Assignment Project Exam Help

Week 3 SQL

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SEQUEL (Structured English QUEry Language)

v.s.

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SQL (Structured Query Language)

Housekeeping

Assignment Project Exam Help

1. Assignment 1 on SQL will be available on Wattle at 11:59pm on 16 Aug (Tuesday) and due at 11:59pm on 30 Aug (Tuesday).

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Housekeeping

Assignment Project Exam Help

1. Assignment 1 on SQL will be available on Wattle at 11:59pm on 16 Aug (Tuesday) and due at 11:59pm on 30 Aug (Tuesday).
   - This assessment should be done individually and no group work is allowed.
   - You should not post any solutions/results/ideas/interpretations related to assessment items on the Wattle discussion forum.
   - Additional drop-in sessions will be available in Week 4 and Week 5 if you need any further clarification for Assignment 1.

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Housekeeping

Assignment Project Exam Help

1. Assignment 1 on SQL will be available on Wattle at 11:59pm on 16 Aug (Tuesday) and due at 11:59pm on 30 Aug (Tuesday).
   - This assessment should be done individually and no group work is allowed.
   - You should not post any solutions/results/ideas/interpretations related to assessment items on the Wattle discussion forum.
   - Additional drop-in sessions will be available in Week 4 and Week 5 if you need any further clarification for Assignment 1.
2. An optional exercise website is available for our course

   `https://cs.anu.edu.au/dab/bench/db-exercises/`

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Outline

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1. Insert, Update, Delete Statements *v.s.* Relational Database State

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2. Select Statements

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3. A Bunch of Tables

Insert, Update, Delete Statements

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- **Insert, Delete, Update Statements *v.s.* Relational Database State**

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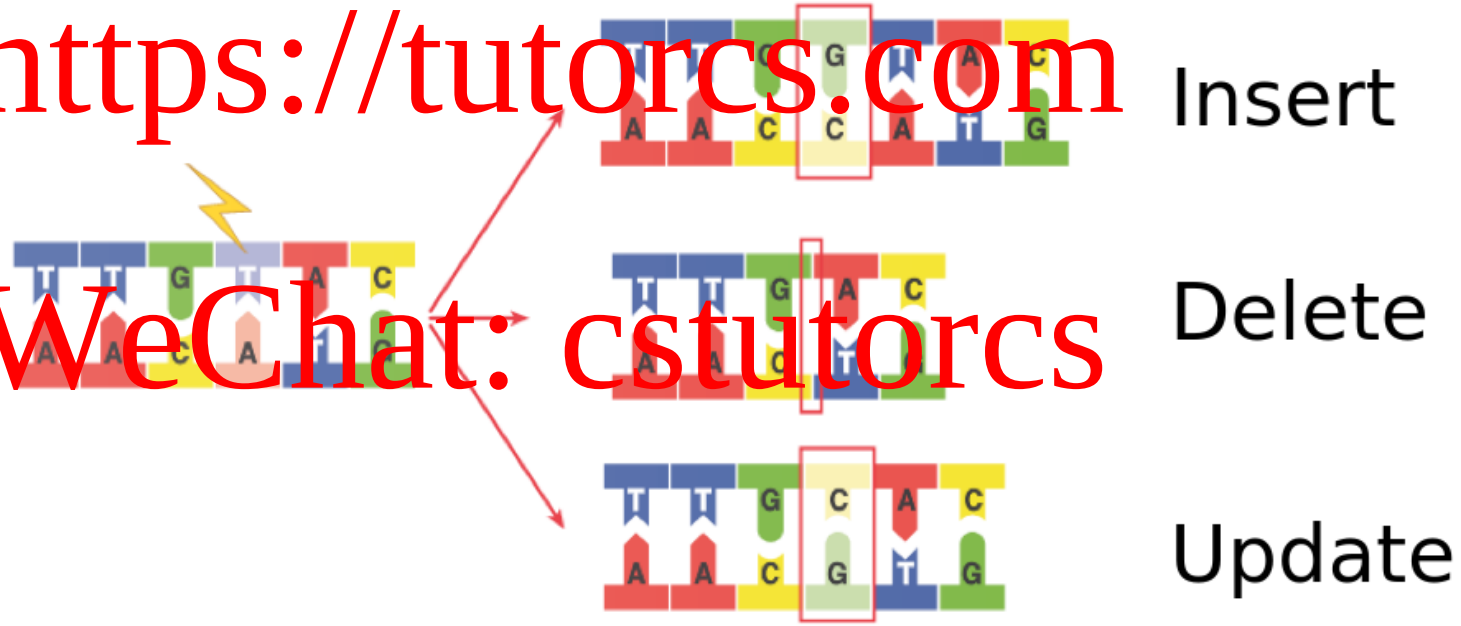

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Relational Database State – Example

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- A **relational database state** of S is a set of relations such that
- there is just one relation for each relation schema in S, and
- all the relations satisfy the integrity constraints IC.

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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COURSE		
No	Cname	Unit
COMP1130	Introduction to Advanced Computing I	6
COMP2400	Relational Databases	6

ENROL				
StudentID	CourseNo	Semester	Status	EnrolDate
456	COMP2400	2016 S2	active	25/05/2016
458	COMP1130	2016 S1	active	20/02/2016
459	COMP2400	2016 S2	active	11/06/2016

Insert Statement – Example

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```
CREATE TABLE STUDENT(StudentID INT PRIMARY KEY, Name VARCHAR(50)
DoB DATE, Email VARCHAR(100));
```

- Will the following Insert statements work?
-

```
INSERT INTO STUDENT
VALUES (456, 'Tom', '25/01/1988', 'tom@gmail.com');
```

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Insert Statement – Example

Assignment Project Exam Help

```
CREATE TABLE STUDENT(StudentID INT PRIMARY KEY, Name VARCHAR(50)
DoB DATE, Email VARCHAR(100));
```

- Will the following Insert statements work?
- ```
  INSERT INTO STUDENT
  VALUES (456, 'Tom', '25/01/1988', 'tom@gmail.com');
  ```
  Yes.

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  ```

Insert Statement – Example

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```
CREATE TABLE STUDENT(StudentID INT PRIMARY KEY, Name VARCHAR(50)
DoB DATE, Email VARCHAR(100));
```

- Will the following Insert statements work?
- ```
  INSERT INTO STUDENT
  VALUES (456, 'Tom', '25/01/1988', 'tom@gmail.com');
  ```
  Yes.
- ```
  INSERT INTO STUDENT(StudentID)
  VALUES (459);
  ```

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Insert Statement – Example

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```
CREATE TABLE STUDENT(StudentID INT PRIMARY KEY, Name VARCHAR(50)
DoB DATE, Email VARCHAR(100));
```

- Will the following Insert statements work?
- ```
  INSERT INTO STUDENT
  VALUES (456, 'Tom', '25/01/1988', 'tom@gmail.com');
  ```
  Yes.
- ```
  INSERT INTO STUDENT(StudentID)
  VALUES (459);
  ```
  Yes. The values for Name, DoB and Email will be NULL.

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Insert Statement – Example

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```
CREATE TABLE STUDENT(StudentID INT PRIMARY KEY, Name VARCHAR(50)
DoB DATE, Email VARCHAR(100));
```

- Will the following Insert statements work?
- ```
  INSERT INTO STUDENT
  VALUES (456, 'Tom', '25/01/1988', 'tom@gmail.com');
  ```
  Yes.
- ```
  INSERT INTO STUDENT(StudentID)
  VALUES (459);
  ```
  Yes. The values for Name, DoB and Email will be NULL.
- ```
  INSERT INTO STUDENT(Name, DoB, Email)
  VALUES ('John', '15/11/1998', 'john@gmail.com');
  ```

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  ```

Insert Statement – Example

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```
CREATE TABLE STUDENT(StudentID INT PRIMARY KEY, Name VARCHAR(50)
DoB DATE, Email VARCHAR(100));
```

- Will the following Insert statements work?
- ```
  INSERT INTO STUDENT
  VALUES (456, 'Tom', '25/01/1988', 'tom@gmail.com');
  ```
  Yes.
- ```
  INSERT INTO STUDENT(StudentID)
  VALUES (459);
  ```
  Yes. The values for Name, DoB and Email will be NULL.
- ```
  INSERT INTO STUDENT(Name, DoB, Email)
  VALUES ('John', '15/11/1998', 'john@gmail.com');
  ```
  No. The primary key value cannot be NULL.

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  ```

Update Statement – Example

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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- What is the resulting table after executing the following statement?

```
UPDATE STUDENT SET Name='Tom Lee', Email='tom.lee@yahoo.com'
WHERE StudentID=456;
```

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Update Statement – Example

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

- What is the resulting table after executing the following statement?

```
UPDATE STUDENT SET Name='Tom Lee', Email='tom.lee@yahoo.com'
WHERE StudentID=456;
```

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STUDENT			
StudentID	Name	DoB	Email
456	**Tom Lee**	25/01/1988	**tom.lee@yahoo.com**
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

Delete Statement – Example

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	10/09/1987	frank@gmail.com

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- What is the resulting table after executing the following statement?

```
DELETE FROM STUDENT WHERE StudentID=456;
```

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Delete Statement – Example

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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- What is the resulting table after executing the following statement?

```
DELETE FROM STUDENT WHERE StudentID=456;
```

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STUDENT			
StudentID	Name	DoB	Email
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

Delete Statement – Example

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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- What is the resulting table after executing the following statement?

```
DELETE FROM STUDENT;
```

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Delete Statement – Example

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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- What is the resulting table after executing the following statement?

```
DELETE FROM STUDENT;
```

STUDENT			
StudentID	Name	DoB	Email

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Delete Statement – Example

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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- What is the resulting table after executing the following statement?

```
DELETE FROM STUDENT;
```

STUDENT			
StudentID	Name	DoB	Email

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```
DROP TABLE STUDENT;
```

The Table STUDENT is deleted.

Delete Statement – Example

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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- What is the resulting table after executing the following statement?

```
DELETE FROM STUDENT;
```

STUDENT			
StudentID	Name	DoB	Email

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```
DROP TABLE STUDENT;
```

The Table STUDENT is deleted.

- Note the difference between the Delete and Drop Table statements.

Delete Statement – Example

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- Consider the following foreign key defined on ENROL:

  FOREIGN KEY(StudentID) REFERENCES STUDENT(StudentID)

  ON DELETE NO ACTION

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ENROL

StudentID	CourseNo	Semester	Status	EnrolDate
456	COMP1130	2016 S1	active	25/02/2016
458	COMP1130	2016 S1	active	25/02/2016
456	COMP2400	2016 S2	active	09/03/2016

STUDENT

StudentID	Name	DoB	Email
456	Tom	25/01/1983	tom@gmail.com
458	Peter	20/02/1991	peter@hotmail.com

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- What will happen if we execute the following statement?

```
DELETE FROM STUDENT WHERE StudentID=456;
```

Delete Statement – Example

Assignment Project Exam Help

- Consider the following foreign key defined on ENROL:

  FOREIGN KEY(StudentID) REFERENCES STUDENT(StudentID)

  ON DELETE NO ACTION

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ENROL				
StudentID	CourseNo	Semester	Status	EnrolDate
456	COMP1130	2016 S1	active	25/02/2016
458	COMP1130	2016 S1	active	25/02/2016
456	COMP2400	2016 S2	active	09/03/2016

STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1983	tom@gmail.com
458	Peter	20/02/1991	peter@hotmail.com

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- What will happen if we execute the following statement?

```
DELETE FROM STUDENT WHERE StudentID=456;
```

- The deletion of a student who has enrolled at least one course will throw out an error concerning the foreign key.

Delete Statement – Example

- Consider the following foreign key defined on ENROL:

  FOREIGN KEY(StudentID) REFERENCES STUDENT(StudentID)
  ON DELETE CASCADE

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ENROL

StudentID	CourseNo	Semester	Status	EnrolDate
456	COMP1130	2016 S1	active	25/02/2016
458	COMP1130	2016 S1	active	25/02/2016
456	COMP2400	2016 S2	active	09/03/2016

STUDENT

StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@gmail.com
458	Peter	20/02/1991	peter@hotmail.com

Delete Statement – Example

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- Consider the following foreign key defined on ENROL:

  FOREIGN KEY(StudentID) REFERENCES STUDENT(StudentID)
  ON DELETE CASCADE

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ENROL

StudentID	CourseNo	Semester	Status	EnrolDate
456	COMP1130	2016 S1	active	25/02/2016
458	COMP1130	2016 S1	active	25/02/2016
456	COMP2400	2016 S2	active	09/03/2016

STUDENT

StudentID	Name	DoB	Email
456	Tom	25/01/1983	tom@gmail.com
458	Peter	20/02/1991	peter@hotmail.com

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- What will happen if we execute the following statement?

```
DELETE FROM STUDENT WHERE StudentID=456;
```

Delete Statement – Example

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- Consider the following foreign key defined on ENROL:

  FOREIGN KEY(StudentID) REFERENCES STUDENT(StudentID)

  ON DELETE CASCADE

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ENROL

StudentID	CourseNo	Semester	Status	EnrolDate
456	COMP1130	2016 S1	active	25/02/2016
458	COMP1130	2016 S1	active	25/02/2016
456	COMP2400	2016 S2	active	09/03/2016

STUDENT

StudentID	Name	DoB	Email
456	Tom	25/01/1983	tom@gmail.com
458	Peter	20/02/1991	peter@hotmail.com

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- What will happen if we execute the following statement?

```
DELETE FROM STUDENT WHERE StudentID=456;
```

- We would have ENROL below after deleting the student 456.

StudentID	CourseNo	Semester	Status	EnrolDate
458	COMP1130	2016 S1	active	25/02/2016

Select Statement

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- Select Statement

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Select Statement

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- The `SELECT` statement has the following basic form:

```
SELECT attribute_list
  FROM table_list
 [WHERE condition]
[GROUP BY attribute_list [HAVING group_condition]]
[ORDER BY attribute_list];
```

Select Statement

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STUDENT

StudentID	Name	DoB	Email
456	Tom	23/01/1988	tom@hotmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

- What is the result for the following Select statement?

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```
SELECT * FROM STUDENT WHERE Email like '%@gmail.com';
```

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Select Statement

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STUDENT

StudentID	Name	DoB	Email
456	Tom	23/01/1988	tom@hotmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

- What is the result for the following Select statement?

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```
SELECT * FROM STUDENT WHERE Email like '%@gmail.com';
```

StudentID	Name	DoB	Email
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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Select Statement

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STUDENT

StudentID	Name	DoB	Email
456	Tom	23/01/1988	tom@hotmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

- What is the result for the following Select statement?

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```
SELECT * FROM STUDENT WHERE Email like '%@gmail.com';
```

StudentID	Name	DoB	Email
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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```
SELECT StudentID FROM STUDENT WHERE Email like '%@gmail.com';
```

Select Statement

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STUDENT

StudentID	Name	DoB	Email
456	Tom	23/01/1988	tom@hotmail.com
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

- What is the result for the following Select statement?

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```
SELECT * FROM STUDENT WHERE Email like '%@gmail.com';
```

StudentID	Name	DoB	Email
458	Peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com

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```
SELECT StudentID FROM STUDENT WHERE Email like '%@gmail.com';
```

StudentID
458
459

Select Statement

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@hotmail.com
458	peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com
460	Peter	03/09/1992	Peter@Github.com

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- What is the result for the following Select statement?

```
SELECT * FROM STUDENT WHERE Name = 'Peter';
```

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Select Statement

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@hotmail.com
458	peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com
460	Peter	03/09/1992	Peter@Github.com

- What is the result for the following Select statement?

```
SELECT * FROM STUDENT WHERE Name = 'Peter';
```

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STUDENT			
StudentID	Name	DoB	Email
460	Peter	03/09/1992	Peter@Github.com

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Select Statement

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@hotmail.com
458	peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com
460	Peter	03/09/1992	Peter@Github.com

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- What is the result for the following Select statement?

```
SELECT * FROM STUDENT WHERE Name = 'Peter';
```

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STUDENT			
StudentID	Name	DoB	Email
460	Peter	03/09/1992	Peter@Github.com

```
SELECT * FROM STUDENT WHERE lower(Name) = 'peter';
```

Select Statement

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STUDENT			
StudentID	Name	DoB	Email
456	Tom	25/01/1988	tom@hotmail.com
458	peter	23/05/1993	peter@gmail.com
459	Fran	11/09/1987	frankk@gmail.com
460	Peter	03/09/1992	Peter@Github.com

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- What is the result for the following Select statement?

```
SELECT * FROM STUDENT WHERE Name = 'Peter';
```

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STUDENT			
StudentID	Name	DoB	Email
460	Peter	03/09/1992	Peter@Github.com

```
SELECT * FROM STUDENT WHERE lower(Name) = 'peter';
```

STUDENT			
StudentID	Name	DoB	Email
458	peter	23/05/1993	peter@gmail.com
460	Peter	03/09/1992	Peter@Github.com

Select + Group By

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- `GROUP BY` *attribute_list* groups tuples for each value combination in the attribute_list.

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Select + Group By

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- `GROUP BY` *attribute_list* groups tuples for each value combination in the attribute_list.
- Aggregate functions can be applied to aggregate a group of attribute values into a single value, e.g.,
  - `COUNT` returns the total number of argument values
  - `AVG` returns the average of argument values
  - `MIN` returns the minimum value of the arguments
  - `MAX` returns the maximum value of the arguments
  - `SUM` returns the sum of the argument values

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Select + Group By

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- `GROUP BY` *attribute_list* groups tuples for each value combination in the attribute_list.
- Aggregate functions can be applied to aggregate a group of attribute values into a single value, e.g.,
  - `COUNT` returns the total number of argument values
  - `AVG` returns the average of argument values
  - `MIN` returns the minimum value of the arguments
  - `MAX` returns the maximum value of the arguments
  - `SUM` returns the sum of the argument values
- We can use `HAVING` *condition* to add the condition on the groups.

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Aggregate Functions – Example

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- List the total number of courses, the sum of the units of courses, the minimum unit in COURSE

COURSE		
No	Cname	Unit
COMP1130	Introduction to Advanced Computing I	6
COMP2400	Relational Databases	6
COMP3600	Algorithms	4

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Aggregate Functions – Example

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- List the total number of courses, the sum of the units of courses, the minimum unit in COURSE

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COURSE		
No	Cname	Unit
COMP1130	Introduction to Advanced Computing I	6
COMP2400	Relational Databases	6
COMP3600	Algorithms	4

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```
SELECT COUNT(unit), MAX(unit) FROM COURSE;
```

Aggregate Functions – Example

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- List the total number of courses, the sum of the units of courses, the minimum unit in COURSE

COURSE		
No	Cname	Unit
COMP1130	Introduction to Advanced Computing I	6
COMP2400	Relational Databases	6
COMP3600	Algorithms	4

```
SELECT COUNT(unit), MAX(unit) FROM COURSE;
```

- The query result will be:

COUNT	MAX
3	6

Select + Group By – Example

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STUDY		
StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2000	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What would happen for the following SELECT + Group By StudentID?

```
SELECT ...
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

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Group StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

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- What would happen for the following SELECT + Group By StudentID?

```
SELECT ...
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID
FROM STUDY
Group By StudentID;
```

StudentID
111
222
333

Select + Group By – Example

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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, COUNT(*)
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

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Group

StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, COUNT(*)
FROM STUDY
Group By StudentID;
```

StudentID	COUNT
111	3
222	1
333	2

Select + Group By – Example

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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, MAX(hours)
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, MAX(hours)
FROM STUDY
Group By StudentID;
```

StudentID	MAX
111	120
222	115
333	130

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, COUNT(StudentID)
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

Assignment Project Exam Help
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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, COUNT(StudentID)
FROM STUDY
Group By StudentID;
```

StudentID	COUNT
111	3
222	1
333	2

Select + Group By – Example

Assignment Project Exam Help
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Group StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, CourseNo
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

Assignment Project Exam Help
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Group StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT StudentID, CourseNo
FROM STUDY
Group By StudentID;
```

Error Message.

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
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Group StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT *
FROM Study
Group By StudentID;
```

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
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Group StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT *
FROM Study
Group By StudentID;
```

Error Message.

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
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Group StudentID	STUDY StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT COUNT(*)
FROM STUDY
Group By StudentID;
```

Select + Group By – Example

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Group StudentID	STUDY		
	StudentID	CourseNo	Hours
111	111	COMP2400	120
	111	BUSN2011	110
	111	ECON2102	120
222	222	COMP2400	115
333	333	STAT2001	120
	333	BUSN2011	130

- What is the result for the following SELECT + Group By StudentID?

```
SELECT COUNT(*)
FROM STUDY
Group By StudentID;
```

COUNT
3
1
2

Select + Group By – Example

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STUDY		
StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2000	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What would happen for the following SELECT + Group By CourseNo?

```
SELECT ...
FROM STUDY
Group By CourseNo;
```

Select + Group By – Example

Assignment Project Exam Help
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Group	STUDY		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What would happen for the following SELECT + Group By CourseNo?

```
SELECT ...
FROM STUDY
Group By CourseNo;
```

Select + Group By – Example

Assignment Project Exam Help
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Group CourseNo	STUDY StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By CourseNo?

```
SELECT CourseNo, COUNT(*)
FROM STUDY
Group By CourseNo;
```

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
WeChat: cstutorcs

Group CourseNo	STUDY StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By CourseNo?

```
SELECT CourseNo, COUNT(*)
FROM STUDY
Group By CourseNo;
```

CourseNo	COUNT
BUSN2011	2
COMP2400	2
ECON2102	1
STAT2001	1

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
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Group	STUDY		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By CourseNo?

```
SELECT CourseNo, Hours
FROM STUDY
Group By CourseNo;
```

Select + Group By – Example

Assignment Project Exam Help
https://tutorcs.com
WeChat: cstutorcs

Group	STUDY		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By CourseNo?

```
SELECT CourseNo, Hours
FROM STUDY
Group By CourseNo;
```

Error Message.

Select + Group By + Having – Example

Assignment Project Exam Help
https://tutorcs.com
WeChat: cstutorcs

Group	Study		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By + Having?

```
SELECT CourseNo
FROM Study
Group By CourseNo
Having MAX(Hours) > 120;
```

Select + Group By + Having – Example

Assignment Project Exam Help
https://tutorcs.com
WeChat: cstutorcs

Group	STUDY		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By + Having?

```
SELECT CourseNo
FROM STUDY
Group By CourseNo
Having MAX(Hours) > 120;
```

CourseNo
BUSN2011

Select + Group By + Having – Example

Assignment Project Exam Help
https://tutorcs.com
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Group	STUDY		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By + Having?

```
SELECT CourseNo
FROM Study
Group By CourseNo
Having COUNT(*) > 1;
```

Select + Group By + Having – Example

Assignment Project Exam Help
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Group	STUDY		
CourseNo	StudentID	CourseNo	Hours
BUSN2011	111	BUSN2011	110
	333	BUSN2011	130
COMP2400	111	COMP2400	120
	222	COMP2400	115
ECON2102	111	ECON2102	120
STAT2001	333	STAT2001	120

- What is the result for the following SELECT + Group By + Having?

```
SELECT CourseNo
FROM STUDY
Group By CourseNo
Having COUNT(*) > 1;
```

CourseNo
BUSN2011
COMP2400

A Bunch of Tables

Assignment Project Exam Help

- A Bunch of Tables

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Set Operations

Assignment Project Exam Help

- SQL incorporates several set operations: `UNION` (set union) and `INTERSECT` (set intersection), and sometimes `EXCEPT` (set difference / minus).

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- Set operations result in return of a relation of tuples (no duplicates).

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- Set operations apply to relations that have the same attribute types appearing in the same order.

Set Operations

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STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

WeChat: cstutorcs

```
SELECT StudentID FROM STUDY
WHERE CourseNo='COMP2400'
 UNION
SELECT StudentID FROM STUDY
WHERE CourseNo='ECON2102';
```

Set Operations

Assignment Project Exam Help

STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

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- What is the result for the following SQL query?

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```
SELECT StudentID FROM STUDY
WHERE CourseNo='COMP2400'
 UNION
SELECT StudentID FROM STUDY
WHERE CourseNo='ECON2102';
```

StudentID
111
222

UNION

StudentID
111

Set Operations

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STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

WeChat: cstutorcs

```
SELECT StudentID FROM STUDY
WHERE CourseNo='COMP2400'
 UNION
SELECT StudentID FROM STUDY
WHERE CourseNo='ECON2102';
```

StudentID
111
222

Set Operations

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STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

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```
SELECT CourseNo FROM STUDY
WHERE StudentID=111
 EXCEPT
SELECT CourseNo FROM STUDY
WHERE StudentID=222;
```

Set Operations

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STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

WeChat: cstutorcs

```
SELECT CourseNo FROM STUDY
WHERE StudentID=111
 EXCEPT
SELECT CourseNo FROM STUDY
WHERE StudentID=222;
```

CourseNo
COMP2400
BUSN2011
ECON2102

EXCEPT

CourseNo
COMP2400

Set Operations

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STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

WeChat: cstutorcs

```
SELECT CourseNo FROM STUDY
WHERE StudentID=111
 EXCEPT
SELECT CourseNo FROM STUDY
WHERE StudentID=222;
```

CourseNo
BUSN2011
ECON2102

Set Operations

Assignment Project Exam Help

https://tutorcs.com

STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

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```
SELECT CourseNo FROM STUDY
WHERE StudentID=111
 EXCEPT
SELECT StudentID FROM STUDY
WHERE CourseNo='ECON2102';
```

Set Operations

Assignment Project Exam Help
https://tutorcs.com

STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

WeChat: cstutorcs

```
SELECT CourseNo FROM STUDY
WHERE StudentID=111
 EXCEPT
SELECT StudentID FROM STUDY
WHERE CourseNo='ECON2102';
```

CourseNo
COMP2400
BUSN2011
ECON2102

EXCEPT

StudentID
111

Set Operations

Assignment Project Exam Help

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STUDY

StudentID	CourseNo	Hours
111	COMP2400	120
222	COMP2400	115
333	STAT2001	120
111	BUSN2011	110
111	ECON2102	120
333	BUSN2011	130

- What is the result for the following SQL query?

WeChat: cstutorcs

```
SELECT CourseNo FROM STUDY
WHERE StudentID=111
 EXCEPT
SELECT StudentID FROM STUDY
WHERE CourseNo='ECON2102';
```

ERROR MESSAGE

Join Operations

Assignment Project Exam Help

- When we want to retrieve data from *more than one relations*, we often need to use **join** operations.
- **Inner Join**: tuples are included in the result only if there is at least one matching in both relations.
- **Left/Right Join**: all tuples of the left/right table are included in the result, even if there are no matches in the relations.

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Inner Join – Example

Assignment Project Exam Help

COURSE

No	Name	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What would happen for the following INNER JOIN statement?

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```
SELECT ...
FROM COURSE INNER JOIN ENROL ON COURSE.No=ENROL.CourseNo;
```

Inner Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What would happen for the following INNER JOIN statement?

WeChat: cstutorcs

```
SELECT ...
FROM Course INNER JOIN Enrol ON Course.No=Enrol.CourseNo;
```

COURSE			ENROL			
No	Cname	Unit	StudentID	CourseNo	Semester	Status
COMP2400	Relational Databases	6	222	**COMP2400**	2016 S1	active
COMP2400	Relational Databases	6	111	**COMP2400**	2016 S2	active
BUSN2011	Management Accounting	6	111	**BUSN2011**	2016 S1	active

Inner Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following INNER JOIN statement?

WeChat: cstutorcs

```
SELECT COURSE.No
FROM COURSE INNER JOIN ENROL ON COURSE.No=ENROL.CourseNo;
```

COURSE			ENROL			
No	Cname	Unit	StudentID	CourseNo	Semester	Status
COMP2400	Relational Databases	6	222	COMP2400	2016 S1	active
COMP2400	Relational Databases	6	111	COMP2400	2016 S2	active
BUSN2011	Management Accounting	6	111	BUSN2011	2016 S1	active

Inner Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following INNER JOIN statement?

WeChat: cstutorcs

```
SELECT COURSE.No
FROM COURSE INNER JOIN ENROL ON COURSE.No=ENROL.CourseNo;
```

No
COMP2400
COMP2400
BUSN2011

Left Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What would happen for the following LEFT JOIN statement?

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```
SELECT . . .
FROM Course LEFT JOIN Enrol ON Course.No=Enrol.CourseNo;
```

Left Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

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ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What would happen for the following LEFT JOIN statement?

WeChat: cstutorcs

```
SELECT . . .
FROM Course LEFT JOIN Enrol ON Course.No=Enrol.CourseNo;
```

COURSE			ENROL			
No	Cname	Unit	StudentID	CourseNo	Semester	Status
COMP2400	Relational Databases	6	222	COMP2400	2016 S1	active
COMP2400	Relational Databases	6	111	COMP2400	2016 S2	active
BUSN2011	Management Accounting	6	111	BUSN2011	2016 S1	active
ECON2102	Macroeconomics	6	NULL	NULL	NULL	NULL

Left Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following LEFT JOIN statement?

WeChat: cstutorcs

```
SELECT Course.No
FROM Course LEFT JOIN Enrol ON Course.No=Enrol.CourseNo;
```

COURSE			ENROL			
No	Cname	Unit	StudentID	CourseNo	Semester	Status
COMP2400	Relational Databases	6	222	COMP2400	2016 S1	active
COMP2400	Relational Databases	6	111	COMP2400	2016 S2	active
BUSN2011	Management Accounting	6	111	BUSN2011	2016 S1	active
ECON2102	Macroeconomics	6	NULL	NULL	NULL	NULL

Left Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following LEFT JOIN statement?

WeChat: cstutorcs

```
SELECT Course.No
FROM COURSE LEFT JOIN ENROL ON COURSE.No=ENROL.CourseNo;
```

No
COMP2400
COMP2400
BUSN2011
ECON2102

Natural Join

Assignment Project Exam Help

- A natural join is considered as one kind of inner join.

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- In a natural join, two relations are joined implicitly by comparing all attributes of the same names in both relations.

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- A natural join retains all the data of the two tables for only the matched rows, without duplication.

Natural Join – Example

Assignment Project Exam Help

COURSE

CourseNo	CName	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

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ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

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- What would happen for the following NATURAL JOIN statement?

```
SELECT ...
FROM Course NATURAL JOIN Enrol;
```

Natural Join – Example

Assignment Project Exam Help

COURSE

CourseNo	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

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ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What would happen for the following NATURAL JOIN statement?

WeChat: cstutorcs

```
SELECT ...
FROM COURSE NATURAL JOIN ENROL;
```

	COURSE		ENROL		
CourseNo	Cname	Unit	StudentID	Semester	Status
COMP2400	Relational Databases	6	222	2016 S1	active
COMP2400	Relational Databases	6	111	2016 S2	active
BUSN2011	Management Accounting	6	111	2016 S1	active

Natural Join – Example

Assignment Project Exam Help

COURSE

CourseNo	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

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ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following NATURAL JOIN statement?

WeChat: cstutorcs

```
SELECT CourseNo
FROM COURSE NATURAL JOIN ENROL;
```

	COURSE		ENROL		
CourseNo	Cname	Unit	StudentID	Semester	Status
COMP2400	Relational Databases	6	222	2016 S1	active
COMP2400	Relational Databases	6	111	2016 S2	active
BUSN2011	Management Accounting	6	111	2016 S1	active

Natural Join – Example

Assignment Project Exam Help

COURSE

CourseNo	CName	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

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ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

WeChat: cstutorcs

- What is the result for the following NATURAL JOIN statement?

```
SELECT CourseNo
FROM COURSE NATURAL JOIN ENROL;
```

CourseNo
COMP2400
COMP2400
BUSN2011

Natural Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

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ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

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- What is the result for the following NATURAL JOIN statement?

```
SELECT *
FROM COURSE NATURAL JOIN ENROL;
```

Natural Join – Example

Assignment Project Exam Help

COURSE

No	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

https://tutorcs.com

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

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- What is the result for the following NATURAL JOIN statement?

```
SELECT *
FROM Course NATURAL JOIN Enrol;
```

If there are no matching attributes in two tables for NATURAL JOIN,

```
SELECT *
FROM Course, Enrol;
```

Natural Join – Example

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COURSE

CourseNo	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following NATURAL JOIN statement?

```
SELECT *
FROM Course NATURAL JOIN Enrol ON Course.CourseNo=Enrol.CourseNo;
```

Natural Join – Example

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COURSE

CourseNo	Cname	Unit
COMP2400	Relational Databases	6
BUSN2011	Management Accounting	6
ECON2102	Macroeconomics	6

ENROL

StudentID	CourseNo	Semester	Status
111	BUSN2011	2016 S1	active
222	COMP2400	2016 S1	active
111	COMP2400	2016 S2	active

- What is the result for the following NATURAL JOIN statement?

```
SELECT *
FROM Course NATURAL JOIN Enrol ON Course.CourseNo=Enrol.CourseNo;
```

ERROR MESSAGE because a NATURAL JOIN **implicitly** compares all attributes of the same names in two table.

Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

https://tutorcs.com

COURSE		
No	Cname	Unit

ENROL		
StudentID	CourseNo	Status

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- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
  1. Use SELECT + FROM (Cartesian Product) + WHERE
  2. Use SELECT + FROM (INNER JOIN) + ON
  3. Use SELECT + FROM (INNER JOIN) + ON + WHERE
  4. Use SELECT + FROM (NATURAL JOIN) + WHERE

Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (1) Use SELECT + FROM (Cartesian Product) + WHERE

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Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (1) Use SELECT + FROM (Cartesian Product) + WHERE

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```
SELECT STUDENT.*, ENROL.CourseNo
FROM STUDENT, ENROL
WHERE (STUDENT.StudentID=ENROL.StudentID)
      AND (ENROL.CourseNo = 'X');
```

Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (2) Use SELECT + FROM (INNER JOIN) + ON

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Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (2) Use SELECT + FROM (INNER JOIN) + ON

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```
SELECT STUDENT.*, ENROL.CourseNo
FROM STUDENT INNER JOIN ENROL
ON (STUDENT.StudentID=ENROL.StudentID)
    AND (ENROL.CourseNo = 'X');
```

Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (3) Use SELECT + FROM (INNER JOIN) + ON + WHERE

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Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (3) Use SELECT + FROM (INNER JOIN) + ON + WHERE

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```
SELECT STUDENT.*, ENROL.CourseNo
FROM STUDENT INNER JOIN ENROL
ON STUDENT.StudentID=ENROL.StudentID
WHERE ENROL.CourseNo = 'X';
```

Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (4) Use SELECT + FROM (NATURAL JOIN) + WHERE

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Join – More Examples

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

https://tutorcs.com

- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses.
- (4) Use SELECT + FROM (NATURAL JOIN) + WHERE

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```
SELECT STUDENT.*, ENROL.CourseNo
FROM STUDENT NATURAL JOIN ENROL
WHERE ENROL.CourseNo = 'X';
```

Subqueries

Assignment Project Exam Help

- **Subqueries** can be viewed as temporary tables (usually in conjunction with aliases and renaming, exist only for the query).
- Subqueries can be specified within the `FROM`-clause.
- Subqueries can also be specified within the `WHERE`-clause, e.g.,
  - `IN` *subquery* tests if tuple occurs in the temporary table of the subquery.
  - `EXISTS` *subquery* tests whether the temporary table of the subquery is empty or not.
  - using `ALL`, `SOME` or `ANY` before a subquery makes subqueries usable in comparison formulae (`SOME` and `ANY` are interchangeable).
  - in all these cases the condition involving the subquery can be negated using a preceding `NOT`.

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Subqueries IN – Example

Assignment Project Exam Help

STUDENT			
StudentID	Name	DoB	Email

ENROL		
StudentID	CourseNo	Status

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- List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses, we have:

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```
SELECT STUDENT.*, ENROL.CourseNo
FROM STUDENT NATURAL JOIN ENROL
WHERE ENROL.CourseNo = 'X';
```

- Now if we want to list all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

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Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.
  - List the CourseNo of the courses in Enrol *that have less than 10 students enrolled*.

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Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.
  - List the CourseNo of the courses in Enrol *that have less than 10 students enrolled*.

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```
SELECT CourseNo
FROM Enrol
GROUP BY CourseNo
HAVING COUNT(*)<10;
```

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Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.
  - List the CourseNo of the courses in Enrol *that have less than 10 students enrolled*.

https://tutorcs.com

```
SELECT CourseNo
FROM ENROL
GROUP BY CourseNo
HAVING COUNT(*)<10;
```

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  - List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.
  - List the CourseNo of the courses in Enrol *that have less than 10 students enrolled*.

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```
SELECT CourseNo
FROM ENROL
GROUP BY CourseNo
HAVING COUNT(*)<10;
```

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  - List all information of students who have enrolled in a course with CourseNo='X' and the CourseNo of these courses

```
SELECT Student.*, Enrol.CourseNo
FROM STUDENT NATURAL JOIN ENROL
WHERE Enrol.CourseNo = 'X';
```

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

https://tutorcs.com

```
SELECT STUDENT.*, CourseNo
FROM STUDENT NATURAL JOIN ENROL
WHERE CourseNo IN (SELECT CourseNo
                   FROM ENROL
                   GROUP BY CourseNo
                   HAVING COUNT(*)<10);
```

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Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

https://tutorcs.com

```
SELECT STUDENT.*, CourseNo
FROM STUDENT NATURAL JOIN ENROL
WHERE CourseNo IN (SELECT CourseNo
                   FROM ENROL
                   GROUP BY CourseNo
                   HAVING COUNT(*)<10);
```

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- Does the above query look confusing?

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

https://tutorcs.com

```
SELECT STUDENT.*, CourseNo
FROM STUDENT NATURAL JOIN ENROL
WHERE CourseNo IN (SELECT CourseNo
                   FROM ENROL
                   GROUP BY CourseNo
                   HAVING COUNT(*)<10);
```

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- Does the above query look confusing?

  It is better to distinguish two ENROL tables.

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

https://tutorcs.com

```
SELECT STUDENT.*,e1.CourseNo
FROM STUDENT NATURAL JOIN ENROL e1
WHERE e1.CourseNo IN (SELECT e2.CourseNo
                      FROM ENROL e2
                      GROUP BY e2.CourseNo
                      HAVING COUNT(*)<10);
```

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Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

https://tutorcs.com

```
SELECT STUDENT.*,e1.CourseNo
FROM STUDENT NATURAL JOIN ENROL e1
WHERE e1.CourseNo IN (SELECT e2.CourseNo
                      FROM ENROL e2
                      GROUP BY e2.CourseNo
                      HAVING COUNT(*)<10);
```

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- Why do we use aliases e1 and e2 for ENROL?

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

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```
SELECT STUDENT.*,e1.CourseNo
FROM STUDENT NATURAL JOIN ENROL e1
WHERE e1.CourseNo IN (SELECT e2.CourseNo
                      FROM ENROL e2
                      GROUP BY e2.CourseNo
                      HAVING COUNT(*)<10);
```

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- Why do we use aliases e1 and e2 for ENROL?

  Distinguish two ENROL tables.

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

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```
SELECT STUDENT.*,e1.CourseNo
FROM STUDENT NATURAL JOIN ENROL e1
WHERE e1.CourseNo IN (SELECT e2.CourseNo, COUNT(*)
                      FROM ENROL e2
                      GROUP BY e2.CourseNo
                      HAVING COUNT(*)<10);
```

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Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

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```
SELECT STUDENT.*,e1.CourseNo
FROM STUDENT NATURAL JOIN ENROL e1
WHERE e1.CourseNo IN (SELECT e2.CourseNo, COUNT(*)
                      FROM ENROL e2
                      GROUP BY e2.CourseNo
                      HAVING COUNT(*)<10);
```

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- Is the above query correct?

Subqueries IN – Example

Assignment Project Exam Help

- List all information of students who have enrolled in a course *that has less than 10 students enrolled* and the CourseNo of these courses.

https://tutorcs.com

```
SELECT STUDENT.*,e1.CourseNo
FROM STUDENT NATURAL JOIN ENROL e1
WHERE e1.CourseNo IN (SELECT e2.CourseNo, COUNT(*)
                      FROM ENROL e2
                      GROUP BY e2.CourseNo
                      HAVING COUNT(*)<10);
```

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- Is the above query correct?

  No. `IN` *subquery* tests if tuple occurs in the temporary table of the subquery.

Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	John
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

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Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	John
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT s
WHERE EXISTS (SELECT *
              FROM ENROL e
              WHERE s.StudentID=e.StudentID);
```

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Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	John
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT s
WHERE EXISTS (SELECT *
              FROM ENROL e
              WHERE s.StudentID=e.StudentID);
```

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1st tuple of STUDENT, EXISTS

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
111	COMP2400	2016 S2

2st tuple of STUDENT, EXISTS

StudentID	CourseNo	Semester
222	COMP2400	2016 S1

- **The above query (returning 2) is correct!**

Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	John
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM ENROL e
WHERE EXISTS (SELECT *
              FROM STUDENT s
              WHERE e.StudentID=s.StudentID);
```

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Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM ENROL e
WHERE EXISTS (SELECT *
              FROM STUDENT s
              WHERE e.StudentID=s.StudentID);
```

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1st tuple in ENROL, EXISTS

2nd tuple in ENROL, EXISTS

3rd tuple in ENROL, EXISTS

StudentID	Name
111	Tom

StudentID	Name
222	Emily

StudentID	Name
111	Tom

- **The above query (returning 3 instead of 2) is incorrect!**

Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2031	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT s
WHERE EXISTS (SELECT *
              FROM ENROL e
              WHERE s.StudentID=e.StudentID);
```

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```
SELECT COUNT(*)
FROM STUDENT s
WHERE EXISTS (SELECT StudentID
              FROM ENROL e
              WHERE s.StudentID=e.StudentID);
```

Subqueries EXISTS – Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2031	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT s
WHERE EXISTS (SELECT *
              FROM ENROL e
              WHERE s.StudentID=e.StudentID);
```

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```
SELECT COUNT(*)
FROM STUDENT s
WHERE EXISTS (SELECT StudentID
              FROM ENROL e
              WHERE s.StudentID=e.StudentID);
```

- **Both queries are correct!** `EXISTS` *subquery* tests whether the temporary table of the subquery is empty or not.

Using Cartesian Product – Same Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT, ENROL
WHERE STUDENT.StudentID=ENROL.StudentID;
```

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Using Cartesian Product – Same Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT, ENROL
WHERE STUDENT.StudentID=ENROL.StudentID;
```

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STUDENT		ENROL		
StudentID	Name	StudentID	CourseNo	Semester
111	Tom	111	BUSN2011	2016 S1
111	Tom	111	COMP2400	2016 S2
222	Emily	222	COMP2400	2016 S1

Using Cartesian Product – Same Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT, ENROL
WHERE STUDENT.StudentID=ENROL.StudentID;
```

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STUDENT		ENROL		
StudentID	Name	StudentID	CourseNo	Semester
111	Tom	111	BUSN2011	2016 S1
111	Tom	111	COMP2400	2016 S2
222	Emily	222	COMP2400	2016 S1

- **The above query is incorrect!**

Using Cartesian Product – Same Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

https://tutorcs.com

```
SELECT COUNT(*)
FROM STUDENT, ENROL
WHERE STUDENT.StudentID=ENROL.StudentID;
```

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STUDENT		ENROL		
StudentID	Name	StudentID	CourseNo	Semester
111	Tom	111	BUSN2011	2016 S1
111	Tom	111	COMP2400	2016 S2
222	Emily	222	COMP2400	2016 S1

- **The above query is incorrect!**
  We should use COUNT(DISTINCT StudentID) instead of COUNT(*).

Using INNER JOIN – Same Example

Assignment Project Exam Help

Student	
StudentID	Name
111	Tom
222	Emily
333	John

Enrol		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

https://tutorcs.com

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student s INNER JOIN Enrol e
ON s.StudentID=e.StudentID;
```

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Using INNER JOIN – Same Example

Assignment Project Exam Help

Student

StudentID	Name
111	Tom
222	Emily
333	John

Enrol

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

https://tutorcs.com

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student s INNER JOIN Enrol e
ON s.StudentID=e.StudentID;
```

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s | e

StudentID	Name	StudentID	CourseNo	Semester
111	Tom	111	BUSN2011	2016 S1
111	Tom	111	COMP2400	2016 S2
222	Emily	222	COMP2400	2016 S1

Using INNER JOIN – Same Example

Assignment Project Exam Help

Student

StudentID	Name
111	Tom
222	Emily
333	John

Enrol

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

https://tutorcs.com

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student s INNER JOIN Enrol e
ON s.StudentID=e.StudentID;
```

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s ⋈ e

StudentID	Name	StudentID	CourseNo	Semester
111	Tom	111	BUSN2011	2016 S1
111	Tom	111	COMP2400	2016 S2
222	Emily	222	COMP2400	2016 S1

- **The above query is incorrect!**

Using INNER JOIN – Same Example

Assignment Project Exam Help

Student

StudentID	Name
111	Tom
222	Emily
333	John

Enrol

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

https://tutorcs.com

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student s INNER JOIN Enrol e
ON s.StudentID=e.StudentID;
```

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s ⋈ e

StudentID	Name	StudentID	CourseNo	Semester
111	Tom	111	BUSN2011	2016 S1
111	Tom	111	COMP2400	2016 S2
222	Emily	222	COMP2400	2016 S1

- **The above query is incorrect!**
  We should use COUNT(DISTINCT StudentID) instead of COUNT(*).

Using NATURAL JOIN – Same Example

Assignment Project Exam Help

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

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- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM STUDENT NATURAL JOIN ENROL;
```

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Using NATURAL JOIN – Same Example

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STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student NATURAL JOIN Enrol;
```

StudentID	Name	CourseNo	Semester
111	Tom	BUSN2011	2016 S1
111	Tom	COMP2400	2016 S2
222	Emily	COMP2400	2016 S1

Using NATURAL JOIN – Same Example

Assignment Project Exam Help
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STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student NATURAL JOIN Enrol;
```

StudentID	Name	CourseNo	Semester
111	Tom	BUSN2011	2016 S1
111	Tom	COMP2400	2016 S2
222	Emily	COMP2400	2016 S1

- **The above query is incorrect!**

Using NATURAL JOIN – Same Example

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STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(*)
FROM Student NATURAL JOIN Enrol;
```

StudentID	Name	CourseNo	Semester
111	Tom	BUSN2011	2016 S1
111	Tom	COMP2400	2016 S2
222	Emily	COMP2400	2016 S1

- **The above query is incorrect!**
  We should use COUNT(DISTINCT StudentID) instead of COUNT(*).

A Simple Solution – Same Example

Assignment Project Exam Help

STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John

ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

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- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(DISTINCT StudentID)
FROM Enrol;
```

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A Simple Solution – Same Example

Assignment Project Exam Help

STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John

ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

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- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(DISTINCT StudentID)
FROM Enrol;
```

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- **The above query is correct!**

A Simple Solution – Same Example

Assignment Project Exam Help

STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John

ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S1
222	COMP2400	2016 S1
111	COMP2400	2016 S2

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- Count the number of students who have enrolled in at least one course?

```
SELECT COUNT(DISTINCT StudentID)
FROM Enrol;
```

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- **The above query is correct!**
  - Is this the shortest query to answer the above question? Refer to the last slide on "[Credit Cookie] The Shortest Code/Program?".

Subqueries – More Examples

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

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Subqueries – More Examples

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016
  - List the CourseNo and the corresponding number of students enrolled for all courses in Semester 2 2016

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Subqueries – More Examples

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016
  - List the CourseNo and the corresponding number of students enrolled for all courses in Semester 2 2016

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```
SELECT CourseNo, COUNT(*) AS NoOfStudents
FROM ENROL
WHERE Semester = '2016 S2'
GROUP BY CourseNo;
```

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Subqueries – More Examples

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016
  - List the CourseNo and the corresponding number of students enrolled for all courses in Semester 2 2016

https://tutorcs.com

```
SELECT CourseNo, COUNT(*) AS NoOfStudents
FROM ENROL
WHERE Semester = '2016 S2'
GROUP BY CourseNo;
```

  - List the largest number of students enrolled in a course in Semester 2 2016

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Subqueries – More Examples

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016
  - List the CourseNo and the corresponding number of students enrolled for all courses in Semester 2 2016

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```
SELECT CourseNo, COUNT(*) AS NoOfStudents
FROM Enrol
WHERE Semester = '2016 S2'
GROUP BY CourseNo;
```

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  - List the largest number of students enrolled in a course in Semester 2 2016

```
SELECT MAX(NoOfStudents)
FROM (SELECT CourseNo, COUNT(*) AS NoOfStudents
      FROM Enrol
      WHERE Semester = '2016 S2'
      GROUP BY CourseNo);
```

Subqueries – Combination and Aliases

- List the courses that have the largest number of students enrolled in Semester 2 2016

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```
SELECT CourseNo
FROM (SELECT CourseNo, COUNT(*) AS NoOfStudents
      FROM Enrol
      WHERE Semester = '2016 S2'
      GROUP BY CourseNo)
WHERE NoOfStudents =
      (SELECT MAX(NoOfStudents)
       FROM (SELECT CourseNo, COUNT(*) AS NoOfStudents
             FROM Enrol
             WHERE Semester = '2016 S2'
             GROUP BY CourseNo));
```

Subqueries – Combination and Aliases

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

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```
SELECT CourseNo
FROM (SELECT CourseNo, COUNT(*) AS NoOfStudents
      FROM Enrol
      WHERE Semester = '2016 S2'
      GROUP BY CourseNo)
WHERE NoOfStudents =
      (SELECT MAX(NoOfStudents)
       FROM (SELECT CourseNo, COUNT(*) AS NoOfStudents
             FROM Enrol
             WHERE Semester = '2016 S2'
             GROUP BY CourseNo));
```

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- **ERROR**: Subqueries specifying a derived table must be enclosed in parentheses and must be assigned a table alias name.

Subqueries – Combination and Aliases

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

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```
SELECT e.CourseNo
FROM (SELECT e1.CourseNo, COUNT(*) AS NoOfStudents
      FROM Enrol e1
      WHERE e1.Semester = '2016 S2'
      GROUP BY e1.CourseNo) e
WHERE e.NoOfStudents =
        (SELECT MAX(e2.NoOfStudents)
         FROM (SELECT e1.CourseNo, COUNT(*) AS NoOfStudents
               FROM Enrol e1
               WHERE e1.Semester = '2016 S2'
               GROUP BY e1.CourseNo) e2);
```

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- Which alias(es) are essential in the above query?

Subqueries – Combination and Aliases

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

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```
SELECT e.CourseNo
FROM (SELECT e1.CourseNo, COUNT(*) AS NoOfStudents
      FROM Enrol e1
      WHERE e1.Semester = '2016 S2'
      GROUP BY e1.CourseNo) e
WHERE e.NoOfStudents =
        (SELECT MAX(e2.NoOfStudents)
         FROM (SELECT e1.CourseNo, COUNT(*) AS NoOfStudents
               FROM Enrol e1
               WHERE e1.Semester = '2016 S2'
               GROUP BY e1.CourseNo) e2);
```

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- Which alias(es) are essential in the above query?
  The aliases e and e2 are essential but e1 is not.

Subqueries – Use "With"

- List the courses that have the largest number of students enrolled in Semester 2 2016

Use "WITH" to break down complicated queries into simpler parts.[1]

Assignment Project Exam Help

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[1] https://www.postgresql.org/docs/current/static/queries-with.html

Subqueries – Use "With"

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

Use "WITH" to break down complicated queries into simpler parts.[1]

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```
WITH Sem2Students AS
     (SELECT e1.CourseNo, COUNT(*) AS NoOfStudents
      FROM ENROL e1
      WHERE e1.Semester = '2016 S2'
      GROUP BY e1.CourseNo)
SELECT e.CourseNo
FROM Sem2Students e
WHERE e.NoOfStudents =
            (SELECT MAX(e2.NoOfStudents)
             FROM Sem2Students e2);
```

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- Which alias(es) are essential in the above query?

[1] https://www.postgresql.org/docs/current/static/queries-with.html

Subqueries – Use "With"

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

Use "WITH" to break down complicated queries into simpler parts.[1]

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```
WITH Sem2Students AS
     (SELECT e1.CourseNo, COUNT(*) AS NoOfStudents
      FROM ENROL e1
      WHERE e1.Semester = '2016 S2'
      GROUP BY e1.CourseNo)
SELECT e.CourseNo
FROM Sem2Students e
WHERE e.NoOfStudents =
            (SELECT MAX(e2.NoOfStudents)
             FROM Sem2Students e2);
```

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- Which alias(es) are essential in the above query?
  None of the aliases e, e1 and e2 are essential.

[1] https://www.postgresql.org/docs/current/static/queries-with.html

Subqueries – Result

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

Input: https://tutorcs.com

ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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Subqueries – Result

Assignment Project Exam Help

- List the courses that have the largest number of students enrolled in Semester 2 2016

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Input:

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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Output:

CourseNo
COMP2400
BUSN2011

Subqueries – More Examples

Assignment Project Exam Help

- List all students' IDs and names who are under-enrolled ($<$ 4 courses) in Semester 2 2016.

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Subqueries – More Examples

Assignment Project Exam Help

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- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.
  - List the students' IDs and the corresponding number of enrolled courses in Semester 2 2016

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Subqueries – More Examples

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- List all students' IDs and names who are under-enrolled ($<$ 4 courses) in Semester 2 2016.
  - List the students' IDs and the corresponding number of enrolled courses in Semester 2 2016

```
SELECT e.StudentID, COUNT(*) AS NoOfEnrols
FROM ENROL e
WHERE e.Semester = '2016 S2'
GROUP BY e.StudentID;
```

Subqueries – More Examples

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

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Subqueries – More Examples

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

```
SELECT s.StudentID, s.Name
FROM (SELECT e.StudentID, COUNT(*) AS NoOfEnrols
      FROM ENROL e
      WHERE e.Semester = '2016S2'
      GROUP BY e.StudentID) ne INNER JOIN STUDENT s
ON (s.StudentID = ne.StudentID) AND (ne.NoOfEnrols < 4);
```

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Subqueries – More Examples

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

```
SELECT s.StudentID, s.Name
FROM (SELECT e.StudentID, COUNT(*) AS NoOfEnrols
      FROM Enrol e
      WHERE e.Semester = '2016 S2'
      GROUP BY e.StudentID) ne INNER JOIN Student s
ON (s.StudentID = ne.StudentID) AND (ne.NoOfEnrols < 4);

WITH StudEnrols AS (
      SELECT e.StudentID, COUNT(*) AS NoOfEnrols
      FROM Enrol e
      WHERE e.Semester = '2016 S2'
      GROUP BY e.StudentID)
SELECT s.StudentID, s.Name
FROM Student s INNER JOIN StudEnrols ne
ON (s.StudentID = ne.StudentID) AND (ne.NoOfEnrols < 4);
```

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Subqueries – Is The Previous Query Correct?

Assignment Project Exam Help

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John

Subqueries – Is The Previous Query Correct?

Assignment Project Exam Help

- List all students IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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Result:

StudentID	Name
222	Emily
333	John

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STUDENT

StudentID	Name
111	Tom
222	Emily
333	John

Subqueries – What About The Following Scenario?

Assignment Project Exam Help

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

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ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John
444	Ana

Subqueries – What About The Following Scenario?

Assignment Project Exam Help

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

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ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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Result (still correct?):

StudentID	Name
222	Emily
333	John

STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John
444	Ana

Subqueries – Use LEFT/RIGHT JOIN?

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

```
SELECT s.StudentID, s.Name
FROM (SELECT e.StudentID, COUNT(*) AS NoOfEnrols
      FROM ENROL e
      WHERE e.Semester = '2016 S2'
      GROUP BY e.StudentID) ne RIGHT JOIN STUDENT s
ON (s.StudentID = ne.StudentID) AND (ne.NoOfEnrols < 4);

WITH StudEnrols AS (
      SELECT e.StudentID, COUNT(*) AS NoOfEnrols
      FROM ENROL e
      WHERE e.Semester = '2016 S2'
      GROUP BY e.StudentID)
SELECT s.StudentID, s.Name
FROM STUDENT s LEFT JOIN StudEnrols ne
ON (s.StudentID = ne.StudentID) AND (ne.NoOfEnrols < 4);
```

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Subqueries – Using LEFT/RIGHT JOIN Is Still Incorrect!

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- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

ENROL

StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

STUDENT

StudentID	Name
111	Tom
222	Emily
333	John
444	Ana

Result (still incorrect?):

StudentID	Name
111	Tom
222	Emily
333	John
444	Ana

- The reason why "111, Tom" is incorrectly included in the final result is due to "Query Processing and Optimisation", which will be discussed in Week 8.

Subqueries – Use Set Operations

Assignment Project Exam Help

- List all students' IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

The set of all students EXCEPT the set of students enrolled in at least 4 courses in Semester 2 2016.

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```
SELECT s.StudentID, s.Name
FROM (SELECT StudentID
      FROM STUDENT
      EXCEPT
      SELECT e.StudentID
      FROM ENROL e
      WHERE e.Semester = '2016 S2'
      GROUP BY e.StudentID
      HAVING COUNT(*) > 3) e4 INNER JOIN Student s
ON (e4.StudentID = s.StudentID);
```

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Subqueries – Using Set Operations Works.

Assignment Project Exam Help

- List all students IDs and names who are under-enrolled (< 4 courses) in Semester 2 2016.

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ENROL		
StudentID	CourseNo	Semester
111	BUSN2011	2016 S2
111	COMP1100	2016 S2
111	COMP2400	2016 S2
111	ECON2102	2016 S2
222	BUSN2011	2016 S2
222	COMP2400	2016 S2
333	BUSN2011	2016 S2
333	COMP2400	2016 S2
333	ECON2102	2016 S2

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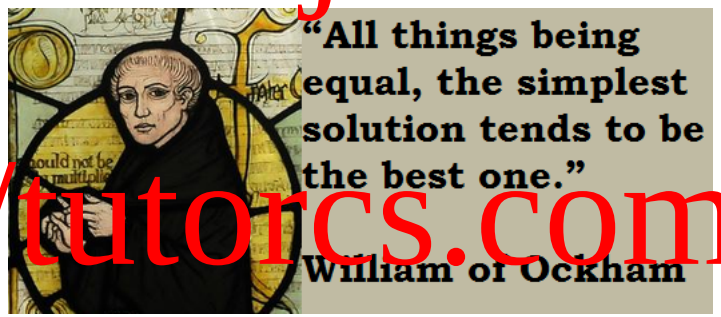
Result:

StudentID	Name
222	Emily
333	John
444	Ana

STUDENT	
StudentID	Name
111	Tom
222	Emily
333	John
444	Ana

[Credit Cookie] The Shortest Code/Program?

- Occam's razor is the problem-solving principle that "entities should not be multiplied beyond necessity".



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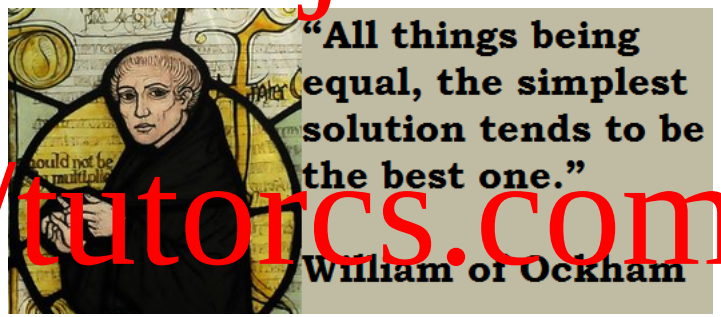
[Credit Cookie] The Shortest Code/Program?

Assignment Project Exam Help

- Occam's razor is the problem-solving principle that "entities should not be multiplied beyond necessity".



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- The minimum description length of a data set (i.e., Kolmogorov complexity) cannot be computed.

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`https://en.wikipedia.org/wiki/Andrey_Kolmogorov`