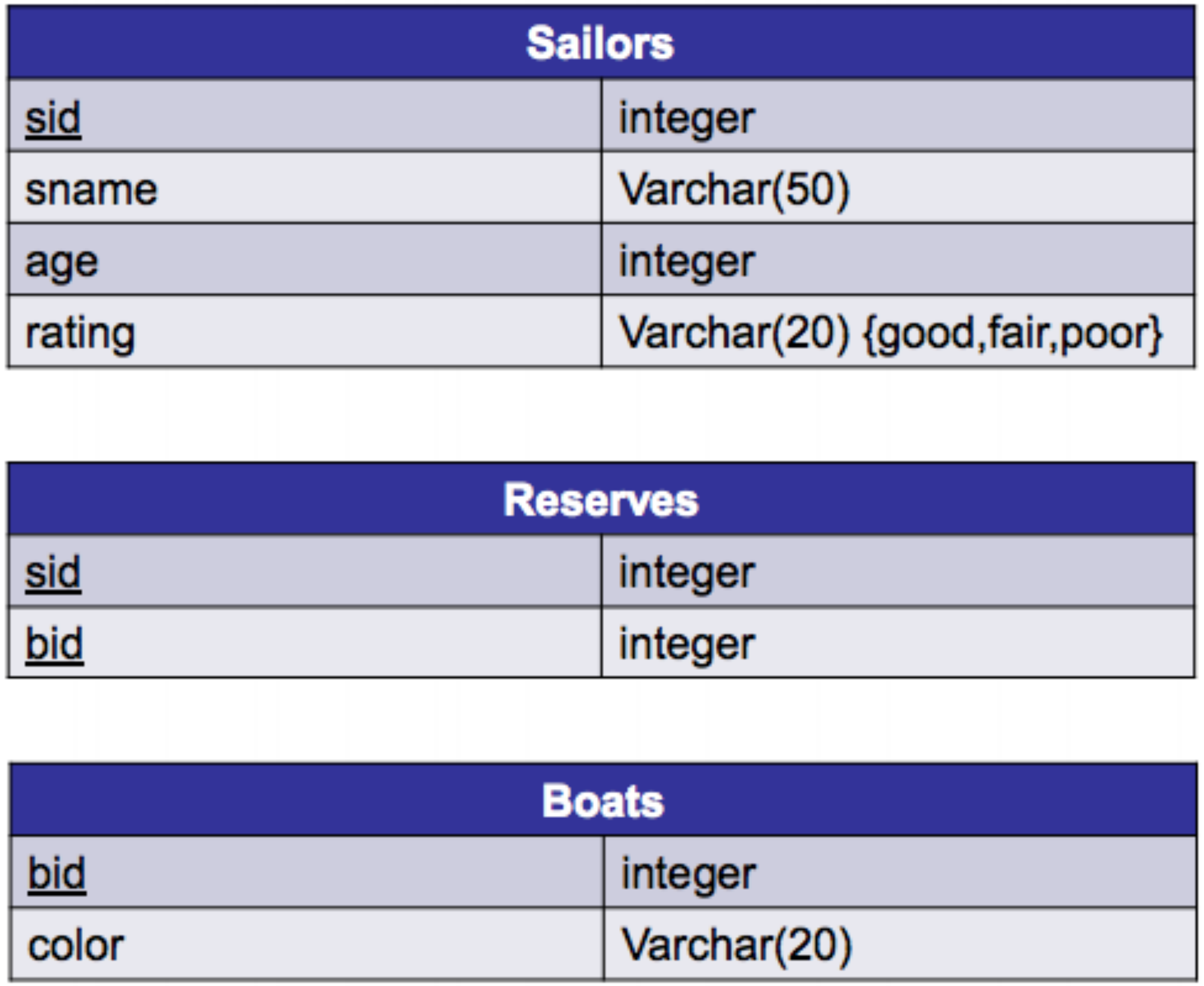
You need the data that we inserted in Lab2 and Lab3. Answer this question by writing a similar query that is described in previous slide.

- Using our Artist database, find names of Customers who likes both an artist born in Malaga and an artist born in Florence.

Load Sailor DB SQL

- Download the Sailor.sql file from virtual campus
- Create a schema “sailor” as part of your DB using pgadmin
- Open pgadmin query tool and load sailor.sql and execute it.

Sailors DB (2)



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

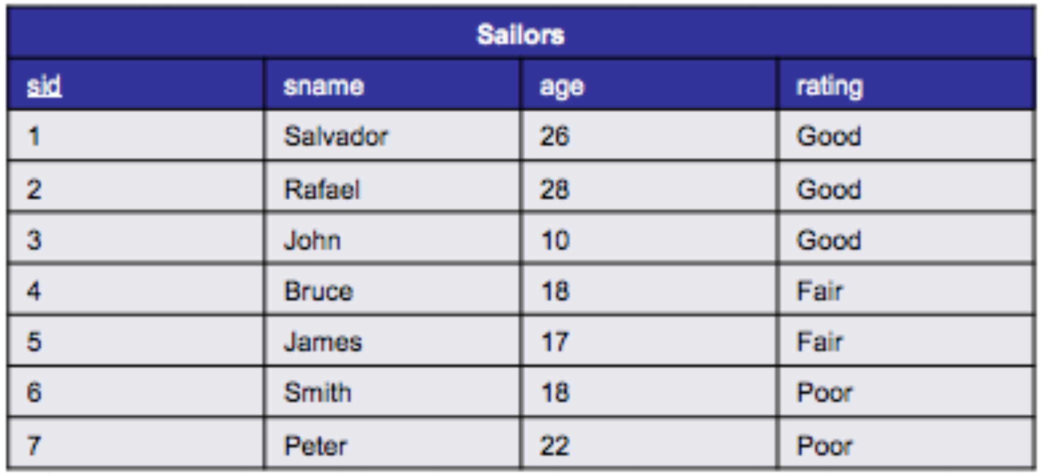
```
SELECT <attribute-list>
FROM <table-list>
WHERE <record-qualification>
GROUP BY <grouping-list>
HAVING <group-qualification>
```

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.
- Run the query

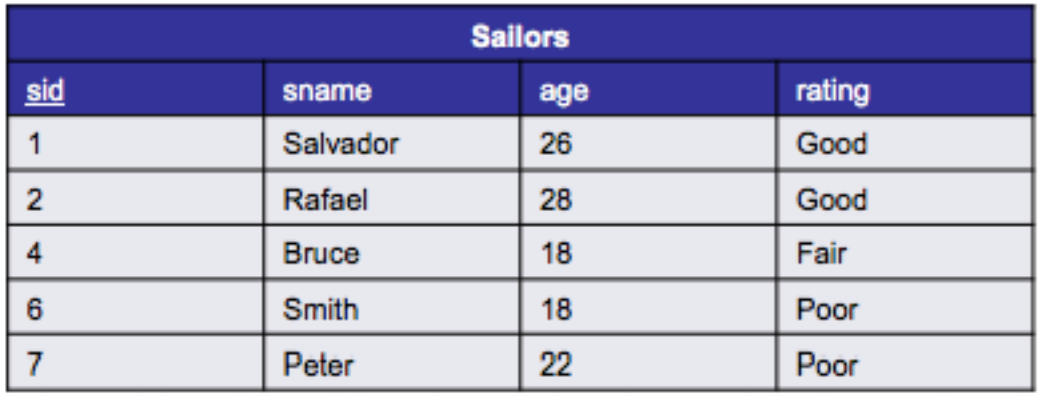
```
SELECT *
FROM Sailors S
WHERE S.age >= 18
```

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



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



Sailors

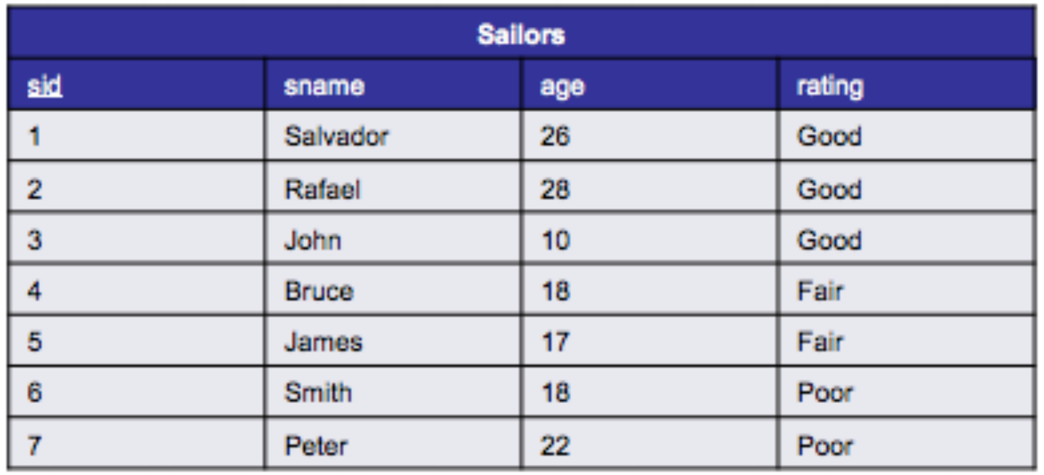
sid	sname	age	rating
1	Salvador	26	Good
2	Rafael	28	Good
4	Bruce	18	Fair
6	Smith	18	Poor
7	Peter	22	Poor

A query using aggregate function AVG, and GROUP BY and HAVING clauses in Sailors DB

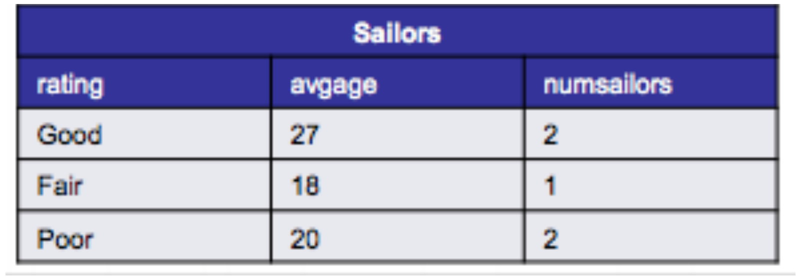
- Find the average age of sailors who are at least 18 years old, for each rating level that has at least two such sailors.
- Run the query

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

- 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			
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



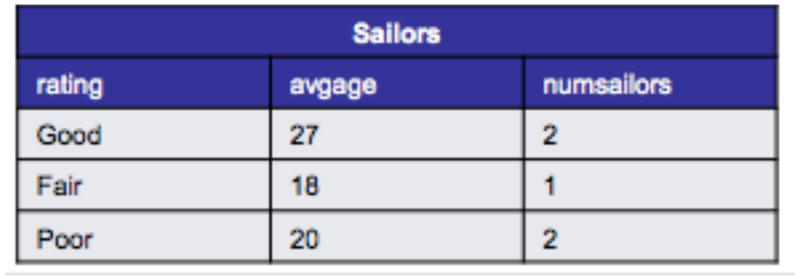
Sailors		
rating	avgage	numsailors
Good	27	2
Fair	18	1
Poor	20	2

A query using aggregate function AVG, and GROUP BY and HAVING clauses in Sailors DB

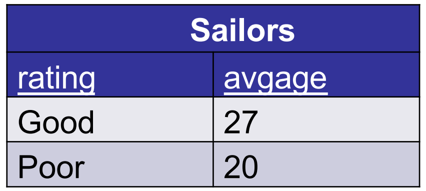
- Find the average age of sailors who are at least 18 years old, for each rating level that has at least two such sailors.
- Run the query

```
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.
- TIP: WHERE --> SELECT
  HAVING --> GROUP BY



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



Sailors	
rating	avgage
Good	27
Poor	20

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

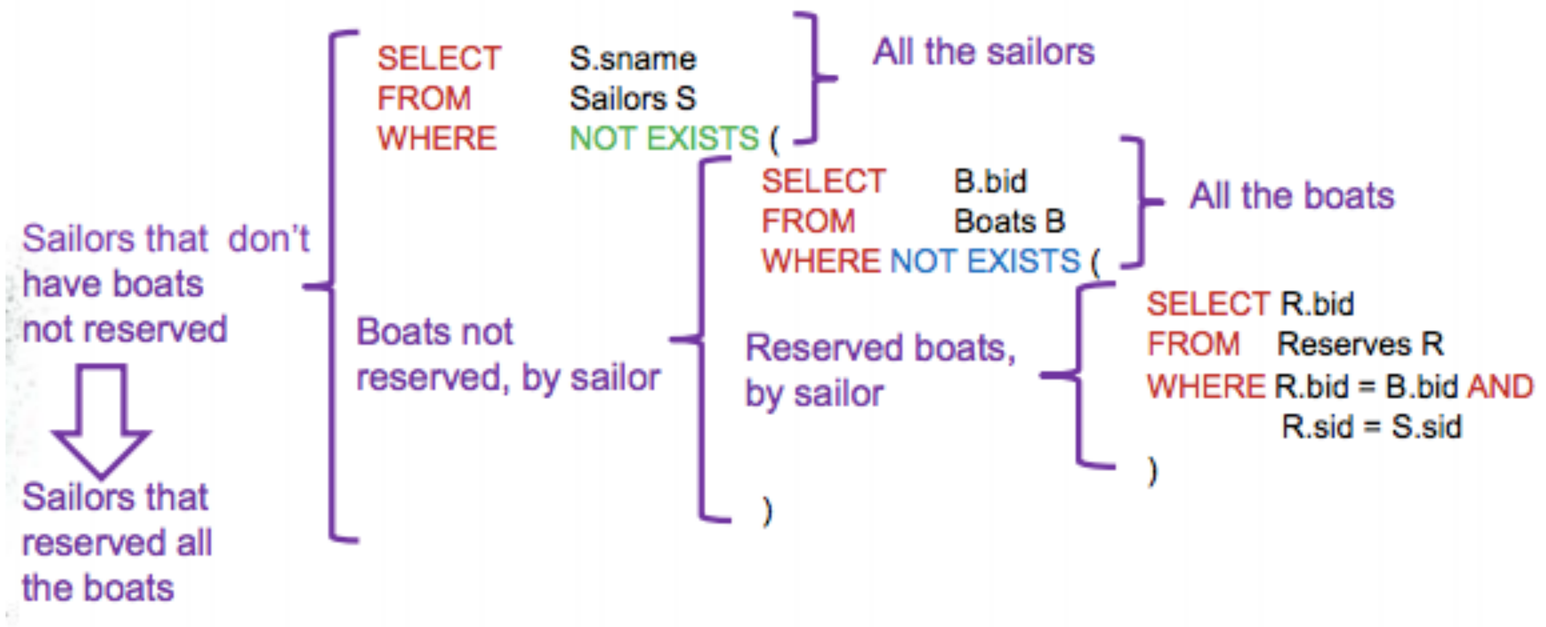
- You need to insert following rows to Artwork table.
  - ('Saints', 1470, 'Renaissance', 30000.00, 'Leonardo')
  - ('Hand of god', 1510, 'Renaissance', 52000.00, 'Michelangelo')
  - ('Murder', 1600, 'Baroque', 15000.00, 'Caravaggio')
  - ('Green', 1950, 'Modern', 5000.00, 'John')

Write queries similar to what is described in previous slides to answer the question

- 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).

A nested query using NOT EXISTS

- 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

- 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' .

Your turn

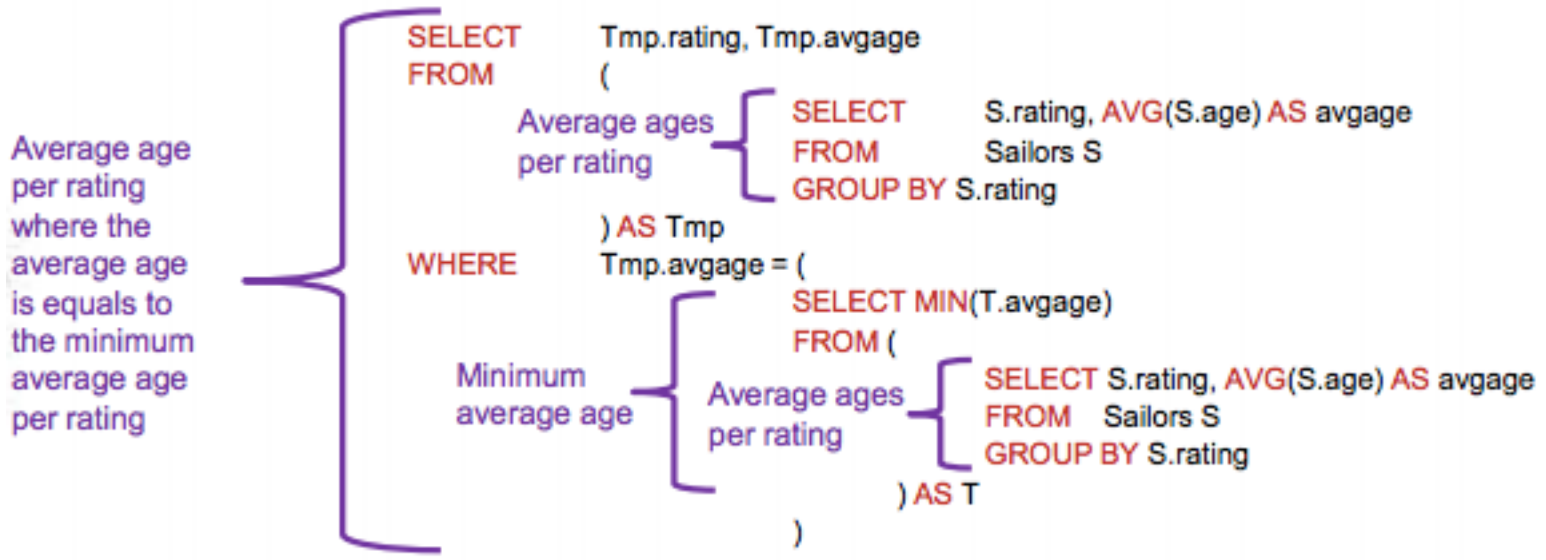
You need the following values inserted into LikeArtist table first.

- ➢(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

- 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.

End of lab

- If the time was not enough, please complete today’s lab before next lab, since we might use the data that we have created in this lab.