

**Understanding RDBMS**

IT4GIS  
Keith T. Weber, GISP  
GIS Director  
ISU-GIS Training and Research Center

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**FUNDAMENTALS**

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**RDBMS**

- Relational Database Management System
- The “I” in GIS (*Information*)

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**BTW**

- The Wisdom Pathway

Data    Information    Knowledge    Wisdom

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**Database software...**

- Light Duty
- Medium Duty
- Heavy Duty

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**Database software...**

- Light Duty
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- Medium Duty
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- Heavy Duty
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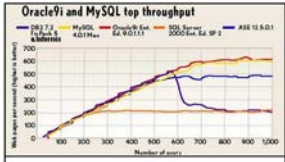
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## IBM DB2 UDB

- The GIS Center's heavy hitter- IBM DB2, Universal Database



DB2 Data Management Software



Article found in 25 February 2002 edition of eWeek



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## Spreadsheets vs. Databases

- Integrity!
- Structure

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## RDBMS CONCEPTS AND TERMS

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## Independence

- Physical
- Logical



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## Integrity

- Important for consistency and transaction management.
- Types:
  - Domain
  - Redundancy
  - Constraint
  - Entity
  - Referential
    - Cascading or non-cascading

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## Key Fields



- Unique Identifiers (?)
  - Primary key
  - Foreign key
- AKA- Relate fields.

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## RDBMS STRUCTURE

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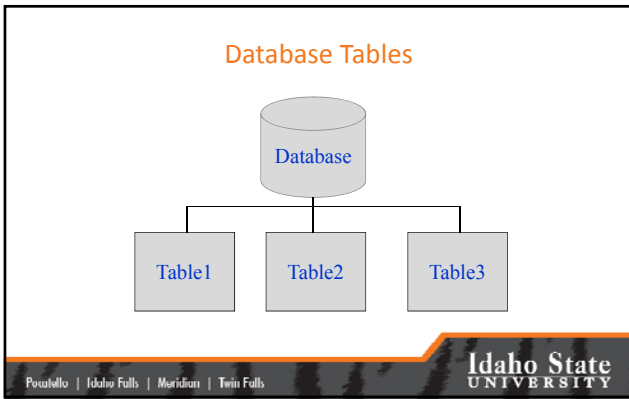
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### Table Structure

	COLUMN 1 (FIELD OR ATTRIBUTE)	COLUMN 2
ROW 1 (RECORD OR ENTITY)	VALUE	
ROW 2		

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## Data Value Types

Type Name	Storage Occupied/ data value	Valid Domain Range
Short Integer	2 bytes	-32768 to 32767
Long Integer	4 bytes	-2147483648 to 2147483647
Float	4 bytes	Any number from $n^{-45}$ to $n^{38}$
Double	8 bytes	Any number from $n^{-324}$ to $n^{308}$
Text (string)	10 + max. length = bytes	Any alphanumeric characters
Date	8 bytes	Jan 1, 100 to Dec. 31 9999
LOB (variant)	22 + max. length = bytes	Any alphanumeric characters

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## DATABASE DESIGN

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## Basic Steps in Database Design



- Understand and document the business' needs.
  - Problem statement
  - Business object types
  - Business relationships
  - Business constraints
- Create an ERM
- Data and process inventory
- Develop tuple types
- Tuple types to tables
- Integrity
- Populate the database

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## A Scenario...

- Develop a GIS-Based Tourism database for Southeast Idaho.



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## Document the business needs

- What problem or issue is this database going to address?
- This is a **business statement**



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## READING A BUSINESS STATEMENT

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## Identify Candidate Classes

- A *candidate* class may or may not remain a class throughout the design process
- A *candidate* class may or may not become a table
- Do not think about tables and relationship classes at this point

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## Think Object-Oriented

- Classes are nouns
- A noun is a “person, places, and things”

**SCHOOLHOUSE ROCK**



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## And now...Verbs

- *Candidate* methods are verbs
  - They show action
  - They are behaviors

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## Methods

- Identifying *candidate* methods allows us to better understand how the business operates and how the Enterprise uses GIS data.
- A method is a behavior...a relationship between classes
- The candidate methods will describe an inheritance, aggregation, or dependency relationship

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## DATABASE DESIGN (CONT'D)

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## The Preliminary ERM

- Symbolized.
  - Standard Representation
  - Attribute Representation
  - Entity Instance Representation

### DINING

K Restaurant Number: 126

Name: Burger King

Type of food: Fast

#### Basic Steps in Database Design



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## Relationships

- Determine the relationships between your entity types.
- Add these to the ERM

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## Define the List

- Database Dictionary
  - Restaurant\_Name
    - The name of the restaurant
  - Food\_Type
    - Categories of food (e.g., 1 = Continental, 2 = Fast food, etc.)
  - Cost\_Mean
    - The average cost of all regular menu items



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## Develop Tuple Types

- Use your ERM with relationships
- Perform a “Walk-through” exercise
  - Simulate information is being added/used in your database.
- Symbolize using Attribute Representation

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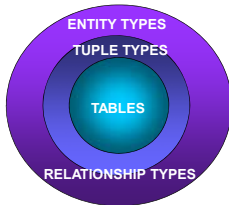
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## Tuple Types to Tables



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## Normalization

- First-Fifth Form Normal (1FN, 2FN,...5FN)
- Academic
- Applied

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## 1FN

- All values are atomic
  - Single cell contains single data value
- Eliminate repeating groups
  - Puppy\_Trick1, Puppy\_Trick2, ...

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Check this (1FN)...

Field Name	Data Type	Length	Description	Examples
OWNER1	Text	100	Owner of Parcel	John Smith
OWNER2	Text	100	Additional owner of parcel	Mary Smith
MAIL_ADD1	Text	100	Mailing address of owner	1234 S Paper Rd
MAIL_ADD2	Text	100	Additional mailing address of owner	Jpt 9C
MAIL_CITY	Text	100	Mailing city of owner	Anderskn Pass
MAIL_STATE	Text	2	Mailing state of owner	AK
MAIL_ZIP	Text	10	Mailing U.S zip code of owner	99721-0000
MAIL_COUNTRY	Text	4000	Mailing country of owner	USA
SITE_ADD	Text	100	Site address of property	6700 W Stanger Ave
SITE_CITY	Text	100	City of property	Keegan
SITE_ZIP	Text	10	Zip code of property	16003-0000
CATEGORY1	Text	2	Assessed land use	01
CATEGORY2	Text	2	Assessed land use	02
CATEGORY3	Text	2	Assessed land use	03
CATEGORY4	Text	2	Assessed land use	04
CATEGORY5	Text	2	Assessed land use	05
CATEGORY6	Text	2	Assessed land use	06
CATEGORY7	Text	2	Assessed land use	07
BRK_ACRES	Double	TBD	Irrigated acreage by land use category	7.500
DRY_ACRES	Double	TBD	Drained agricultural acreage by land use category	1.648
ZONING	Text	100	Zoning category	R3W
DESC1	Text	100	Property description	P&R 3000 of S25814
DESC2	Text	100	Property description	S&C 25 IN 11
DESC3	Text	100	Property description	#44030-5
DESC4	Text	100	Property description	
DESC5	Text	100	Property description	
SI_NAME	Text	100	Sideline name	Happy Valley
VALUATION	Integer	TBD	Net assessed value of property	100,000

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2FN

- Satisfy 1FN and...
- Redundant **data** must be eliminated
  - How?
  - Example: Puppy\_ID, Trick\_ID, Trick\_Name

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Check this (2FN)...

Field Name	Data Type	Length	Description	Examples
OWNER1	Text	100	Owner of Parcel	John Smith
OWNER2	Text	100	Additional owner of parcel	Mary Smith
MAIL_ADD1	Text	100	Mailing address of owner	1234 S Paper Rd
MAIL_ADD2	Text	100	Additional mailing address of owner	Jpt 9C
MAIL_CITY	Text	100	Mailing city of owner	Anderskn Pass
MAIL_STATE	Text	2	Mailing state of owner	AK
MAIL_ZIP	Text	10	Mailing U.S zip code of owner	99721-0000
MAIL_COUNTRY	Text	4000	Mailing country of owner	USA
SITE_ADD	Text	100	Site address of property	6700 W Stanger Ave
SITE_CITY	Text	100	City of property	Keegan
SITE_ZIP	Text	10	Zip code of property	16003-0000
CATEGORY1	Text	2	Assessed land use	01
CATEGORY2	Text	2	Assessed land use	02
CATEGORY3	Text	2	Assessed land use	03
CATEGORY4	Text	2	Assessed land use	04
CATEGORY5	Text	2	Assessed land use	05
CATEGORY6	Text	2	Assessed land use	06
CATEGORY7	Text	2	Assessed land use	07
BRK_ACRES	Double	TBD	Irrigated acreage by land use category	7.500
DRY_ACRES	Double	TBD	Drained agricultural acreage by land use category	1.648
ZONING	Text	100	Zoning category	R3W
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DESC5	Text	100	Property description	
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VALUATION	Integer	TBD	Net assessed value of property	100,000

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### 3FN

- Satisfy 1NF and 2FN and...
- No non-key attributes are dependent on other non-key attributes.
  - Example: Appointment\_ID, Name, Date, Time, Species

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### After Normalization

- New tuple types will be created.
- New tables will be planned.
- Many-many relationships will be handled using associative tables (bridge tables).



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### De-Normalization

- What? Is this heresy?



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## Designing the Actual RDBMS

- Visual modeling based upon your ERM and Tuple type model.
- Implementation of integrity rules based upon your business constraints.



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## Populate...

- Questions and concerns to revisit
  - Null data
  - Reporting discrepancies and variations
  - Measuring or estimating methods
  - Client utility/efficiency

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## The Last Step?

# Validation!

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Questions?



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