

# **Database Modeling**

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## Assumptions and Adjustments

Some assumptions and adjustments had to be made due to lack of information. Below is a list of assumptions and adjustments that were made.

- Postal Code attribute's value is unique and can not be duplicated. Each postal code is tied to a specific area within a City in a specific Province.
- Pay Week End Date Attribute's value is tied to a unique date and can not be duplicated.
- Days Available Attribute: Is defined as how many days the store was opened for that week.
- Person Hours Worked attribute: As this is a calculated value, the attribute was removed from the table as tables within the database should not contain any calculated fields as it is at a higher risk of being incorrect and you also lose data integrity.
- Inc. Tax attribute: Is defined as an employee paying taxes or not.
- A Committee Meeting can not happen on multiple days.
- Job Code Date is when the employee started that position.
- A position can only have one supervisor
- The full supervisor name is good enough to identify the supervisor record and as such will not be broken down to first and last supervisor name.
- The senior programmer expressed the opinion that dates shouldn't be used as a primary key when the normalization was being done.

## Normalization Section

### First Normal Form (1NF)

**Definition:** For a relation to be in First Normal Form(1NF), there can be no repeating groups, no duplicate primary key values and every column row value must be atomic. [1:82-83]

#### 1NF conversion:

While a detailed description of this conversion was not required, the Committee Membership Table was not in 1NF as it had repeating values (Employees Names). More detail regarding this conversation will be listed in the Committee conversion section.

To remove repeating primary key values within the Employee Job and Payroll Data Table the following fields had to be removed and a new table called Work Week was created.

Fields removed: Payweek end Date, Days Available, Hours and OT

#### 1NF table

1NF Employee Job and Payroll Data Table

Candidate Keys: {Employee ID}

Non-Prime attributes: Sin, Last Name, First Name, Street, Hire Date, Birth Date, Inc, Tax, Postal Code, City, Prov, Postion, PayRate, Supervisor, Supervisors Cell, Hours, OT, Position ID, Job Code Date

### 1NF Work Week Table

A composite key was used as EmpID and Payweek End Dates has a many to many relation. One Employee can have many Payweek End Dates IDs and one Payweek End Dates IDs can have many Employees. Since the OT and Hours Attributes are tied to both the Employee ID and the Pay Week End Date ID these attributes were attached to this table.

Candidate Keys: {Payweek End Date, EmpID}

Non-Prime Attributes: Days Available, Hours, OT

### Second Normal Form (2NF)

**Definition:** For a relation to be in Second Normal form (2NF), the relation must be in the First Normal Form (1NF) relation, every non-key attribute is fully functionally dependent on the primary key and partial dependencies must be removed. [1:89]

#### 2NF Conversion:

While the above tables are normalized to 1NF, Employee Job and Payroll Data table is not in 2NF because of the below non-prime attributes:

- Position, PayRate, Supervisor and Supervisor Cell# is dependent upon Job Code, they are not dependent upon EmpID. This is because these attributes provide detail to the job and not the employee.
- Job Code Date is dependent upon EmpID however it is also dependent upon Job Code as Job Code date is when the employee started this position.

These non-prime attributes violate the rule saying that every non-key attribute must be fully functionally dependent on the primary key(EmpID).

The Work Week table, while it was in 1NF was not in 2NF because of the below non-Prime Attributes:

- Days Available, while days available is dependent upon the Payweek End Date as it tells how many days that week had, it is not dependent upon the EmpID as the Days available for that period will remain the same even if there is no employee.

To get the 1NF relation into a 2NF relation the Employee Job and Payroll Data table was broken up into 3 tables named Employee Table, Job Table and Job Date Table. Work Week table was broken up into 2 tables named Work Week Table and Pay Week End Date Table. Nothing was done to the Committee tables as it was already in 2NF.

2NF Tables as shown in Fig 1.2

### **2NF Employee Table**

Candidate Keys: {Emp ID}

Non-Prime Attributes: SIN, Last Name, First Name, Street, Inc. Tax, Hire Date, Birth Date, City, Prov, Postal Code, Job Code (FK).

### **2NF Job Table**

Candidate Keys: {Job Code}

Non-Prime Attributes: Position, PayRate, Supervisor, Supervisor Cell#

### **2NF Job Table**

Candidate Keys:{Job Code, Emp ID}

Non-Prime Attributes: Job Code Date

### **2NF Pay Week End Date Table**

As the senior developer did not want a date type to be used as a primary Key, a new attribute was created called Pay Week Date ID and that attribute will be used as a primary key for the Payweek End Date Table and Work Week Table.

Candidate Keys: {Pay Week End Date ID}

Non-Prime Attributes: Days Available, Pay Week End Date

### **2NF Work Week Table**

Pay Week End date was replaced with Pay Week End Date ID

Candidate Keys: {Pay Week End Date ID, Emp ID}

Non-Prime Attributes: Hours, OT.

### Third Normal Form (3NF)

**Definition:** For a relation to be in Third Normal Form (3NF), the relation must be in the 2NF relation and all non-key attributes be non-transitively dependent on the primary key [1:96].

#### 3NF conversion

While the Employee table is in 2NF it is not in 3NF as the City and Prov attributes are transitively dependent on the primary key (EmpID) and the Postal Code. The Job Table also does not pass the 3NF check as Supervisor Cell # is transitively dependent on the primary key (Job Code) and the Supervisor. As such these values will have to be taken out of the tables and placed in two new tables.

3NF tables as shown in Fig 1.3

#### **3NF Postal Code table**

Since a Postal Code is already unique, as per my assumption, I used that as my primary key.

Candidate Keys: {Postal Code}

Non-Prime Attributes: City, Province

#### **3NF Supervisor Table**

Since, there can be another supervisor with the same first and last name, I created a primary key called Supervisor ID.

Candidate Keys: {Supervisor ID}

Non-Prime Attributes: Supervisor, Supervisor Cell #

Nothing had to be done to the Committee table as it was already in 3NF

## Database Design Decision

### MS Access Relation

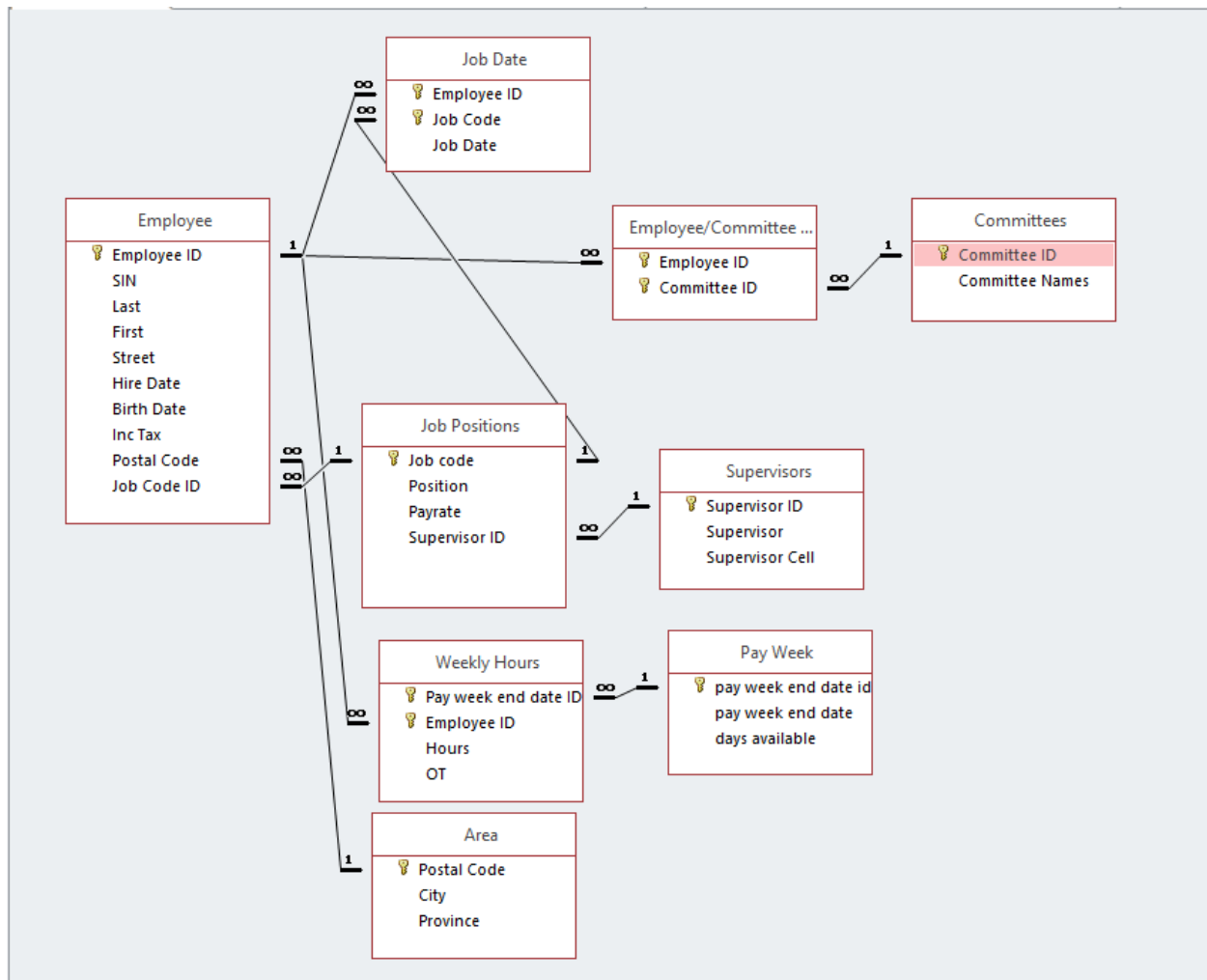


Fig 1.1

To address the point of interest about the committee being made up with many employees and an employee can serve on many committees a Junction table was created. The junction table consisted of Employee ID and Committee ID so this allowed a many to many relation to be created between the Committees table and Employees table.

To address the concern of the senior developer not liking dates as a key field, during the 2NF relation creation, a new attribute was created called Pay Week End Date ID which was made the primary key within the Pay Week End Date table and Work Week Table.

To address the concern of the accountant, the Person Hours Worked column was removed from the table. This value is to be calculated within an Access Query - Total Hours Worked per pay week: which sums the hour and OT of all employees that worked during the pay period. By doing this, it got rid of the chance of data integrity loss and bad data surrounding this previous field.



## Database Relationship diagrams

### 2NF Database Diagram

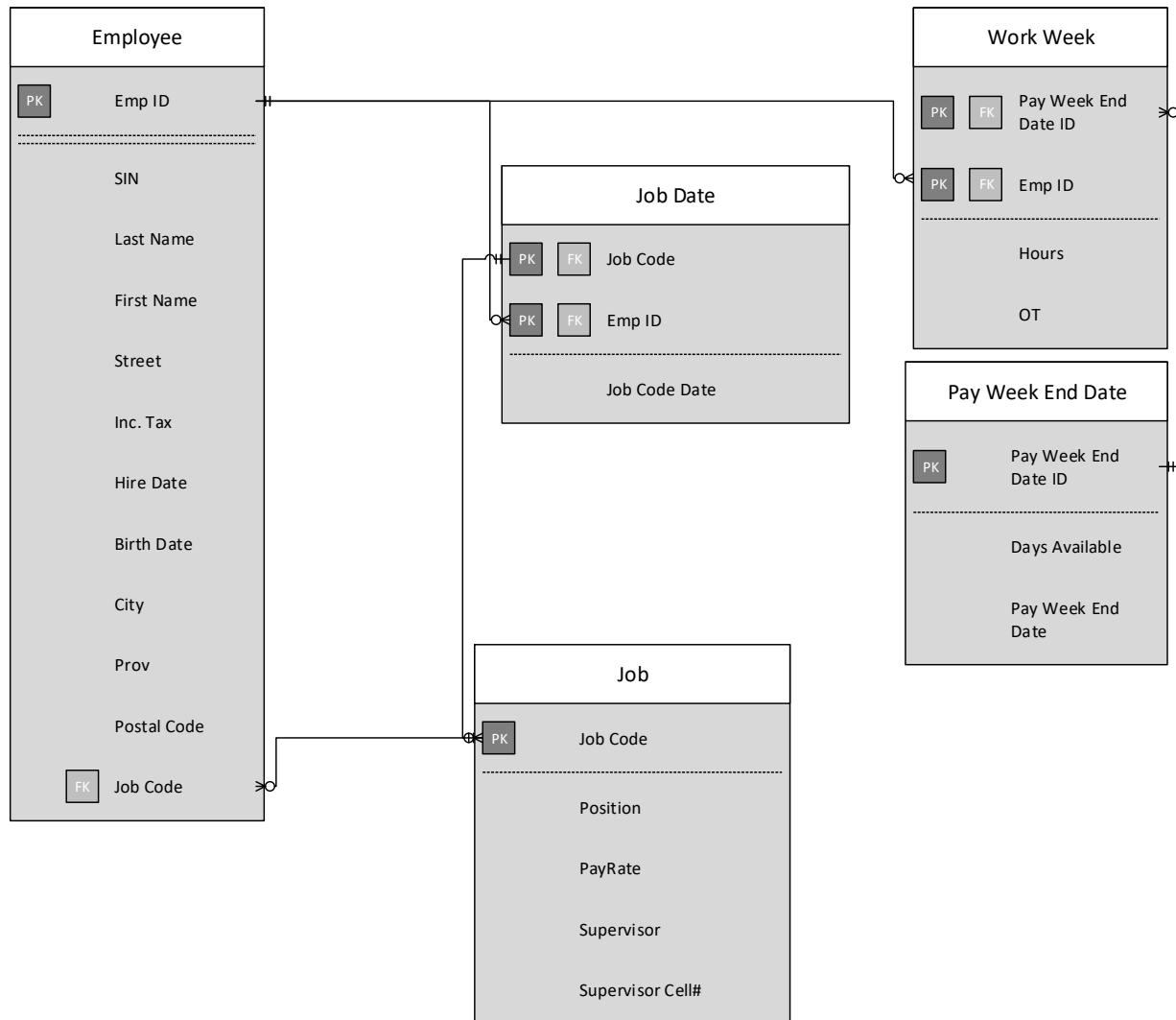


Fig 1.2

### 3NF Database Diagram

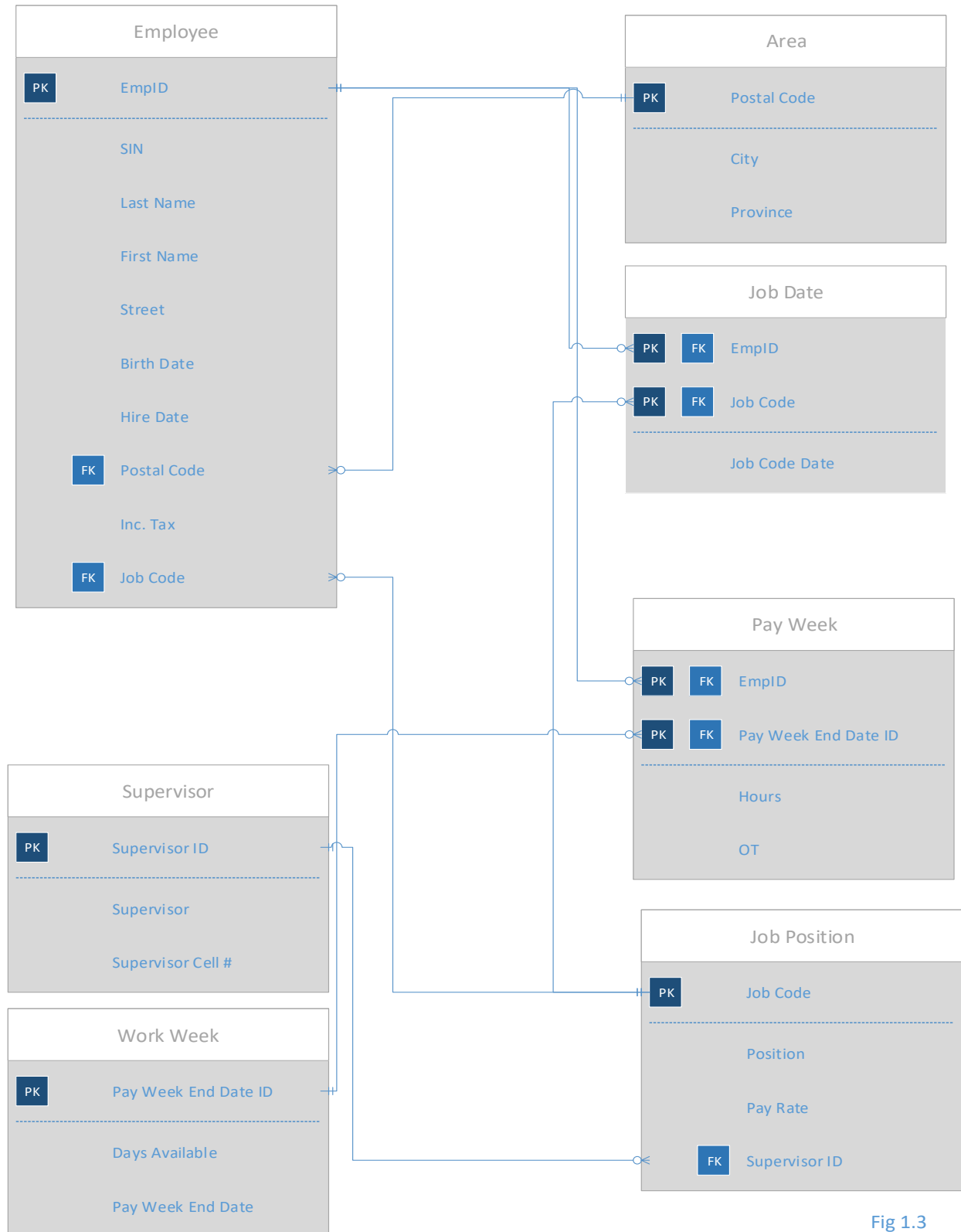


Fig 1.3

## 3NF Committee Diagrams

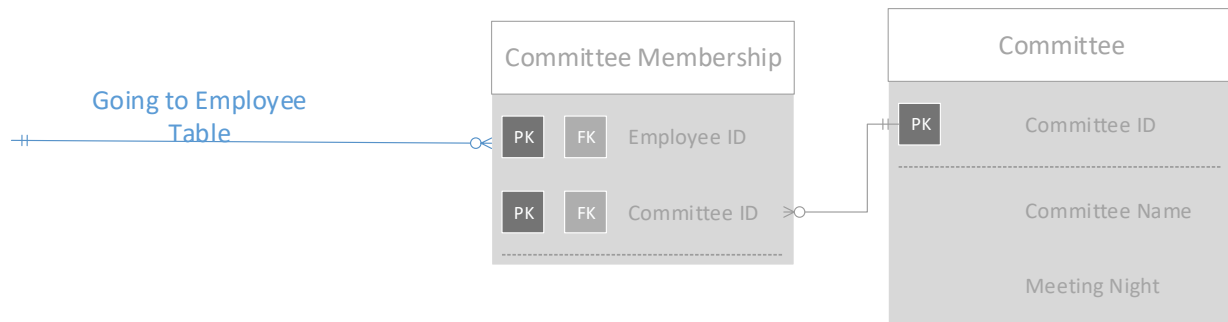


Fig 1.4

## Committee Table considerations

The committee membership table had multiple employees per committee and multiple committees per employee and as such I created a junction table to address this. By doing this both tables became 3NF. See Figure 1.4

## Committee Conversion

3NF Table as shown in Fig 1.4

**3NF Committee Membership Table**

This table is a junction table as one employee can belong to many committees and one committee can have many employees.

Candidate Keys: {Committee ID, Emp ID}

**3NF Committee Table**

Candidate Keys: {Committee ID}

Non-Primary Attributes: Committee Name, Meeting Night

## Calculated Query Field Solution

## Query Results

## 5.1 Query

Relationships Employee's who worked more than 35 hrs

Employee

\*

Employee ID

SIN

Last

First

Street

Weekly Hours

\*

Pay week end date ID

Employee ID

Hours

OT

Field:	Employee ID	Full Name: [Employee]	Hours
Table:	Employee		Weekly Hours
Sort:			
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:			> 35
or:			

## 5.1 Result

Employee ID	Full Name	Hours
32177	Robbie DaSilva	40
33982	Robin Boychuk	40
3571	Jo Hashimoto	40
41822	Chris Miller	40
72690	Jodie Wong	36
81216	Jaimie Hansen	40
85833	Lindsey Singh	37
32177	Robbie DaSilva	40
33982	Robin Boychuk	38
3571	Jo Hashimoto	40
41822	Chris Miller	38
52421	Shelley O'Day	40

## 5.2 Query

Field:	Expr1: [Employee]!	pay week end date	OT		
Table:		Pay Week	Weekly Hours		
Sort:					
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:		#2013-05-30#	>0		
or:					

## 5.2 Result

Relationships Employee's who worked more than 35 hrs OT for May 30-2013			
Full Name	pay week end date	OT	
Robbie DaSilva	30-May-13	3.7	
Chris Miller	30-May-13	1.25	
Shelley O'Day	30-May-13	4.5	
*			

## 5.3 Query

Field:	Employee ID	Job code	Supervisor	Supervisor Cell	
Table:	Employee	Job Positions	Supervisors	Supervisors	
Sort:					
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Criteria:	[Enter The Employees]				
or:					

## 5.3 Result

Employee ID	Job code	Supervisor	Supervisor Cell
33982	5000	Chand Long	(306)304-1212
*			

## 5.4 Query

Job Positions

- \* Job code
- Position
- Payrate
- Supervisor ID

Employee

- \* Employee ID
- SIN
- Last
- First
- Street

Area

- \* Postal Code
- City
- Province

Field: City

Table: Area

Sort:

Show: ☒

Criteria: [Enter City]

or:

## 5.4 Result

Employees and Positions based on City			
City	Full Name	Position	
Moose Jaw	Gerry Novak	Stockperson	
Moose Jaw	Jodie Wong	Cleaner	
Moose Jaw	Robbie DaSilva	Baker	
Moose Jaw	Robin Boychuk	Butcher	
Moose Jaw	Kelly Ramirez	Stockperson	
*			

## 5.5 Query

Employee/Committee ...

Employee

Job Positions

Committees

Field: Name: [Employee]! Position Committee Names

Table: Job Positions Committees

Sort:

Show: ☒ ☒ ☒ ☐ ☐

Criteria: [Enter The Committee]

or:

## 5.5 Result

	Name	Position	Committee
	Robbie DaSilva	Baker	OH&S
	Robin Boychuk	Butcher	OH&S
	Kelly Ramirez	Stockperson	OH&S
	Gerry Novak	Stockperson	OH&S
*			



## 5.6 Query

The screenshot displays a Microsoft Access query design and its results. The design view at the top shows three tables: Employee, Job Positions, and Supervisors. Employee and Job Positions are linked with a 1-to-many relationship. Job Positions and Supervisors are linked with a 1-to-many relationship. The data table view below shows the results of the query, with columns for Supervisor's Lastname, Employee's Name, and Job code.

Field:	Supervisor's Lastname	Employee's Name: [En	Job code			
Table:			Job Positions			
Sort:						
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:	[Enter Last Name of S					
or:						

Query that is contained in the field "Supervisor's LastName"

Supervisor's Lastname: Right([Supervisors]![Supervisor],Len([Supervisors]![Supervisor]))-  
InStr([Supervisors]![Supervisor]," ")

## 5.6 Result

Supervisor's Lastname	Employee's	Job code
Goldberg	Kelly Ramirez	3000
Goldberg	Gerry Novak	3000
Goldberg	Shelley O'Day	6000
Goldberg	Jodie Wong	6000
*		

## 5.7 Query

Weekly Hours		Pay Week	
*		*	
Pay week end date ID		pay week end date id	
Employee ID		pay week end date	
Hours		days available	
OT			

Field:	Pay Week: Pay We	Total Worked Hours:	Total Worked OT: OT	Regular Hours + OT: Sum
Table:	Pay Week	Weekly Hours	Weekly Hours	
Total:	Group By	Sum	Sum	Expression
Sort:	Ascending			
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:				
or:				

Query that is contained in the filed Regular hours + OT

Regular Hours + OT: Sum([Weekly Hours].[Hours]+[Weekly Hours].[OT])

## 5.7 Result

Pay Week	Total Worked Hours	Total Worked OT	Regular Hours + OT
23-May-13	322	2.75	324.75
30-May-13	236	9.45	245.45

## References

- [1]G. Powel. “Understanding Normalization,” in *Beginning Database Design*. Indianapolis, IN: Wiley Publishing, 2006. pp. 73-104.

# Appendix

Report based on Query 5.1

## Employee's who worked more than 35 hrs

Employee ID	Full Name	Hours
32177	Robbie DaSilva	40
33982	Robin Boychuk	40
3571	Jo Hashimoto	40
41822	Chris Miller	40
72690	Jodie Wong	36
81216	Jaimie Hansen	40
85833	Lindsey Singh	37
32177	Robbie DaSilva	40
33982	Robin Boychuk	38
3571	Jo Hashimoto	40
41822	Chris Miller	38
52421	Shelley O'Day	40

Number of Employees: 12

Report based on Query 5.4

Employees and Positions based on City		
City	Full Name	Position
<input type="text" value="Moose Jaw"/>	<input type="text" value="Kelly Ramirez"/>	<input type="text" value="Stockperson"/>
	<input type="text" value="Robin Boychuk"/>	<input type="text" value="Butcher"/>
	<input type="text" value="Robbie DaSilva"/>	<input type="text" value="Baker"/>
	<input type="text" value="Jodie Wong"/>	<input type="text" value="Cleaner"/>
	<input type="text" value="Gerry Novak"/>	<input type="text" value="Stockperson"/>

Number of Employees:

Report based on Query 5.5

### Who serves on a committee and the position they hold

Committee Names	Expr1	Position
OH&S	Robbie DaSilva	Baker
OH&S	Robin Boychuk	Butcher
OH&S	Kelly Ramirez	Stockperson
OH&S	Gerry Novak	Stockperson

Number of Employees:

Report based on Query 5.6

Employees who are under the Supervisor		
Supervisor's Lastname	Employee's Name	Job code
Goldberg	Jodie Wong	6000
	Shelley O'Day	6000
	Gerry Novak	3000
	Kelly Ramirez	3000
Number of Employees:	4	