CS:4400/01: Database Systems

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Structured Query Language SQL

Chapter 6

IOWA

Acknowledgements to Prof. Raman Aravamudhan and Pearson Education.

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Reporting Aggregated Data Using GROUP BY Functions

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Use of GROUP BY

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

- Find number of staff in each branch and their total salaries.

```
SELECT branchNo,
        COUNT(staffNo) AS myCount,
        SUM(salary) AS mySum
FROM Staff
GROUP BY branchNo
ORDER BY branchNo;
```

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Use of GROUP BY

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
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SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
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SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

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```
SELECT branchNo,
        COUNT(staffNo) AS myCount,
        SUM(salary) AS mySum
FROM Staff
GROUP BY branchNo
ORDER BY branchNo;
```

What would be the output?

How many rows?

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Use of GROUP BY

- Find number of staff in each branch and their total salaries.

```
SELECT branchNo,
        COUNT(staffNo) AS myCount,
        SUM(salary) AS mySum
FROM Staff
GROUP BY branchNo
ORDER BY branchNo;
```

branchNo	staffNo	salary
B003	SG37	12000.00
B003	SG14	18000.00
B003	SG5	24000.00
B005	SL21	30000.00
B005	SL41	9000.00
B007	SA9	9000.00

COUNT(staffNo)	SUM(salary)
3	54000.00
2	39000.00
1	9000.00

Use of HAVING

- WHERE restricts individual rows.
- HAVING restricts groups.

What would be the output?

How many rows?

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Use of HAVING

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

- For each branch with more than 1 member of staff, find number of staff in each branch and sum of their salaries.

```
SELECT branchNo,
        COUNT(staffNo) AS myCount,
        SUM(salary) AS mySum
FROM Staff
GROUP BY branchNo
HAVING COUNT(staffNo) > 1
ORDER BY branchNo;
```

What would be the output?

How many rows?

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Use of HAVING

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

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        SUM(salary) AS mySum
FROM Staff
GROUP BY branchNo
HAVING COUNT(staffNo) > 1
ORDER BY branchNo;
```

What would be the output?

How many rows?

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Use of HAVING

- For each branch with more than 1 member of staff, find number of staff in each branch and sum of their salaries.

```
SELECT branchNo,
        COUNT(staffNo) AS myCount,
        SUM(salary) AS mySum
FROM Staff
GROUP BY branchNo
HAVING COUNT(staffNo) > 1
ORDER BY branchNo;
```

branchNo	myCount	mySum
B003	3	54000.00
B005	2	39000.00

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Nested Subqueries

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Subqueries

- A sub-select can be used in WHERE and HAVING clauses of an outer SELECT, where it is called a subquery or nested query.

- List staff who work in branch at '163 Main St'.

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

Subqueries

- A sub-select can be used in WHERE and HAVING clauses of an outer SELECT, where it is called a subquery or nested query.

- List staff who work in branch at '163 Main St'.

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David						
SA9	Mary						
SG5	Susan						
SL41	Julie						

Branch

branchNo	street	city	postcode
B005	22 Deer Rd	London	SW1 4EH
B007	16 Argyll St	Aberdeen	AB2 3SU
B003	163 Main St	Glasgow	G11 9QX
B004	32 Manse Rd	Bristol	BS99 1NZ
B002	56 Clover Dr	London	NW10 6EU

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Subqueries

- List staff who work in branch at ‘163 Main St’.

```
SELECT staffNo, fName, lName, position
FROM Staff
WHERE branchNo = (SELECT branchNo
                  FROM Branch
                  WHERE street = ‘163 Main St’);
```

staffNo	fName	lName	position
SG37	Ann	Beech	Assistant
SG14	David	Ford	Supervisor
SG5	Susan	Brand	Manager

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Nested subquery: use of IN

- List properties handled by staff at '163 Main St'.

```
SELECT propertyNo, street, city, postcode, type, rooms, rent
FROM PropertyForRent
WHERE staffNo IN
      (SELECT staffNo
       FROM Staff
       WHERE branchNo =
                (SELECT branchNo
                 FROM Branch
                 WHERE street = '163 Main St'));
```

propertyNo	street	city	postcode	type	rooms	rent
PG16	5 Novar Dr	Glasgow	G12 9AX	Flat	4	450
PG36	2 Manor Rd	Glasgow	G32 4QX	Flat	3	375
PG21	18 Dale Rd	Glasgow	G12	House	5	600

Schema ‘DreamHome’

Client

clientNo	fName	lName	telNo	prefType	maxRent	eMail
CR76	John	Kay	0207-774-5632	Flat	425	john.kay@gmail.com
CR56	Aline	Stewart	0141-848-1825	Flat	350	astewart@hotmail.com
CR74	Mike	Ritchie	01475-392178	House	750	mritchie01@yahoo.co.uk
CR62	Mary	Tregear	01224-196720	Flat	600	maryt@hotmail.co.uk

Branch

branchNo	street	city	postcode
B005	22 Deer Rd	London	SW1 4EH
B007	16 Argyll St	Aberdeen	AB2 3SU
B003	163 Main St	Glasgow	G11 9QX
B004	32 Manse Rd	Bristol	BS99 1NZ
B002	56 Clover Dr	London	NW10 6EU

PropertyForRent

propertyNo	street	city	postcode	type	rooms	rent	ownerNo	staffNo	branchNo
PA14	16 Holhead	Aberdeen	AB7 5SU	House	6	650	CO46	SA9	B007
PL94	6 Argyll St	London	NW2	Flat	4	400	CO87	SL41	B005
PG4	6 Lawrence St	Glasgow	G11 9QX	Flat	3	350	CO40		B003
PG36	2 Manor Rd	Glasgow	G32 4QX	Flat	3	375	CO93	SG37	B003
PG21	18 Dale Rd	Glasgow	G12	House	5	600	CO87	SG37	B003
PG16	5 Novar Dr	Glasgow	G12 9AX	Flat	4	450	CO93	SG14	B003

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

Viewing

clientNo	propertyNo	viewDate	comment
CR56	PA14	24-May-13	too small
CR76	PG4	20-Apr-13	too remote
CR56	PG4	26-May-13	
CR62	PA14	14-May-13	no dining room
CR56	PG36	28-Apr-13	

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Use of ANY/SOME

Find staff whose salary is larger than salary of at least one member of staff at branch B003.

```
SELECT staffNo, fName, lName, position, salary
FROM Staff
WHERE salary > SOME
                    (SELECT salary
                     FROM Staff
                     WHERE branchNo = 'B003');
```

Use of ANY/SOME

Find staff whose salary is larger than salary of at least one member of staff at branch B003.

```
SELECT staffNo, fName, lName, position, salary
FROM Staff
WHERE salary > SOME
                    (SELECT salary
                     FROM Staff
                     WHERE branchNo = 'B003');
```

staffNo	fName	lName	position	salary
SL21	John	White	Manager	30000.00
SG14	David	Ford	Supervisor	18000.00
SG5	Susan	Brand	Manager	24000.00

Use of ALL

- Find staff whose salary is larger than salary of every member of staff at branch B003.

```
SELECT staffNo, fName, lName, position, salary
FROM Staff
WHERE salary > ALL
                    (SELECT salary
                     FROM Staff
                     WHERE branchNo = 'B003');
```

staffNo	fName	lName	position	salary
SL21	John	White	Manager	30000.00

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Joins

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Simple Join

- List names of all clients who have viewed a property along with any comment supplied.

```
SELECT c.clientNo, fName, lName, propertyNo, comment
FROM Client c, Viewing v
WHERE c.clientNo = v.clientNo;
```

clientNo	fName	lName	propertyNo	comment
CR56	Aline	Stewart	PG36	
CR56	Aline	Stewart	PA14	too small
CR56	Aline	Stewart	PG4	
CR62	Mary	Tregear	PA14	no dining room
CR76	John	Kay	PG4	too remote

Simple Join

- List names of all clients who have viewed a property along with any comment supplied.

```
SELECT c.clientNo, fName, lName, propertyNo, comment
FROM Client c, Viewing v
WHERE c.clientNo = v.clientNo;
```

- Alternatives

1. FROM Client c JOIN Viewing v ON c.clientNo = v.clientNo
2. FROM Client JOIN Viewing USING clientNo
3. FROM Client NATURAL JOIN Viewing

Three Table Join

For each branch, list **staff** who manage properties, including city in which **branch** is located and **properties** they manage.

```
SELECT b.branchNo, b.city, s.staffNo, fName, lName, propertyNo
FROM Branch b, Staff s, PropertyForRent p
WHERE b.branchNo = s.branchNo AND s.staffNo = p.staffNo
ORDER BY b.branchNo, s.staffNo, propertyNo;
```

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Three Table Join

For each branch, list **staff** who manage properties, including city in which **branch** is located and **properties** they manage.

```
SELECT b.branchNo, b.city, s.staffNo, fName, lName, propertyNo
FROM Branch b, Staff s, PropertyForRent p
WHERE b.branchNo = s.branchNo AND s.staffNo = p.staffNo
ORDER BY b.branchNo, s.staffNo, propertyNo;
```

⟶ Sorts Join

branchNo	city	staffNo	fName	lName	propertyNo
B003	Glasgow	SG14	David	Ford	PG16
B003	Glasgow	SG37	Ann	Beech	PG21
B003	Glasgow	SG37	Ann	Beech	PG36
B005	London	SL41	Julie	Lee	PL94
B007	Aberdeen	SA9	Mary	Howe	PA14

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Outer Joins

- Consider following tables:

Branch1

branchNo	bCity
B003	Glasgow
B004	Bristol
B002	London

PropertyForRent1

propertyNo	pCity
PA14	Aberdeen
PL94	London
PG4	Glasgow

Outer Joins

- The (inner) join of these two tables:

```
SELECT b.*, p.*
FROM Branch1 b, PropertyForRent1 p
WHERE b.bCity = p.pCity;
```

branchNo	bCity	propertyNo	pCity
B003	Glasgow	PG4	Glasgow
B002	London	PL94	London

No match for branches in Bristol and Aberdeen!

Left Outer Join

List branches and properties that are in same city along with any unmatched branches.

```
SELECT b.*, p.*
FROM Branch1 b LEFT JOIN
        PropertyForRent1 p ON b.bCity = p.pCity;
```

branchNo	bCity	propertyNo	pCity
B003	Glasgow	PG4	Glasgow
B004	Bristol	NULL	NULL
B002	London	PL94	London

Right Outer Join

List branches and properties in same city and any unmatched properties.

```
SELECT b.*, p.*
FROM Branch1 b RIGHT JOIN
PropertyForRent1 p ON b.bCity = p.pCity;
```

What will be the output? What Changed?

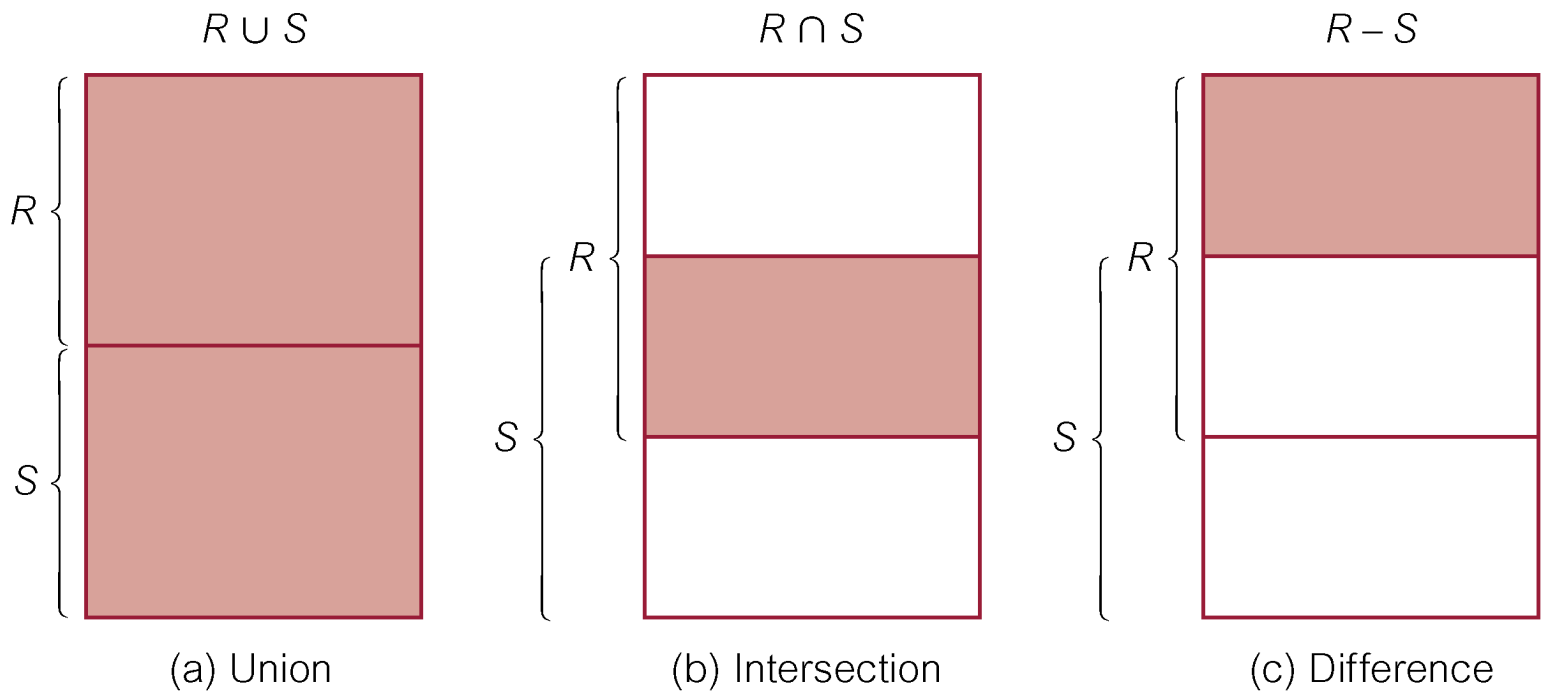
Full Outer Join

List branches and properties in same city and any unmatched branches or properties.

Results of left outer join UNION Results of right outer join

branchNo	bCity	propertyNo	pCity
NULL	NULL	PA14	Aberdeen
B003	Glasgow	PG4	Glasgow
B004	Bristol	NULL	NULL
B002	London	PL94	London

Union, Intersect, and Difference (Except)



Use of UNION

List all cities where there is either a branch office or a property.

```
(SELECT city
FROM Branch
WHERE city IS NOT NULL)
 UNION
(SELECT city
FROM PropertyForRent
WHERE city IS NOT NULL);
```

Use of UNION

- Or

```
(SELECT *
FROM Branch
WHERE city IS NOT NULL)
UNION CORRESPONDING BY city
(SELECT *
FROM PropertyForRent
WHERE city IS NOT NULL);
```

➔If BY is not specified UNION is performed on the columns that are common.

➔It is the Projection (selected Column List that needs to match)

➔Result Table from 1st query is merged with Result Table from second query

Use of UNION

- Produces result tables from both queries and merges both tables together.

city
London
Glasgow
Aberdeen
Bristol

Use of INTERSECT

List all cities where there is both a branch office and a property.

```
(SELECT city FROM Branch)
 INTERSECT
 (SELECT city FROM PropertyForRent);
```

Use of INTERSECT

- Or

```
(SELECT * FROM Branch)
INTERSECT CORRESPONDING BY city
(SELECT * FROM PropertyForRent);
```

city
Aberdeen
Glasgow
London

Use of INTERSECT

- List all cities where there is both a branch office and a property.
- Write this query in any other formats
  without using INTERSECT

Use of INTERSECT

```
SELECT b.city
FROM Branch b PropertyForRent p
WHERE b.city = p.city;
```

- Or:
- Could also use EXISTS – returns true or false from subquey

```
SELECT DISTINCT city FROM Branch b
WHERE EXISTS
   (SELECT * FROM PropertyForRent p
   WHERE p.city = b.city);
```

Use of EXCEPT

List of all cities where there is a branch office but no properties.

```
(SELECT city FROM Branch)
  EXCEPT
  (SELECT city FROM PropertyForRent);
```

- Or

```
(SELECT * FROM Branch)
EXCEPT CORRESPONDING BY city
(SELECT * FROM PropertyForRent);
```

city
Bristol

Use of EXCEPT

- List all cities where there is both a branch office and a property.
- Write this query in any other formats
  without using INTERSECT

Use of EXCEPT

```
SELECT DISTINCT city FROM Branch
WHERE city NOT IN
(SELECT city FROM PropertyForRent);
```

- Or

```
SELECT DISTINCT city FROM Branch b
WHERE NOT EXISTS
(SELECT * FROM PropertyForRent p
WHERE p.city = b.city);
```

Simple INSERT

INSERT INTO TableName [(columnList)]
VALUES (dataValueList)

- *columnList* is optional; if omitted,
  - SQL assumes a list of all columns
- Any columns omitted must have been
  - declared as NULL when table creating
  - Or DEFAULT was specified when creating column.

INSERT

- *dataValueList* must match *columnList* as follows:
  - number of items in each list must be same;
  - order of values should match order of columns
  - data type of each item in *dataValueList* must be compatible with data type of column.

INSERT … VALUES

Insert a new row into Staff table supplying data for all columns.

```
INSERT INTO Staff
    VALUES ('SG16', 'Alan', 'Brown', 'Assistant', 'M', '1957-
      05-25', 8300, 'B003');
```

INSERT … SELECT

Assume there is a table that contains names of staff and number of properties they manage:

StaffPropCount(staffNo, fName, lName, propCnt)

PopulateStaffPropCount using Staff and PropertyForRent tables.

INSERT … SELECT

```
INSERT INTO StaffPropCount
   (SELECT s.staffNo, fName, lName, COUNT(*)
   FROM Staff s, PropertyForRent p
   WHERE s.staffNo = p.staffNo
   GROUP BY s.staffNo, fName, lName)
   UNION
   (SELECT staffNo, fName, lName, 0
   FROM Staff
   WHERE staffNo NOT IN
      (SELECT DISTINCT staffNo
      FROM PropertyForRent));
```

INSERT … SELECT

staffNo	fName	lName	propCount
SG14	David	Ford	1
SL21	John	White	0
SG37	Ann	Beech	2
SA9	Mary	Howe	1
SG5	Susan	Brand	0
SL41	Julie	Lee	1

- If second part of UNION is omitted, excludes those staff who currently do not manage any properties.

UPDATE

UPDATE TableName

SET columnName1 = dataValue1

[, columnName2 = dataValue2...]

[WHERE searchCondition]

- *TableName* can be name of a base table or an updatable view.
- SET clause specifies names of one or more columns that are to be updated.

UPDATE All Rows

Give all staff a 3% pay increase.

```
UPDATE Staff
SET salary = salary*1.03;
```

Give all Managers a 5% pay increase.

```
UPDATE Staff
SET salary = salary*1.05
WHERE position = 'Manager';
```

UPDATE Multiple Columns

Promote staff ‘SG14’ to Manager and change his salary to £20,000.

```
UPDATE Staff
SET position = ‘Manager’, salary = 20000
WHERE staffNo = ‘SG14’;
```

Did it change?

Staff

staffNo	fName	lName	position	sex	DOB	salary	branchNo
SL21	John	White	Manager	M	1-Oct-45	30000	B005
SG37	Ann	Beech	Assistant	F	10-Nov-60	12000	B003
SG14	David	Ford	Supervisor	M	24-Mar-58	18000	B003
SA9	Mary	Howe	Assistant	F	19-Feb-70	9000	B007
SG5	Susan	Brand	Manager	F	3-Jun-40	24000	B003
SL41	Julie	Lee	Assistant	F	13-Jun-65	9000	B005

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DELETE

```
DELETE FROM TableName
[WHERE searchCondition]
```

- *TableName* can be name of a base table or an updatable view.
- *searchCondition* is optional; if omitted, all rows are deleted from table.
  - This does not delete table.

DELETE Specific Rows

Delete all viewings that relate to property PG4.

```
DELETE FROM Viewing
WHERE propertyNo = 'PG4';
```

Delete all records from the Viewing table.

```
DELETE FROM Viewing;
```

- Text Book Reference
  - Chapter 6 - Connolly