Database System Design

IS240 – DBMS

Lecture #3 - 2010-01-25

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Overview

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User views of data.

> Class diagram that shows business entities, relationships, and rules.



list.

Customer(<u>CustomerID</u>, Name, Address, ...) SalesPerson(EmployeeID, Name, Commission, ...)

Order(OrderID, OrderDate, CustomerID, EmployeeID,

OrderItem(OrderID, ItemID, Quantity, Price, ...) Item(ItemID, Description, ListPrice, ...)

> Indexes and storage methods to
> improve
> performance.

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Designing Systems

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Physical

storage.

data

- Designs model existing & proposed systems Provide picture or representation of reality DSimplification
 - □Someone should be able to read your design (model) and describe features of actual system.
- > You build models by talking with users
 - □Identify processes
 - □Identify objects
 - □Determine current problems and future needs □Collect user documents (views)
- > Break complex systems into pieces and levels

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Topics

- > Overview
- Design
- > Entities / Classes
- ≻UML
- > Associations
- > Inheritance
- > PetStore
- > Data Types
- > Events

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> Rolling Thunder

The Need for Design



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 Goal: To produce an information system that adds value for user
 Reduce costs
 Increase sales/revenue

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- Provide competitive advantage
- Objective: To understand system
 To improve it
- It is a start of the start o

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> Methodology: Build models of system

Design Stages

- NORWICH
- Initiation Physical Design □ Scope □ Table definitions Feasibility Application development Cost & Time estimates ✓ Queries > Requirements Analysis ✓ Forms User Views & Needs ✓ Reports ✓ Forms ✓ Application integration ✓ Reports Data storage □ Processes & Events □ Security Objects & Attributes Procedures Conceptual Design > Implementation □ Models □ Training ✓ Data flow diagram Purchases ✓ Entity Relationships Data conversion ✓ Objects Installation User feedback Evaluation & Review

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Initial Steps of Design

- 1. Identify exact goals of system.
- 2. Talk with users to identify basic forms and reports.
- 3. Identify data items to be stored.
- 4. Design classes (tables) and relationships.
- 5. Identify any business constraints.
- 6. Verify design matches business rules.

Definitions



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- > Relational database: A collection of tables.
- > Table: collection of columns (attributes) describing an entity. Individual objects stored as rows of data in table.

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- > Property (attribute): characteristic or descriptor of class or
- entity.

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- > Every table has primary key.
 - The smallest set of columns that uniquely identifies any row □ Primary keys can span more than one column (concatenated keys)
 - UWe often create primary key to insure uniqueness (e.g., CustomerID, Product#, . . .) called surrogate key.

R	ows/Obje	Primary ects	/ key	Pi Employee	roperties	Class: Employee
	Employeel	D TaxpayerID	LastName	FirstName	HomePhone	Address
	12512	888-22-5552	Cartom	Abdul	(603) 323-9893	252 South Street
	15293	222-55-3737	Venetiaan	Roland	(804) 888-6667	937 Paramaribo Lane
	22343	293-87-4343	Johnson	John	(703) 222-9384	234 Main Street
	29387	837-36-2933	Stenheim	Susan	(410) 330-9837	8934 W. Maple

. . .

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Definitions	UNIVERSITY.	Associations		
Entity: Something in real world that we wish to describe or track. Class: Description of an entity, that includes its attributes (properties) and behavior (methods). Object: One instance of class with specific data. Property: A characteristic or descriptor of class or entity. Method: A function that is performed by class. Association: A relationship between two or more classes. Pet Store Examples Entity: Customer, Merchandise, Sales Class: Customer, Merchandise, Sale Object: Joe Jones, Premium Cat Food, Sale #32 Property: LastName, Description, SaleDate Method: AddCustomer, UpdateInventory, ComputeTotal Association: Each Sale can have only one Customer.		 > General > General > One-to-one (1:1) > One-to-many (1:M) > Many-to-many (M:N) > Relationships represent business rules > Sometimes common- sense > Sometimes unique to an organization > Users often know current relationships, rarely future 		
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隋 **Entities/Classes** NORWICH Name Customer CustomerID LastName **Properties FirstName** Phone Address City State **ZIP Code** Add Methods Customer Delete (optional for database) Customer Copyright @ 2010 Jerry Post. All rights reserved

Unified Modeling Language (UML)



A relatively new method to design systems. Contains several types of diagrams:

Contains several types of diagrams:

Class diagram	Shows the static model of things that exist and their		
	relationships.		
Use case diagram	Shows how actors will use the functionality of the system.		
Sequence diagram	Represents an interaction or set of messages exchanged		
	among objects. Specifically shows interaction over time.		
Collaboration diagram	Shows the interaction and links among objects. Does not show		
	time as a separate dimension. It is a process diagram.		
Statechart diagrams	Shows the sequence of states that an object goes through		
	during its lifetime in response to stimuli.		
Implementation diagrams	Shows the structure of the code or of the run-time modules.		

The class diagram is most important for database design.

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- Objects related to objects □ An employee can work
- in only one department □ Many departments can work on many different
- products Objects related to properties
- □ An employee can have only one name
- Many employees can have same last name

е Emp * * Tasks



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Pet Store Class Diagram: Access



Data Types (cont'd)



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> Numeric

□Bvte	1 byte	0 to 255
□Boolear	12 bytes	True or False
□Integer	2 bytes	-32,768 to 32,767 (no decimal points)
□Long	4 bytes	-2,147,483,648 to 2,147,483,647 (no decimal points)
□Floating	J 4 bytes	1.401298E-45 to 3.402823E38
Double	8 bytes	4.94065645841247E-324 to 1.79769313486232E308
□ Currency	8 bytes	-922,377,203,685,477.5808 to 922.377,203.685.477.5807

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Computed Attributes

Denote computed values with preceding slash (/).



Data Types (Domain)

≻ Text

- Fixed length 1 to 64 K bytes
 - □ Variable length 1 to 2 G bytes
- > Memo/Note
- Date/Time 8 bytes Jan 1, 100 to Dec 31, 9999
- > Objects/Raw binary
 - □ Any type of data supported by machine
 - □ Pictures, sound, video . . .

Data Type Sizes

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	Access	SQL Server	Oracle
Text fixed variable Unicode memo	Text Memo	char, varchar nchar, nvarchar text	CHAR VARCHAR2 NVARCHAR2 LONG
Number Byte (8 bits) Integer (16 bits) Long (32 bits) (64 bits) Fixed precision Float Double Currency Yes/No	Byte Integer Long NA NA Float Double Currency Yes/No	tinyint smallint int bigint decimal(p,s) real float money bit	INTEGER INTEGER NUMBER(38,0) NUMBER(p,s) NUMBER, FLOAT NUMBER NUMBER(38,4) INTEGER
Date/Time Interval	Date/Time NA	datetime smalldatetime interval year	DATE INTERVAL YEAR
Image	OLE Object	image	LONG RAW, BLOB
AutoNumber	AutoNumber	Identity rowguidcol	

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Business Event

Event Examples

- □ Item is sold.
 - Decrease Inventory count.

Data Event

- □ Inventory drops below preset level.
- □ Order more inventory.

User Event

- User clicks on icon.
- $\hfill\square$ Send purchase order to supplier.



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DISCUSSION