

# Database Queries

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- Mandatory: Chapter 4 – Sections 4.6 & 4.7

## Reading Assignment

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- Can be found on:

<http://pages.cpsc.ucalgary.ca/~kawash/peeking.html>

- Includes all examples in the book
  - Numbered by exercise numbers

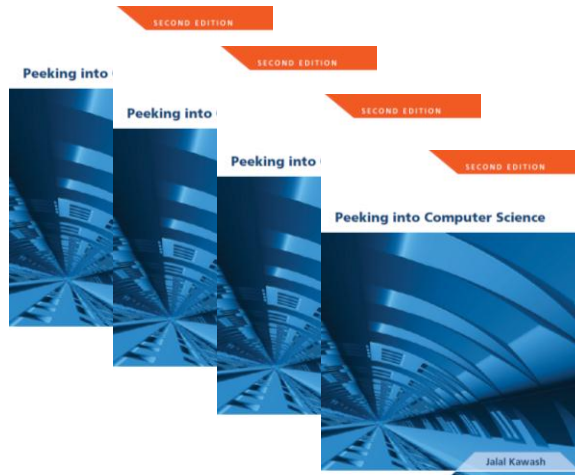


## Example Access DB

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## Structured Query Language

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By the end of this section, you will be able to:

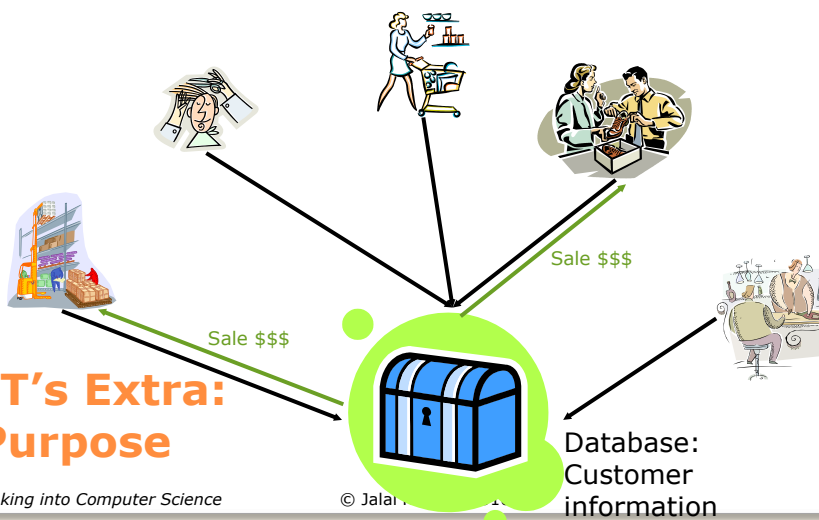
1. Name the two parts of SQL
2. Understand the function of each part
3. Formulate basic DDL & DML statements in SQL

## Objectives

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- To store & retrieve information

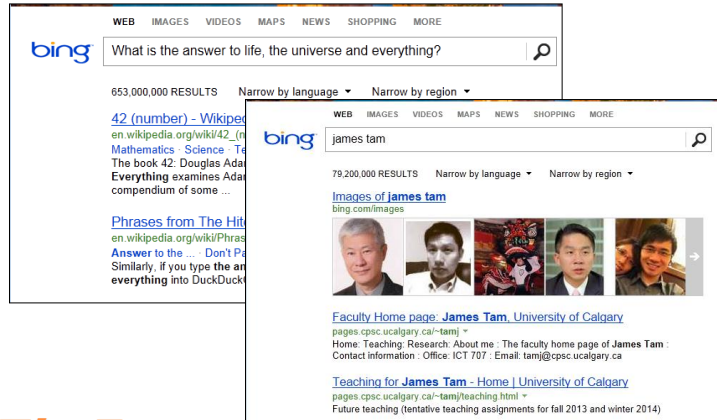


## JT's Extra: Purpose

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- Queries are questions 'asked' of/to the database in order to retrieve information.



## JT's Extra: Queries

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- Data retrieval occurs through the use of 'queries':
  - A query is a question asked of the data in the database.
  - Typically worded to show only the parts of the database for which the answer to the question is true.
  - **Example 1:** What is the SIN, name and pay rate of every employee in the Employees Table:

SIN	LastName	FirstName	PayRate
123 415 322	Simcox	Cole	30
123 456 789	Smith	John	20
371 988 812	Carswell	Mary	30
413 754 621	Kennedy	Leon	30
444 638 047	Redfield	Claire	35

- **Example 2:** What employees have the last name of Morris?  
Query

Field:	SIN	LastName	FirstName	Address
Tables:	Employees	Employees	Employees	Employees
Sort:				
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:		"Morris"		
or:				

## JT's Extra: Retrieving Data Via Queries

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- SQL JT's Extra: SQL = **Structured Query Language**
- Programming language, specialized for databases
- Data Definition Language (DDL)
  - Defining the structure of the DB

JT's Extra: Creating the data (table)

  - What fields?
  - What will each field store?
- Data Manipulation Language (DML)
  - Manipulating the contents of the DB

JT's Extra: Modifying the data (table)

  - Insertions
  - Deletions



## Structured Query Language

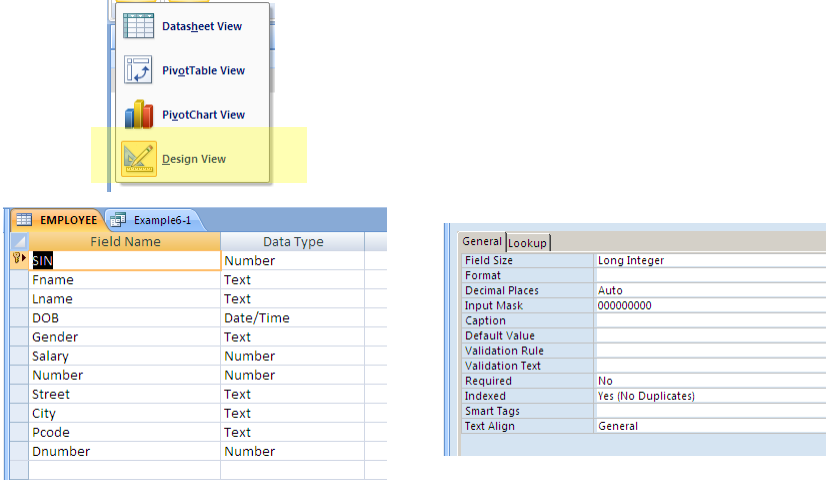
```

CREATE TABLE EMPLOYEE
(
  SIN          CHAR (9) ,
  Fname       CHAR (15) ,
  Lname       CHAR (15) ,
  DOB         DATE,
  Gender      CHAR (6) ,
  Salary      NUMBER,
  Street      CHAR (30) ,
  City        CHAR (15) ,
  Pcode       CHAR (7) ,
  Dnumber    NUMBER
)

```



## DDL



The screenshot displays the Microsoft Access interface. At the top, a menu shows four view options: Datasheet View, PivotTable View, PivotChart View, and Design View. The Design View is selected and highlighted in yellow. Below this, the 'EMPLOYEE' table is shown in Design View. The table has the following fields and data types:

Field Name	Data Type
SIN	Number
Fname	Text
Lname	Text
DOB	Date/Time
Gender	Text
Salary	Number
Number	Number
Street	Text
City	Text
Pcode	Text
Dnumber	Number

To the right of the table design is the 'General' tab of the Properties window. The properties listed are:

Property	Value
Field Size	Long Integer
Format	
Decimal Places	Auto
Input Mask	000000000
Caption	
Default Value	
Validation Rule	
Validation Text	
Required	No
Indexed	Yes (No Duplicates)
Smart Tags	
Text Align	General

## Access Table Creation

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Recall: Data manipulation language modifies the tables

### General format:

- `<Action> into/from <Table name>`

### Example:

- Insert into Employees {some values}
- Delete from Employees {conditions for deletion }

## JT's Extra: DML General Structure

**INSERT INTO EMPLOYEE VALUES**

(171717171, 'Debra', 'Beacon', '15-Aug-1961', 'Female', 70000, 15, 'Baron Hill', 'Calgary', 'T2X Y0Y', 1)

**INSERT INTO EMPLOYEE VALUES**

(181817178, 'Sam', 'Field', '17-Feb-1978', 'Male', 40000, 15, 'Kick Way', 'Calgary', 'Y2K K0K', 1)

**INSERT INTO EMPLOYEE VALUES**

(123456789, 'Rajet', 'Folk', '30-Apr-1967', 'Male', 78000, 123, 'One Road', 'Toronto', 'H1H J9J', 2)

**INSERT INTO EMPLOYEE VALUES**

(987654321, 'Marie', 'Band', '12-Jan-1985', 'Female', 53500, 2828, 'Exit Close', 'Toronto', 'K8O O8K', 2)

**INSERT INTO EMPLOYEE VALUES**

(666333999, 'Saleh', 'Dice', '25-Mar-1970', 'Male', 90400, 66, 'Straight Way', 'Toronto', 'T4E T6B', 1)

**EMPLOYEE**

SIN	Fname	Lname	DOB	Gender	Salary	Number	Street	City	Peode	Dnumber
171717171	Debra	Beacon	15-Aug-1961	Female	70000	15	Baron Hill	Calgary	T2X Y0Y	1
181817178	Sam	Field	17-Feb-1978	Male	40000	15	Kick Way	Calgary	Y2K K0K	1
123456789	Rajet	Folk	30-Apr-1967	Male	78000	123	One Road	Toronto	H1H J9J	2
987654321	Marie	Band	12-Jan-1985	Female	53500	2828	Exit Close	Toronto	K8O O8K	2
666333999	Saleh	Dice	25-Mar-1970	Male	90400	66	Straight Way	Toronto	T4E T6B	3



## DML - Insertion

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**DELETE FROM EMPLOYEE****WHERE** Gender = 'Male'**EMPLOYEE**

SIN	Fname	Lname	DOB	Gender	Salary	Number	Street	City	Peode	Dnumber
171717171	Debra	Beacon	15-Aug-1961	Female	70000	15	Baron Hill	Calgary	T2X Y0Y	1
181817178	Sam	Field	17-Feb-1978	Male	40000	15	Kick Way	Calgary	Y2K K0K	1
123456789	Rajet	Folk	30-Apr-1967	Male	78000	123	One Road	Toronto	H1H J9J	2
987654321	Marie	Band	12-Jan-1985	Female	53500	2828	Exit Close	Toronto	K8O O8K	2
666333999	Saleh	Dice	25-Mar-1970	Male	90400	66	Straight Way	Toronto	T4E T6B	3

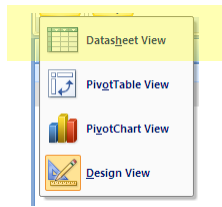


## DML - Deletion

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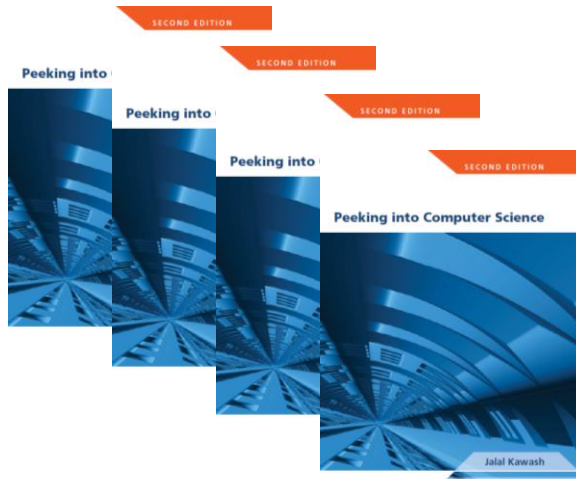
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SIN	Fname	Lname	DOB	Gender	Salary
123456789	Rajeet	Folk	30-Apr-67	Male	7000
171717171	Debra	Beacon	15-Aug-61	Female	7000
181817178	Sam	Field	17-Feb-78	Male	4000
666333999	Saleh	Dice	25-Mar-70	Male	9000
987654321	Marie	Band	12-Jan-85	Female	5000

## Access Insertion and Deletion



## SQL Queries

Questioning the database



By the end of this section, you will be able to:

1. Know the basic parts of speech in SQL
2. Formulate SQL queries
3. Use set operations in SQL queries
4. Use complex logic in SQL queries



## Objectives

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### EMPLOYEE

SIN	Fname	Lname	DOB	Gender	Salary	Number	Street	City	Pcode	Dnumber
171717171	Debra	Beacon	15-Aug-1961	Female	70000	15	Baron Hill	Calgary	T2X Y0Y	1
181817178	Sam	Field	17-Feb-1978	Male	40000	15	Kick Way	Calgary	Y2K K0K	1
123456789	Rajeet	Folk	30-Apr-1967	Male	78000	123	One Road	Toronto	H1H J9J	2
987654321	Marie	Band	12-Jan-1985	Female	53500	2828	Exit Close	Toronto	K8O O8K	2
666333999	Saleh	Dice	25-Mar-1970	Male	90400	66	Straight Way	Toronto	T4E T6B	3

### DEPARTMENT

Dnumber	Dname	MGR_SIN	StartDate
1	IT	171717171	12-Feb-2008
2	Finance	123456789	1-Mar-2002
3	Marketing	666333999	1-Jan-2005

### PROJ\_EMP

SIN	Pnumber	Hours
171717171	1	15
171717171	2	20
171717171	4	5
181817178	1	30
181817178	2	10
123456789	3	40
666333999	4	40

### PROJECT

Pnumber	Pname	Location	Dnumber
1	Web Shopping	Calgary	1
2	Network Upgrade	Calgary	1
3	New Benefits	Toronto	2
4	Product XT345	Toronto	3



## Example Database

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- Questions submitted to the DB
- Query By Example (QBE)
- Using SQL



## Queries

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### **Informal English description**

Given some condition(s) is/are met what columns of what tables will appear.

#### **Example:**

If last name is "Morris" show the employee number, first name and last name from the employees table.



## JT's Extra: Basic Format Of SQL Queries

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- Specifying the query in the form of QBE (Query by example) in MS-Access

The screenshot shows the QBE grid for the 'Employees' table. The fields listed are EmployeeNumber, LastName, FirstName, MiddleName, LocationID, TitleID, BaseSalary, YearsOfService, Picture, Picture.FileData, Picture.FileName, and Picture.FileType. The grid below shows the following configuration:

Field:	EmployeeNumber	FirstName	LastName
Table:	Employees	Employees	Employees
Sort:			
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:			*Morris*



## JT's Extra: Basic Format Of SQL Queries (2)

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### Formal SQL structure

- SELECT <columns of table(s)>
- FROM <table(s) >
- WHERE <Boolean expression(s)>
- ORDER BY<sup>1</sup>

1 Optional section: used to format or rank query results



## JT's Extra: Basic Format Of SQL Queries (3)

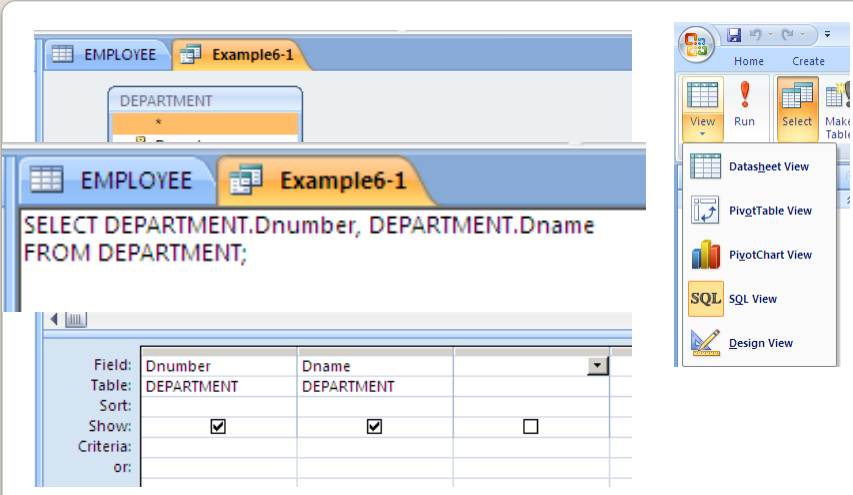
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- **SELECT**
  - Employees.EmployeeNumber,
  - Employees.FirstName,
  - Employees.LastName
- **FROM** EMPLOYEES
- **WHERE**  
EMPLOYEES.LastName="Morris";

## JT's Extra: Example SQL Query



EMPLOYEE Example6-1

DEPARTMENT

EMPLOYEE Example6-1

```
SELECT DEPARTMENT.Dnumber, DEPARTMENT.Dname
FROM DEPARTMENT;
```

Field:	Dnumber	Dname	
Table:	DEPARTMENT	DEPARTMENT	
Sort:			
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Criteria:			
or:			

Home Create

View Run Select Make Table

Datasheet View

PivotTable View

PivotChart View

SQL SQL View

Design View

## QBE – Projection

```

SELECT  Dnumber, Dname
FROM    DEPARTMENT
    
```

**DEPARTMENT**

Dnumber	Dname	MGR_SIN	StartDate
1	IT	171717171	12-Feb-2008
2	Finance	123456789	1-Mar-2002
3	Marketing	666333990	1-Jan-2005

**SQL - Projection**

The screenshot shows a database query editor with two tabs: 'EMPLOYEE' and 'Example6-2(a)'. A 'PROJECT' table is displayed with fields: Pnumber, Pname, Location, and Dnumber. Below the table, a QBE grid is shown with columns for each field. The 'Location' column has a filter criterion of 'Calgary'. Checkmarks are present in the 'Show' row for all fields, and in the 'Criteria' row for 'Location'.

Field:	Pnumber	Pname	Location	Dnumber
Table:	PROJECT	PROJECT	PROJECT	PROJECT
Sort:				
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:			"Calgary"	
or:				

**QBE - Selection**

```

SELECT Pnumber, Pname, Location, Dnumber
FROM PROJECT
WHERE Location = 'Calgary'

```

### PROJECT

Pnumber	Pname	Location	Dnumber
1	Web Shopping	Calgary	1
2	Network Upgrade	Calgary	1
<del>3</del>	<del>New Benefits</del>	<del>Toronto</del>	<del>2</del>
<del>4</del>	<del>Product XT345</del>	<del>Toronto</del>	<del>3</del>

## SQL - Selection

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- The 'wildcard' character can stand for any number of characters in the position that it's placed:
  - Example queries that follow will be from the Employees table:

Employees : Table							
	SIN	LastName	FirstName	Address	City	Province	PostalCode
▶	123 115 323	Simcox	Cole	311 Ocean View Drive	Vancouver	British Columbia	T1N-4N9
+	123 456 789	Smith	John	123 Peanut Lane	Calgary	Alberta	T1N-3N4
+	371 988 812	Carswell	Mary	425 Remington Ave	Calgary	Alberta	T3N-7N4
+	413 754 621	Kennedy	Leon	808, 4900 Wildman A	Racoon City	Alberta	T2S-1M0
+	444 638 047	Redfield	Claire	653 Wildpark Place	Racoon City	Alberta	T2S-1M0
+	456 438 624	Lemoy	Leonard	55 Logic Way	Vulcan	Alberta	VS1-3N3
+	456 789 123	Cartman	Eric	456 Lynchview Road	Southpark	Alberta	S0S-9A9
+	456 789 124	Simpson	Homer	59 Evergreen Terrace	Springfield	Alberta	N1E-7X6
+	456 889 123	Flanders	Ned	60 Evergreen Terrace	Springfield	Alberta	N1E-7X6
+	620 451 097	Williams	Amanda	25 Rodeo Drive	Edmonton	Alberta	V6N-6N5
+	638 666 670	Cartland	Douglas	1109, 4944 Dalworth	Silent Hill	Alberta	S6N-9X9
+	666 666 666	Morris	Heather	7 Luckstone Dr	Silent Hill	Alberta	T3A-3H1
+	666 666 667	Mason	Harry	7 Luckstone Dr	Silent Hill	Alberta	T3A-3H1
+	666 666 668	Sunderland	James	7 Heartbroken Ave	Silent Hill	Alberta	T3A-2E6
+	666 666 669	Wolf	Claudia	66 Twisted View	Silent Hill	Alberta	T1N-3O4
+	670 380 456	Edgar	Maureen	300, Lockinvar Road	Calgary	Alberta	T4P-3N9

## JT's Extra: Using The Wildcard In Queries

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- Examples:

- Which employees have a last name that begins with 'm'?

	LastName	FirstName
▶	Mason	Harry
	Morris	Heather

Field:	LastName	FirstName
Table:	Employees	Employees
Sort:		
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:	Like "m**"	

- Which employees have a last name ends with 's'?

	LastName	FirstName
▶	Flanders	Ned
	Morris	Heather
	Williams	Amanda

Field:	LastName	FirstName
Table:	Employees	Employees
Sort:		
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:	Like "**s"	

## JT's Extra: Using The Wildcard In Queries (Access)

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- Which employees have the letter 'a' anywhere in their first name?

	LastName	FirstName
▶	Cartland	Douglas
	Edgar	Maureen
	Lemoy	Leonard
	Mason	Harry
	Morris	Heather
	Redfield	Claire
	Sunderland	James
	Williams	Amanda
	Wolf	Claudia
	Carswell	Mary

Field:	LastName	FirstName
Table:	Employees	Employees
Sort:		
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:		Like "**a**"
or:		

## JT's Extra: Using The Wildcard In Queries (Access: 2)

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```

SELECT *
FROM PROJECT
WHERE Location = 'Calgary'

```

### PROJECT

Pnumber	Pname	Location	Dnumber
1	Web Shopping	Calgary	1
2	Network Upgrade	Calgary	1
3	New Benefits	Toronto	2
4	Product XT345	Toronto	3

## Wild Cards

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- UNION
- INTERSECT
- MINUS

## JT's Extra: Set Operations On Databases

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A Venn diagram illustrating the union of three sets. On the left, three overlapping circles represent the populations of Alberta (A, blue), Saskatchewan (B, green), and Manitoba (C, red). On the right, three yellow circles represent the union of these sets, labeled with the equation  $A \cup B \cup C = D$  (Population of the Prairie provinces). Below the diagram is the text "JT Extra: Set Union (Prairies)".

**JT's Extra: Union (Logical "OR")**

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A Venn diagram illustrating the intersection of two sets. On the left, three circles represent 'Men' (green), 'Women' (dark blue), and '203 student' (red). On the right, two overlapping circles represent 'Men' (green) and 'Women' (light blue). The intersection of these two circles is shaded blue and labeled '203 student' with an arrow pointing to it. Below the diagram is the text "(203 student) AND (Women)".

**JT's Extra: Intersection (Logical "AND")**

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A = Population of the prairie provinces

B = Population of Alberta

Venn Diagram: Set Subtraction

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A - B = C  
Prairies sans AB

Venn Diagram: Set Subtraction

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## JT's Extra: Subtraction "Minus"

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- **Format:**  
 $\langle \text{SQL Query 1} \rangle$   
 SET OPERATION  
 $\langle \text{SQL Query 2} \rangle$

## JT's Extra: Forming SQL Queries Using The Set Operations

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```
SELECT *  
FROM PROJECT  
WHERE Location = 'Calgary'
```

## SQL – Set Operations

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```
SELECT *  
FROM PROJECT  
WHERE Location = 'Calgary'
```

```
SELECT *  
FROM PROJECT  
WHERE Location = 'Toronto'
```

## SQL – Set Operations

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```

SELECT *
FROM PROJECT
WHERE Location = 'Calgary'
UNION
SELECT *
FROM PROJECT
WHERE Location = 'Toronto'

```

## SQL – Set Operations

- Cannot be done in design view, only in SQL view

Example6-5(a) Example6-5(b)

```

SELECT * FROM PROJECT
WHERE Location = "Calgary"
UNION SELECT * FROM PROJECT
WHERE Location = "Toronto";

```

## Union in Access

```
SELECT      SIN
FROM        EMPLOYEE
WHERE       Gender = 'Female'
INTERSECT
SELECT      MGR_SIN
FROM        DEPARTMENT
```

## SQL – Set Operations

```
SELECT      SIN
FROM        EMPLOYEE
WHERE       Gender = 'Male'
MINUS
SELECT      MGR_SIN
FROM        DEPARTMENT
```

## SQL – Set Operations

- No direct support
- Can use IN for intersect
- Can use NOT IN for Minus

## INTERSECT and MINUS in Access



### Example 6-4(b)

```
SELECT SIN
FROM employee
WHERE Gender = 'Female'
AND SIN IN
(SELECT MGR_SIN
FROM DEPARTMENT);
```

## INTERSECT in Access

```
SELECT SIN
FROM employee
WHERE Gender = 'Female'
AND SIN IN
(SELECT MGR_SIN
FROM DEPARTMENT);
```

**Result**  
**171717171**

MGR_SIN
171717171
123456789
666333999

EMPLOYEE					
SIN	Fname	Lname	DOB	Gender	S
171717171	Debra	Beacon	15-Aug-1961	Female	7
<del>181817178</del>	<del>Sam</del>	<del>Plett</del>	<del>17-Feb-1978</del>	<del>Male</del>	<del>4</del>
<del>123456789</del>	<del>Rajeev</del>	<del>Folk</del>	<del>30-Apr-1967</del>	<del>Male</del>	<del>7</del>
987654321	Marie	Band	12-Jan-1985	Female	5
<del>666333999</del>	<del>Saten</del>	<del>Dice</del>	<del>23-Mar-1970</del>	<del>Male</del>	<del>9</del>

## How IN Works

### Example6-4(c)

```
SELECT EMPLOYEE.Sin
FROM EMPLOYEE
WHERE (((EMPLOYEE.Sin) Not In
(SELECT DEPARTMENT.MGR_SIN FROM DEPARTMENT)));
```

## MINUS in Access

- Equals =
- Not equal !=
- Greater >
- Greater or equal >=
- Less than <
- Less than or equal <=



## Comparison Operators

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- AND
- OR
- NOT



## Boolean Operators

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```

SELECT  Lname, DOB
FROM    EMPLOYEE
WHERE   Gender = 'Female'
          AND Salary > 40000

```

## SQL – Example Query

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Example6-5(a)

EMPLOYEE

- \*
  - PK SIN
  - Fname
  - Lname
  - DOB
  - Gender
  - Salary
  - Number
  - Street
  - City
  - Pcode
  - Dnumber

Field:	Lname	DOB	Gender	Salary
Table:	EMPLOYEE	EMPLOYEE	EMPLOYEE	EMPLOYEE
Sort:				
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:			"Female"	>40000
or:				

## QBE – Example Query

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```
SELECT SIN, Lname, Fname
FROM EMPLOYEE
WHERE Salary >= 30000
      AND Salary <= 50000
```

## SQL – Example Query

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```
SELECT SIN, Lname, Fname
FROM EMPLOYEE
WHERE ( Gender = 'Male' AND Salary > 30000 )
      OR ( Gender = 'Female' AND Salary > 40000 )
```

## SQL – Example Query

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The screenshot shows a database query editor with a table named 'EMPLOYEE' and a query named 'Query1'. The query criteria are set to filter employees based on their salary. A yellow callout box highlights the criteria '>30000'.

Field:	SIN	Lname	Fname	[Gender]	[Salary]
Table:	EMPLOYEE	EMPLOYEE	EMPLOYEE	EMPLOYEE	EMPLOYEE
Sort:					
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:				'Male'	>3000
or:				'Female'	>40000

**QBE – Example Query**

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- Take care not to specify queries that can never be true! (Logic: contradiction)
- This will result in an “Empty Query”, a query that yields no results.
  - Example: Which employees have a gross pay lower than \$1,000 AND higher than \$2,000 (inclusive for both) on one of their time cards?

**Query**

StartPayPeriod	PayRate	HoursWorked	GrossPay: [PayRate]
TimeBilled	Employees	TimeBilled	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
			k=1000 And >=2000

**Result of the (empty) query**

Employees with pay les than \$1K AND greater than \$2K : Select Query						
SIN	LastName	FirstName	StartPayPeriod	PayRate	HoursWorked	GrossPay

**JT’s Extra: Empty Queries (Contradiction)**

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Wav file from “The Simpson” © Fox

- In a similar fashion take care not to specify queries that are always true. (Tautology)

#### Query

Field:	YearsOfService	LastName	FirstName
Table:	Employees	Employees	Employees
Sort:			
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:	>=10		
on:	<=20		

#### SQL

```
SELECT Employees.YearsOfService,
Employees.LastName, Employees.FirstName
FROM Employees
WHERE (((Employees.YearsOfService)>=10))
OR (((Employees.YearsOfService)<=20));
```

#### Query result

YearsOfServ	LastName	FirstName
8	Tam	James
2	Morris	Heather
10	Mason	Harry
2	Cartman	Eric
1	Griffin	Stewie
15	Pike	Christopher
25	Lee	Bruce
12	Long	Fei
7	Akash	Akabar
20	Linnear	Nicolas

**JT's Extra: Queries Resulting From A Tautology**  
*Peeking into Computer Science*

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