

Structuring A Database

CSE
100

Plugging data into tables haphazardly is a guaranteed way to create consistency problems and limit what can be extracted from the data base. Good database design is a complex subject, but we can learn the basics

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FIT 100 Overview

- ❖ A *database* is a set of *tables*
- ❖ The tables are sets of *records* known as *tuples* composed of *fields* each having values of from some primitive data type

DoctorID	Social Security	LicenseNumber	First Name	Middle Name	Last Name	Title
1	000-12-3456	88-022623	Jane	Marie	Curry	MD
2	611-64-0271	88-000438	Thomas	John	Calloun	MD

A table named Doctors composed of two tuples or records composed of seven fields, the first of which is an integer and the rest of which are text fields, some with specific formats

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FIT 100 Specifying A Table

Fields have names, which should be meaningful and there are facilities available for specifying the field types, format, etc.

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FIT 100 Terminology

- ❖ The structure of a data base is called a *database schema*
- ❖ The schema specifies ...
 - + The list of table names forming the database
 - + For each table, the fields of its records
 - + For each field, its attributes or properties, i.e. data type, key or not key, default value, etc.
- ❖ A database as the word is normally used, i.e. tables with specific contents, is known as a database *instance* (of a data base schema)
- ❖ There can be many instances of a single database schema

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FIT 100 Designing A Database Schema

- ❖ Suppose a college wants a database of their students, faculty, courses taught, student transcripts, and so forth, what things should go into a design and how should it be organized?
 - Students: first name, last name, home address, transcript ...
 - Faculty: first name, last name, SS#, home address, rank ...
 - Courses: class name, number, students attending, grades ...
- ❖ Deciding on the schema is called "database design" and it takes a little study to do right ... but it's easy to see the principles in action

Avoid redundancy!

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FIT 100 An Example Data Base Schema

- ❖ Consider the Students & Classes DB from Access

Tables of the Students and Classes data base ... click on the **Design** button to show the record structure and field properties

Switchboard is special table constructed by Access to navigate the user interface Ignore it in the following discussion

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FIT 100 More Of The S&C DB Schema

Classes : Table		Students : Table	
Field Name	Data Type	Field Name	Data Type
ClassID	AutoNumber	StudentID	AutoNumber
ClassName	Text	FirstName	Text
DepartmentID	Number	LastName	Text
SectionNumber	Number	Address	Text
InstructorID	Number	City	Text
Term	Text	StateOrProvince	Text
Units	Text	PostalCode	Text
Year	Number	PhoneNumber	Text
Location	Text	Major	Text
DaysAndTimes	Text	StudentNumber	Text
Notes	Memo		

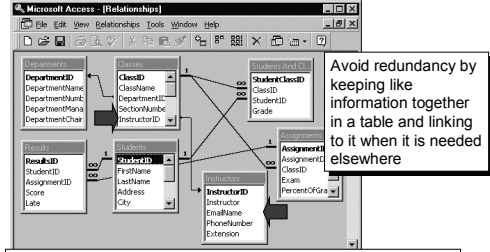
Departments : Table	
Field Name	Data Type
DepartmentID	AutoNumber
DepartmentName	Text
DepartmentPhone	Number
DepartmentManager	Text
DepartmentChairperson	Text

Assignments : Table	
Field Name	Data Type
AssignmentID	AutoNumber
AssignmentDescription	Text
ClassID	Number
Exam	Yes/No
PercentOfGrade	Number
MaximumPoints	Number

The Design windows give the remaining structural information for the data base schema ... notice how Classes, Students etc have unique IDs

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FIT 100 The Tables For The University



Avoid redundancy by keeping like information together in a table and linking to it when it is needed elsewhere

Bad design ... in the Classes table, do not include instructor's name, email, etc ... rather link to the instructor information by ID

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FIT 100 The User's View

Classes			
Class Name	Class ID	Section #	Term
CSE100	1	1	Spring
Instructor	Snyder		
Department	Computer Science & E		
Days/Times	MMF 2:30-3:20		Year 1999
Location	EE1 003		Notes: All students got whistles to use to interrupt class to ask questions
Units	5		

Student	Major	Phone Number
Smith, Tiffany	Art	() 555-1212

A database system gives users a view of the DB that is meaningful to them, but may be synthesized from tables actually forming the database

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FIT 100 Consider A Student's List Of Classes

Classes			
Class Name	Class ID	Section #	Term
CSE100	1	1	Spring
Instructor	Snyder		
Department	Computer Science & E		
Days/Times	MMF 2:30-3:20		Year 1999
Location	EE1 003		Notes: All students got whistles to use to interrupt class to ask questions
Units	5		

Student	Major	Phone Number
Smith, Tiffany	Art	() 555-1212
Jones, Brad	Epidemiology	() 555-5555

Though the admin information at the top comes from the Classes table, the class list at the bottom is not stored explicitly in any table. It is synthesized.

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FIT 100 Synthesizing The Class List

Student	Major	Phone Number	Grade
Smith, Tiffany	Art	() 555-1212	
Jones, Brad	Epidemiology	() 555-5555	

Students And Classes : Table	
Field Name	Data Type
StudentClassID	AutoNumber
ClassID	Number
StudentID	Number
Grade	Text

Each tuple is set up by STAR when you register

- ❖ By listing all records with FIT100's ClassID, a table is created of the students in FIT100 by StudentID
- ❖ By looking up each student using StudentID, the other fields of the class list can be located

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FIT 100 Why Use This Schema?

- ❖ Associating a student with a class is the logical idea behind *registering* for a class, so Students & Classes corresponds to a real phenomenon -- a plus
- ❖ Having classes listed in the student record violates the goal of a fixed length record, and makes it cumbersome to create a class list -- minus
- ❖ Having students listed in the class record violates the fixed length record goal, and makes it cumbersome to create a registration list for each student -- minus
- ❖ "Registering students" -- what STAR does -- can be done without touching either Students or Classes tables -- a plus

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Not All Views Are Synthesized

- ❖ Many tables will be of interest on their own, too

Instructors : Table	
Field Name	Data Type
InstructorID	AutoNumber
Instructor	Text
PhoneNumber	Text
Extension	Text

The screenshot shows a data entry form titled "Instructors" with the following fields and values:

Instructor ID	1
Instructor	Snyder
Phone Number	(206) 543-9265
Extension	

Record: 1 of 1