

# Database Design Project

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## CIS 422

## Database Design/Implementation

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## Statement of Objectives

The purpose of this project is to create an easy to use database where technicians can log the chemical names and quantities used for each customer. The database will allow generation of reports which will show total monthly billing by each technician in each zip code area. This will also include functionality to produce individual bills for each customer that will itemize the chemicals used and their price.

OUND

One of the maintenance personnel at your university has sent your instructor an e-mail message, asking for help designing a database for his business. Here's what he wrote.

TO: [professor@youruniversity.edu](mailto:professor@youruniversity.edu)

FROM: [joe.green@youruniversity.edu](mailto:joe.green@youruniversity.edu)

I own a small lawn care business, and I need your help designing a database. Since the start of my company in 1995, business has grown rapidly due to a core of good customers who have recommended me to friends. I have been doing all my own bookkeeping by hand, but it's becoming a difficult task with the expansion of my business. I would like to implement a computerized billing system this winter, while business is a little slow.

Here's how my business works. I have four technicians who travel to customers' homes to apply chemicals to treat lawns. Each technician has an area defined by Zip Code. The technician travels to the customer's home, inspects the lawn, and then decides which chemicals to apply. The customer is only charged for the chemicals used that day, so the bills to individual customers vary month by month. The charge for each chemical applied depends on the quantity applied. All of my lawn chemicals are charged by the gallon.

A few of my customers require that I use only organic products on their lawn. This is noted on their customer records. When technicians go to the customer's home, they know from the list whether to apply only organic products. Since the products carried on the truck are normally synthetic chemicals, I need a list of those customers who prefer "organic only," so their lawns can be treated at a separate time.

I would like a system that is easy enough for my technicians to use, so when they return to the office after a day's work, they can log the chemical names and quantities used for each customer. Then I will take that information and generate a report which will show my total monthly billing by each technician in each Zip Code area. This will help me to identify which technicians are generating the most income. I also want to be able to produce individual bills for each customer that will itemize the chemicals used and their price.

I hope you can help me set up my system.

Thank you.

Joe Green

**Figure 1. Original Document Describing Project**

## Requirements

1. This database system must hold information for Technicians, Customers, Treatments, and Chemicals.
2. The table for technicians shall hold the technician's first name, last name, and their associated zip code.
3. The table for customers shall hold their name, address, zip code, an id, and if they want organic chemicals.
4. The chemicals table shall hold the name of the chemical, its cost per gallon, and if it is organic.
5. The treatments table will contain the customer id, chemical name, chemical quantity, the zip code, the price corresponding to the chemical and its amount, and the data and time of the treatment.
6. The treatment table must also produce individual bills for each customer that will itemize the chemicals used and their price.
7. The treatments and the technicians table will all be used to create a view that shows total monthly billing by each tech in each zip code.

	1	2	3	4	5	6
Req 1	X	X	X	X		
Req 2	X					
Req 3		X				
Req 4			X			
Req 5				X		
Req 6					X	
Req 7						X

**Figure 2. Requirements Matrix**

## E-R Diagram

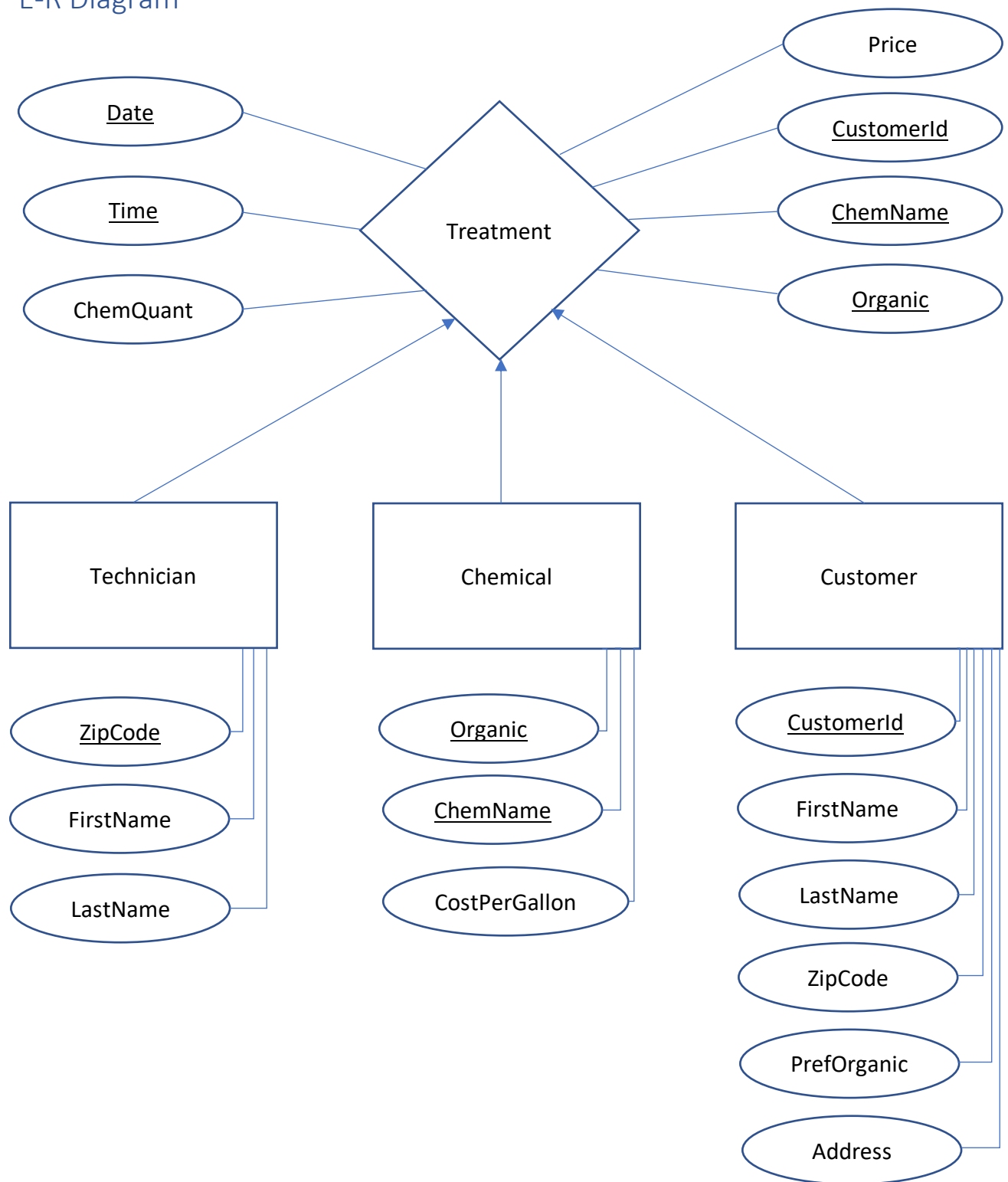


Figure 3. E-R Diagram of database

## Schema

Technician (ZipCode: STRING, FirstName: STRING, LastName: STRING)

Key: {ZipCode}

Chemical (Organic: BOOL, ChemName: STRING, CostPerGallon: DOUBLE)

Key: {Organic, ChemName}

Customer (FirstName: STRING, LastName: STRING, ZipCode: STRING, PrefOrganic: BOOL,  
Address: STRING, CustomerId: STRING)

Key: {CustomerId}

Treatment (CustomerId: STRING, ChemName: STRING, ChemQuant: DOUBLE, Price: DOUBLE,  
Date: STRING, Time: STRING)

Key: {CustomerId, ChemName, Organic, Date, Time}

Treatment (CustomerId) references Customer

Treatment (ChemName) references Chemical

## Queries in Structured English:

1. Create a table for technicians with zip code, first name and last name attributes.
2. Create a table for customers with first name, last name, zip code, address, ID, and organic preference attributes.
3. Create a table for chemicals with organic, name, and cost attributes.
4. Create a table for treatments with customer id, chemical name, quantity, price, date and time attributes.
5. Retrieve a table that shows customer billing; including ID, chemical name, quantity and price attributes.
6. Retrieve a table for monthly reports showing zip codes and prices.

## SQL

### Query 1:

```
CREATE TABLE Technician (  
    ZipCode      CHAR(5),  
    FirstName    CHAR(20),  
    LastName     CHAR(20),  
    PRIMARY KEY(ZipCode)  
)
```

### Query 2:

```
CREATE TABLE Customer (  
    FirstName    CHAR(20),  
    LastName     CHAR(20),  
    ZipCode      CHAR(20),  
    PrefOrganic  BOOLEAN,  
    Address      CHAR(100),  
    CustomerId   CHAR(6),  
    PRIMARY KEY (CustomerId)  
)
```

### Query 3:

```
CREATE TABLE Chemical (  
    Organic      BOOLEAN,  
    ChemName     CHAR(50),  
    CostPerGallon DOUBLE(5,2),  
    PRIMARY KEY(Organic, Name)  
)
```



Query 4:

```
CREATE TABLE Treatment (  
    CustomerId CHAR(20),  
    ChemName CHAR(20),  
    ChemQuant (DOUBLE(7,2)),  
    Price (DOUBLE(7,2))  
        DEFAULT = ChemQuant * SELECT CostPerGallon IN Chemical  
        WHERE ChemName = Name,  
    Date CHAR(8),  
    Time CHAR(6),  
    PRIMARY KEY (CustomerId, ChemName, Organic, Date, Time)  
    FOREIGN KEY (CustomerId) REFERENCES Customer,  
    FOREIGN KEY (ChemName) REFERENCES Chemical  
)
```

Query 5:

```
CREATE VIEW CustomerBilling(CustomerId, ChemName, ChemQuant, Price) AS  
    SELECT CustomerId, ChemName, ChemQuant, Price  
    FROM Treatment  
    WHERE EXIST
```

Query 6:

```
CREATE VIEW MonthlyReport (ZipCode, Price) AS  
    SELECT TE.ZipCode, T.Price  
    FROM Technician TE, Treatment T  
    Where Date > USERDATA AND Date < USERDATA
```

## Test Plan

### Technician

ZipCode	First name	Last name
14580	Bob	Bobsmen
14607	Tim	Timson

### Customer table

FirstName	LastName	ZipCode	PrefOrganic	Address	CustomerId
Greg	Evevsky	14580	no	123 Fake St	111111
Cameron	Goldberg	14607	yes	246 Real St	222222

### Chemical

Organic	name	CostPerGallon
False	Chemical X	25.52
True	Chemical Y	11.11

### Treatment

Customer ID	ChemName	ChemQuant	Price	Date	Time
1111111	Chemical X	2	51.04	3/12/2020	16:30
1111111	Chemical Y	5	55.55	3/12/2020	16:50
2222222	Chemical X	2	51.04	3/13/2020	12:00

**Figure 4. Test Data to Be Implemented in The Database**

### CustomerBilling

Customer ID	ChemName	ChemQuant	Price
1111111	Chemical X	2	51.04
1111111	Chemical Y	5	55.55
2222222	Chemical x	2	51.04

### MonthlyReport (Given the USERDATA is 03/01/2020 to 03/31/2020)

ZipCode	Price
14580	51.04
14580	55.55
14607	51.04

**Figure 5. Resulting View Tables from Test Data**