



# INFO20003 Database Systems

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Lecture 9  
SQL Summary

Semester 2 2018, Week 5



1. Find the name of all sailors whose rating is above 9

$$\pi_{sname}(\sigma_{rating > 9}(Sailors))$$

2. Find all sailors who reserved a boat prior to November 1, 1996

$$\pi_{sname}(Sailors \bowtie \sigma_{day < "11/01/96"}(Reserves))$$

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3. Find (the names of) all boats that have been reserved at least once

$$\pi_{bname}(Boats \bowtie Reserves)$$



4. Find all pairs of sailors with the same rating

$\rho(S1(1 \rightarrow sid1, 2 \rightarrow sname1, 3 \rightarrow rating1, 4 \rightarrow age1), Sailors)$

$\rho(S2(1 \rightarrow sid2, 2 \rightarrow sname2, 3 \rightarrow rating2, 4 \rightarrow age2), Sailors)$

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$\pi_{sname1, sname2}(S1 \bowtie_{rating1=rating2 \wedge sid1 \neq sid2} S2)$



## Examples for marks deduction:

- Entity / Attribute incorrect or missing
- Relationship cardinality incorrect (e.g. one - many)
- Poor naming of object (e.g. T1, T2)
- Wrong data type (e.g. varchar for placing 'age')
- Incorrect primary or foreign key
- Not Null is wrong
- Unresolved M-M exists, or associative entity is incorrect
- Business rules can't be supported (e.g. you cannot obtain the exchange rate on a particular date)

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NOTE: These are EXAMPLES, not a contract set in stone



- Extending your knowledge
  - DML
    - Comparison & Logic Operators
    - Set Operations
    - Subquery
    - Multiple record INSERTs
    - INSERT from a table, UPDATE, DELETE, REPLACE
    - Views
  - DDL
    - ALTER and DROP, TRUNCATE, RENAME
- How to think about SQL
  - Problem Solving

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- SQL keywords are case insensitive
  - We try to CAPITALISE them to make them clear
- Table names are Operating System Sensitive
  - If case sensitivity exists in the operating system, then the table names are case sensitive! (i.e. Mac, Linux)
    - Account <> ACCOUNT
- Field names are case insensitive
  - ACCOUNTID == accountid
- You can do maths in SQL...
  - SELECT 1\*1+1/1-1;

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- Comparison:

Operator	Description
=	Equal to
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to
<> OR !=	Not equal to (depends on DBMS as to which is used)

- Logic:

- AND, NOT, OR
- Example:** SELECT \* FROM Furniture WHERE ((Type="Chair" AND Colour = "Black") OR (Type = "Lamp" AND Colour = "Black"))



- UNION
  - Shows all rows returned from the queries (or tables)
- INTERSECT
  - Shows only rows that are common in the queries (or the tables)
- [UNION/INTERSECT] ALL
  - If you want duplicate rows shown in the results you need to use the ALL keyword.. UNION ALL etc
- In MySQL only UNION and UNION ALL are supported

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```
SELECT Employee.Name, EmployeeType
FROM Employee INNER JOIN Hourly
ON Employee.ID = Hourly.ID

UNION

SELECT Employee.Name, EmployeeType
FROM Employee INNER JOIN Salaried
ON Employee.ID = Salaried.ID;
```

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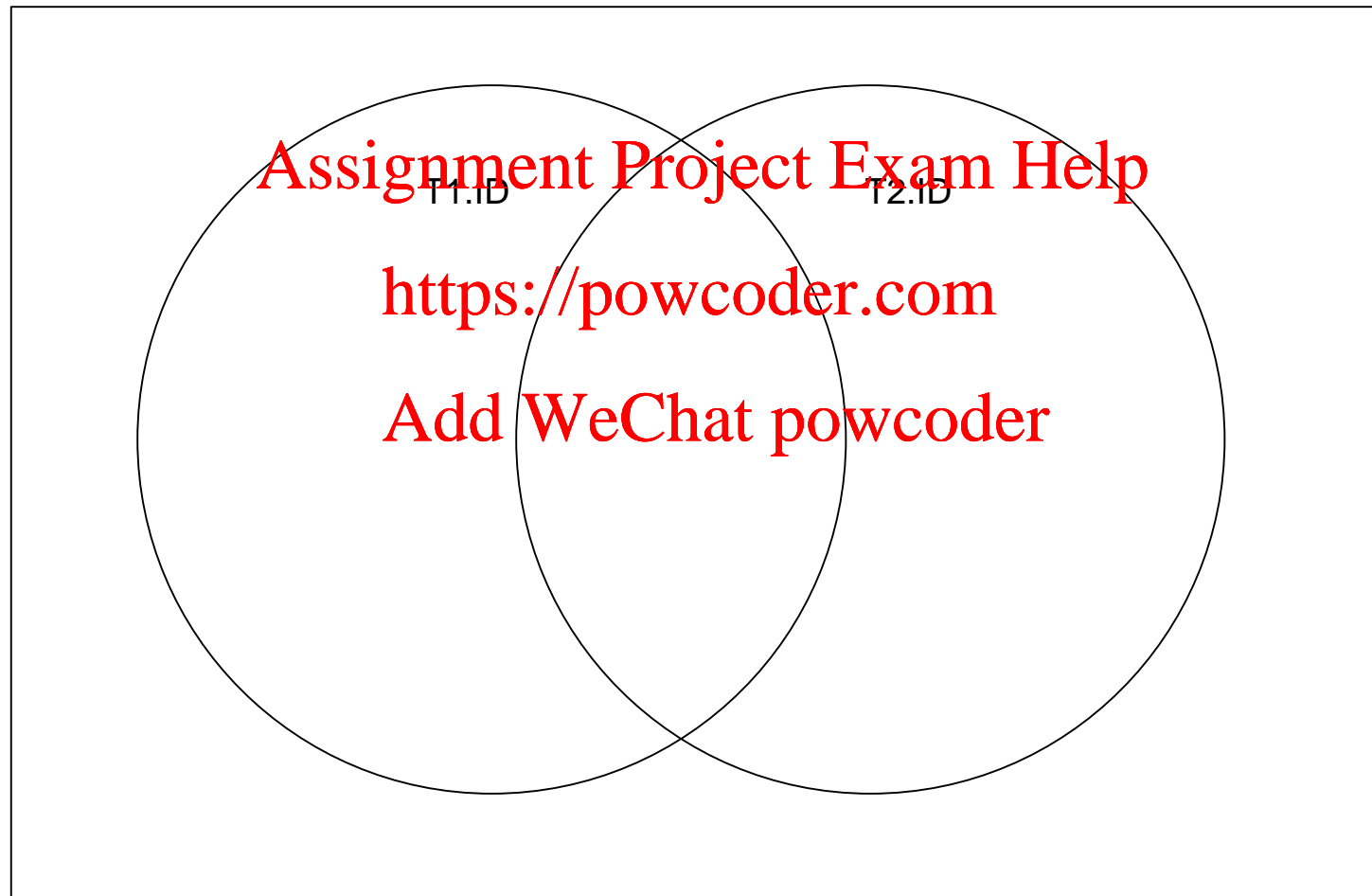
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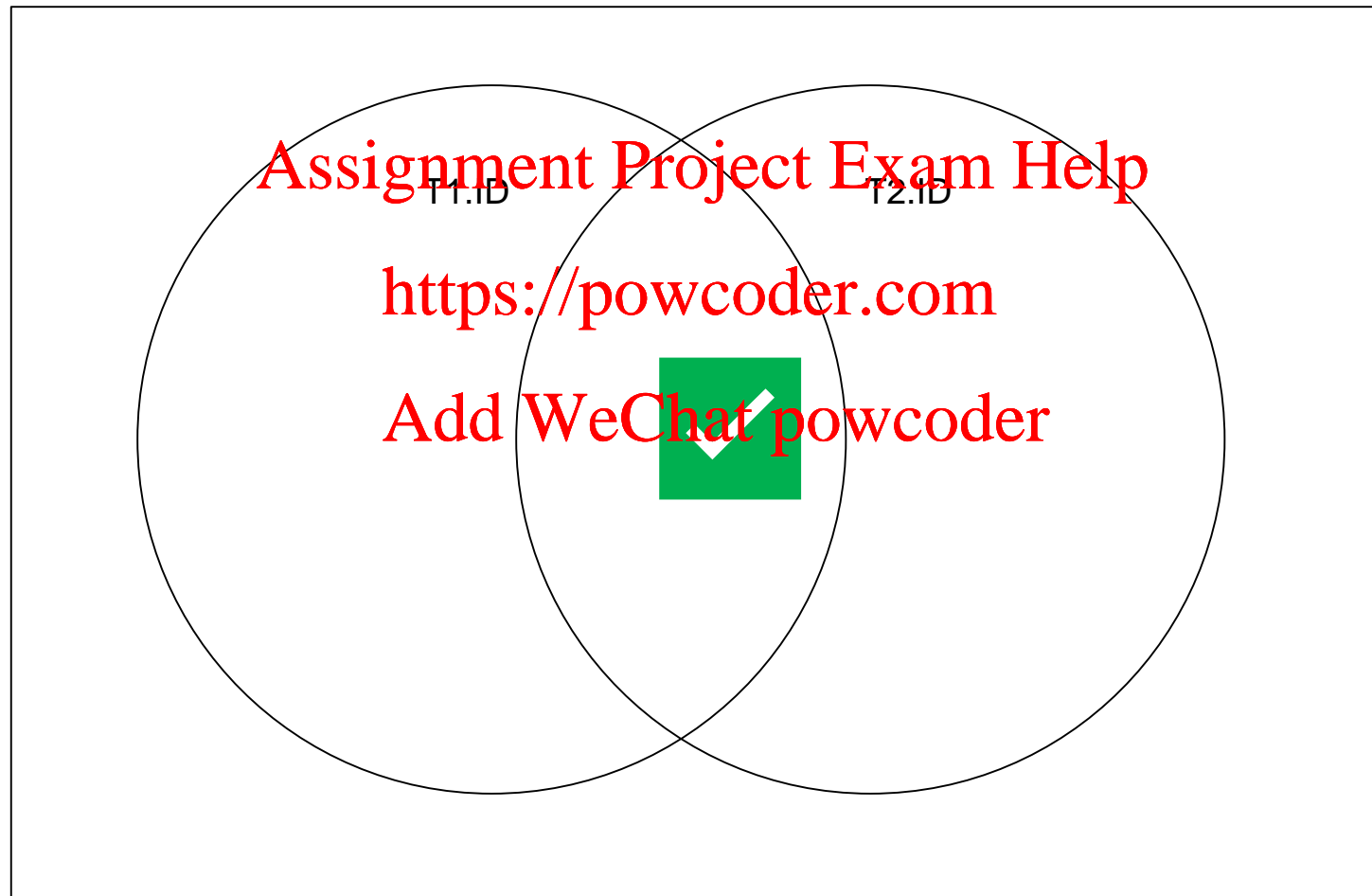
Lecture7.sql Result	
v Output Snippets Query 1 Result	
Fetches 4 records. Duration	
Name	EmployeeType
Alice	H
Alan	H
Sean	S
Linda	S



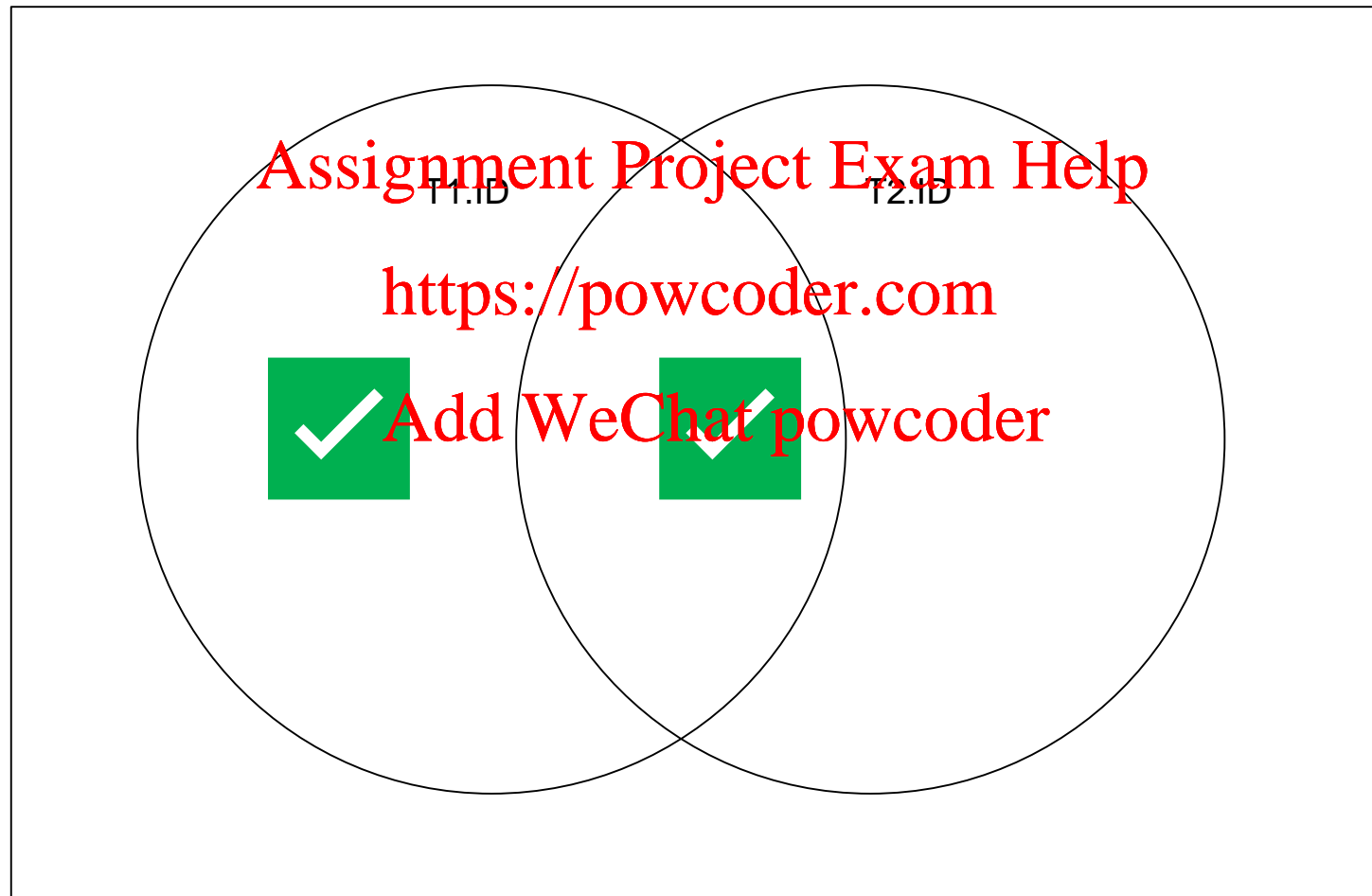
W. EDWARDS



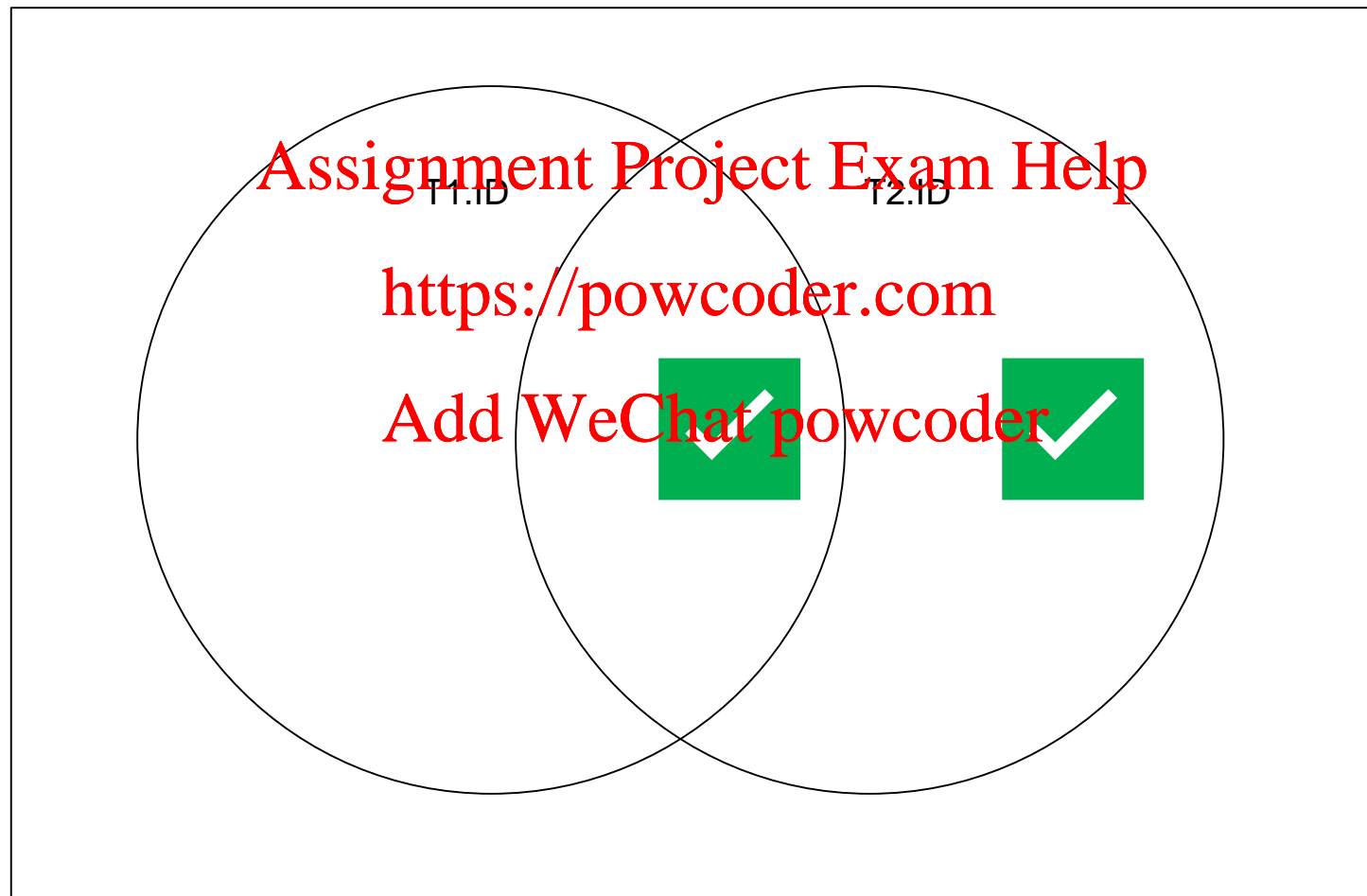
- T1 **INNER JOIN** T2 **ON** T1.ID = T2.ID
- T1 **NATURAL JOIN** T2



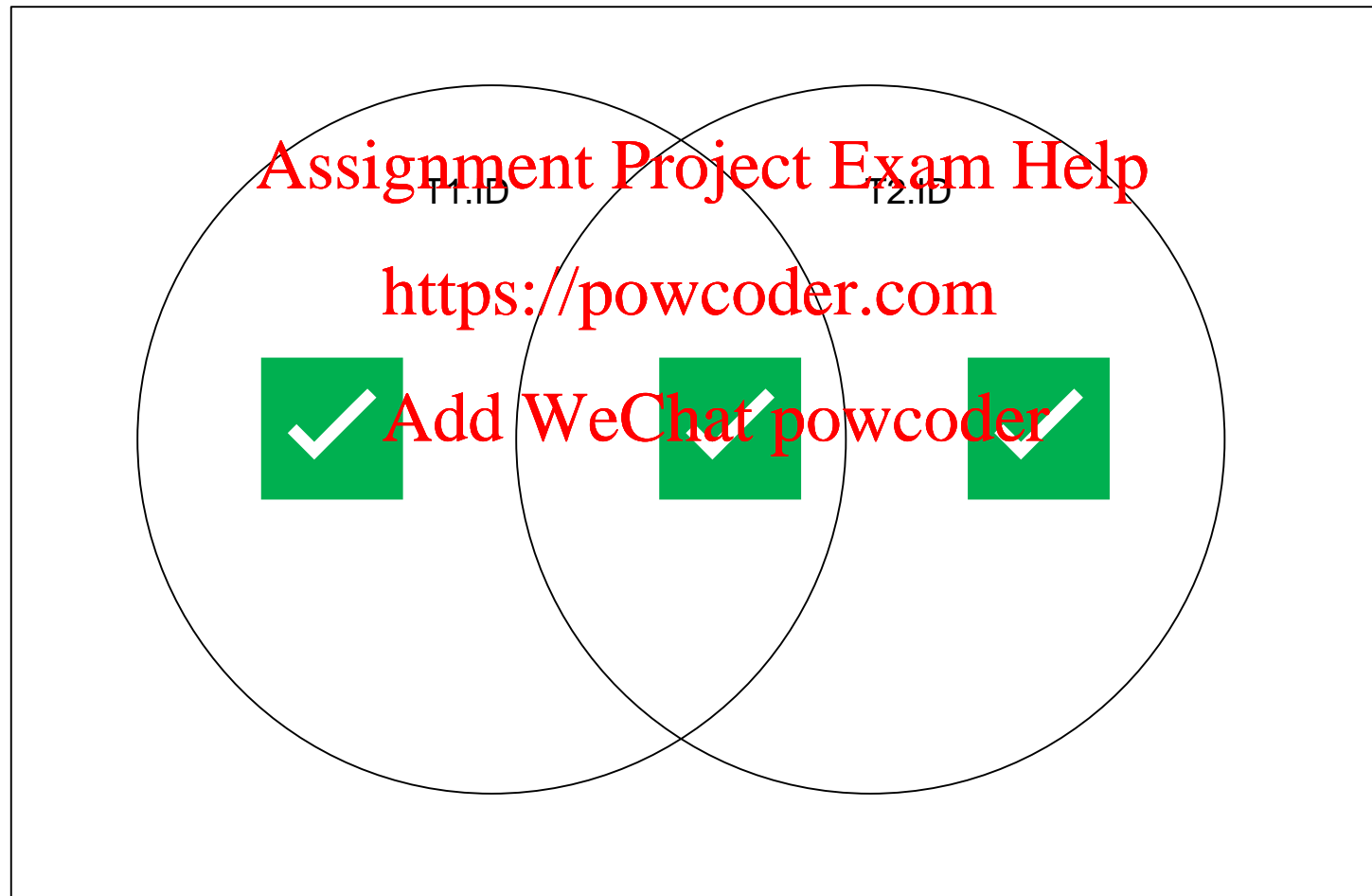
- T1 LEFT OUTER JOIN T2 ON T1.ID = T2.ID



- T1 RIGHT OUTER JOIN T2 ON T1.ID = T2.ID



- T1 FULL OUTER JOIN T2 ON T1.ID = T2.ID





- SQL provides the ability to *nest* subqueries
- A nested query is simply another select query you write to produce a table set
  - Remember that all select queries return a table set of data
- A common use of subqueries is to perform set tests
  - Set membership, set comparisons

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- IN / NOT IN
  - Used to test whether the attribute is IN/NOT IN the subquery list
- ANY
  - True if any value returned meets the condition
- ALL
  - True if all values returned meet the condition
- EXISTS
  - True if the subquery returns one or more records
- For more info:
- [https://www.w3schools.com/sql/sql\\_any\\_all.asp](https://www.w3schools.com/sql/sql_any_all.asp)
- [https://www.w3schools.com/sql/sql\\_exists.asp](https://www.w3schools.com/sql/sql_exists.asp)
- General help with SQL: <https://www.w3schools.com/sql/> (great tutorial)

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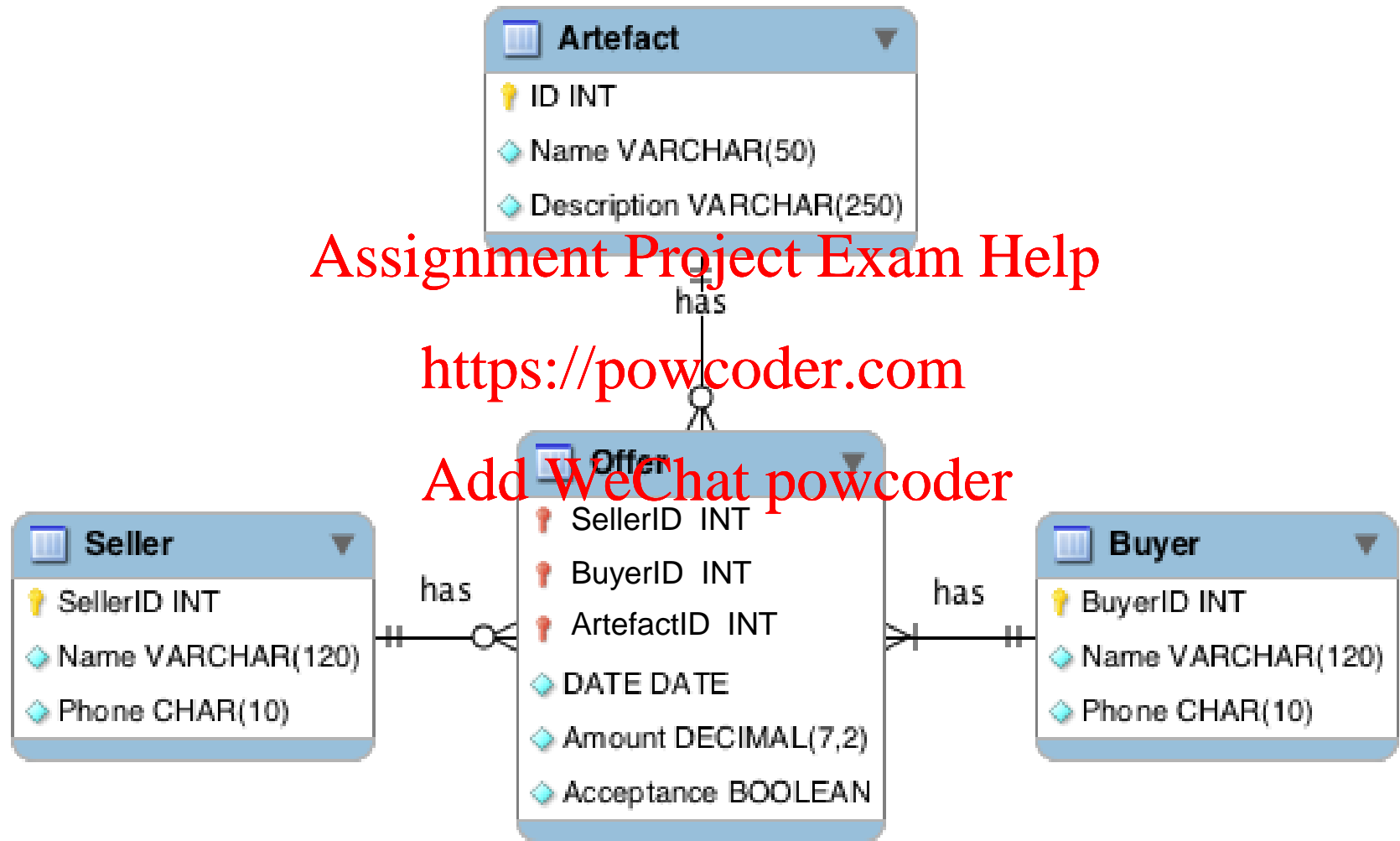
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## Artefact

ID	Name	Description
1	Vase	Old Vase
2	Knife	Old Knife
3	Pot	Old Pot

## Seller

SellerID	Name	Phone
1	Abby	0233333333
2	Ben	0311111111
3	Carl	0555555555

## Buyer

BuyerID	Name	Phone
1	Maggie	0333333333
2	Nicole	0444444444
3	Oleg	0555555555

## Offer

SellerID	ArtefactID	BuyerID	Date	Amount	Acceptance
1	1	1	2012-06-20	81223.23	N
1	1	2	2012-06-20	82223.23	N
2	2	1	2012-06-20	19.95	N
2	2	2	2012-06-20	23.00	N

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## Example: Subquery

- List the BuyerID, Name and Phone number for all bidders on artefact 1

```
SELECT * FROM Buyer
WHERE BuyerID IN
(SELECT BuyerID FROM Offer WHERE ArtefactID = 1)
```

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BuyerID	Name	Phone
1	Maggie	0333333333
2	Nicole	0444444444

- Which Artefacts don't have offers made on them

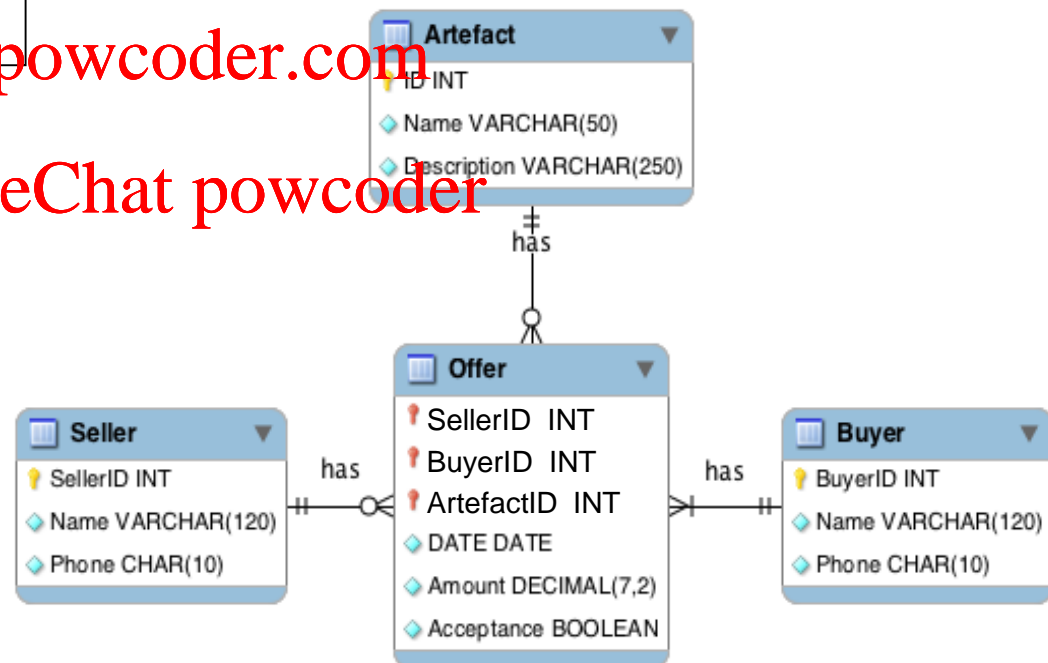
```
SELECT * FROM Artefact
WHERE ID NOT IN
(SELECT ArtefactID FROM Offer);
```

ID	Name	Description
3	Pot	Old Pot

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# Show buyer names for all buyers that haven't made a bid for Artefact 3?

```
SELECT Name FROM Buyer WHERE  
BuyerID IN (SELECT BuyerID FROM  
Offer WHERE ArtefactID = 3);
```

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```
SELECT Name FROM Buyer WHERE  
BuyerID NOT IN (SELECT BuyerID FROM  
Offer WHERE ArtefactID = 3);
```

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```
SELECT Name FROM Buyer NATURAL  
JOIN Offer WHERE ArtefactID !=3;
```



- List the BuyerID, Name and Phone number for all bidders on artefact 1

```
SELECT * FROM Buyer
WHERE BuyerID IN (SELECT BuyerID FROM Offer
WHERE ArtefactID = 1)
```

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Equals to  
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```
SELECT BuyerID, Name and Phone
FROM Buyer NATURAL JOIN Offer
WHERE ArtefactID = 1
```

This is a more efficient way

- Returns true if the subquery returns one or more records
- **Example:** *List the BuyerID, Name and Phone number for all bidders on artefact 1*

```
SELECT * FROM Buyer
```

```
WHERE EXISTS
```

```
(SELECT * FROM Offer
```

```
WHERE Buyer.BuyerID = Offer.BuyerID
```

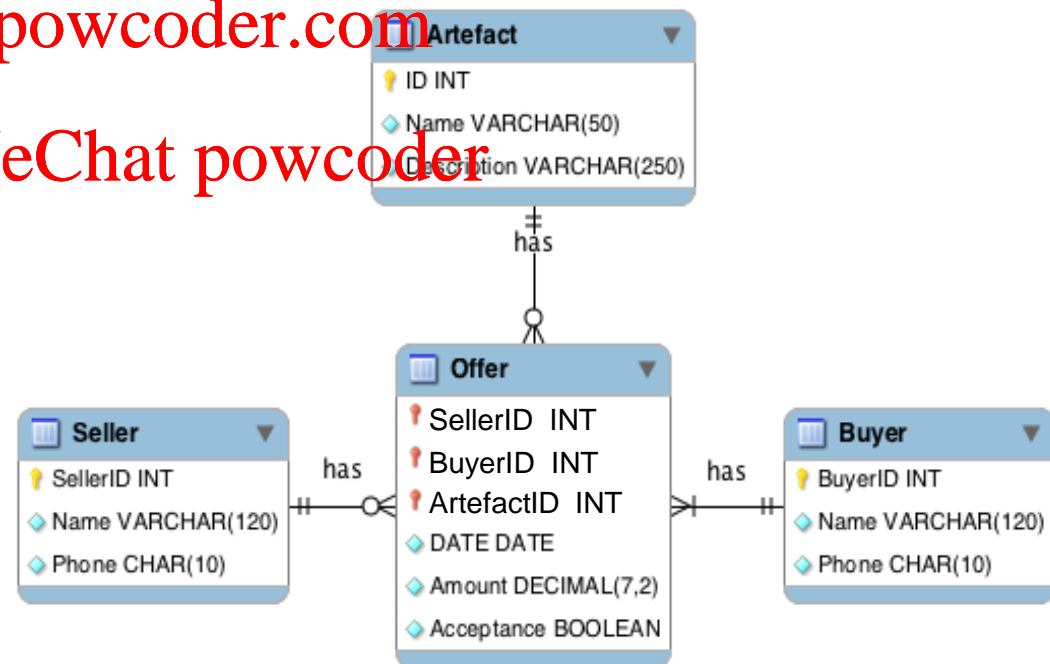
```
AND ArtefactID = 1)
```

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BuyerID	Name	Phone
1	Maggie	0333333333
2	Nicole	0444444444





- Inserting records from a table:
  - Note: table must already exist

```
INSERT INTO NewEmployee  
SELECT * FROM Employee;
```

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- Multiple record inserts:

All columns must be inserted

```
INSERT INTO Employee VALUES  
(DEFAULT, "A", "A's Addr", "2012-02-02", NULL, "S"),  
(DEFAULT, "B", "B's Addr", "2012-02-02", NULL, "S"),  
(DEFAULT, "C", "C's Addr", "2012-02-02", NULL, "S");
```

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Specific columns will be inserted

```
INSERT INTO Employee  
(Name, Address, DateHired, EmployeeType)  
VALUES  
("D", "D's Addr", "2012-02-02", "C"),  
("E", "E's Addr", "2012-02-02", "C"),  
("F", "F's Addr", "2012-02-02", "C");
```



- Changes *existing* data in tables
  - Order of statements is important
  - Specifying a WHERE clause is important
    - Unless you want it to operate on the whole table

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`UPDATE Hourly  
SET HourlyRate = HourlyRate * 1.10;`

- **Example:** Increase all salaries greater than \$100000 by 10% and all other salaries by 5%

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`UPDATE Salaried  
SET AnnualSalary = AnnualSalary * 1.05  
WHERE AnnualSalary <= 100000;  
UPDATE Salaried  
SET AnnualSalary = AnnualSalary * 1.10  
WHERE AnnualSalary > 100000;`

Any problems with this?



# The UPDATE Statement: CASE

- A better solution in this case is to use the **CASE** command

```
UPDATE Salaried
SET AnnualSalary =
CASE
  WHEN AnnualSalary <= 100000
  THEN AnnualSalary * 1.05
  ELSE AnnualSalary * 1.10
END;
```

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If salary is lower than 100000 increase it by 5%,  
otherwise increase it by 10%



- REPLACE
  - REPLACE works identically as INSERT
    - Except if an old row in a table has a key value the same as the new row then it is overwritten...

- DELETE

- The DANGEROUS command – deletes ALL records

```
DELETE FROM Employee;
```

- The better version (unless you are really, really sure)

```
DELETE FROM Employee  
WHERE Name = "Grace";
```

- Be aware of the foreign key constraints
  - ON DELETE CASCADE or ON DELETE RESTRICT (lab practice)

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- Any relation that is not in the physical models, but is made available to the “user” as a virtual relation is called a view.
- Views are good because:
  - They help hide the query complexity from users
  - They help hide data from users
    - Different users use different views
      - Prevents someone from accessing the employee tables to see salaries for instance
    - One way of improving database security
- Create view statement:  
**CREATE VIEW** nameofview **AS** validsqlstatement
- Once a view is defined
  - Its definition is stored in the database (not the data, but metadata – schema information)
  - Can be used just like any other table

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```
CREATE VIEW EmpPay AS
SELECT Employee.ID, Employee.Name, DateHired,
       EmployeeType, HourlyRate AS Pay
FROM Employee INNER JOIN Hourly
ON Employee.ID = Hourly.ID
UNION
SELECT Employee.ID, Employee.Name, DateHired,
       EmployeeType, AnnualSalary AS Pay
FROM Employee INNER JOIN Salaried
ON Employee.ID = Salaried.ID
UNION
SELECT Employee.ID, Employee.Name, DateHired,
       EmployeeType, BillingRate AS Pay
FROM Employee INNER JOIN Consultant
ON Employee.ID = Consultant.ID;
```

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```
SELECT * FROM EmpPay;
```

ID	Name	DateHired	EmployeeType	Pay
3	Alice	2012-12-02	H	23.43
4	Alan	2010-01-22	H	29.43
1	Sean	2012-02-02	S	92000.00
2	Linda	2011-06-12	S	92300.00
5	Peter	2010-09-07	C	210.00
6	Rich	2012-05-19	C	420.00

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```
SELECT * FROM EmpPay  
WHERE EmployeeType = "H" OR EmployeeType = "C"
```

ID	Name	DateHired	EmployeeType	Pay
3	Alice	2012-12-02	H	23.43
4	Alan	2010-01-22	H	29.43
5	Peter	2010-09-07	C	210.00
6	Rich	2012-05-19	C	420.00



- There are more than CREATE!
- ALTER
  - Allows us to add or remove attributes (columns) from a relation (table)
    - `ALTER TABLE TableName ADD AttributeName AttributeType`
    - `ALTER TABLE TableName DROP AttributeName`
- RENAME
  - Allows the renaming of tables (relations)
    - `RENAME TABLE CurrentTableName TO NewTableName`

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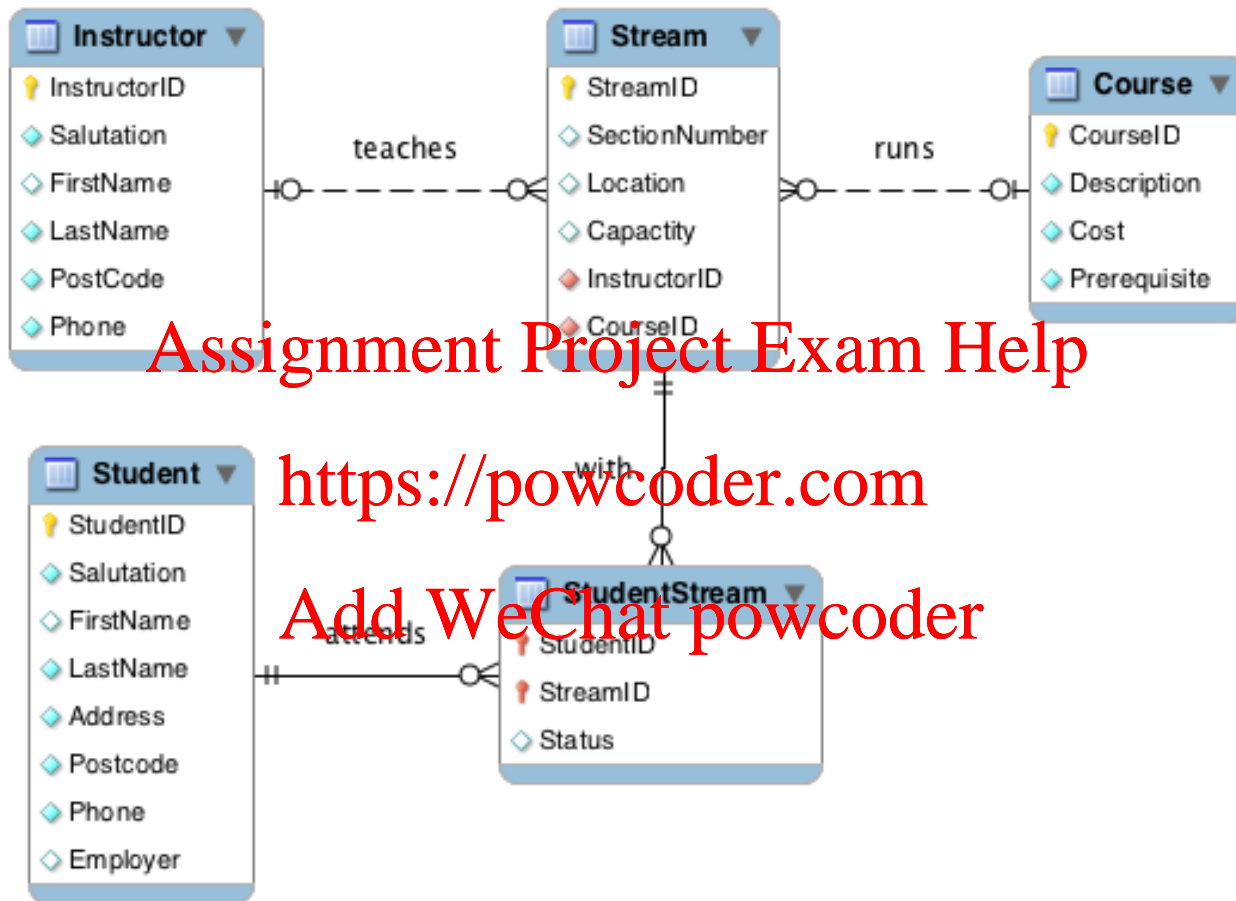
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- It's going to be critical for you to think like SQL to handle the queries you will need to write...
- Hopefully the following discussion will help you in this endeavour: **Assignment Project Exam Help**
  1. USE the database design as a MAP to help you when you are formulating queries  
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  2. USE the structure of the SELECT statement as a template  
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  3. FILL out parts of the SELECT structure and BUILD the query
- Let's try it!





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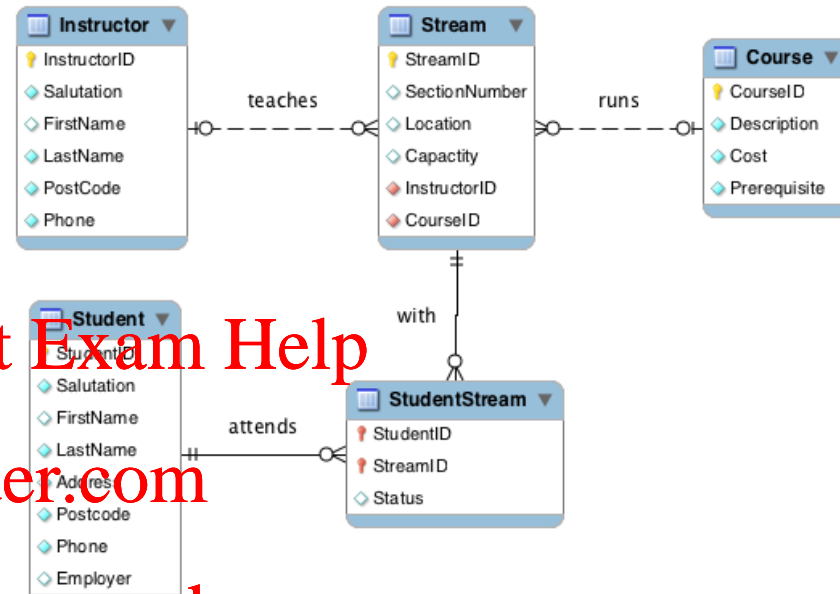
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**Example:** Which employers employ students who are doing a course in locations where the capacity is greater than 20 persons, and what are those locations?



*Which employers employ students  
who are doing a course in locations  
where the capacity is greater than 20 persons,  
and what are those locations?*



- What is the query asking for:
  - Which fields & tables:  
F: Employer, Location, Capacity  
T: Student, Stream, StudentStream
  - But only if the capacity > 20 (condition)

- Lets try to use the structure of the SELECT statement now:

```

SELECT Employer, Location, Capacity
FROM Student INNER JOIN StudentStream
ON Student.StudentID = StudentStream.StudentID
INNER JOIN Stream
ON StudentStream.StreamID = Stream.StreamID
WHERE Capacity > 20;
    
```

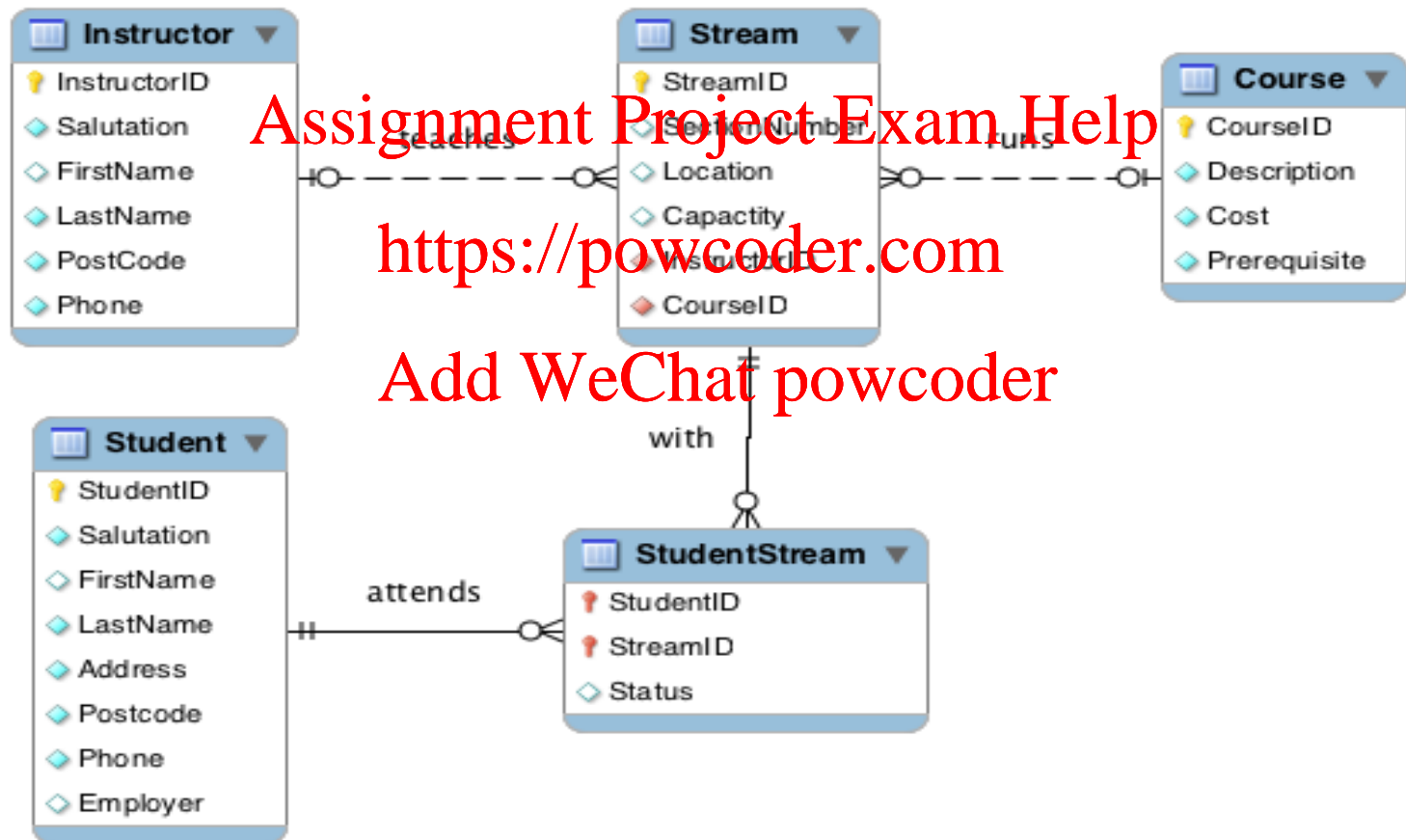
```

SELECT Employer, Location, Capacity
FROM Student
NATURAL JOIN StudentStream
NATURAL JOIN Stream
WHERE Capacity > 20;
    
```

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*What is the phone number of the instructor who teaches a course that costs over 10000\$ attended by studentID 202.*





- A very good overview:

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<https://www.youtube.com/watch?v=uRdlddUkTc&index=7&list=PLdQddgMBv5zHcEN9RrhADq3CBColhY2hl>

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- You need to know how to write SQL

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Greenwood Theatre

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- Storage and indexing
  - Learn how data is stored and accessed within a DBMS
  - Alternative types of indexes
  - Going “under the hood” of a DBMS

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