

Week 6 - Lab 1: Introduction to Databases

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CPSC 203 - T16

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Overview

- In this tutorial, we will learn:
 - Basic parts of a Database
 - Entity Relationship Diagrams

Databases vs. Spreadsheets

- Spreadsheets
 - Used like paper worksheets to record data
 - Provides useful tools such as:
 - Complex formula support
 - Formula and function builders
 - Sorting and filtering
 - Scenario managers (for "What-if" analysis)
 - Charts and graphs
 - Extended data formatting tools

Databases vs. Spreadsheets

- Databases
 - Organizes information on a particular subject for **retrieval**.
 - Can manage a large amount of information and better maintain data integrity.
 - Useful to maintain records for ongoing use or if the information is subject to many changes.
 - Can generate reports based on the data.

Basics of Databases

Elements of databases

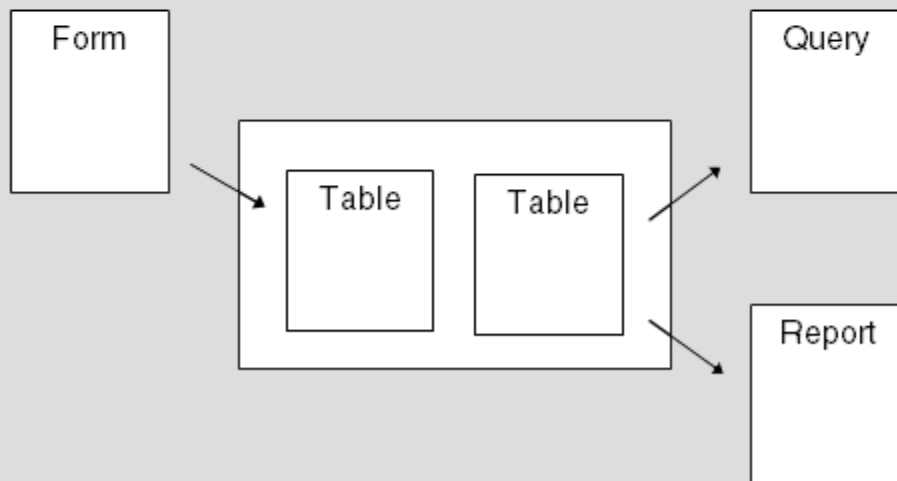
A database stores information in an organized way, and makes it easy to get information in and out.

Tables store data within the database.

Forms make it easy to put data into tables.

Queries pull out specific data.

Reports put data in an easily-read format.



Basics of Databases

- A **Database Management System (DBMS)** is a mixture of software and data that consist of:
 - The physical collection of files that contain data.
 - The software that allows users to interact with the database and make modifications.
 - The **schema** that specifies the logical structure of how the data is to be stored.

Basics of Databases

- We will work with **Relational Databases**:
 - Use a database model that organizes data and the relationship among them into **tables**.
 - A **table** is defined as a collection of **records**.
 - A **record** is a collection of related **fields**.
 - Each **field** of a database table represents a single piece of data that is stored.

Database Schema

- In a relational database, the schema defines:
 - the tables,
 - the fields in each table,
 - and the relationships between fields and tables.
- **Entity:**
 - an object in the world, which can have many relationships with other entities.
 - Represented by a “Table”.
 - Must have a primary key, which is a unique ID for the records of the table.
 - Ex: A university course

Database Schema

- **Attribute:**
 - A feature of an entity (a "variable")
 - Represented by a “field” in a Table.
 - Ex: Title of course, course number, instructor name,...etc.
 - Course number can be the ID or Primary Key.
- **Relationship:**
 - A link between two entities

Example – Basic Table

<u>PersonID</u>	<u>Firstname</u>	<u>Lastname</u>	email	birthday
101	Rick	<u>Edwards</u>	rick.edwards@email.com	7-Mar-68
102	Jimmy	Foster	jimmy.foster@email.com	28-Feb-87
103	Nathan	<u>Garcia</u>	nathan.garcia@email.com	2-Jun-82
104	Louise	Knight	louise.knight@email.com	12-Dec-67
105	Gary	<u>Knox</u>	gary.knox@email.com	1-Dec-92
106	Rafael	Lorenz	rafael.lorenz@email.com	9-Jul-78
107	Veronica	Page	veronica.page@email.com	9-Sep-45
108	Hector	<u>Sanchez</u>	hector.sanchez@email.com	1-Apr-00
109	Billy	Smith	billy.smith@email.com	30-Aug-99
110	<u>Ricardo</u>	<u>Stuckey</u>	ricardo.stuckey@email.com	17-Nov-55
111	Ken	Weaver	ken.weaver@email.com	13-May-45
112	<u>Lorenzo</u>	West	lorenzo.west@email.com	1-Jun-84

- The structure of the table corresponds to the schema that it represents.
- The **schema** is an expression of the attributes of the records in a table.

Address Book (PersonID:key, Firstname, Lastname, Email, Birthday)

Example – Relationships

- We're going to add **City** and **Province** to the database schema.
- Because these two fields have information that **repeats** themselves, there is no point in creating this type of information repeatedly.

<u>PersonID</u>	<u>Firstname</u>	<u>Lastname</u>	<u>email</u>	<u>birthday</u>	<u>City</u>	<u>Province</u>
101	Rick	<u>Edwards</u>	rick.edwards@email.com	7-Mar-68	Calgary	Alberta
102	Jimmy	Foster	jimmy.foster@email.com	28-Feb-87	Vancouver	British Columbia
103	Nathan	<u>Garcia</u>	nathan.garcia@email.com	2-Jun-82	Edmonton	Alberta
104	Louise	Knight	louise.knight@email.com	12-Dec-67	Ottawa	Ontario
105	Gary	<u>Knox</u>	gary.knox@email.com	1-Dec-92	Regina	Saskatchewan
106	Rafael	Lorenz	rafael.lorenz@email.com	9-Jul-78	Surrey	British Columbia
107	Veronica	Page	veronica.page@email.com	9-Sep-45	Richmond	British Columbia
108	Hector	<u>Sanchez</u>	hector.sanchez@email.com	1-Apr-00	<u>Markham</u>	Ontario
109	Billy	Smith	billy.smith@email.com	30-Aug-99	Winnipeg	Manitoba
110	<u>Ricardo</u>	<u>Stuckey</u>	ricardo.stuckey@email.com	17-Nov-55	Toronto	Ontario
111	Ken	Weaver	ken.weaver@email.com	13-May-45	Hamilton	Ontario
112	<u>Lorenzo</u>	West	lorenzo.west@email.com	1-Jun-84	Montreal	Quebec

Example – Relationships

- New Design:
 - Create a new Table for **City** with **CityID** as Key.
 - Create a new Table for **Province** with **ProvinceID** as Key.
 - In the Person table, substitute the actual City and Province by reference to their keys (Foreign Keys).

CityID	City
1	Calgary
2	Ottawa
3	Vancouver
4	Richmond
5	Surrey
6	Regina
7	Markham
8	Hamilton
9	Edmonton
10	Toronto
11	Winnipeg

ProvinceID	Province
1	British Columbia
2	Alberta
3	Saskatchewan
4	Manitoba
5	Ontario
6	Quebec

Example – Relationships

PersonID	Firstname	Lastname	email	birthday	CityID	ProvinceID
101	Rick	Edwards	rick.edwards@email.com	7-Mar-68	1	2
102	Jimmy	Foster	jimmy.foster@email.com	28-Feb-87	3	1
103	Nathan	Garcia	nathan.garcia@email.com	2-Jun-82	9	2
104	Louise	Knight	louise.knight@email.com	12-Dec-67	2	5
105	Gary	Knox	gary.knox@email.com	1-Dec-92	6	3
106	Rafael	Lorenz	rafael.lorenz@email.com	9-Jul-78	5	1
107	Veronica	Page	veronica.page@email.com	9-Sep-45	4	1
108	Hector	Sanchez	hector.sanchez@email.com	1-Apr-00	7	5
109	Billy	Smith	billy.smith@email.com	30-Aug-99	11	4
110	Ricardo	Stuckey	ricardo.stuckey@email.com	17-Nov-55	10	5
111	Ken	Weaver	ken.weaver@email.com	13-May-45	8	5
112	Lorenzo	West	lorenzo.west@email.com	1-Jun-84	12	6

CityID	City
1	Calgary
2	Ottawa
3	Vancouver
4	Richmond
5	Surrey
6	Regina
7	Markham
8	Hamilton
9	Edmonton
10	Toronto
11	Winnipeg

ProvinceID	Province
1	British Columbia
2	Alberta
3	Saskatchewan
4	Manitoba
5	Ontario
6	Quebec

- Use Relationships to connect the tables and avoid using duplicate data.
- The complete table can be created later on if needed by the user through a query.

More Exercises

- [http://wiki.ucalgary.ca/page/Courses/Computer Science/C PSC 203/CPSC 203 Template/Labs Template/TA Examples for Access#Navneet: Week 1 - Lab 1](http://wiki.ucalgary.ca/page/Courses/Computer%20Science/C%20PSC%20203/CPSC%20203%20Template/Labs%20Template/TA%20Examples%20for%20Access#Navneet:Week%201%20-%20Lab%201)

Student Table

Student ID	First Name	Last Name	Email	Major	Faculty
200120	Kate	West	kwest@email.com	Music	Arts
200121	Julie	McLain	jmclain@email.com	Finance	Business
200122	Tom	Erlich	terlich@email.com	Sculpture	Arts
200123	Mark	Smith	msmith@email.com	Biology	Science
200124	Jen	Foster	jfoster@email.com	Physics	Science
200125	Matt	Knight	mknight@email.com	Finance	Business
200126	Karen	Weaver	kweaver@email.com	Music	Arts
200127	John	Smith	jsmith@email.com	Sculpture	Arts
200128	Allison	Page	apage@email.com	History	Humanities
200129	Craig	Cambell	ccambell@email.com	Music	Arts
200130	Steve	Edwards	sedwards@email.com	Biology	Science
200131	Mike	Williams	mwilliams@email.com	Linguistics	Humanities
200132	Jane	Reid	jreid@email.com	Music	Arts

Instrument Table

Instrument Number	Student ID	Instrument Type	Instrument Description
10100	200129	Guitar	Stratocaster
10101	200126	Drums	Ludwig Pro
10102	200123	Guitar	Les Paul
10103	200132	Guitar	Telecaster

More Exercises

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- Questions:
 - What is the candidate key for the Student table? Is there more than one candidate key?
 - What is the candidate key for the Instrument table?
 - What is the primary key for the Student table?
 - What is the primary key for the Instrument table?
 - What is the schema of the Student table?
 - What is the schema of the Instrument table?
 - What is the foreign key in the Instrument table?

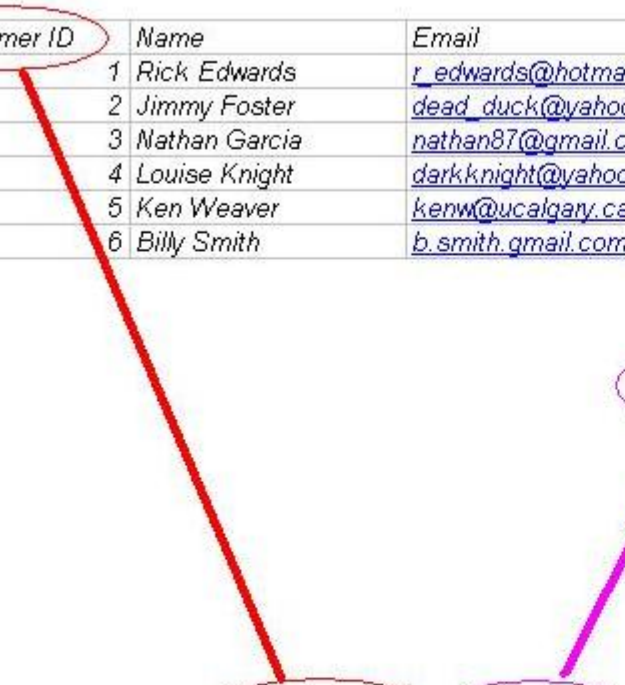
More Exercises

- [http://wiki.ucalgary.ca/page/Courses/Computer Science/C PSC 203/CPSC 203 Template/Labs Template/TA Examples for Access#Tuan Vu: Week 1 - Lab 1](http://wiki.ucalgary.ca/page/Courses/Computer%20Science/C%20PSC%20203/CPSC%20203%20Template/Labs%20Template/TA%20Examples%20for%20Access#Tuan%20Vu:Week%201%20-%20Lab%201)

Customer ID	Name	Email	Address	Phone number
1	Rick Edwards	r_edwards@hotmail.com	Calgary	403-111111
2	Jimmy Foster	dead_duck@yahoo.com	Calgary	403-524323
3	Nathan Garcia	nathan87@gmail.com	Alberta	n/a
4	Louise Knight	darkknight@yahoo.com	UoC Campus	403-987343
5	Ken Weaver	kenw@ucalgary.ca	12th Ave, Calgary	403-876234
6	Billy Smith	b.smith@gmail.com	Glacier, 24 Ave, Calgary	403-234124

Item ID	Name	Price	Current Quantity in Stock
1	Seagate 1TB HDD	150\$	10
2	2GB memory stick	20\$	5
3	17" Sony LCD monitor	200\$	12
4	Ipod	90\$	150

Order ID	Customer ID	Item ID	Quantity	Date	Status
1	1	1	1	03-Jun-08	Delivered Successfully
2	1	2	2	12-Jul-08	Cancelled
3	4	3	3	01-Aug-08	Delivered Successfully
4	6	4	1	10-Sep-08	Processing



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An example of the database that an online store would have:

1) A table that stores customer information.

Q: What kind of information do we want to keep for each customer?

A: Customer ID, Name, Email, Address, Phone number...

2) A table that stores item information.

Q: What kind of information that we want to keep for each item?

A: Item ID, Name, Price, Current quantity in stock...

3) A table that stores order information.

Q: What kind of information should we have?

A: Order ID, Customer ID, Item ID, Quantity, Date, Status...

Questions:

- What kind of relationship between the tables do we have here?
- Why don't we just have the complete customer and item information in each order instead of using the reference?
- If so, what would happen if some customer changes his profile?