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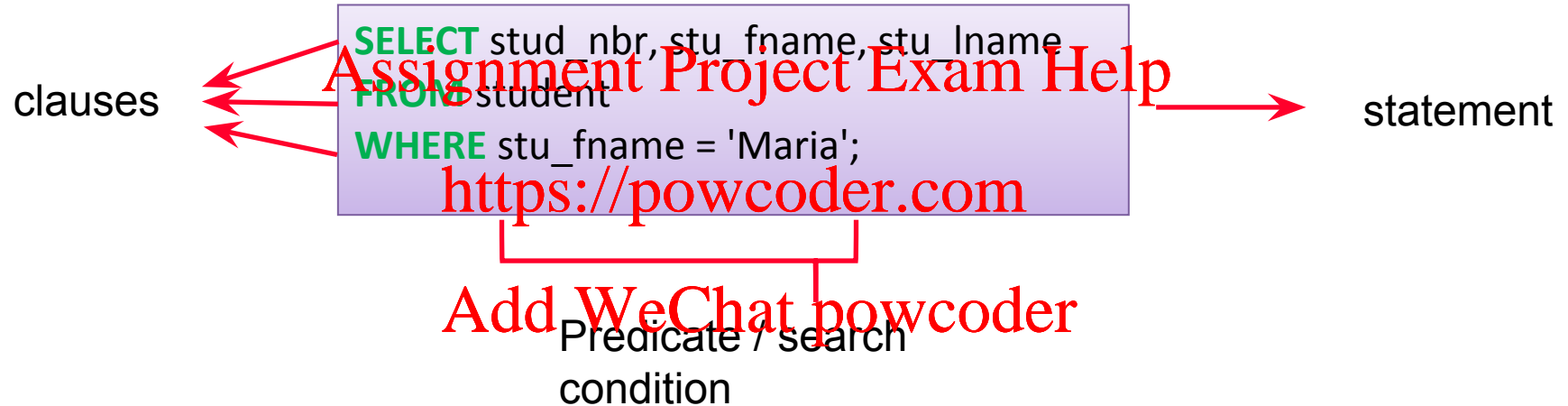
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INFORMATION
TECHNOLOGY

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Structured Query Language (SQL) – Part 1
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Anatomy of an SQL SELECT Statement



SQL SELECT Statement - Usage

What column/s to display

What table(s) the data come from?

```
SELECT stu_id, stu_fname, stu_lname  
FROM student  
WHERE stu_fname = 'Maria';
```

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What row/s to retrieve – the
RESTRICTION on the select

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: =, !=, <, >, <=, >=
 - Example: salary > 5000
- **Range**
 - Test whether the value of an expression falls within a specified range of values.
 - Operator: BETWEEN
 - Example: salary BETWEEN 1000 AND 3000 (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 : `city IN ('Melbourne' 'Sydney')`

■ 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 city LIKE 'M%'`
 - `WHERE unit_code LIKE 'FIT20__'`

SQL Predicates or Search Conditions

- **NULL**

- To test whether a column has a NULL (unknown) value.
- Example: WHERE grade IS NULL.

- Use in subquery (to be discussed in the future)

- ANY, ALL
- EXISTS

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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.

Q1. Consider the predicate "enrol_mark >= 50", what row(s) will be selected for this predicate by the DBMS?

	STU_NBR	UNIT_CODE	ENROL_YEAR	ENROL_SEMESTER	ENROL_MARK	ENROL_GRADE
1	11111111	FIT1001	2012	1	78	D
2	11111111	FIT1002	2013	1	(null)	(null)
3	11111111	FIT1004	2013	1	(null)	(null)
4	11111112	FIT1001	2013	1	35	D
5	11111112	FIT1001	2013	1	(null)	(null)
6	11111113	FIT1001	2012	2	65	C
7	11111113	FIT1004	2013	1	(null)	(null)
8	11111114	FIT1004	2013	1	(null)	(null)

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- a. 1, 4 and 6
b. All rows
c. 1 and 6
d. All rows except row 4

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

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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

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Unknown = NULL in
relational database

Q2. What row will be retrieved when the WHERE clause predicate is written as

V_CODE = 21344 AND V_CODE = 24288 ?

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V_CODE

1	21344	a. 1,3,5
2	20001	b. 1
3	24288	c. 3,5
4	20001	d. No rows will be retrieved
5	24288	

Q3. What row will be retrieved when the WHERE clause predicate is written as

V_CODE <> 21344 OR V_CODE <> 24288 ?

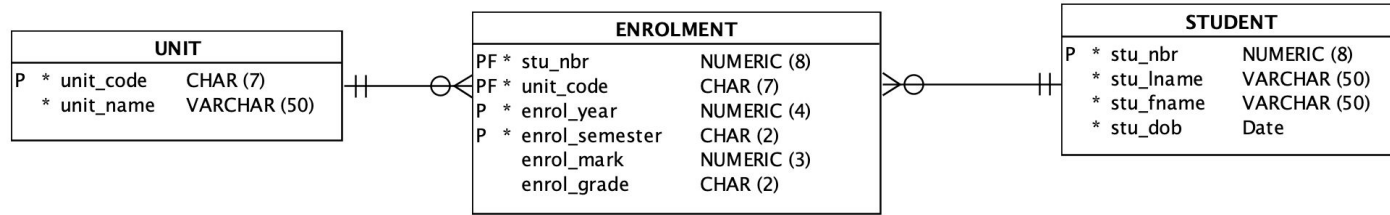
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V_CODE

1	21344	a. 1,3,5
2	20001	b. 2,4
3	24288	c. 3,5
4	20001	d. 1,2,3,4,5
5	24288	

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SELECT * FROM UNIT;

Script Output x Query Result x

SQL | All Rows Fetched: 3 in 0.015 seconds

	UNIT_CODE	UNIT_NAME
1	FIT1001	Computer Systems
2	FIT1002	Computer Programming
3	FIT1004	Database

SELECT * FROM STUDENT;

Script Output x Query Result x

SQL | All Rows Fetched: 4 in 0.022 seconds

	STU_NBR	STU_LNAME	STU_FNAME	STU_DOB
1	11111111	Bloggs	Fred	01/JAN/90
2	11111112	Nice	Nick	10/OCT/94
3	11111113	Wheat	Wendy	05/MAY/90
4	11111114	Sheen	Cindy	25/DEC/96

SELECT * FROM ENROLMENT;

Script Output x Query Result x

SQL | All Rows Fetched: 8 in 0.016 seconds

	STU_NBR	UNIT_CODE	ENROL_YEAR	ENROL_SEMESTER	ENROL_MARK	ENROL_GRADE
1	11111111	FIT1001	2012	1	78	D
2	11111111	FIT1002	2013	1	(null)	(null)
3	11111111	FIT1004	2013	1	(null)	(null)
4	11111112	FIT1001	2012	1	35	N
5	11111112	FIT1001	2013	1	(null)	(null)
6	11111113	FIT1001	2012	2	65	C
7	11111113	FIT1004	2013	1	(null)	(null)
8	11111114	FIT1004	2013	1	(null)	(null)

Q4. What is the correct SQL predicate to retrieve those students who have passed and also those students who have not been awarded any mark?

	STU_NBR	UNIT_CODE	ENROL_YEAR	ENROL_SEMESTER	ENROL_MARK	ENROL_GRADE
1	11111111	FIT1001	2012	1	78	D
2	11111111	FIT1002	2013	1	(null)	(null)
3	11111111	FIT1004	2013	1	(null)	(null)
4	11111112	FIT1001	2012	1	35	N
5	11111112	FIT1001	2013	1	(null)	(null)
6	11111113	FIT1001	2012	2	65	C
7	11111113	FIT1004	2013	1	(null)	(null)
8	11111114	FIT1004	2013	1	(null)	(null)

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- a. enrol_mark >= 50 AND enrol_mark IS NULL
- b. enrol_mark >= 50 OR enrol_mark IS NULL
- c. enrol_mark >= 50 AND enrol_mark IS NOT NULL
- d. enrol_mark >= 50 OR enrol_mark IS NOT NULL
- e. None of the above

Arithmetic Operations

- Can be performed in SQL.
- For example:

```
SELECT stu_nbr, enrol_mark/10  
FROM enrolment;
```

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STU_NBR	ENROL_MARK
1 11111111	7.8
2 11111111	(null)
3 11111111	(null)
4 11111112	3.5
5 11111112	(null)
6 11111113	6.5
7 11111113	(null)
8 11111114	(null)

Oracle NVL function

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

```
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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Renaming Column

- Note column headings on slide 16
- Use the word "AS"
 - New column name in " " to maintain case or spacing
- Example

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SELECT stu_nbr, enrol_mark/10 AS new_mark
FROM enrolment;

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SELECT stu_nbr, enrol_mark/10 AS "New Mark"
FROM enrolment;

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 stu_nbr, enrol_mark  
FROM enrolment  
ORDER BY enrol_mark DESC
```

	STU_NBR	ENROL_MARK
1	11111111	(null)
2	11111111	(null)
3	11111114	(null)
4	11111112	(null)
5	11111113	(null)
6	11111111	78
7	11111113	65
8	11111112	35



Q5. What will be the output of the following SQL statement?

```
SELECT stu_nbr  
FROM enrolment  
WHERE enrol_mark IS NULL;
```

	STU_NBR	UNIT_CODE	ENROL_YEAR	ENROL_SEMESTER	ENROL_MARK	ENROL_GRADE
1	11111111	FIT1001	2012	1	78	D
2	11111111	FIT1002	2013	1	(null)	(null)
3	11111111	FIT1004	2013	1	(null)	(null)
4	11111112	FIT1001	2012	1	35	N
5	11111112	FIT1001	2013	1	(null)	(null)
6	11111113	FIT1001	2013	1	65	C
7	11111113	FIT1004	2013	1	(null)	(null)
8	11111114	FIT1004	2013	1	(null)	(null)

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a.

11111111
11111112
11111113
11111114

b.

11111111
11111111
11111112
11111113
11111114

c.

11111111
11111112
11111113

Removing Duplicate Rows in the Query Result

- Use "DISTINCT" as part of SELECT clause
 - *use with care*

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```
SELECT DISTINCT stu_nbr  
FROM enrolment  
WHERE enrol_mark IS NULL;
```

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	STU_NBR
1	111111114
2	111111111
3	111111112
4	111111113

SQL NATURAL JOIN

STUDENT

sno	name
1	alex
2	maria
3	bob

QUALIFICATION

sno	degree	year
1	bachelor	1990
1	master	2000
2	PhD	2001

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SELECT *
FROM student JOIN qualification
ON student.sno = qualification.sno
ORDER BY student.sno

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sno	name	degree	year
1	alex	bachelor	1990
1	alex	master	2000
2	maria	PhD	2001



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 product and then restricted by the where clause
- ANSI JOINS
 - ON
 - the general form which always works, hence the syntax we tend to use
 - FROM student JOIN qualification ON student.sno = qualification.sno
 - USING
 - requires matching attribute names for the PK and FK
 - FROM student JOIN qualification USING (sno)
 - NATURAL
 - requires matching attribute names for the PK and FK
 - FROM student NATURAL JOIN qualification

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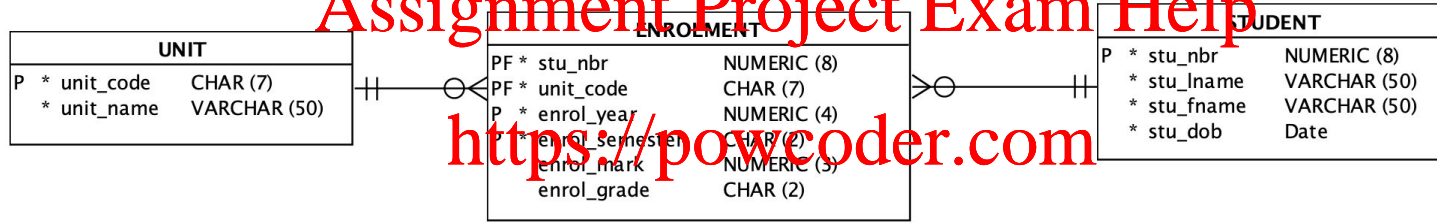
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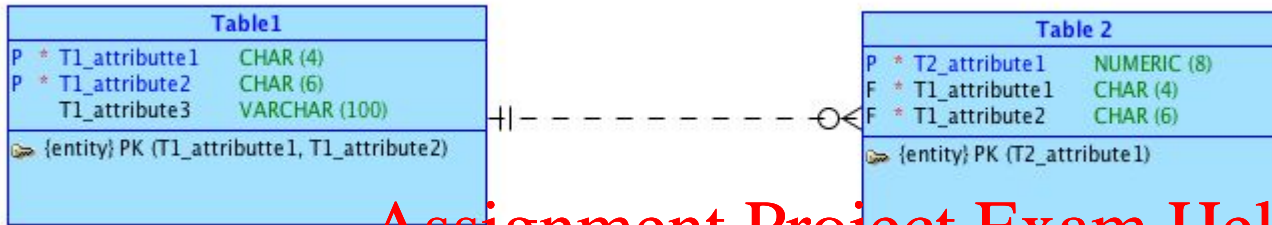
JOIN-ing Multiple Tables

Pair the PK and FK in the JOIN condition
Note table aliasing e.g. unit u in FROM clause



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```
SELECT s.stu_nbr, s.stu_lname, u.unit_name
FROM ((unit u JOIN enrolment e ON u.unit_code=e.unit_code)
      JOIN student s ON e.stu_nbr=s.stu_nbr)
ORDER BY s.stu_nbr, u.unit_name;
```



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How many conditions will be used to join the two tables?

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SELECT *

FROM table1 t1 JOIN table2 t2 ON

(t1.T1_attribute1 = t2.T1_attribute1

AND

t1.T1_attribute2 = t2.T1_attribute2)

ORDER BY t1.T1_attribute1, t1.T1_attribute2;

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

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Oracle Date Data Type <https://powcoder.com>

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Oracle Data 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 (can use arithmetic)
 - Output is controlled by formatting
 - select `to_char(sysdate,'dd-Mon-yyyy')` from dual;
» 04-May-2020
 - select `to_char(sysdate,'dd-Mon-yyyy hh:mi:ss PM')` from dual;
» 04-May-2020 02:51:24 PM



- DATE data type should be formatted with **TO_CHAR** when selecting for **display**.
- Text representing date **must be formatted** with **TO_DATE** when comparing or inserting/updating.
- Example: <https://powcoder.com>

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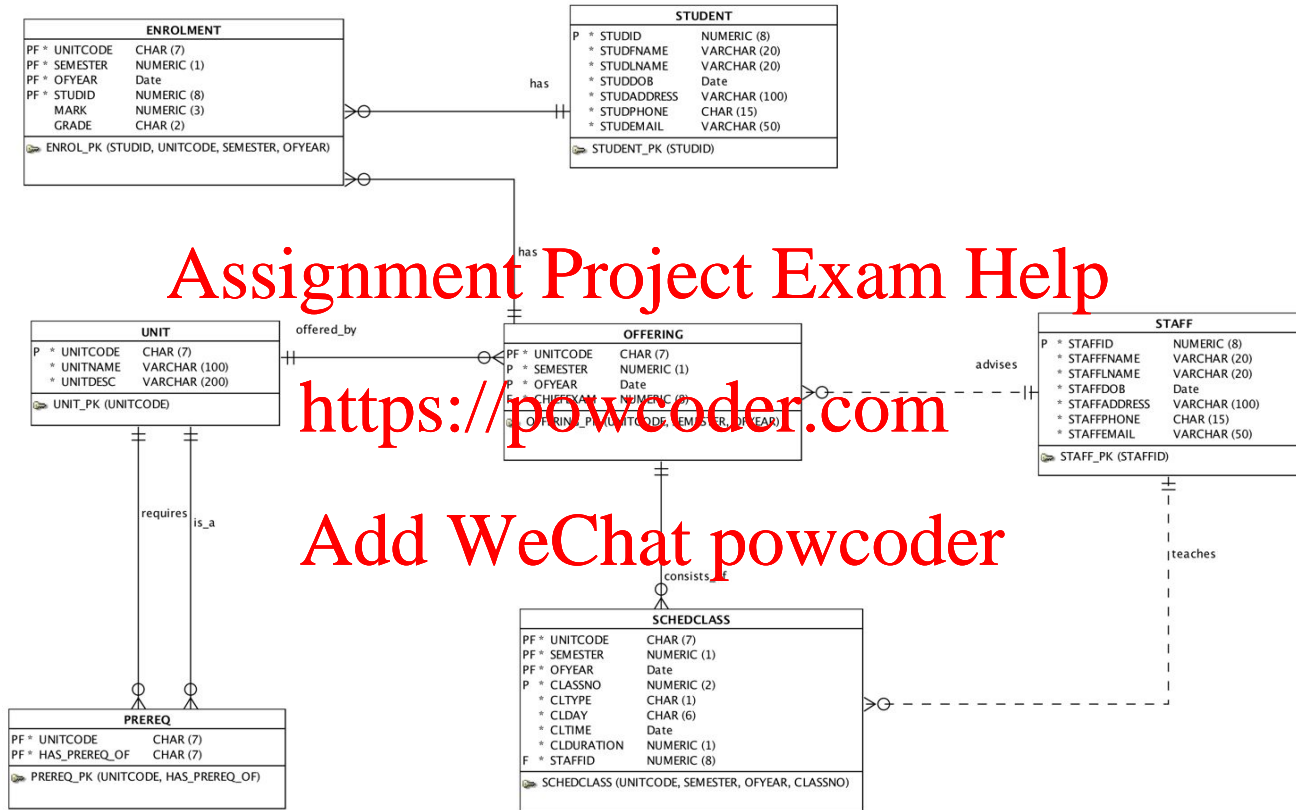
```
select studid,  
       studfname || ' ' || studlname as StudentName,  
       to_char(studdob,'dd-Mon-yyyy') as StudentDOB  
from uni.student  
where studdob > to_date('01-Apr-1991','dd-Mon-yyyy')  
order by studdob;
```



Current Date

- Current date can be queried from the DUAL table using the **SYSDATE** attribute.
 - SELECT **sysdate** FROM dual;
- Oracle internal attributes include:
 - **sysdate**: current date/time
 - **systimestamp**: current date/time as a timestamp
 - **user**: current logged in user

Uni Data Model



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Putting this to Work

- Q1. Show the ids, names of students as a single column called NAME and their DOBs. Order the output in date of birth order
- Q2. Show the ids, names of students as a single column called NAME, unit code, and year and semester of enrolment where the mark is NULL. Order the output by student id, within unit code order

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Sample Solutions

Q1:

```
SELECT
  studfname
  || ' '
  || studlname AS name,
  to_char(studdob, 'DD-MON-YYYY')
AS dob
FROM
  uni.student
ORDER BY
  studdob;
```

Q2:

```
SELECT
  studid,
  studfname
  || ' '
  || studlname AS name,
  unitcode
  to_char(oryear, 'YYYY') AS year,
  semester
FROM
  uni.student NATURAL JOIN uni.enrolment
WHERE
  mark IS NULL
ORDER BY
  unitcode, studid;
```

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