Basic implementation of data warehouse for John Book's bookstore in MS SQL Server 2017

1. Introductory information

Implementation of data warehouse for John Book's bookstore in MS SQL Server 2017 is a step-by-step exercise prepared to familiarize students with modeling mappings between relational and multidimensional model. The task is designed to be performed in Visual Studio 2019.

An exemplary data warehouse was implemented according to the data warehouse design described in *Data Warehouse design for book sale process*.

All the configuration is valid for 237 NE laboratory classes and can vary with other classes and your own installations.

Warning!
In the laboratory classes you must be logged in to Microsoft Windows System as a .\dblab user. This user's password will be given to you by the tutor. In your own installation, please remember to use a user with administrator privileges who has password assigned.

2. Implementation of data warehouse

2.1. Creating a relational database for the John Book's data warehouse

1. Open SQL Server Management Studio 2017.
2. In the Connect to Server window , select Server Type: Database Engine and Server Name .\LAB1.
3. Select Connect.
4. Select the Restore Database right clicking on Databases folder of Object Explorer window.
5. After selecting Device, specify the path to the bookstoreDW.bak.
6. Restore the database.

The restored database should contain a set of sample data. Remember! You have just restored the relational model of data warehouse (not the data source). Check if the database is visible in Databases catalog. Execute some SQL queries to check if

the database has been properly restored and the structure is analogical to the one presented in the design document. You can create the database diagram. To do that right click on the Database Diagrams for bookstoreDW and choos New Database Diagram option. If you will not have privileges to do that execute (as a query) the following command:

```
USE bookstoreDW
GO
sp_changedbowner '[yourUserName]'
```

2.2. Creating the cube in SQL Server Visual Studio

7. Open Visual Studio 2019.
8. Create a new project. Choose the template Analysis Services Multidimensional and Data Mining Project.
9. Create project bookstoreDW.

Defining bookstoreDW database as a data source

10. Select Data Sources from the Solution Explorer window and create a new source (right click on Data Sources and choose New Data Source...). Skip welcome page.
11. Set the server name (check its name in Microsoft SQL Server Management Studio - it is seen in Object Explorer and in the laboratories it should be .\LAB1).
12. In the Connect to a database part of the window Select or enter a database name bookstoreDW and click OK.
13. In the next window select Microsoft Windows username and password (.\dblab user).

Defining data view for bookstoreDW.

14. Select Data Source Views from Solution Explorer and create a new data view. Analogically as for new data source.
15. Select the previously created data source.
16. Include all tables in the data view.
17. Finish creation of the data source.

Cube creation

18. Select Cubes from the Solution Explorer window and create a new cube analogically as for the data source and the data view.

19. Select Use existing tables and click Next.

Facts and measures table

20. For the Measure group tables, select Book_sale and Authorship tables (these are fact tables), and then click Next.

Warning!
In the lecture we use the notion fact table in Microsoft the measure group table notion is used.

21. Leave the default measures and select Next.
22. In the dimension window, deselect Seller dimension (check if Bookstore has been also deselected) and select Next.
23. Finish the creation of the cube.

Dimensions definitions

<u>Book, Junk and Author Dimension</u>
24. Open the Dimensions directory from Solution Explorer and select Book dimension.
25. In the Dimension Structure tab, drag the ISBN, Genre, Title and PriceCategory from Data Source View to Attributes.
26. To create exemplary hierarchy for Book dimension drag the Genre, PriceCategory, and Title dimension attributes to the Hierarchies tab.
27. Name the hierarchy BookHierarchy.
28. Check if all hierarchical dimensions, according to the design file has been created. If not create them.

Analogically, according to the design file, create Junk and Author dimensions (with all defined hierarchical dimensions).

<u>Date dimension</u>
29. Select Date dimension.
30. Drag all needed attributes.

The next points allow to sort months from January to December (not in alphabetical order)
31. In the Attributes pane, select MonthNo, and then set the AttributeHierarchyEnabled property to False in the Properties window, set the AttributeHierarchyOptimizedState property to NotOptimized, and set the AttributeHierarchyOrdered property to False.

32. Click the Attribute Relationships tab.

Notice that all the attributes in the Date dimension are related directly to the Date attribute, which is the member key that relates the dimension members to the facts in the related measure groups. There is no relationship defined between the Month attribute and the MonthNo attribute.

33. In the diagram, right-click the Month attribute and then select New Attribute Relationship.
34. In the Create Attribute Relationship dialog box, the Source Attribute is Month. Set the Related Attribute to MonthNo.
35. In the Relationship type list, set the relationship type to Rigid.
36. Select Month in the Attributes pane, and then change the value of the OrderBy property in the Properties window to AttributeKey and change the value of the OrderByAttribute property to MonthNo.

Do not forget to create Date hierarchies defined in the design document.

For the Date dimensions you must Add Business Intelligence… (right click on the dimension name of Solution Explorer window).

37. In Business Intelligence Wizard in Choose Enhancement window choose Define Dimension Intelligence.
38. Choose Time Dimension Type.
39. Include Year (map it to Year dimension attribute), Month (map it to Month), Month of Year (map it to Month No), Date (map it to Date)
40. Finish defining dimension intelligence.

Time dimension

Design Time dimension analogically as Date dimension. Remember that Day Of Week must be properly sorted and the hierarchy must be defined. Analogically as for Date dimension add Business Intelligence (only Hour attribute must be associated with the one defined in BI)

Processing the cube

41. In Solution Explorer, right-click the project name and select Process to process the cube.

Warning!
You should check if the privileges to the data source are set properly. To do that double click on the data source name in Solution Explorer and choose Impersonation Information tab.
The second thing you must check is the OLAP server connection configuration. To do that choose properties of the project (right click on the project name in Solution Explorer and choose Deployment tab). Set Server name to .\LAB1. This is the OLAP server (not database engine). To check what cubes are loaded to the OLAP server open Microsoft SQL Server Management Studio 2017, choose Connect-> Analysis Services and see available databases.

Viewing data

42. Choose, double clicking from the Cubes catalog in Solution Explorer created cube.
43. Select the Browser tab and create several sample views.

Defining aggregation functions for measures

44. In the Cube Structure tab, select the Show Measures Grid option. Change some aggregation functions, process the cube and recreate several sample views. Observe how the values change depending on the aggregation function assigned. Create at least two measures built on the same value (measure) but having different aggregation functions.

Defining a degenerate dimension

45. In the Solution Explorer window, select the Dimensions and right clicking choose New Dimension.
46. Skip the welcome screen and select Use an existing table.
47. As a Main table, select the Book_sale and add as Key columns and as a Name column Transaction No.
48. Click Next.
49. Deselect all related tables, and in the next window, all attributes except TransactionNo.
50. Finish creating the dimension.
51. For the cube you have created, select the Dimension Usage tab.
52. In the right-click menu, choose Add Cube Dimension.
53. Choose TransactionNo.
54. Select by double-clicking the TransactionNo at right bottom corner.
55. Set the Select relationship type to Fact.
56. Choose OK.

Seller dimension definition

57. In the Solution Explorer create New Dimension.
58. Skip the welcome screen and select the Use an existing table option.
59. Select Seller table as the Main table. Make sure that the key column is ID_Seller. For the name columns, set NameAndSurname column.
60. In the next window unselect Bookstore.
61. Next select all available attributes except IsCurrent.
62. Finish creation of the dimension.
63. Go to the Dimension Structure tab.
64. Right clicking show the property window of Boss dimension attribute.
65. Check if the Usage property is set to Parent.
66. Rename the hierarchy (Name property) to Supervisor.
67. Create names for subsequent levels of the hierarchy selecting NamingTemplate property. Enter subsequent job titles Director and Seller.
68. Confirm the changes by selecting OK.
69. In the Dimension Usage tab add the newly created dimension to the measure group table (analogically as for degenerate dimension).
70. Create appropriate hierarchies.
71. Do not forget to process the cube.
72. Observe data using embedded Browser and Excel (if it is installed you can click Excel icon on Browser tab).

Bookstore dimension definition

73. In the Solution Explorer create New Dimension.
74. Skip the welcome screen and select the Use an existing table option.
75. Select Bookstore table as the Main table. Make sure that the key column is ID_Bookstore.
76. Select all available attributes.
77. Finish creating the dimension.
78. Choose Dimension Usage Tab.
79. In the right-click menu, choose Add Cube Dimension.
80. Choose Bookstore.
81. Select by double-clicking the connection between Bookstore and Book Sale.
82. Set the Select relationship type to Referenced (Bookstore is connected to the Book Sale via Seller).
83. Choose Seller as Intermediate dimension
84. In the Relationship choose ID_Bookstore twice.
85. Choose OK.

Calculated measure definition

86. In the Calculations tab in Script Organizer by right clicking, create a New Calculation Member named Tax.
87. In the Expression field, enter 0.07 * [Measures]. [Profit].

88. Process the cube and have fun with various views.

Good luck!!!