Chapter 7
Using SQL in Applications

DATABASE PROCESSING
Fundamentals, Design, and Implementation, 9/e

View Ridge Gallery

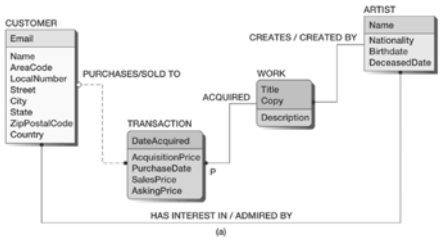
- View Ridge Gallery is a small art gallery that has been in business for 30 years
- It sells contemporary European and North American fine art
- View Ridge has one owner, three salespeople, and two workers
- View Ridge owns all of the art that it sells; it holds no items on a consignment basis

Application Requirements

- View Ridge application requirements
  - Track customers and their artist interests
  - Record gallery's purchases
  - Record customers' art purchases
  - List the artists and works that have appeared in the gallery
  - Report how fast an artist's works have sold and at what margin
  - Show current inventory in a Web page

View Ridge Data Model

Figure 7.2a View Ridge Database with Data Keys — Data Model

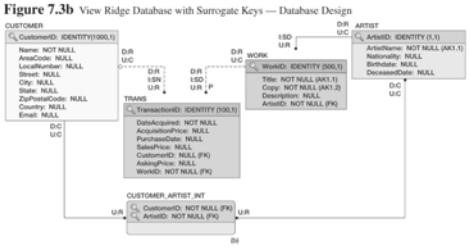


View Ridge Data Model

- Problems: the keys for WORK and TRANSACTION are huge and the key for CUSTOMER is doubtful as many customers may not have an email address

Surrogate Key Database Design

Figure 7.3b View Ridge Database with Surrogate Keys — Database Design



Sample Values

Figure 7.5a Sample View Ridge Data — Sample ARTIST Data

ArtistID	Name	Nationality	Birthdate	DeceasedDate
3	Miro	Spanish	1870	1950
4	Kandinsky	Russian	1854	1900
5	Frings	US	1700	1800
6	Klee	German	1900	<NULL>
8	Moos	US	<NULL>	<NULL>
14	Tobey	US	<NULL>	<NULL>
15	Matisse	French	<NULL>	<NULL>
16	Chagall	French	<NULL>	<NULL>

(a)

Sample Values

Figure 7.5b Sample View Ridge Data — Sample WORK Data

WorkID	Title	Description	Copy	ArtistID
505	Mystic Fabric	One of the only pr	99/135	14
506	Mi Vida	Very black, but ve	7/100	3
507	Slow Embers	From the artist's c	HC	14
525	Mystic Fabric	Some water dama	105/135	14
530	Northwest by Night	Wonderful, moody	37/50	16

(b)

Sample Values

Figure 7.5c Sample View Ridge Data — Sample TRANSACTION Data

TransactionID	DateAcquired	AcquisitionPrice	PurchaseDate	SalesPrice	AskingPrice	CustomerID	WorkID
100	2/27/1974	8750	3/18/1974	18500	20000	1015	505
101	7/17/1989	28900	10/14/1989	46700	47000	1001	505
121	11/17/1989	4500	11/21/2000	9750	10000	1040	525
122	2/27/1999	8000	3/15/2000	17500	17500	1036	525
124	4/7/2001	38700	8/17/2000	73500	75000	1036	506
129	11/21/2001	6750	3/18/2002	14500	15000	1040	507
130	11/21/2001	21500	<NULL>	<NULL>	<NULL>	<NULL>	525
135	7/17/2002	47000	10/2/2002	71500	72500	1015	530

(c)

Sample Values

Figure 7.5d Sample View Ridge Data — Sample CUSTOMER Data

CustomerID	Name	Street	City	State	ZipPostalCode	Country	AreaCode	PhoneNumber	Email
1000	Jeffrey Janes	123 W. Elm St	Renton	WA	98123	USA	206	555-1345	Customer1000@somewhere.com
1001	David Smith	813 Tumbleweed L	Loveland	CO	80345	USA	303	555-5434	Customer1001@somewhere.com
1015	Tiffany Twilight	88 - First Avenue	Langley	WA	98114	USA	206	555-1000	Customer1015@somewhere.com
1033	Fred Smothers	10899 - 88th Ave	Bainbridge Islan	WA	98106	USA	206	555-1234	Customer1033@somewhere.com
1034	Mary Beth Frederi	25 South Lafayette	Denver	CO	80210	USA	303	555-1000	Customer1034@somewhere.com
1036	Selma Warning	205 Burnaby	Vancouver	BC	V0N 1B4	Canada	253	555-1234	Customer1036@somewhere.com
1037	Susan Wu	105 Locust Ave	Atlanta	GA	23224	USA	721	555-1234	Customer1037@somewhere.com
1040	Donald G. Gray	55 Bodega Ave	Bodega Bay	CA	92114	USA	705	555-1234	Customer1040@somewhere.com
1041	Lynda Johnson	117 C Street	Washington	DC	11345	USA	703	555-1000	<NULL>
1051	Chris Wilkens	87 Highland Drive	Olympia	WA	98006	USA	206	555-1234	<NULL>

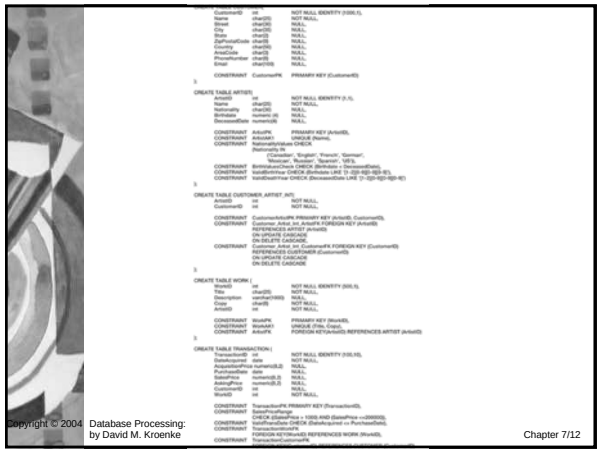
(d)

Sample Values

Figure 7.5e
Sample View Ridge Data — Sample CUSTOMER_ARTIST_INT Data

ArtistID	CustomerID
3	1036
5	1015
5	1034
5	1041
5	1051
8	1034
8	1041
14	1001
14	1015
14	1033
14	1034
14	1036
14	1040
14	1041
14	1051
16	1015

(e)



CHECK CONSTRAINT

Does not work in MS Access

- CHECK CONSTRAINT defines limits for column values
- Two common uses
  - Specifying a range of allowed values
  - Specifying an enumerated list
- CHECK constraints may be used
  - To compare the value of one column to another
  - To specify the format of column values
  - With subqueries

SQL Views

Views do work in MS Access!

- SQL view is a virtual table that is constructed from other tables or views
- It has no data of its own, but obtains data from tables or other views
- SELECT statements are used to define views
  - A view definition may not include an ORDER BY clause
- SQL views are a subset of the external views
  - They can be used only for external views that involve one multi-valued path through the schema

SQL Views

- Views may be used to
  - Hide columns or rows
  - Show the results of computed columns
  - Hide complicated SQL statements
  - Provide a level of indirection between application programs and tables
  - Assign different sets of processing permissions to tables
  - Assign different sets of triggers

Example: CREATE VIEW

```
CREATE VIEW
   CustomerNameView AS
SELECT Name AS
   CustomerName
FROM CUSTOMER;

SELECT *
FROM CustomerNameView
ORDER BY CustomerName;
```

- Insert Figure 7-6

Updating Views

- Views may or may not be updatable
- Rules for updating views are both complicated and DBMS-specific
- Guidelines: Insert Figure 7-13

Embedding SQL In Program Code

Triggers & Stored Procedures in MS Access require VBA

- SQL can be embedded in triggers, stored procedures, and program code
- Problem: assigning SQL table columns with program variables
- Solution: object-oriented programming, PL/SQL
- Problem: paradigm mismatch between SQL and application programming language
  - SQL statements return sets of rows; an applications work on one row at a time
- Solution: process the SQL results as pseudo-files

Triggers

Requires VBA to work in MS Access

- A trigger is a stored program that is executed by the DBMS whenever a specified event occurs on a specified table or view
- Three trigger types:
  BEFORE, INSTEAD OF, and AFTER
  - Each type can be declared for Insert, Update, and Delete
  - Resulting in a total of nine trigger types
- Oracle supports all nine trigger types
- SQL Server supports six trigger types (only for INSTEAD OF and AFTER triggers)

Firing Triggers

- When a trigger is fired, the DBMS supplies
  - Old and new values for the update
  - New values for inserts
  - Old values for deletions
- The way the values are supplied depends on the DBMS product
- Trigger applications:
  - Checking validity (Figure 7-14)
  - Providing default values (Figure 7-15)
  - Updating views (Figure 7-16)
  - Enforcing referential integrity actions (Figure 7-17, 7-18)

Stored Procedures

Requires VBA to work in MS Access

- A stored procedure is a program that is stored within the database and is compiled when used
  - In Oracle, it can be written in PL/SQL or Java
  - In SQL Server, it can be written in TRANSACT-SQL
- Stored procedures can receive input parameters and they can return results
- Stored procedures can be called from
  - Programs written in standard languages, e.g., Java, C#
  - Scripting languages, e.g., JavaScript, VBScript
  - SQL command prompt, e.g., SQL Plus, Query Analyzer

Stored Procedure Advantages

- Greater security as store procedures are always stored on the database server
- Decreased network traffic
- SQL can be optimized by the DBMS compiler
- Code sharing resulting in
  - Less work
  - Standardized processing
  - Specialization among developers

Using SQL In Application Code

This does work with MS Access

- SQL can be embedded in application programs
- Several SQL statements need to be executed to populate an external view
- The application program causes the statements to be executed and then displays the results of the query in the form's grid controls

Using SQL In Application Code (cont.)

- The application program also processes and coordinates user actions on a form, including
  - Populating a drop-down list box
  - Making the appropriate changes to foreign keys to create record relationships
- The particulars by which SQL code is inserted into applications depend on the language and data-manipulation methodology used

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