MONASH University

MONASH
INFORMATION
TECHNOLOGY

Week 7 – Structured Query Language (SQL) – Part I

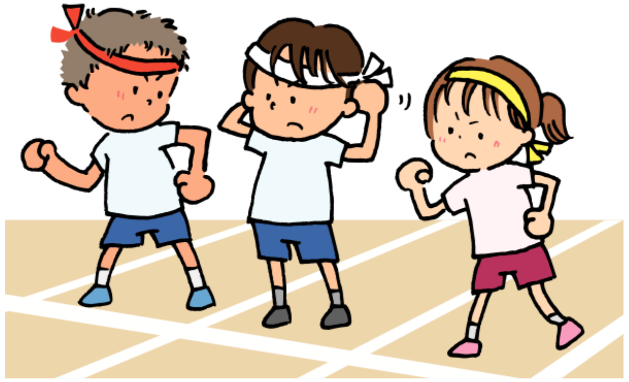
FIT3171 Databases
Semester 1 2022

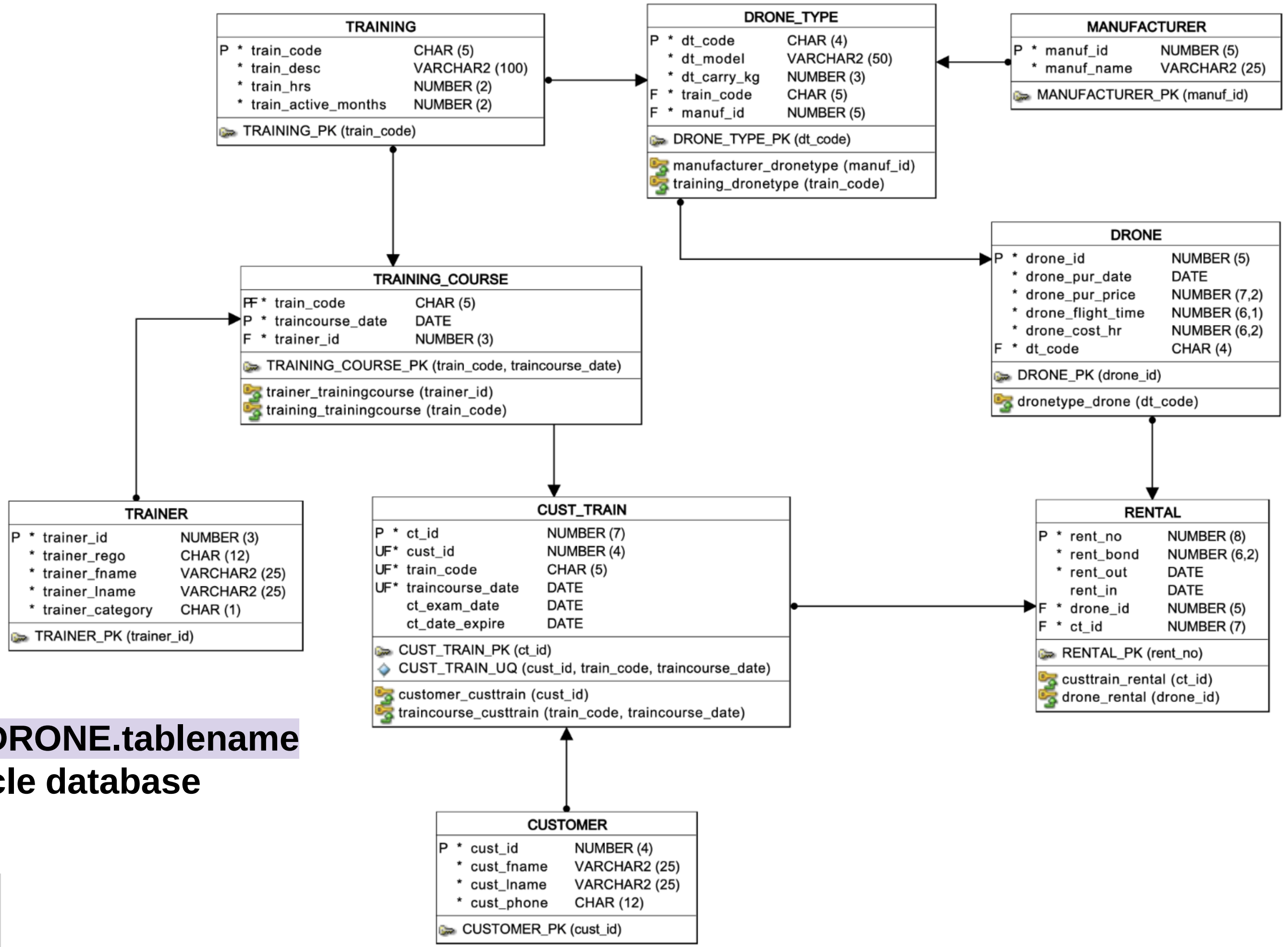
Malaysia Campus

Preparation for the Forum - ready, set ……

Please

- connect to Flux - flux.qa and be ready to answer questions
- test SQL Developer and your Oracle connection to ensure you can login to the database (local install or via MoVE)





Access tables via DRONE.tablename in the Monash Oracle database

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Anatomy of an SQL SELECT Statement

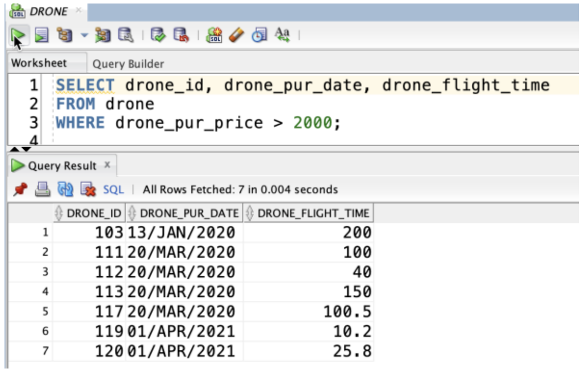
clauses

```
SELECT drone_id, drone_pur_date, drone_flight_time
FROM drone
WHERE drone_pur_price > 2000;
```

statement

Predicate / search condition

Note slides use *tablename* not drone.*tablename* - command as run by drone account user



```
SELECT drone_id, drone_pur_date, drone_flight_time
FROM drone
WHERE drone_pur_price > 2000;
```

All Rows Fetched: 7 in 0.004 seconds

	DRONE_ID	DRONE_PUR_DATE	DRONE_FLIGHT_TIME
1	103	13/JAN/2020	200
2	111	20/MAR/2020	100
3	112	20/MAR/2020	40
4	113	20/MAR/2020	150
5	117	20/MAR/2020	100.5
6	119	01/APR/2021	10.2
7	120	01/APR/2021	25.8

SQL SELECT Statement - Usage

What column/s to display

```
SELECT drone_id, drone_pur_date, drone_flight_time
FROM drone
WHERE drone_pur_price > 2000;
```

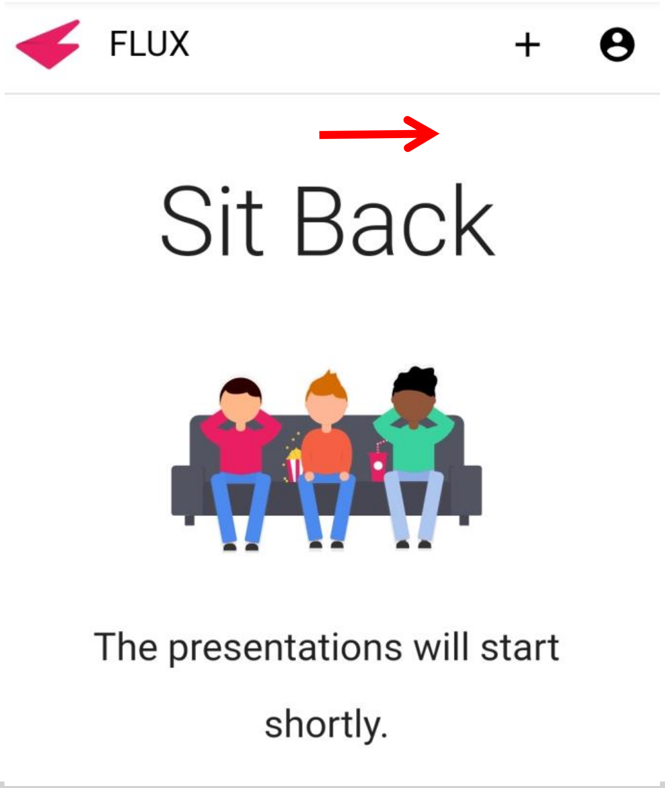
What table(s) the data is to be drawn from

What row/s to retrieve – the RESTRICTION to place on the rows retrieved

Run this command against the Oracle Database

Flux.qa: for lecture participation

flux.qa/QBGYRS


FLUX

Sit Back

The presentations will start shortly.

Q1. List all the drones which cost from $3000 to $5300 to purchase (multiple answers may be selected):

[✓ A.] SELECT * FROM drone where drone_pur_price BETWEEN 3000 AND 5300;

B. SELECT * FROM drone where drone_pur_price >= 3000 or drone_pur_price <= 5300;

C. SELECT * FROM drone where drone_pur_price IN (3000,5300);

[✓ D.] SELECT * FROM drone where drone_pur_price >= 3000 and drone_pur_price <= 5300;

E. SELECT * FROM drone where drone_pur_price >= 3000 or <= 5300;

SQL Predicates or Search Conditions

- The search conditions are applied on each row, and the row is returned if the search conditions are evaluated to be TRUE for that row.
- **Comparison**
  - Compare the value of one expression to the value of another expression.
  - Operators: =, !=,< >, <, >, <=, >=
    (same, not equal meaning)
  - Example: drone_pur_price > 2000
- **Range**
  - Test whether the value of an expression falls within a specified range of values.
  - Operator: BETWEEN
  - Example: drone_pur_price BETWEEN 3000 AND 5300 (both are inclusive)

SQL Predicates or Search Conditions

- **Set Membership**
  - To test whether the value of expression equals one of a set of values.
  - Operator: IN
  - Example : dt_code in ('DMA2','DSPA') -> which drones of this type?
- **Pattern Match**
  - To test whether a string (text) matches a specified pattern.
  - Operator: LIKE
  - Patterns:
    - % character represents any sequence of zero or more character.
    - _ character represents any single character.
  - Example:
    - WHERE dt_model LIKE 'DJI%' -> drone type models starting with DJI
    - WHERE train_code LIKE '__I__' -> drone types with a train_code with an I in the middle

Flux Task coming up ….

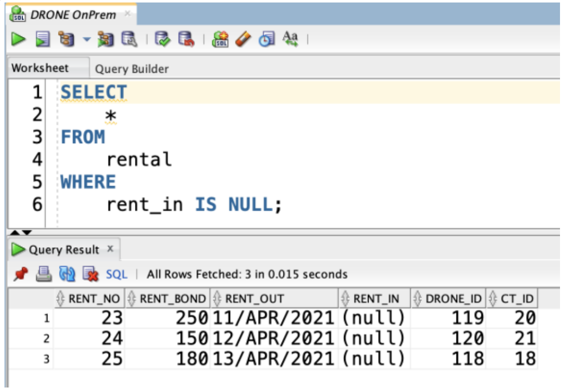
Q2. To list the rentals which have not been returned, the SQL would be:

A. select * from rental where rent_in = null;
[✓ B.] select * from rental where rent_in is null;
C. select * from rental where rent_in is not null;
D. select * from rental where rent_in is empty;

A is not correct because null is not a value,
therefore we cannot compare them by using
a comparison operator

SQL Predicates or Search Conditions

- **NULL**
  - To test whether a column has a NULL (unknown) value.
  - Example: WHERE rent_in IS NULL.
- Use in subquery (to be discussed in the future)
  - ANY, ALL
  - EXISTS



```
SELECT
    *
FROM
    rental
WHERE
    rent_in IS NULL;
```

```
   RENT_NO  RENT_BOND  RENT_OUT      RENT_IN  DRONE_ID  CT_ID
1       23        250  11/APR/2021  (null)        119     20
2       24        150  12/APR/2021  (null)        120     21
3       25        180  13/APR/2021  (null)        118     18
```

What row will be retrieved?

- Predicate evaluation is done using three-valued logic.
  - **TRUE**, **FALSE** and **UNKNOWN**
- DBMS will evaluate the predicate against each row.
- Row that is evaluated to be **TRUE** will be retrieved.
- NULL is considered to be UNKNOWN.

Combining Predicates

- Logical operators
  - AND, OR, NOT
- Rules:
  - An expression is evaluated LEFT to RIGHT
  - Sub-expression in brackets are evaluated first
  - NOTs are evaluated before AND and OR
  - ANDs are evaluated before OR
  - **Use of BRACKETS better alternative**

Truth Table

- **AND** is evaluated to be TRUE if and only if **both** conditions are TRUE
- **OR** is evaluated to be TRUE if and only if at least one of the conditions is TRUE

AND

A \ B	T	U	F
T	T	U	F
U	U	U	F
F	F	F	F

OR

A \ B	T	U	F
T	T	T	T
U	T	U	U
F	T	U	F

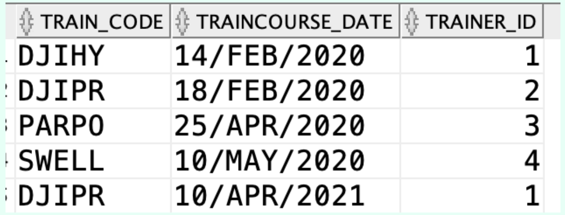
T = TRUE
F = FALSE
U = Unknown

Unknown = NULL in relational database

Flux Task coming up ….

Q3. Find all the training courses which are not run by the trainer with trainer_id 1 or the trainer with trainer_id 2:

B AND D IS NOT CORRECT
BECAUSE THE SYNTAX
IS NOT CORRECT



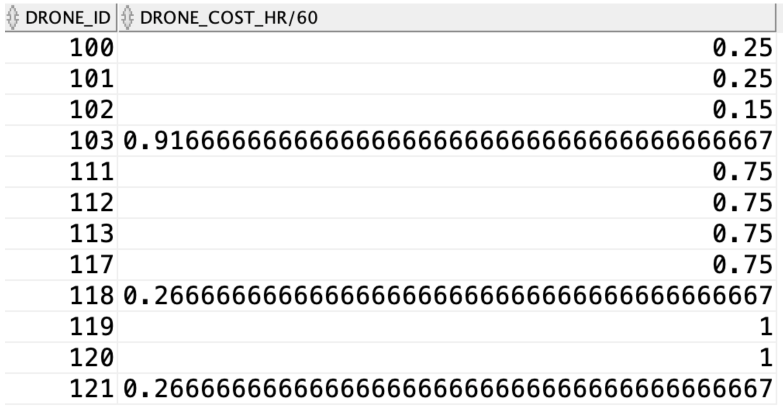
TRAIN_CODE	TRAINCOURSE_DATE	TRAINER_ID
DJIHY	14/FEB/2020	1
DJIPR	18/FEB/2020	2
PARPO	25/APR/2020	3
SWELL	10/MAY/2020	4
DJIPR	10/APR/2021	1

A. select * from training_course where trainer_id <>1 or trainer_id <> 2;
B. select * from training_course where trainer_id <> (1 or 2);
[✓ C.] select * from training_course where trainer_id <>1 and trainer_id <> 2;
D. select * from training_course where trainer_id <> (1 and 2);

Arithmetic Operations

- Can be performed in SQL.
- For example, what is the drone cost per minute:

select drone_id, drone_cost_hr/60 from drone;



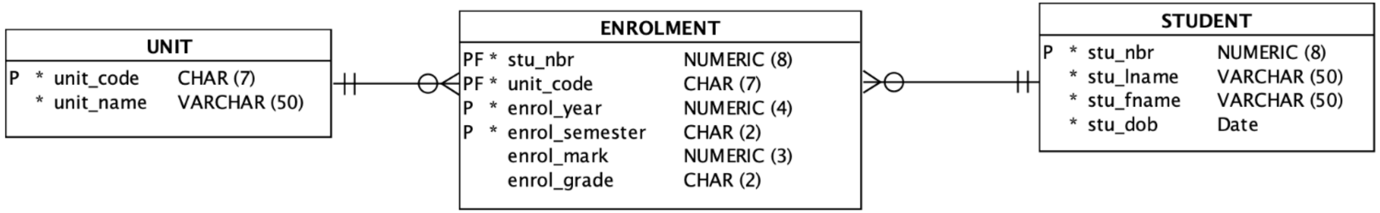
DRONE_ID	DRONE_COST_HR/60
100	0.25
101	0.25
102	0.15
103	0.916666666666666666666666666666666666667
111	0.75
112	0.75
113	0.75
117	0.75
118	0.266666666666666666666666666666666666667
119	1
120	1
121	0.266666666666666666666666666666666666667

Formatting?

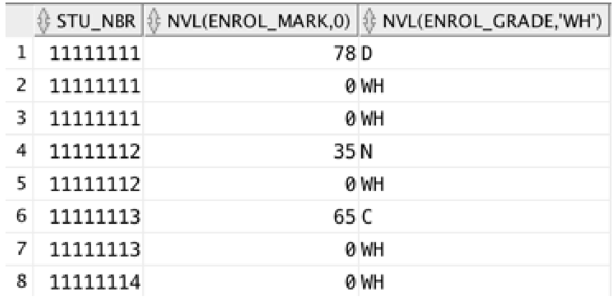
Oracle NVL function

NVL STANDS FOR NULL VALUE LOGIC

- It is used to replace a NULL with a value (numeric OR character/string)



```
SELECT stu_nbr,
   NVL(enrol_mark,0),
   NVL(enrol_grade,'WH')
FROM enrolment;
```



	STU_NBR	NVL(ENROL_MARK,0)	NVL(ENROL_GRADE,'WH')
1	11111111	78	D
2	11111111	0	WH
3	11111111	0	WH
4	11111112	35	N
5	11111112	0	WH
6	11111113	65	C
7	11111113	0	WH
8	11111114	0	WH

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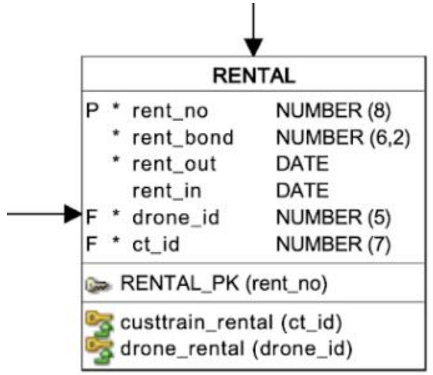
Oracle NVL function continued



```
P * rent_no     NUMBER (8)
  * rent_bond   NUMBER (6,2)
  * rent_out    DATE
    rent_in     DATE
F * drone_id    NUMBER (5)
F * ct_id       NUMBER (7)
RENTAL_PK (rent_no)
custtrain_rental (ct_id)
drone_rental (drone_id)
```

```
select rent_no, drone_id, rent_out,
      nvl(rent_in,'Still out') from  rental;
```

Run this command against the Oracle Database

What happens, why?

Renaming Column

- Note column heading from **drone_cost_hr/60**
- Use the word "AS"
  - New column name in " " to maintain case, special characters or spacing
- Example

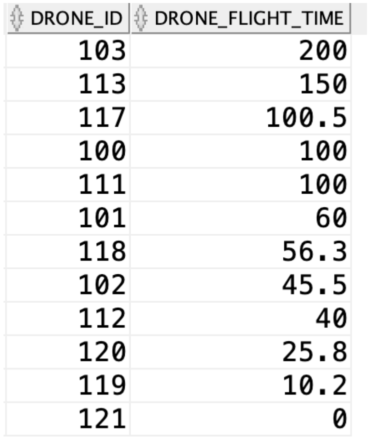
```
select drone_id, drone_cost_hr/60 as costpermin
from drone;

select drone_id, drone_cost_hr/60 as "COST/MIN"
from drone;
```

Sorting Query Result

- "ORDER BY" clause – *tuples have no order*
  - – Must be used if more than one row may be returned
- Order can be ASCending or DESCending. The default is ASCending.
  - – NULL values can be explicitly placed first/last using "NULLS LAST" or "NULLS FIRST" command
- Sorting can be done for multiple columns.
  - – order of the sorting is specified for each column.
- Example:

```
select drone_id, drone_flight_time
from  drone order by
drone_flight_time desc, drone_id;
```

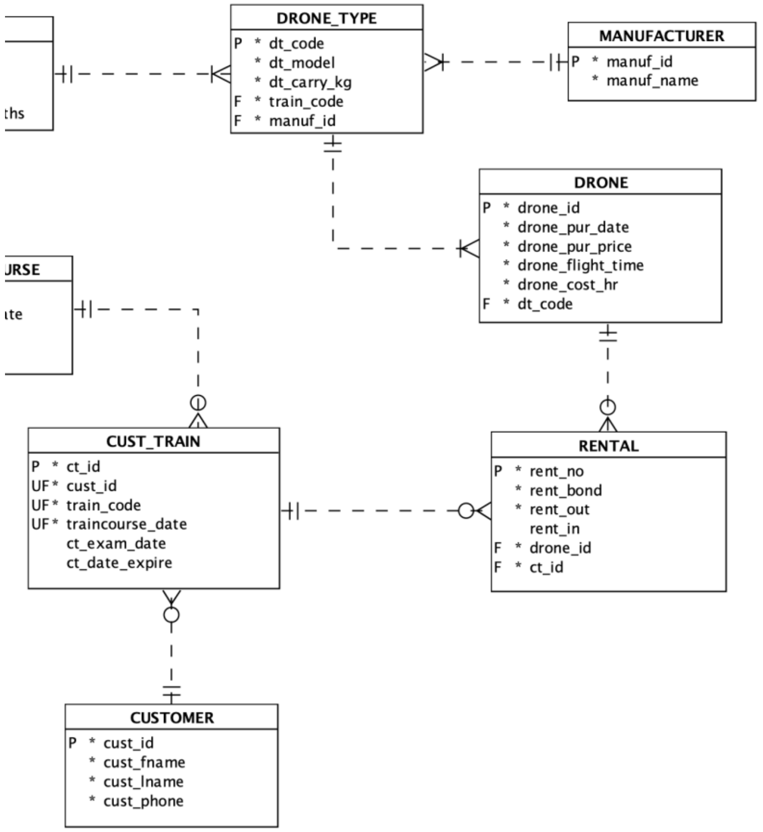


DRONE_ID	DRONE_FLIGHT_TIME
103	200
113	150
117	100.5
100	100
111	100
101	60
118	56.3
102	45.5
112	40
120	25.8
119	10.2
121	0

Q4. Write a query to satisfy the following requirements:

- Show the rental number, when the rental was taken out and when the rental was returned
  - no attribute formatting is necessary, use the table column names directly
- The output should show
  - the most recently returned rental first
  - show nulls at the end of the output

Obtain the ids of those drones which have been rented?

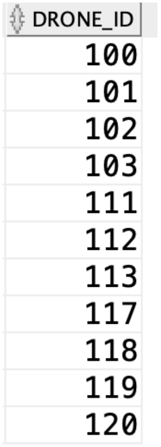


Run this command against the Oracle Database

Removing Duplicate Rows in the Query Result

- Use "DISTINCT" as part of SELECT clause
  - *use with care*
  - Which of our drones have been rented?

```
select distinct drone_id
from rental
order by drone_id;
```



DRONE_ID
100
101
102
103
111
112
113
117
118
119
120

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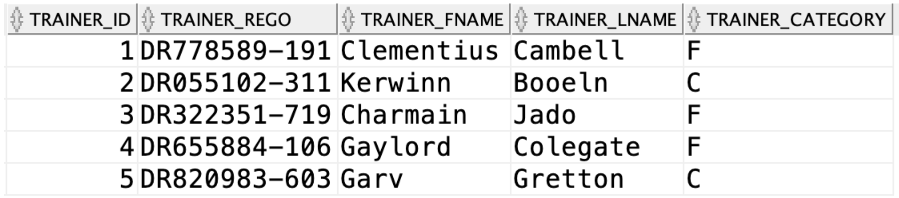
Run this command against the Oracle Database and note the difference

SQL JOIN

- For database students are **required to use ANSI JOINS**
  - placing the join in the where clause is not acceptable and will be ***marked as incorrect for all assessment purposes***
    - such a join is sometimes known as "implicit join notation" - effectively a cross join and then restricted by the where clause
- ANSI JOINS
  - ON
    - the general form which always works, hence the syntax we tend to use
    - FROM trainer JOIN training_course ON trainer.trainer_id = training_course.trainer_id
  - USING
    - requires matching attribute/s in the two tables
    - FROM trainer JOIN training_course USING (trainer_id)
  - NATURAL
    - requires matching attribute/s in the two tables
    - FROM trainer NATURAL JOIN training_course

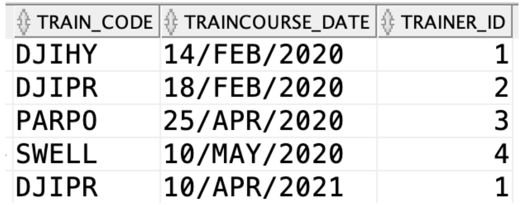
SQL EQUI JOIN

TRAINER

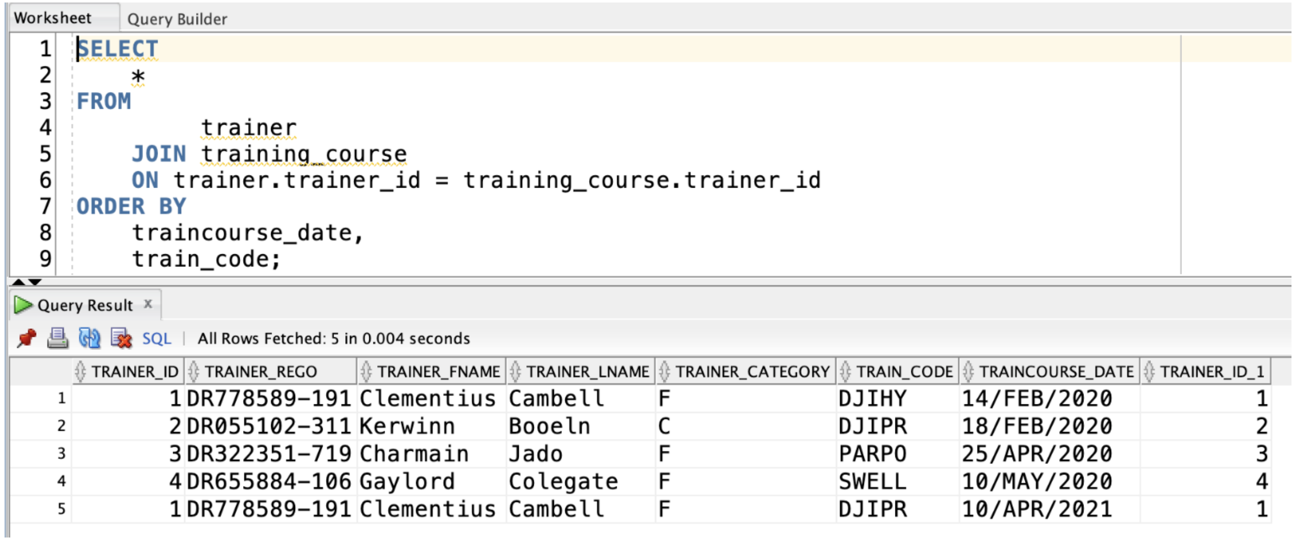


TRAINER_ID	TRAINER_REGO	TRAINER_FNAME	TRAINER_LNAME	TRAINER_CATEGORY
1	DR778589-191	Clementius	Cambell	F
2	DR055102-311	Kerwinn	Booeln	C
3	DR322351-719	Charmain	Jado	F
4	DR655884-106	Gaylord	Colegate	F
5	DR820983-603	Garv	Gretton	C

TRAINING_COURSE



TRAIN_CODE	TRAINCOURSE_DATE	TRAINER_ID
DJIHY	14/FEB/2020	1
DJIPR	18/FEB/2020	2
PARPO	25/APR/2020	3
SWELL	10/MAY/2020	4
DJIPR	10/APR/2021	1



```sql
SELECT
    *
FROM
        trainer
    JOIN training_course
    ON trainer.trainer_id = training_course.trainer_id
ORDER BY
    traincourse_date,
    train_code;
```

All Rows Fetched: 5 in 0.004 seconds

	TRAINER_ID	TRAINER_REGO	TRAINER_FNAME	TRAINER_LNAME	TRAINER_CATEGORY	TRAIN_CODE	TRAINCOURSE_DATE	TRAINER_ID_1
1	1	DR778589-191	Clementius	Cambell	F	DJIHY	14/FEB/2020	1
2	2	DR055102-311	Kerwinn	Booeln	C	DJIPR	18/FEB/2020	2
3	3	DR322351-719	Charmain	Jado	F	PARPO	25/APR/2020	3
4	4	DR655884-106	Gaylord	Colegate	F	SWELL	10/MAY/2020	4
5	1	DR778589-191	Clementius	Cambell	F	DJIPR	10/APR/2021	1

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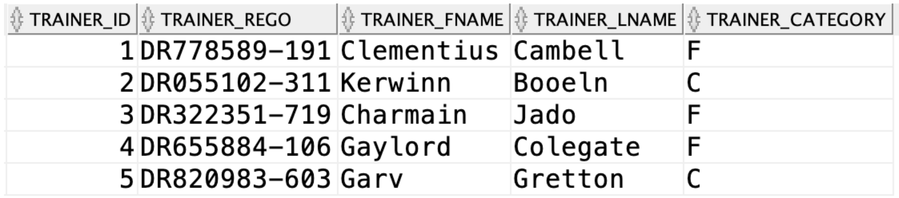
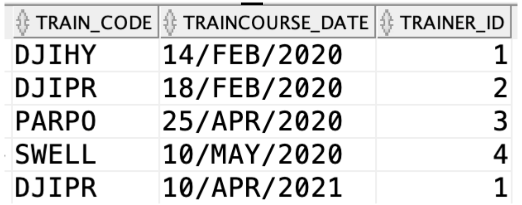
Special form of EQUI: SQL NATURAL JOIN

TRAINER

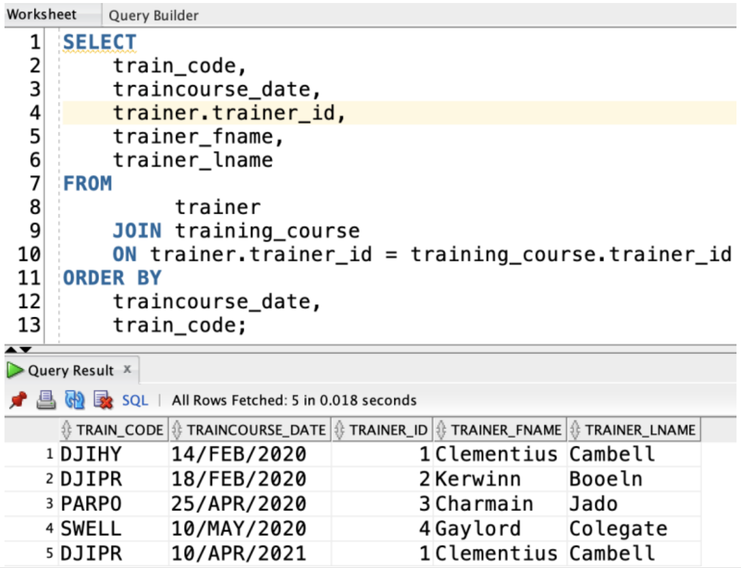


TRAINER_ID	TRAINER_REGO	TRAINER_FNAME	TRAINER_LNAME	TRAINER_CATEGORY
1	DR778589-191	Clementius	Cambell	F
2	DR055102-311	Kerwinn	Booeln	C
3	DR322351-719	Charmain	Jado	F
4	DR655884-106	Gaylord	Colegate	F
5	DR820983-603	Garv	Gretton	C

TRAINING_COURSE



TRAIN_CODE	TRAINCOURSE_DATE	TRAINER_ID
DJIHY	14/FEB/2020	1
DJIPR	18/FEB/2020	2
PARPO	25/APR/2020	3
SWELL	10/MAY/2020	4
DJIPR	10/APR/2021	1



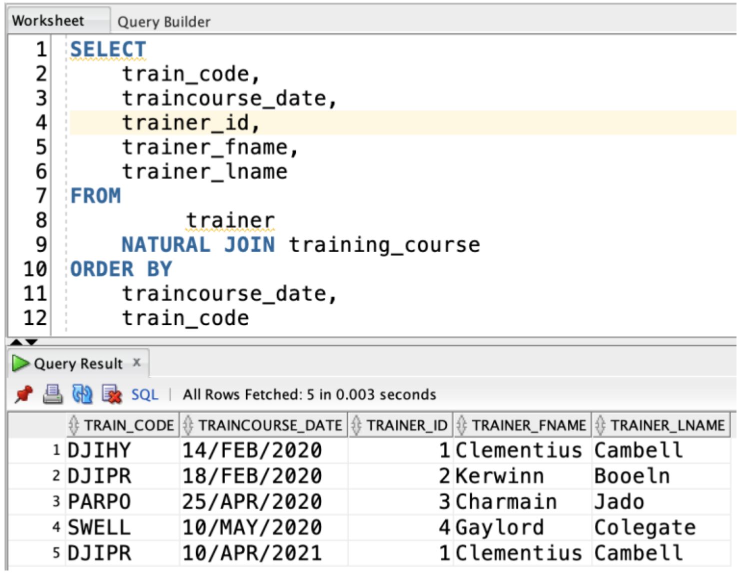
Worksheet Query Builder

```sql
SELECT
    train_code,
    traincourse_date,
    trainer.trainer_id,
    trainer_fname,
    trainer_lname
FROM
         trainer
    JOIN training_course
    ON trainer.trainer_id = training_course.trainer_id
ORDER BY
    traincourse_date,
    train_code;
```

Query Result ×

SQL | All Rows Fetched: 5 in 0.018 seconds

	TRAIN_CODE	TRAINCOURSE_DATE	TRAINER_ID	TRAINER_FNAME	TRAINER_LNAME
1	DJIHY	14/FEB/2020	1	Clementius	Cambell
2	DJIPR	18/FEB/2020	2	Kerwinn	Booeln
3	PARPO	25/APR/2020	3	Charmain	Jado
4	SWELL	10/MAY/2020	4	Gaylord	Colegate
5	DJIPR	10/APR/2021	1	Clementius	Cambell



Worksheet Query Builder

```sql
SELECT
    train_code,
    traincourse_date,
    trainer_id,
    trainer_fname,
    trainer_lname
FROM
         trainer
    NATURAL JOIN training_course
ORDER BY
    traincourse_date,
    train_code
```

Query Result ×

SQL | All Rows Fetched: 5 in 0.003 seconds

	TRAIN_CODE	TRAINCOURSE_DATE	TRAINER_ID	TRAINER_FNAME	TRAINER_LNAME
1	DJIHY	14/FEB/2020	1	Clementius	Cambell
2	DJIPR	18/FEB/2020	2	Kerwinn	Booeln
3	PARPO	25/APR/2020	3	Charmain	Jado
4	SWELL	10/MAY/2020	4	Gaylord	Colegate
5	DJIPR	10/APR/2021	1	Clementius	Cambell

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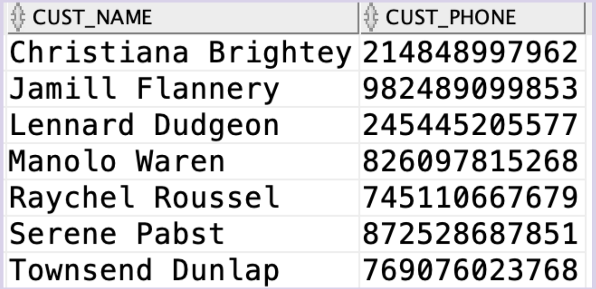
Group Task coming up ….

Q5. Find the full name and contact number for all customers who have completed a training course run by trainer id 1

1. Identify the source tables
2. Build the JOIN table by table (here use ON), maintain all attributes so you can see what is happening
3. Limit rows (where) and attributes (select list)
4. Order by customer name

Output required:



CUST_NAME	CUST_PHONE
Christiana Brightey	214848997962
Jamill Flannery	982489099853
Lennard Dudgeon	245445205577
Manolo Waren	826097815268
Raychel Roussel	745110667679
Serene Pabst	872528687851
Townsend Dunlap	769076023768

Special note: the Oracle symbol to concatenate two strings is ||

Summary

- SQL statement, clause, predicate.
- Writing SQL predicates.
  - Comparison, range, set membership, pattern matching, is NULL
  - Combining predicates using logic operators (AND, OR, NOT)
- Arithmetic operation.
  - NVL function
- Column alias.
- Ordering (Sorting) result.
- Removing duplicate rows.
- JOIN-ing tables

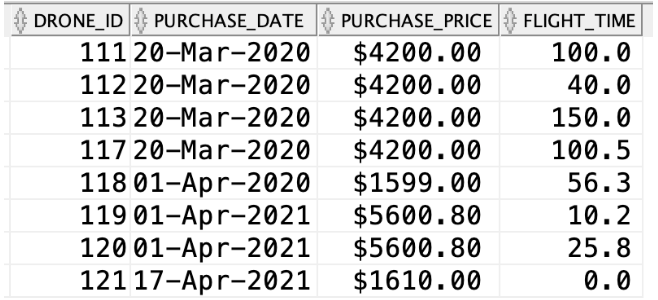
Oracle Date Data Type Revisited

Oracle Date Datatype

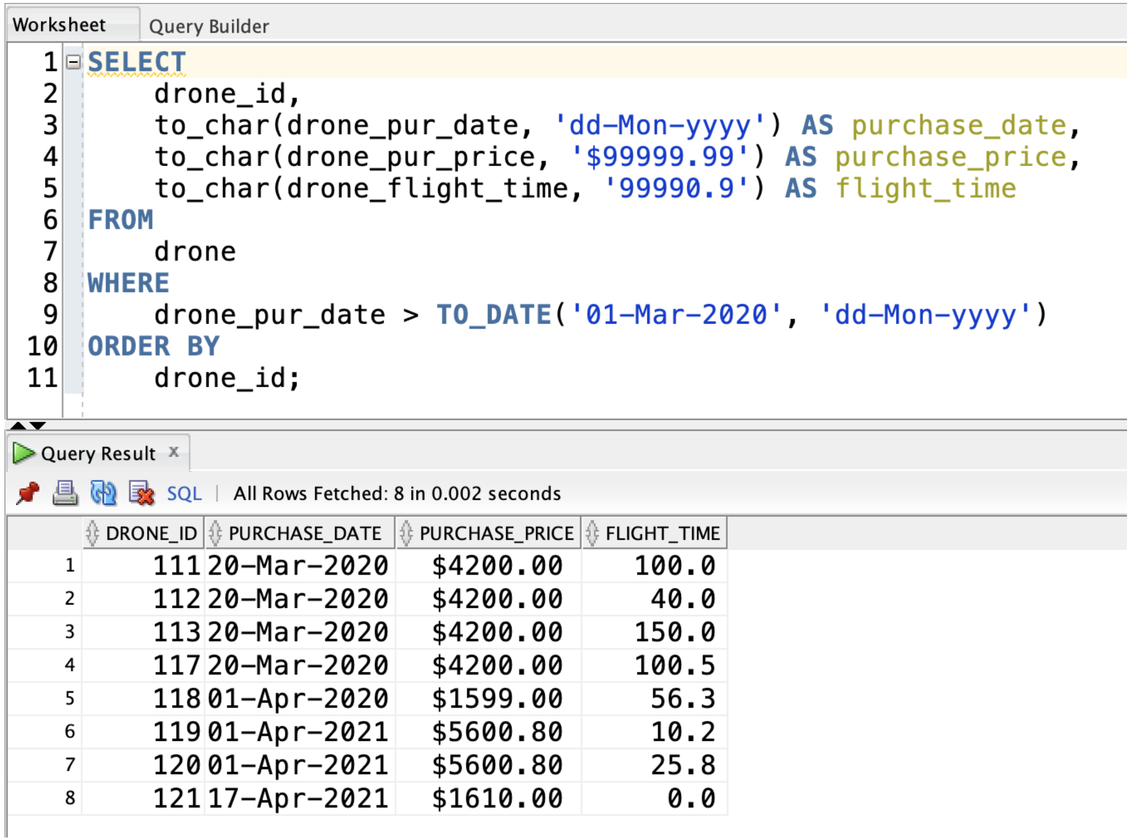
- Dates are stored differently from the SQL standard
  - standard uses two different types: date and time
  - Oracle uses one type: DATE
    - Stored in internal format contains date and time
      - Julian date as number (advantage can use arithmetic)
    - **Output** is controlled by formatting via **to_char**
      - select **to_char**(sysdate,'dd-Mon-yyyy') from dual;
        - » 20-Apr-2021
      - select **to_char**(sysdate,'dd-Mon-yyyy hh:mi:ss AM') from dual;
        - » 20-Apr-2020 02:51:24 PM

- DATE data type **must be formatted** with **TO_CHAR** when selecting for **display**.
  to_char can also be used to format numbers
- Text representing date **must be formatted** with **TO_DATE** when **comparing** or **inserting/updating.**

Report drones purchased after 1st March 2020?



DRONE_ID	PURCHASE_DATE	PURCHASE_PRICE	FLIGHT_TIME
111	20-Mar-2020	$4200.00	100.0
112	20-Mar-2020	$4200.00	40.0
113	20-Mar-2020	$4200.00	150.0
117	20-Mar-2020	$4200.00	100.5
118	01-Apr-2020	$1599.00	56.3
119	01-Apr-2021	$5600.80	10.2
120	01-Apr-2021	$5600.80	25.8
121	17-Apr-2021	$1610.00	0.0



```
SELECT
    drone_id,
    to_char(drone_pur_date, 'dd-Mon-yyyy') AS purchase_date,
    to_char(drone_pur_price, '$99999.99') AS purchase_price,
    to_char(drone_flight_time, '99990.9') AS flight_time
FROM
    drone
WHERE
    drone_pur_date > TO_DATE('01-Mar-2020', 'dd-Mon-yyyy')
ORDER BY
    drone_id;
```

All Rows Fetched: 8 in 0.002 seconds

	DRONE_ID	PURCHASE_DATE	PURCHASE_PRICE	FLIGHT_TIME
1	111	20-Mar-2020	$4200.00	100.0
2	112	20-Mar-2020	$4200.00	40.0
3	113	20-Mar-2020	$4200.00	150.0
4	117	20-Mar-2020	$4200.00	100.5
5	118	01-Apr-2020	$1599.00	56.3
6	119	01-Apr-2021	$5600.80	10.2
7	120	01-Apr-2021	$5600.80	25.8
8	121	17-Apr-2021	$1610.00	0.0

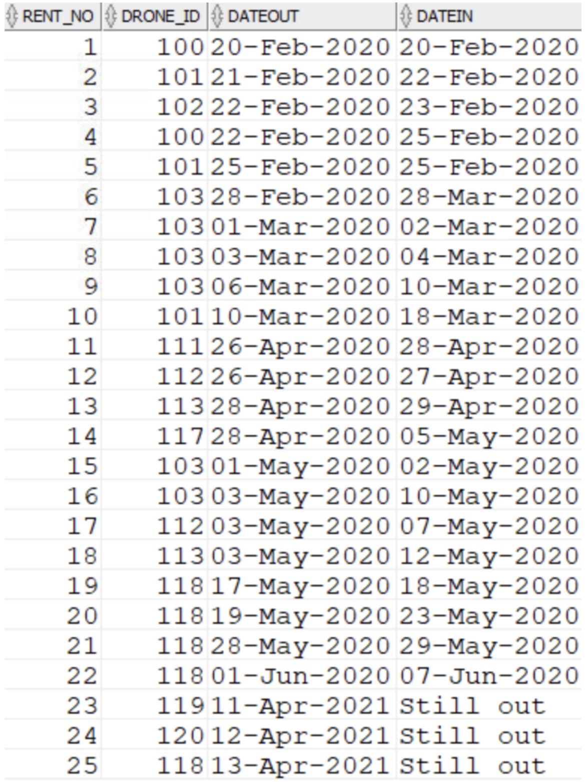
Returning to Oracle NVL function

- It is used to replace a NULL with a value.

```
select rent_no, drone_id, rent_out,
       nvl(rent_in,'Still out') from  rental;
```

- rent_in is date, 'Still out' is string (char)

```
select rent_no, drone_id,
      to_char(rent_out,'dd-Mon-yyyy') as dateout,
       nvl(to_char(rent_in,'dd-Mon-yyyy'),'Still out')
           as datein
      from  rental;
```



RENT_NO	DRONE_ID	DATEOUT	DATEIN
1	100	20-Feb-2020	20-Feb-2020
2	101	21-Feb-2020	22-Feb-2020
3	102	22-Feb-2020	23-Feb-2020
4	100	22-Feb-2020	25-Feb-2020
5	101	25-Feb-2020	25-Feb-2020
6	103	28-Feb-2020	28-Mar-2020
7	103	01-Mar-2020	02-Mar-2020
8	103	03-Mar-2020	04-Mar-2020
9	103	06-Mar-2020	10-Mar-2020
10	101	10-Mar-2020	18-Mar-2020
11	111	26-Apr-2020	28-Apr-2020
12	112	26-Apr-2020	27-Apr-2020
13	113	28-Apr-2020	29-Apr-2020
14	117	28-Apr-2020	05-May-2020
15	103	01-May-2020	02-May-2020
16	103	03-May-2020	10-May-2020
17	112	03-May-2020	07-May-2020
18	113	03-May-2020	12-May-2020
19	118	17-May-2020	18-May-2020
20	118	19-May-2020	23-May-2020
21	118	28-May-2020	29-May-2020
22	118	01-Jun-2020	07-Jun-2020
23	119	11-Apr-2021	Still out
24	120	12-Apr-2021	Still out
25	118	13-Apr-2021	Still out

Current Date

- Current date can be queried from the DUAL table (used to evaluate expressions/functions) by calling **SYSDATE**

```
SELECT
          to_char(sysdate, 'dd-Mon-yyyy hh:mi:ss AM') AS current_datetime
FROM
          dual;
```

- Oracle internal attributes include:
  - **sysdate**: current date/time
  - **systimestamp**: current date/time as a timestamp
  - **user**: current logged in user

What is the current date and time according to Oracle