



Online Library Management System By Allen Arorong



DataSense Analytics SQL Master Class

Online Library Management System

Project Overview:

Project Title: Online Library Management System Database Architecture

Project Description:

The Online Library Management System is a comprehensive project aimed at developing a fully functional library management system using Microsoft SQL Server. This project is designed to help students gain hands-on experience in database design, data manipulation, querying, and access control. It will encompass various phases and tasks that align with DML, DDL, DQL, and DCL operations.

Project Phases and Tasks:

Phase 1: Database Design (DDL)

Task 1: Define the Database Schema

Description: Create the database schema for the library management system, defining tables and relationships.

```
1  -- Create a new database named Online_Library_Management
2  CREATE DATABASE Online_Library_Management;
3
4  -- Switch the current database context to Online_Library_Management
5  USE Online_Library_Management;
6
7
8  -- Create the Books table
9  CREATE TABLE Books (
10     -- ID INT PRIMARY KEY IDENTITY(1,1), -- Uncomment this line if you want an auto-incremented ID
11     ISBN VARCHAR(100) PRIMARY KEY,      -- Primary key for uniquely identifying books
12     Book_Title VARCHAR(255),
13     Book_Author VARCHAR(255),
14     Year_Of_Publication INT,
15     Publisher VARCHAR(255),
16     Image_URL_S VARCHAR(255),
17     Image_URL_M VARCHAR(255),
18     Image_URL_L VARCHAR(255)
19 );
20
21 -- Create the Ratings table
22 CREATE TABLE Ratings (
23     Rating_ID INT PRIMARY KEY IDENTITY(1,1), -- Unique identifier for each rating
24     User_ID INT, -- Foreign key referencing Users table
25     ISBN VARCHAR(100), -- Foreign key referencing Books table
26     Book_Rating INT -- Rating given by the user
27 );
28
29 -- Create the Users table
30 CREATE TABLE Users (
31     -- ID INT PRIMARY KEY IDENTITY(1,1), -- Uncomment this line if you want an auto-incremented ID
32     User_ID INT PRIMARY KEY, -- Primary key for uniquely identifying users
33     Location VARCHAR(255),
34     Age INT
35 );
36
```

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Task 2: Specify Keys and Constraints

Description: Define primary keys, foreign keys, constraints, and relationships between tables.

```

38
39 -- Modify the table to make ISBN not nullable
40 ALTER TABLE Books
41 ALTER COLUMN ISBN VARCHAR(100) NOT NULL;
42
43 -- Add a foreign key constraint in Ratings referencing the Books table
44 ALTER TABLE Ratings
45 ADD FOREIGN KEY (ISBN) REFERENCES Books(ISBN);
46
47
48 -- Add a foreign key constraint in Ratings referencing the Users table
49 ALTER TABLE Ratings
50 ADD CONSTRAINT FK_Ratings_Users
51 FOREIGN KEY (User_ID) REFERENCES Users(User_ID);
52

```

Phase 2: Data Population (DML)

Task 3: Populate the Database with Sample Data

Description: Insert sample data into the database, including books, user and ratings.

Using Data From Kaggle

Books :

Columns :

ISBN	Book-Title	Book-Author	Year-Of-Publication	Publisher
0195153448	Classical Mythology	Mark P. O. Morford	2002	Oxford University Press
0002005018	Clara Callan	Richard Bruce Wright	2001	HarperFlamingo Canada
0060973129	Decision in Normandy	Carlo D'Este	1991	HarperPerennial
0374157065	Flu: The Story of the Great Influenza Pandemic of 1918 and the Search for the Virus That Caused It	Gina Bari Kolata	1999	Farrar Straus Giroux
0393045218	The Mummies of Urumchi	E. J. W. Barber	1999	W. W. Norton & Company
0399135782	The Kitchen God's Wife	Amy Tan	1991	Putnam Pub Group
0425176428	What If?: The World's Foremost Military Historians Imagine What Might Have Been	Robert Cowley	2000	Berkley Publishing Group
0671870432	PLEADING GUILTY	Scott Turow	1993	Audioworks
0679425608	Under the Black Flag: The Romance and the Reality of Life Among the Pirates	David Cordingly	1996	Random House
074322678X	Where You'll Find Me: And Other Stories	Ann Beattie	2002	Scribner
0771074670	Nights Below Station Street	David Adams Richards	1988	Emblem Editions
080652121X	Hitler's Secret Bankers: The Myth of Swiss Neutrality During the Holocaust	Adam Lebor	2000	Citadel Press
0887841740	The Middle Stories	Sheila Heti	2004	House of Anansi Press
1552041778	Jane Doe	R. J. Kaiser	1999	Mira Books
1558746218	A Second Chicken Soup for the Woman's Soul (Chicken Soup for the Soul Series)	Jack Canfield	1998	Health Communications
1567407781	The Witchfinder (Amos Walker Mystery Series)	Loren D. Estleman	1998	Brilliance Audio - Trade
1575663937	More Cunning Than Man: A Social History of Rats and Man	Robert Hendrickson	1999	Kensington Publishing Corp.
1881320189	Goodbye to the Buttermilk Sky	Julia Oliver	1994	River City Pub
0440234743	The Testament	John Grisham	1999	Dell
0452264464	Beloved (Plume Contemporary Fiction)	Toni Morrison	1994	Plume
0609804618	Our Dumb Century: The Onion Presents 100 Years of Headlines from America's Finest News Source	The Onion	1999	Three Rivers Press
1841721522	New Vegetarian: Bold and Beautiful Recipes for Every Occasion	Celia Brooks Brown	2001	Ryland Peters & Small Ltd
1879384493	If I'd Known Then What I Know Now: Why Not Learn from the Mistakes of Others?: You Can't A.J., R. Parrish		2003	Cypress House
0061076031	Mary-Kate & Ashley Switching Goals (Mary-Kate and Ashley Starring in)	Mary-Kate & Ashley Olsen	2000	HarperEntertainment
0439095026	Tell Me This Isn't Happening	Robynn Clairday	1999	Scholastic
0689821166	Flood : Mississippi 1927	Kathleen Duey	1998	Aladdin
0971880107	Wild Animus	Rich Shapero	2004	Too Far
0345402871	Airframe	Michael Crichton	1997	Ballantine Books
0345417623	Timeline	MICHAEL CRICHTON	2000	Ballantine Books
0684823802	OUT OF THE SILENT PLANET	C.S. Lewis	1996	Scribner

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Users :

User-ID	Location	Age
1	nyc, new york, usa	
2	stockton, california, usa	18
3	moscow, yukon territory, russia	
4	porto, v.n.gaia, portugal	17
5	farnborough, hants, united kingdom	
6	santa monica, california, usa	61
7	washington, dc, usa	
8	timmins, ontario, canada	
9	germantown, tennessee, usa	
10	albacete, wisconsin, spain	26
11	melbourne, victoria, australia	14
12	fort bragg, california, usa	
13	barcelona, barcelona, spain	26
14	mediapolis, iowa, usa	
15	calgary, alberta, canada	
16	albuquerque, new mexico, usa	
17	chesapeake, virginia, usa	
18	rio de janeiro, rio de janeiro, brazil	25
19	weston, ,	14
20	langhorne, pennsylvania, usa	19
21	ferrol / spain, alabama, spain	46
22	erfurt, thuringen, germany	
23	philadelphia, pennsylvania, usa	
24	cologne, nrw, germany	19
25	oakland, california, usa	55

Ratings :

User-ID	ISBN	Book-Rating
276725	034545104X	0
276726	0155061224	5
276727	0446520802	0
276729	052165615X	3
276729	0521795028	6
276733	2080674722	0
276736	3257224281	8
276737	0600570967	6
276744	038550120X	7
276745	342310538	10
276746	0425115801	0
276746	0449006522	0
276746	0553561618	0
276746	055356451X	0
276746	0786013990	0
276746	0786014512	0
276747	0060517794	9
276747	0451192001	0
276747	0609801279	0
276747	0671537458	9
276747	0679776818	8
276747	0943066433	7
276747	1570231028	0
276747	1885408226	7
276748	0747558167	6
276748	3442437407	0

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Number of rows in each table :

Ratings

User-ID	ISBN	Book-Rating
276725	034545104X	0
276726	0155061224	5
276727	0446520802	0
276729	052165615X	3
276729	0521795028	6
276733	2080674722	0
276736	3257224281	8
276737	0600570967	6
276744	038550120X	7
276745	342310538	10

Columns [3]
User-ID, ISBN, Book-Rating

Last refreshed
1:14 am

Load status
Loaded to worksheet

The result of this query is too large to be loaded to the specified location on the worksheet. Worksheets have a limit of 1,048,576 rows and 16,384 columns. Please load the query to the Data Model instead.

Load to Data Model

Data Sources
Loading

Queries & Connections

Queries | Connections

3 queries

- Books
271,360 rows loaded. 3 errors.
- Ratings
Load to worksheet failed.
- Users
278,859 rows loaded. 1 error.

Task 4: Implement Data Modification

Description: Create SQL scripts for updating, deleting, and modifying data as needed.

Using Kaggle Dataset [Book Recommendation Dataset] to insert into exist table that has been created previously:

Importing Dataset to SQL Server

- Online_Library_Management
 - Database Diagrams
 - Tables
 - System Tables
 - FileTables
 - External Tables
 - Graph Tables
 - dbo.Books
 - dbo.Bookss
 - dbo.Ratings
 - dbo.Ratingss
 - dbo.Users
 - dbo.Users1

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```

53 --Imported Data--
54 SELECT Top 100 * FROM Bookss
55 SELECT Top 100 * FROM Users1
56 SELECT Top 100 * FROM Ratingss

```

91 %

Results Messages

14	1552041778	Jane Doe	R. J. Kaiser	1999	Mira Books	http://images.amazon.com/images/P/1552041778
15	1558746218	A Second Chicken Soup for the Woman's Soul (Chic...	Jack Canfield	1998	Health Communications	http://images.amazon.com/images/P/1558746218
16	1567407781	The Witchfinder (Amos Walker Mystery Series)	Loren D. Estleman	1998	Brilliance Audio - Trade	http://images.amazon.com/images/P/1567407781

User_ID	Location	Age
1	nyc, new york, usa	NULL
2	stockton, california, usa	18
3	moscow, yukon territory, russia	NULL
4	porto, v.n.gaia, portugal	17
5	farnborough, hants, united ki...	NULL

User_ID	ISBN	Book_Rating
1	92948	8804523379
2	92948	9771129085155
3	92950	0141011904
4	92951	0345339703
5	92951	0886773849
6	92963	0440214041

Query executed successfully. DESKTOP-D0VPHAK\SQLEXPRESS ... DESKTOP-D0VPHAK\Allen ... Online_Library_Management 00:00:07 300 rows

Solving error with regards to duplicates in Bookss before inserting to Books Table:

```

--Checking for Duplicate
SELECT ISBN, COUNT(*)
FROM Bookss
GROUP BY ISBN
HAVING COUNT(*) > 1;

-- Duplicate Removing
WITH DuplicatesCTE AS (
    SELECT ISBN, Book_Title, Book_Author, Year_Of_Publication, Publisher, Image_URL_S, Image_URL_M, Image_URL_L,
           ROW_NUMBER() OVER (PARTITION BY ISBN ORDER BY (SELECT NULL)) AS RowNum
    FROM Bookss
)
DELETE FROM DuplicatesCTE WHERE RowNum > 1;

```

Updating Dataset with regards to Null

```

77 -- Update Ratings table, setting ISBN to NULL for records not present in Books table
78 UPDATE Ratings
79 SET ISBN = NULL -- or set to a valid ISBN value
80 WHERE ISBN NOT IN (SELECT ISBN FROM Books);
81
82 -- USERS
83 -- First, update existing NULL values to a non-null value (assuming there are no conflicting values)
84 UPDATE Users
85 SET User_ID = -1
86 WHERE User_ID IS NULL;
87

```

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Inserting Dataset to Create Table Books , Users and Ratings :

```
-- Insert data from Bookss into Books table
INSERT INTO Books (ISBN, Book_Title, Book_Author, Year_Of_Publication, Publisher, Image_URL_S, Image_URL_M, Image_URL_L)
SELECT * FROM Bookss;

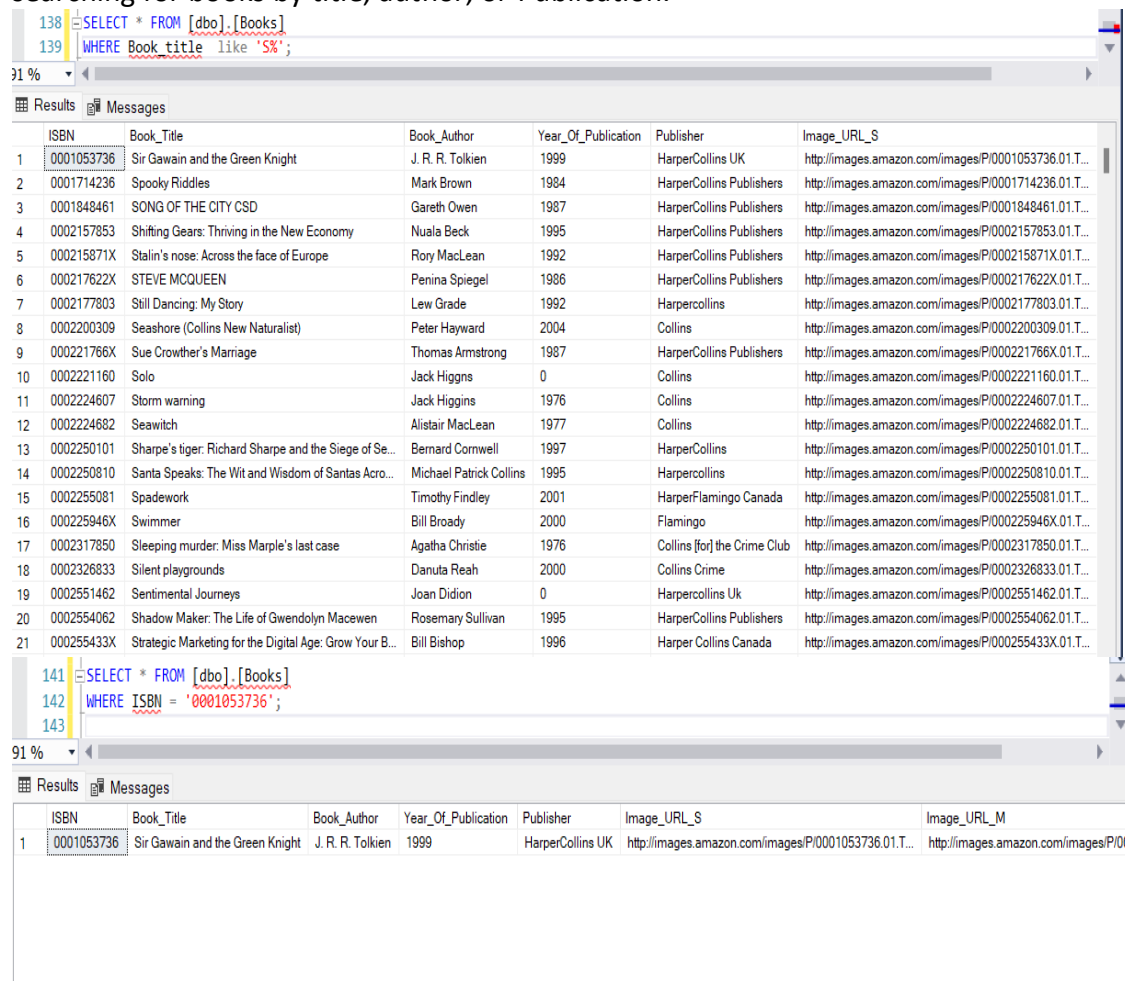
-- Insert data from Ratingss into Ratings table
INSERT INTO Ratings
SELECT * FROM Ratingss;

-- Insert data from Users1 into Users table, excluding records with NULL User_ID
INSERT INTO Users
SELECT * FROM Users1 WHERE User_ID IS NOT NULL;
```

Phase 3: Data Retrieval (DQL)

Task 5: Create SQL Queries for Common Tasks

Description: Develop SQL queries to perform common library-related tasks, such as searching for books by title, author, or Publication.



The screenshot shows a SQL query execution interface. The top part displays the query: `SELECT * FROM [dbo].[Books] WHERE Book_title like '%%';`. Below the query, there are two tabs: 'Results' and 'Messages'. The 'Results' tab is active, showing a table with 7 columns: ISBN, Book_Title, Book_Author, Year_Of_Publication, Publisher, Image_URL_S, and Image_URL_M. The table contains 21 rows of data. The first row is highlighted. Below the table, there is a second query: `SELECT * FROM [dbo].[Books] WHERE ISBN = '0001053736';`. This query also has a 'Results' tab active, showing a single row with the same 7 columns as the first table, but only for the book with ISBN 0001053736.

ISBN	Book_Title	Book_Author	Year_Of_Publication	Publisher	Image_URL_S	Image_URL_M
0001053736	Sir Gawain and the Green Knight	J. R. R. Tolkien	1999	HarperCollins UK	http://images.amazon.com/images/P/0001053736.01.T...	http://images.amazon.com/images/P/0001053736.01.T...
0001714236	Spooky Riddles	Mark Brown	1984	HarperCollins Publishers	http://images.amazon.com/images/P/0001714236.01.T...	http://images.amazon.com/images/P/0001714236.01.T...
0001848461	SONG OF THE CITY CSD	Gareth Owen	1987	HarperCollins Publishers	http://images.amazon.com/images/P/0001848461.01.T...	http://images.amazon.com/images/P/0001848461.01.T...
0002157853	Shifting Gears: Thriving in the New Economy	Nuala Beck	1995	HarperCollins Publishers	http://images.amazon.com/images/P/0002157853.01.T...	http://images.amazon.com/images/P/0002157853.01.T...
000215871X	Stalin's nose: Across the face of Europe	Rory MacLean	1992	HarperCollins Publishers	http://images.amazon.com/images/P/000215871X.01.T...	http://images.amazon.com/images/P/000215871X.01.T...
000217622X	STEVE MCQUEEN	Penina Spiegel	1986	HarperCollins Publishers	http://images.amazon.com/images/P/000217622X.01.T...	http://images.amazon.com/images/P/000217622X.01.T...
0002177803	Still Dancing: My Story	Lew Grade	1992	Harpercollins	http://images.amazon.com/images/P/0002177803.01.T...	http://images.amazon.com/images/P/0002177803.01.T...
0002200309	Seashore (Collins New Naturalist)	Peter Hayward	2004	Collins	http://images.amazon.com/images/P/0002200309.01.T...	http://images.amazon.com/images/P/0002200309.01.T...
000221766X	Sue Crowther's Marriage	Thomas Armstrong	1987	HarperCollins Publishers	http://images.amazon.com/images/P/000221766X.01.T...	http://images.amazon.com/images/P/000221766X.01.T...
0002221160	Solo	Jack Higgins	0	Collins	http://images.amazon.com/images/P/0002221160.01.T...	http://images.amazon.com/images/P/0002221160.01.T...
0002224607	Storm warning	Jack Higgins	1976	Collins	http://images.amazon.com/images/P/0002224607.01.T...	http://images.amazon.com/images/P/0002224607.01.T...
0002224682	Seawitch	Alistair MacLean	1977	Collins	http://images.amazon.com/images/P/0002224682.01.T...	http://images.amazon.com/images/P/0002224682.01.T...
0002250101	Sharpe's tiger: Richard Sharpe and the Siege of Se...	Bernard Cornwell	1997	HarperCollins	http://images.amazon.com/images/P/0002250101.01.T...	http://images.amazon.com/images/P/0002250101.01.T...
0002250810	Santa Speaks: The Wit and Wisdom of Santos Acro...	Michael Patrick Collins	1995	Harpercollins	http://images.amazon.com/images/P/0002250810.01.T...	http://images.amazon.com/images/P/0002250810.01.T...
0002255081	Spadework	Timothy Findley	2001	HarperFlamingo Canada	http://images.amazon.com/images/P/0002255081.01.T...	http://images.amazon.com/images/P/0002255081.01.T...
000225946X	Swimmer	Bill Broady	2000	Flamingo	http://images.amazon.com/images/P/000225946X.01.T...	http://images.amazon.com/images/P/000225946X.01.T...
0002317850	Sleeping murder: Miss Marple's last case	Agatha Christie	1976	Collins [for] the Crime Club	http://images.amazon.com/images/P/0002317850.01.T...	http://images.amazon.com/images/P/0002317850.01.T...
0002326833	Silent playgrounds	Danuta Reah	2000	Collins Crime	http://images.amazon.com/images/P/0002326833.01.T...	http://images.amazon.com/images/P/0002326833.01.T...
0002551462	Sentimental Journeys	Joan Didion	0	Harpercollins Uk	http://images.amazon.com/images/P/0002551462.01.T...	http://images.amazon.com/images/P/0002551462.01.T...
0002554062	Shadow Maker: The Life of Gwendolyn Macewen	Rosemary Sullivan	1995	HarperCollins Publishers	http://images.amazon.com/images/P/0002554062.01.T...	http://images.amazon.com/images/P/0002554062.01.T...
000255433X	Strategic Marketing for the Digital Age: Grow Your B...	Bill Bishop	1996	Harper Collins Canada	http://images.amazon.com/images/P/000255433X.01.T...	http://images.amazon.com/images/P/000255433X.01.T...

ISBN	Book_Title	Book_Author	Year_Of_Publication	Publisher	Image_URL_S	Image_URL_M
0001053736	Sir Gawain and the Green Knight	J. R. R. Tolkien	1999	HarperCollins UK	http://images.amazon.com/images/P/0001053736.01.T...	http://images.amazon.com/images/P/0001053736.01.T...

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Task 6: Implement Advanced Queries Description: Construct more advanced SQL queries for generating reports on borrowed books, overdue books, and popular book genres.

Description: The query selects the book title, author, publication year, and rating for books with a rating greater than 8 from the Books and Ratings tables. It uses a JOIN operation to combine data based on matching ISBNs and orders the results by rating in descending order.

```
100
101 -- Selects book details and ratings for books with a rating greater than 8, joining Books and Ratings tables on ISBN,
102 --and orders the results by rating in descending order.
103
104 SELECT Top 1000 Bo.Book_Title, Bo.Book_Author, Bo.Year_of_Publication ,Ra.Book_Rating
105 FROM Books AS Bo
106 JOIN Ratings AS Ra ON Bo.ISBN = Ra.ISBN
107 WHERE Ra.Book_Rating > 8
108 ORDER BY Book_Rating Desc;
```

91 %

Results Messages

	Book_Title	Book_Author	Year_of_Publication	Book_Rating
1	The Fellowship of the Ring (The Lord of the Rings, Part ...	J.R.R. TOLKIEN	1986	10
2	Mordecai of Monterey	Keith Abbott	1985	10
3	In the Place of Fallen Leaves: A Novel	Tim Pears	1995	10
4	The Last Hero (Gollancz SF S.)	Terry Pratchett	2001	10
5	Dracula	Bram Stoker	1997	10
6	Reviving Ophelia: Saving the Selves of Adolescent Girls ...	Mary Pipher	1995	10
7	Los Mitos de Cthulhu	Howard Philips Lovecraft	1998	10
8	The Sweet Hereafter: A Novel	Russell Banks	1991	10
9	Just So Stories (Penguin Twentieth-Century Classics)	Rudyard Kipling	1990	10
10	The Lottery and Other Stories	Shirley Jackson	1992	10
11	Lamb: The Gospel According to Biff, Christ's Childhood ...	Christopher Moore	2002	10
12	Ghost Stories of an Antiquary	Montague Rhodes James	1971	10
13	Who Fears the Devil	Manly Wade Wellman	1980	10
14	Middlemarch (Wadsworth Series in Mass Communicati...	George Eliot	1996	10
15	Ulysses (Vintage International)	James Joyce	1990	10
16	The Talented Mr. Ripley (Vintage Crime/Black Lizard)	Patricia Highsmith	1992	10
17	Dracula Under Ground (Vintage Crime/Black Lizard)	Patricia Highsmith	1992	10

Query executed successfully. DESKTOP-D0VPHAK\SQLEXPRESS ... DESKTOP-D0VPHAK\Allen ... Online_Library_Management 00:00:06 1,000 rows

Phase 4: Access Control (DCL)

Task 7: Define User Roles and Permissions

Description: Define user roles (e.g., librarian, member) and set appropriate permissions.

```
111 -- Setting up roles 'Librarian' and 'Member' in the 'Online_Library_Management' database.
112 USE [Online_Library_Management]
113
114 -- Creating 'Librarian' role.
115 CREATE ROLE Librarian;
116
117 -- Creating 'Member' role.
118 CREATE ROLE Member;
```




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Task 8: Implement Access Control Statements

Description: Implement DCL statements to control access to the database based on user roles and permissions.

```
120 -- Granting CRUD permissions on Books, Ratings, and Users tables to the 'Librarian' role.
121 GRANT SELECT, INSERT, UPDATE, DELETE ON [dbo].[Books] TO Librarian;
122 GRANT SELECT, INSERT, UPDATE, DELETE ON [dbo].[Ratings] TO Librarian;
123 GRANT SELECT, INSERT, UPDATE, DELETE ON [dbo].[Users] TO Librarian;
124
125 -- Granting SELECT permission on the Books table to the 'Member' role.
126 GRANT SELECT ON [dbo].[Books] TO Member;
```

Task 9: Simulate User Interactions

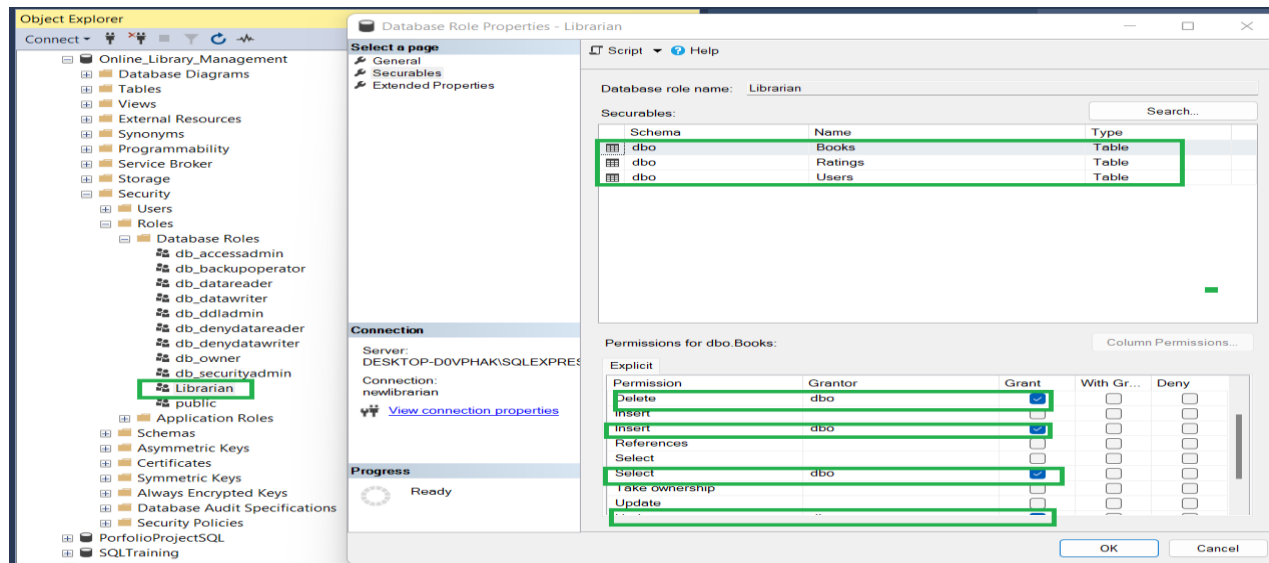
Description: Simulate user interactions with the system, demonstrating how access control works based on user roles.

```
128 -- Create a new login 'newmember' with a password in the 'master' database.
129 USE master;
130 CREATE LOGIN newmember WITH PASSWORD = 'newmember';
131
132 -- Switch to the 'Online_Library_Management' database.
133 USE [Online_Library_Management];
134
135 -- Create a new user 'member1' for the 'newmember' login and add it to the 'Member' role.
136 CREATE USER member1 FOR LOGIN newmember;
137 EXEC sp_addrolemember 'Member', 'member1';
138
139 -- Create a new login 'newlibrarian' with a password in the 'master' database.
140 USE master;
141 CREATE LOGIN newlibrarian WITH PASSWORD = 'newmember';
142
143 -- Switch to the 'Online_Library_Management' database.
144 USE [Online_Library_Management];
145
146 -- Create a new user 'librarian1' for the 'newlibrarian' login and add it to the 'Librarian' role.
147 CREATE USER librarian1 FOR LOGIN newlibrarian;
148 EXEC sp_addrolemember 'Librarian', 'librarian1';
```

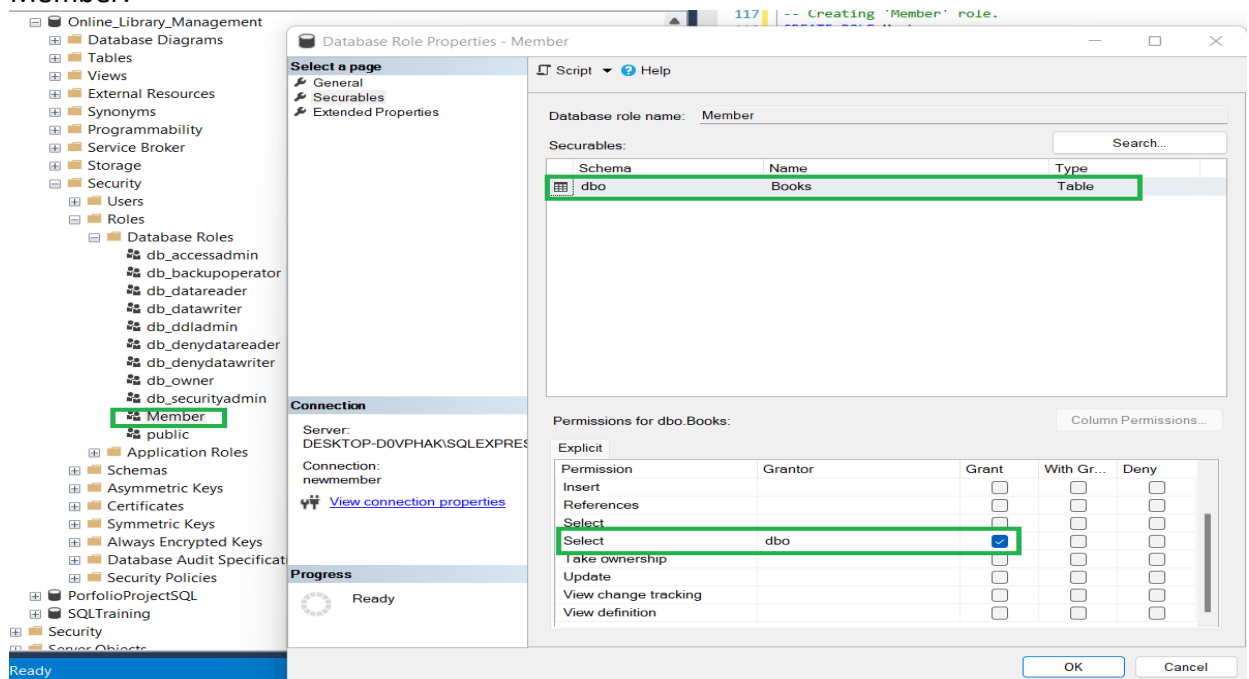
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Librarian:



Member:



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Key Takeaway in SQL Online Library Management Project:

In the Online Library Management project:

Roles and Permissions:

- Utilizing SQL Server roles ('Librarian' and 'Member') and assigning granular permissions ensures secure access control, allowing librarians comprehensive rights and members limited access.

Data Integrity:

- Employing strategies such as primary and foreign keys, along with unique constraints, ensures data integrity. This is crucial for accurate relationships between tables, preventing duplicate entries, and maintaining overall database reliability.

User Authentication and Authorization:

- The creation of logins and users, coupled with the association of roles, strengthens user authentication and authorization mechanisms. This allows for a structured and secure management of different user types within the system.

Data Manipulation and Querying:

- Crafting SQL queries for various operations, including SELECT, INSERT, UPDATE, DELETE, enables efficient data manipulation and retrieval. Utilizing JOIN operations facilitates the combination of information from multiple tables.

Documentation:

- Thorough documentation, including schema diagrams, SQL scripts, and explanations of DML, DDL, DQL, and DCL operations, provides clarity for project understanding, maintenance, and future development.

Incorporating these principles ensures a well-structured, secure, and maintainable SQL-based Online Library Management system.