CPSC203 – Introduction to Problem Solving and Using Application Software

Winter 2010

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Introduction

- Basic Database Concepts
- Entity Relationships

What is a database?

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

When do we use a database instead of a spreadsheet?

- The list of data items grows to hundreds or thousands of items.
- The relationship between data items is complex.

Microsoft Access 2007

- A Relational Database Management system from Microsoft and part of Microsoft Office family of products.

Database Management System

- The collection of files that contain data.
- The software that allows users to interact with the database.
- The schema that specifies the structure of data.

Relational Database

- A database model that organizes data and the relationship among them into *tables*.

PersonID	Firstname	Lastname	email	birthday
101	Rick	Edwards	rick.edwards@email.com	7-Mar-68
102	Jimmy	Foster	jimmy.foster@email.com	28-Feb-87
103	Nathan	Garcia	nathan.garcia@email.com	2-Jun-82
104	Louise	Knight	louise.knight@email.com	12-Dec-67
105	Gary	Knox	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	Sanchez	hector.sanchez@email.com	1-Apr-00
109	Billy	Smith	billy.smith@email.com	30-Aug-99
110	Ricardo	Stuckey	ricardo.stuckey@email.com	17-Nov-55
111	Ken	Weaver	ken.weaver@email.com	13-May-45
112	Lorenzo	West	lorenzo.west@email.com	1-Jun-84

Elements of databases

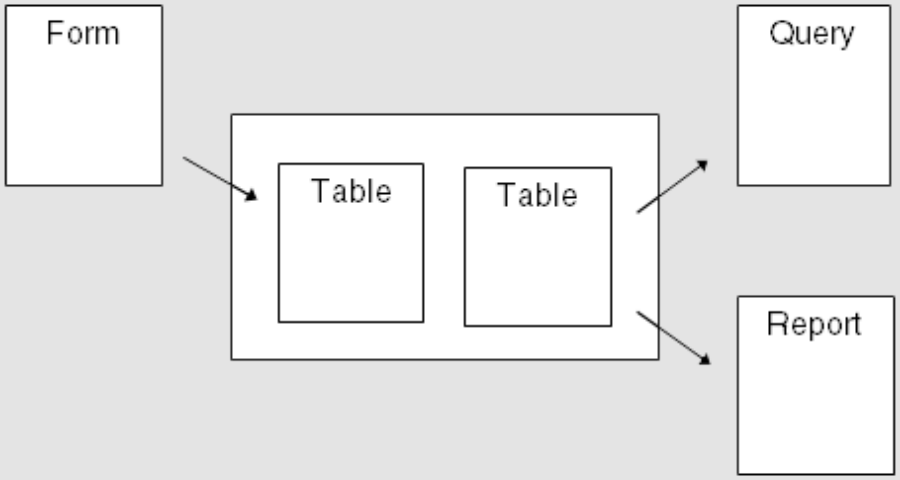
A database stores information in an organized way, and makes it easy to get information in and out.

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.



Elements of a Relational Database

- **Table**: A collection of *records*.
- **Record**: A collection of related *fields*.
- **Field**: A single piece of data that is stored.
- **Key**: A field uniquely identifies a record in a database among other records in a table.

Schema

- An expression that defines the tables, the fields in each table, and the relationships between fields and tables. The structure of the table corresponds to the schema that it represents.

Address Book

PersonID	Firstname	Lastname	Email	Birthday

Relationships (1)

- Consider the following table (note the new fields *City* and *Province* added):

PersonID	Firstname	Lastname	email	birthday	City	Province
101	Rick	Edwards	rick.edwards@email.com	7-Mar-68	Calgary	Alberta
102	Jimmy	Foster	jimmy.foster@email.com	28-Feb-87	Vancouver	British Columbia
103	Nathan	Garcia	nathan.garcia@email.com	2-Jun-82	Edmonton	Alberta
104	Louise	Knight	louise.knight@email.com	12-Dec-67	Ottawa	Ontario
105	Gary	Knox	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	Sanchez	hector.sanchez@email.com	1-Apr-00	Markham	Ontario
109	Billy	Smith	billy.smith@email.com	30-Aug-99	Winnipeg	Manitoba
110	Ricardo	Stuckey	ricardo.stuckey@email.com	17-Nov-55	Toronto	Ontario
111	Ken	Weaver	ken.weaver@email.com	13-May-45	Hamilton	Ontario
112	Lorenzo	West	lorenzo.west@email.com	1-Jun-84	Montreal	Quebec

Address Book

PersonID	Firstname	Lastname	Email	Birthday	City	Province

Relationships (2)

- In a relational database, the goal is to avoid duplicating such data.
- The data in *City* and *Province* fields repeats itself, over time the table will grow substantially large and become very slow.
- For example, if one or more people live in the city of "Calgary" it would be easier to store that information in a separate table and then reference the city using a unique number ID.

Relationships (3)

- This design uses the relationship aspect to avoid using duplicate data. Here the cities and provinces are created once and then referenced multiple times.

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

Relationships (4)

- Also the table is smaller as it is only having to track numbers instead of containing the entire name of a city or province.

Address Book

PersonID	Firstname	Lastname	Email	Birthday	CityID	ProvinceID

City

CityID	CityName

Province

ProvinceID	ProvinceName

Example (1)

- Design the database of an online shop with the following tables:
  - A table that stores customer information including name, email, address, and phone number.
  - A table that stores item information including name, price, and current quantity in stock.
  - A table that stores order information including customer, item, quantity, date, and status.

Example (2)

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	2	03-Jun-08	Delivered Successfully
2	1	2	1	12-Jul-08	Cancelled
3	4	3	1	01-Aug-08	Delivered Successfully
4	6	1	1	10-Sep-08	Processing

Example (3)

Customer

CustomerID	Name	Email	Address	PhoneNumber

Item

ItemID	Name	Price	QuantityInStock

Order

OrderID	CustomerID	ItemID	Quantity	Date	Status

Exercise

- Design a database schema with appropriate tables/fields for a course information system:
  - A table for storing the course
  - A table for storing the course instructor
  - A table for storing the department offering the course
  - A table for storing the university hosting the department (that is offering the course)