CS245: Databases
SQL

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Reading Data From Tables

- Set/Bag operations
  - Union of two tables
  - Intersection between two tables
  - Difference of two tables
  - Cross product of two tables
  - Joining two tables

- Join
  - Natural join
  - Inner join (theta join)
  - Left outer join
  - Right outer join
  - Full outer join

- Duplicate rows cause problems when used IN predicate
- We will provide two to three alternate ways of implementing Intersect, Difference
- The implementation will be discussed after we go through (1) join operator (2) nested queries and (3) querying on the go method

Reading Data From Tables

- Set/Bag operations
  - Union of two tables
  - Intersection between two tables
  - Difference of two tables
  - Cross product of two tables
  - Joining two tables

- Join
  - Natural join
  - Inner join (theta join)
  - Left outer join
  - Right outer join
  - Full outer join
  - Re-naming
  - Creating tables using queries
  - Having clause
  - Using all clauses of SELECT
  - Nested queries
  - Querying tables on go
  - Correlated nested queries
  - Examples

Cartesian (Cross) product

Definition

A × B = { (a, b) | $a \in A$ **AND** $b \in B$}

Example

Table R_1	
A	B
1	2
3	4

Table S_1		
B	C	D
2	5	6
4	7	8
9	10	11

Table $R_1 \times S_1$				
R_1.A	R_1.B	S_1.B	S_1.C	S_1.D
1	2	2	5	6
1	2	4	7	8
1	2	9	10	11
3	4	2	5	6
3	4	4	7	8
3	4	9	10	11

Example Database

Sailors			
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

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Boats		
bid	bname	color
101	Interlake	blue
102	Interlanke	red
103	Clipper	green
104	Marine	red

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019

Sailors			
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
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Reserves		
sid	bid	day
22	101	10-Oct-2019
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22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019

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Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019

Sailors			
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
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sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
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31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019

Sailors			
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
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sid	bid	day
22	101	10-Oct-2019
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22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
22	Dustin	7	45.0	31	102	10-Nov-2019

Sailors			
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
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Reserves		
sid	bid	day
22	101	10-Oct-2019
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22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019

Sailors

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
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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019

Sailors

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
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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019

Sailors

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
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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019

Sailors			
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
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71	Zorba	10	16.0
74	Horatio	9	35.0
85	Art	3	25.5
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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019

Sailors			
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
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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019

Sailors

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
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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019

Sailors			
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
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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019

Sailors			
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
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85	Art	3	25.5
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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019

Sailors			
sid	sname	rating	age
22	Dustin	7	45.0
29	Brutus	1	33.0
31	Lubber	8	55.5
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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019
29	Brutus	1	33.0	31	102	10-Nov-2019

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22	Dustin	7	45.0
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sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
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64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019

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22	Dustin	7	45.0
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sid	bid	day
22	101	10-Oct-2019
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22	104	07-Oct-2019
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64	101	05-Sep-2019
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SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019

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31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019

	Sailors		
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

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	Reserves	
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	08-Sep-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
29	Brutus	1	33.0	22	101	10-Oct-2019
29	Brutus	1	33.0	22	102	10-Oct-2019
29	Brutus	1	33.0	22	103	08-Oct-2019
29	Brutus	1	33.0	22	104	07-Oct-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	08-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019

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Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves					
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
31	Lubber	8	55.5	64	101	05-Sep-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
31	Lubber	8	55.5	22	101	10-Oct-2019
31	Lubber	8	55.5	22	102	10-Oct-2019
31	Lubber	8	55.5	22	103	08-Oct-2019
31	Lubber	8	55.5	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019

Sailors			
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

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Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019
95	Bob	3	63.5	31	102	10-Nov-2019

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019
95	Bob	3	63.5	31	102	10-Nov-2019
95	Bob	3	63.5	31	103	06-Nov-2019

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019
95	Bob	3	63.5	31	102	10-Nov-2019
95	Bob	3	63.5	31	103	06-Nov-2019
95	Bob	3	63.5	31	104	12-Nov-2019

Sailors

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

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Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019
95	Bob	3	63.5	31	102	10-Nov-2019
95	Bob	3	63.5	31	103	06-Nov-2019
95	Bob	3	63.5	31	104	12-Nov-2019
95	Bob	3	63.5	64	101	05-Sep-2019

Sailors			
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

×

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves						
sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019
95	Bob	3	63.5	31	102	10-Nov-2019
95	Bob	3	63.5	31	103	06-Nov-2019
95	Bob	3	63.5	31	104	12-Nov-2019
95	Bob	3	63.5	64	101	05-Sep-2019
95	Bob	3	63.5	64	102	08-Sep-2019

Sailors

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

×

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors CROSS JOIN Reserves

sid	sname	rating	age	sid	bid	day
95	Bob	3	63.5	22	101	10-Oct-2019
95	Bob	3	63.5	22	102	10-Oct-2019
95	Bob	3	63.5	22	103	08-Oct-2019
95	Bob	3	63.5	22	104	07-Oct-2019
95	Bob	3	63.5	31	102	10-Nov-2019
95	Bob	3	63.5	31	103	06-Nov-2019
95	Bob	3	63.5	31	104	12-Nov-2019
95	Bob	3	63.5	64	101	05-Sep-2019
95	Bob	3	63.5	64	102	08-Sep-2019
95	Bob	3	63.5	74	103	08-Sep-2019

Sailors			
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

NATURAL JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019

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Sailors

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

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

NATURAL JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors NATURAL JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019

Sailors			
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

NATURAL JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019

Sailors			
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

NATURAL JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019

Sailors

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

NATURAL JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019

Sailors			
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

NATURAL JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019

Sailors

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

NATURAL JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019

Sailors			
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

NATURAL JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
64	Horatio	7	35.0	64	101	05-Sep-2019

Sailors

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

NATURAL JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019

Sailors			
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

NATURAL JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors NATURAL JOIN Reserves						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019
74	Horatio	9	35.0	74	103	08-Sep-2019

Natural Join

- Join condition is implicit
- Join condition is on attributes whose name is identical
- Attributes are always joined by equality condition

Theta Join

- Specify the condition on which on row from each table to be joined by using ON clause
- Specify filtering condition by using WHERE clause

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019

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Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019

Sailors			
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

JOIN ON Sailors.sid < Reserves.sid

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019
32	Andy	8	25.5	74	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019
32	Andy	8	25.5	74	103	08-Sep-2019
58	Rusty	10	35.0	64	101	05-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019
32	Andy	8	25.5	74	103	08-Sep-2019
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	102	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019
32	Andy	8	25.5	74	103	08-Sep-2019
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	102	08-Sep-2019
58	Rusty	10	35.0	74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019
32	Andy	8	25.5	74	103	08-Sep-2019
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	102	08-Sep-2019
58	Rusty	10	35.0	74	103	08-Sep-2019
64	Horatio	7	35.0	74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition)

Sailors

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

JOIN ON Sailors.sid < Reserves.sid

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	31	102	10-Nov-2019
22	Dustin	7	45.0	31	103	06-Nov-2019
22	Dustin	7	45.0	31	104	12-Nov-2019
22	Dustin	7	45.0	64	101	05-Sep-2019
22	Dustin	7	45.0	64	102	08-Sep-2019
22	Dustin	7	45.0	74	103	08-Sep-2019
29	Brutus	1	33.0	31	102	10-Nov-2019
29	Brutus	1	33.0	31	103	06-Nov-2019
29	Brutus	1	33.0	31	104	12-Nov-2019
29	Brutus	1	33.0	64	101	05-Sep-2019
29	Brutus	1	33.0	64	102	09-Sep-2019
29	Brutus	1	33.0	74	103	08-Sep-2019
31	Lubber	8	55.5	64	101	05-Sep-2019
31	Lubber	8	55.5	64	102	08-Sep-2019
31	Lubber	8	55.5	74	103	08-Sep-2019
32	Andy	8	25.5	64	101	05-Sep-2019
32	Andy	8	25.5	64	102	08-Sep-2019
32	Andy	8	25.5	74	103	08-Sep-2019
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	102	08-Sep-2019
58	Rusty	10	35.0	74	103	08-Sep-2019
64	Horatio	7	35.0	74	103	08-Sep-2019
71	Zobra	10	16.0	74	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid where Sailros.rating ≥ 9

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition) where clause is Sailors.rating ≥ 9

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
58	Rusty	10	35.0	64	101	05-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid where Sailros.rating ≥ 9

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition) where clause is Sailors.rating ≥ 9

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves

sid	sname	rating	age	sid	bid	day
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid where Sailros.rating ≥ 9

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition) where clause is Sailors.rating ≥ 9

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves						
where Sailors.rating ≥ 9						
sid	sname	rating	age	sid	bid	day
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	103	08-Sep-2019
58	Rusty	10	35.0	74	103	08-Sep-2019

Sailors

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

JOIN ON Sailors.sid < Reserves.sid where Sailros.rating $\geq$ 9

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid < Reserves.sid (join on specified condition) where clause is Sailors.rating $\geq$ 9

SELECT * FROM Sailors JOIN Reserves ON Sailors.sid < Reserves where Sailors.rating $\geq$ 9

sid	sname	rating	age	sid	bid	day
58	Rusty	10	35.0	64	101	05-Sep-2019
58	Rusty	10	35.0	64	103	08-Sep-2019
58	Rusty	10	35.0	74	103	08-Sep-2019
71	Zobra	10	16.0	74	103	08-Sep-2019

(Left/Right) Outer Join

Outer join

Definition: In addition to the Natural join, add any dangling tuples from R or S.
Dangling tuples: The tuples that did not meet the Natural join criteria

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019

Sailors			
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

LEFT OUTER JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	$\bot$	$\bot$	$\bot$
31	Lubber	8	55.5	31	102	10-Nov-2019

Sailors			
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

LEFT OUTER JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid						
sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	$\perp$	$\perp$	$\perp$
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019

Sailors			
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

LEFT OUTER JOIN

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves
ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥
64	Horatio	7	35.0	64	101	05-Sep-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019
71	Zorba	10	16.0	⊥	⊥	⊥

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019
71	Zorba	10	16.0	⊥	⊥	⊥
74	Horatio	9	35.0	74	103	08-Sep-2019

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019
71	Zorba	10	16.0	⊥	⊥	⊥
74	Horatio	9	35.0	74	103	08-Sep-2019
85	Art	3	25.5	⊥	⊥	⊥

Sailors

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

LEFT OUTER JOIN

Reserves

sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Join condition: Sailors.sid = Reserves.sid (join identical column names from both tables)

SELECT * FROM Sailors LEFT OUTER JOIN Reserves ON Sailors.sid = Reserves.sid

sid	sname	rating	age	sid	bid	day
22	Dustin	7	45.0	22	101	10-Oct-2019
22	Dustin	7	45.0	22	102	10-Oct-2019
22	Dustin	7	45.0	22	103	08-Oct-2019
22	Dustin	7	45.0	22	104	07-Oct-2019
29	Brutus	1	33.0	⊥	⊥	⊥
31	Lubber	8	55.5	31	102	10-Nov-2019
31	Lubber	8	55.5	31	103	06-Nov-2019
31	Lubber	8	55.5	31	104	12-Nov-2019
32	Andy	8	25.5	⊥	⊥	⊥
58	Rusty	10	35.0	⊥	⊥	⊥
64	Horatio	7	35.0	64	101	05-Sep-2019
64	Horatio	7	35.0	64	102	08-Sep-2019
71	Zorba	10	16.0	⊥	⊥	⊥
74	Horatio	9	35.0	74	103	08-Sep-2019
85	Art	3	25.5	⊥	⊥	⊥
95	Bob	3	63.5	⊥	⊥	⊥

Left Outer Join

Left Outer Join - Example

	U	
A	B	C
1	2	3
4	5	6
7	8	9

LEFT OUTER JOIN

	V	
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U LEFT OUTER JOIN V					
A	B	C	B	C	D
1	2	3	2	3	10

Left Outer Join

Left Outer Join - Example

	U	
A	B	C
1	2	3
4	5	6
7	8	9

LEFT OUTER JOIN

	V	
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U LEFT OUTER JOIN V

A	B	C	B	C	D
1	2	3	2	3	10
1	2	3	2	3	11

Left Outer Join - Example

U		
A	B	C
1	2	3
4	5	6
7	8	9

LEFT OUTER JOIN

V		
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U LEFT OUTER JOIN V					
A	B	C	B	C	D
1	2	3	2	3	10
1	2	3	2	3	11
4	5	6	⊥	⊥	⊥

Left Outer Join - Example

	U	
A	B	C
1	2	3
4	5	6
7	8	9

LEFT OUTER JOIN

	V	
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U LEFT OUTER JOIN V

A	B	C	B	C	D
1	2	3	2	3	10
1	2	3	2	3	11
4	5	6	⊥	⊥	⊥
7	8	9	⊥	⊥	⊥

Right Outer Join - Example

U		
A	B	C
1	2	3
4	5	6
7	8	9

RIGHT OUTER JOIN

V		
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U RIGHT OUTER JOIN V

A	B	C	B	C	D
1	2	3	2	3	10

Right Outer Join - Example

U		
A	B	C
1	2	3
4	5	6
7	8	9

RIGHT OUTER JOIN

V		
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U RIGHT OUTER JOIN V					
A	B	C	B	C	D
1	2	3	2	3	10
1	2	3	2	3	11

Right Outer Join

Right Outer Join - Example

	U	
A	B	C
1	2	3
4	5	6
7	8	9

RIGHT OUTER JOIN

	V	
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U RIGHT OUTER JOIN V					
A	B	C	B	C	D
1	2	3	2	3	10
1	2	3	2	3	11
⊥	⊥	⊥	6	7	12

Full outer join

TableA left outer join TableB
$\cup$
TableA right outer join TableB

FULL Outer Join

FULL Outer Join - Example (Not in MySQL)

	U	
A	B	C
1	2	3
4	5	6
7	8	9

FULL OUTER JOIN

	V	
B	C	D
2	3	10
2	3	11
6	7	12

SELECT * FROM U LEFT OUTER JOIN V					
A	B	C	B	C	D
1	2	3	2	3	10
1	2	3	2	3	11
4	5	6	$\perp$	$\perp$	$\perp$
7	8	9	$\perp$	$\perp$	$\perp$
$\perp$	$\perp$	$\perp$	6	7	12

Re-naming

Example - 01

table		table2	
A	B	B	D
1	2	2	3
1	2	4	5
		4	5

New Table			
A1	B1	B2	D1
1	2	2	3
1	2	2	3

SELECT   A **AS** A1, table1.B **AS** B1,
          table2.B **AS** B2, D **AS** D1
FROM   table1
JOIN   table2
ON   table1.B = table2.B
WHERE   table1.A < table2.D;

Create Table

Create a table out of select query

table		table2	
A	B	B	D
1	2	2	3
1	2	4	5
		4	5

Result			
A1	B1	B2	D1
1	2	2	3
1	2	2	3

```
CREATE TABLE Result (
        SELECT   A AS A1, table1.B AS B1,
                 table2.B AS B2, D AS D1
        FROM     table1
        JOIN     table2
        ON       table1.B = table2.B
        WHERE    table1.A < table2.D);
```

Group by rating such that each group has at least two sailors

SELECT *
FROM Sailors
GROUP BY rating
HAVING COUNT(rating) > 1;

Output

Sailors			
sid	sname	rating	age
22	Dustin	7	45.0
64	Horatio	7	35.0
29	Brutus	1	33.0
31	Lubber	8	55.5
32	Andy	8	25.5
58	Rusty	10	35.0
71	Zorba	10	16.0
74	Horatio	9	35.0
85	Art	3	25.5
95	Bob	3	63.5

$\gamma_{rating}(Sailors)$			
sid	sname	rating	age
22	Dustin	7	45.0
31	Lubber	8	55.5
58	Rusty	10	35.0
85	Art	3	25.5

Group by rating such that each group has at least two sailors where sailor age ≥ 30

```
SELECT      *
FROM        Sailors
WHERE       age >= 30
GROUP BY    rating
HAVING COUNT( rating ) > 1;
```

Output

Sailors			
sid	sname	rating	age
22	Dustin	7	45.0
64	Horatio	7	35.0
29	Brutus	1	33.0
31	Lubber	8	55.5
32	Andy	8	25.5
58	Rusty	10	35.0
71	Zorba	10	16.0
74	Horatio	9	35.0
85	Art	3	25.5
95	Bob	3	63.5

$\gamma_{rating}(Sailors)$			
sid	sname	rating	age
22	Dustin	7	45.0
31	Lubber	8	55.5
58	Rusty	10	35.0

All six clauses of SELECT

Group by rating such that each group has at least two sailors where sailor age $\geq$ 20 sort by sailor names

```
SELECT      *
FROM        Sailors
WHERE       age >= 20
GROUP BY    rating
HAVING COUNT(rating) > 1
ORDER BY    sname;
```

Output

Sailors			
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

$\gamma_{rating}(Sailors)$			
sid	sname	rating	age
85	Art	3	25.5
22	Dustin	7	45.0
31	Lubber	8	55.5
58	Rusty	10	35.0

(Correlated) Nested Queries

Nested Query

Query containing a sub-query

Correlated Nested Query

A sub-query which refers to columns of the tables of its containing query

Queries on Example Database

Q1: Find the names of the Sailors who have reserved Boat 103

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT   R.sid
           FROM     Reserves AS R
           WHERE    R.bid = 103);
```

Q1: Find the names of the Sailors who have reserved Boat 103

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT    R.sid
           FROM      Reserves AS R
           WHERE     R.bid = 103);
```

Sailors			
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

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Q1: Find the names of the Sailors who have reserved Boat 103

```
SELECT      S.sname
FROM        Sailors AS S
WHERE       S.sid IN
            (SELECT     R.sid
             FROM        Reserves AS R
             WHERE       R.bid = 103);
```

Sailors			
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

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 22 in {22, 31, 74} then retrieve sname
Dustin

Queries on Example Database

Q1: Find the names of the Sailors who have reserved Boat 103

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT    R.sid
           FROM      Reserves AS R
           WHERE     R.bid = 103);
```

test condition

Is 29 in {22, 31, 74} then retrieve

sname
Dustin

Sailors			
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

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Q1: Find the names of the Sailors who have reserved Boat 103

Sailors			
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

$\in$

```
SELECT     S.sname
FROM       Sailors AS S
WHERE      S.sid IN
           (SELECT    R.sid
            FROM      Reserves AS R
            WHERE     R.bid = 103);
```

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 31 in {22, 31, 74} then retrieve sname
Dustin, Lubber

Q1: Find the names of the Sailors who have reserved Boat 103

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT    R.sid
           FROM      Reserves AS R
           WHERE     R.bid = 103);
```

test condition

Is 32 in {22, 31, 74} then retrieve

sname
Dustin, Lubber

Sailors			
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

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Q1: Find the names of the Sailors who have reserved Boat 103

Sailors			
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

```
SELECT      S.sname
FROM        Sailors AS S
WHERE       S.sid IN
            (SELECT     R.sid
             FROM       Reserves AS R
             WHERE      R.bid = 103);
```

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 58 in {22, 31, 74} then retrieve sname
Dustin, Lubber

Q1: Find the names of the Sailors who have reserved Boat 103

Sailors			
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

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT    R.sid
           FROM      Reserves AS R
           WHERE     R.bid = 103);
```

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 64 in {22, 31, 74} then retrieve sname
Dustin, Lubber

Q1: Find the **names** of the **Sailors** who have reserved **Boat** 103

Sailors			
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

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT    R.sid
           FROM      Reserves AS R
           WHERE     R.bid = 103);
```

∈

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 71 in {22, 31, 74} then retrieve sname
Dustin, Lubber

Q1: Find the names of the Sailors who have reserved Boat 103

Sailors			
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

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT    R.sid
           FROM      Reserves AS R
           WHERE     R.bid = 103);
```

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 74 in {22, 31, 74} then retrieve sname
Dustin, Lubber, Horatio

Queries on Example Database

Q1: Find the names of the Sailors who have reserved Boat 103

Sailors			
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

```
SELECT     S.sname
FROM       Sailors AS S
WHERE      S.sid IN
           (SELECT    R.sid
            FROM      Reserves AS R
            WHERE     R.bid = 103);
```

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 85 in {22, 31, 74} then retrieve sname

Dustin, Lubber, Horatio

Q1: Find the **names** of the Sailors who have reserved Boat 103

Sailors			
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

```
SELECT    S.sname
FROM      Sailors AS S
WHERE     S.sid IN
          (SELECT   R.sid
           FROM     Reserves AS R
           WHERE    R.bid = 103);
```

$\in$

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

test condition

Is 95 in {22, 31, 74} then retrieve sname
Dustin, Lubber, Horatio

Find the names of sailors who have NOT reserved boat 103

```
SELECT   S1.sname
FROM     Sailors AS S1
WHERE    S1.sid NOT IN
         (SELECT R1.sid
         FROM     Reserves AS R1
         WHERE    R1.bid = 103)
```

Find the names of Sailors who have reserved a red boat

```
SELECT   S1.sname
FROM     Sailors AS S1
WHERE    S1.sid IN
         (SELECT R1.sid
          FROM   Reserves AS R1
          WHERE R1.bid IN
                 (SELECT   B1.bid
                  FROM       Boats AS B1
                  WHERE      B1.color = 'red')
         )
```

Correlated nested queries

- The inner sub-query has been completely independent of the outer query
- In general, the inner sub-query could dependent on the row currently being examined in the outer query
- Such queries are known as Correlated nested queries

Find the names of sailors who have reserved boat number 103

```sql
SELECT   S1.sname
FROM     Sailors AS S1
WHERE    EXISTS
         (SELECT    *
          FROM      Reserves AS R1
          WHERE     R1.bid = 103
          AND       R1.sid = S1.sid
         )
```

EXISTS test whether a set is nonempty

Sailors			
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

Is Reserves not an empty set?

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
        FROM    Reserves AS R1
        WHERE   R1.bid = 103
        AND     R1.sid = 22
        )
```

Result: {Dustin}

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Sailors			
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

Is Reserves not an empty set?

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
        FROM    Reserves AS R1
        WHERE   R1.bid = 103
        AND     R1.sid = 29
        )
```

Result: {Dustin}

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Sailors			
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

Is Reserves not an empty set?

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
         FROM    Reserves AS R1
         WHERE   R1.bid = 103
         AND     R1.sid = 31
        )
```

Result: {Dustin, Lubber}

Sailors			
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

Is Reserves not an empty set?

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
         FROM    Reserves AS R1
         WHERE   R1.bid = 103
         AND     R1.sid = 32
        )
```

Result: {Dustin, Lubber}

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Sailors			
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

Is Reserves not an empty set?

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
        FROM    Reserves AS R1
        WHERE   R1.bid = 103
        AND     R1.sid = 58
        )
```

Result: {Dustin, Lubber}

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Sailors			
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

Is Reserves not an empty set?

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
        FROM    Reserves AS R1
        WHERE   R1.bid = 103
        AND     R1.sid = 64
        )
```

Result: {Dustin, Lubber}

	Sailors		
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

Is Reserves not an empty set?

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
        FROM    Reserves AS R1
        WHERE   R1.bid = 103
        AND     R1.sid = 71
        )
```

Result: {Dustin, Lubber}

Sailors			
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

Is Reserves not an empty set?

Find the names of sailors who have reserved boat number 103

```
SELECT   S1.sname
FROM     Sailors AS S1
WHERE    EXISTS
         (SELECT *
          FROM    Reserves AS R1
          WHERE   R1.bid = 103
          AND     R1.sid = 74
         )
```

Result: {Dustin, Lubber, Horatio}

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Sailors			
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

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
         FROM    Reserves AS R1
         WHERE   R1.bid = 103
         AND     R1.sid = 85
        )
```

Result: {Dustin, Lubber, Horatio}

Is Reserves not an empty set?

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Sailors			
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

Is Reserves not an empty set?

Find the names of sailors who have reserved boat number 103

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   EXISTS
        (SELECT *
        FROM    Reserves AS R1
        WHERE   R1.bid = 103
        AND     R1.sid = 95
        )
```

Result: {Dustin, Lubber, Horatio}

Reserves		
sid	bid	day
22	101	10-Oct-2019
22	102	10-Oct-2019
22	103	08-Oct-2019
22	104	07-Oct-2019
31	102	10-Nov-2019
31	103	06-Nov-2019
31	104	12-Nov-2019
64	101	05-Sep-2019
64	102	08-Sep-2019
74	103	08-Sep-2019

Example 19 - Complex Correlated Nested Queries

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

```
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   S1.sid IN
          (SELECT   R1.sid
           FROM     Reserves AS R1
           JOIN     Boats AS B1
           ON       R1.bid = B1.bid
           WHERE    B1.color = 'red'

           AND      R1.bid IN

           (SELECT   R1.sid
            FROM     Reserves AS R1
            JOIN     Boats AS B1
            ON       R1.bid = B1.bid
            WHERE    B1.color = 'green'
           )
          )
```

Example 20(a) - Complex Correlated Nested Queries

Find the names of sailors who have reserved all boats

```
SELECT   S1.sname
FROM     Sailors AS S1
WHERE    NOT EXISTS
         (SELECT  B1.bid
          FROM    Boats AS B1 NOT IN
                  (SELECT R1.bid
                   FROM    Reserves AS R1
                   WHERE   R1.sid = S1.sid)
         )
```

Example 20(b) - Complex Correlated Nested Queries

Find the names of sailors who have reserved all boats

```sql
SELECT  S1.sname
FROM    Sailors AS S1
WHERE   NOT EXISTS
        (SELECT B1.bid
         FROM   Boats AS B1
         WHERE  NOT EXISTS
                (SELECT  R1.bid
                 FROM    Reserves AS R1
                 WHERE   R1.sid = S1.sid
                 AND     R1.bid = B1.bid
                )
        )
```

Queries on Example Database

Q1: Find the names of the Sailors who have reserved Boat 103

SELECT S.sname
FROM Sailors **AS** S, Reserves **AS** R
WHERE (S.sid = R.sid **AND** R.bid = 103)

Q1: Find the **names** of the Sailors who have reserved Boat 103

```
SELECT   sname
FROM     Sailors
JOIN     Reserves
ON       Sailors.sid = Reserves.sid
WHERE    (Reserves.bid = 103)
```

Queries on Example Database

Q1: Find the names of the Sailors who have reserved Boat 103

```
SELECT  S.sname
FROM    Sailors AS S
JOIN    Reserves AS R
ON      S.sid = R.sid
WHERE   (R.bid = 103)
```

Q1: Find the **names** of the Sailors who have reserved Boat 103

```
SELECT  S.sname
FROM    Sailors AS S
WHERE   S.sid IN
        (SELECT R.sid
         FROM    Reserves AS R
         WHERE   R.bid = 103)
```

Q2: Find the names of the Sailors who reserved a red boat

```
SELECT  S.sname
FROM    Sailors AS S, Reserves AS R, Boats AS B
WHERE   (S.sid  = R.sid AND R.bid = B.bid
        AND B.color = 'red')
```

Queries on Example Database

Q2: Find the names of the Sailors who reserved a red boat

```
SELECT  S.sname
FROM    Sailors AS S
JOIN    Reserves AS R
JOIN    Boats AS B
ON      (S.sid = R.sid AND R.bid = B.bid)
WHERE   B.color = 'red';
```

Q3: Find the colors of boats reserved by Lubber

SELECT S.sname
FROM   Sailors **AS** S, Reserves **AS** R, Boats **AS** B
WHERE   (S.sid = R.sid **AND** R.bid = B.bid **AND**
            S.sname = 'Lubber')

Q3: Find the colors of boats reserved by Lubber

```
SELECT  S.sname
FROM    Sailors AS S
JOIN    Reserves AS R
JOIN    Boats AS B
ON      (S.sid = R.sid AND R.bid = B.bid)
WHERE   S.sname = 'Lubber';
```

Q4: Find the names of Sailors who have reserved at least one boat

SELECT S.sname
FROM   Sailors **AS** S, Reserves **AS** R
WHERE (S.sid = R.sid);

Q4: Find the names of Sailors who have reserved at least one boat

SELECT S.sname
FROM Sailors **AS** S
JOIN Reserves **AS** R
ON (S.sid = R.sid);

Queries on Example Database

Q5: Find the names of Sailors who have reserved a red or a green Boat

SELECT S.sname
FROM Sailors **AS** S, Reserves **AS** R, Boats **AS** B
WHERE (S.sid = R.sid **AND** R.bid = B.bid **AND** B.color = 'red');

UNION

SELECT S.sname
FROM Sailors **AS** S, Reserves **AS** R, Boats **AS** B
WHERE (S.sid = R.sid **AND** R.bid = B.bid **AND** B.color = 'green');

Q5: Find the names of Sailors who have reserved a red or a green Boat

```
 (SELECT  S.sname
FROM       Sailors AS S
JOIN       Reserves AS R
JOIN       Boats AS B
ON         (S.sid = R.sid AND R.bid = B.bid)
WHERE      B.color = 'red');


    UNION


 (SELECT  S.sname
FROM       Sailors AS S
JOIN       Reserves AS R
JOIN       Boats AS B
ON         (S.sid = R.sid AND R.bid = B.bid)
```

Queries on Example Database

```
 (SELECT R.sid
FROM     Reserves AS R
JOIN     Boats AS B
ON       (R.bid = B.bid)
WHERE    B.color = 'red' AND R.sid


         IN

 (SELECT R.sid
FROM     Reserves AS R
JOIN     Boats AS B
ON       (R.bid = B.bid)
WHERE    B.color = 'green');
```

Queries on Example Database

```
SELECT   S1.sname
FROM     Sailors AS S1
JOIN     (SELECT R.sid
           FROM    Reserves AS R
           JOIN    Boats AS B
           ON      (R.bid = B.bid)
           WHERE   B.color = 'red' AND R.sid
                   IN
            (SELECT R.sid
           FROM Reserves AS R
           JOIN Boats AS B
           ON   (R.bid = B.bid)
           WHERE B.color = 'green')) AS S2
ON       S1.sid = S2.sid;
```

Queries on Example Database

Q7: Find the names of Sailors who have reserved at least two boats

```
CREATE TABLE Temp1 AS
        (SELECT S.sid, S.sname, R.bid
         FROM    Sailors AS S, Reserves AS R
         WHERE   S.sid = R.sid);

SELECT T1.sname
FROM   Temp1 AS T1
JOIN   Temp1 AS T2
ON     T1.sid = T2.sid
WHERE  (T1.bid <> T2.bid)
```

Q7: Find the names of Sailors who have reserved at least two boats

```
SELECT  T1.sname
FROM    (SELECT S.sid, S.sname, R.bid
         FROM    Sailors AS S, Reserves AS R
         WHERE   S.sid = R.sid) AS T1
         JOIN    (SELECT S.sid, S.sname, R.bid
                  FROM    Sailors AS S, Reserves AS R
                  WHERE S.sid = R.sid) AS T2
ON      T1.sid = T2.sid
WHERE   (T1.bid <> T2.bid);
```

Queries on Example Database

Q8: Find the sids of Sailors with age over 20 who have not reserved a red boat

```
SELECT  S1.sid
FROM     Sailors AS S1
WHERE    S1.age >= 20 AND S1.sid
          NOT IN
 (
  SELECT  S2.sid
  FROM     Sailors AS S2
  JOIN    Reserves AS R2
  JOIN    Boats As B2
  ON      (S2.sid = R2.sid AND R2.bid = B2.bid)
  WHERE   (B.color = 'red'))
 )
```