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Class: BE - A Roll No: 11

Experiment No.1

Title:

For an organization of your choice, choose a set of business processes. Design star / snow flake schemas for analyzing these processes. Create a fact constellation schema by combining them. Extract data from different data sources, apply suitable transformations and load into destination tables using an ETL tool. For Example: Business Origination: Sales, Order, Marketing Process.

Objective:

Understand the basics of Star/Snowflake/fact Constellation schema & learn the RapidMiner tool for perform various Operation on in-built or external Datasets.

Hardware Requirement:

Any CPU with Pentium Processor or similar, 256 MB RAM or more, 1 GB Hard Disk or more

Software Requirements:

32/64-bit Linux/Windows Operating System, latest RapidMiner Tool

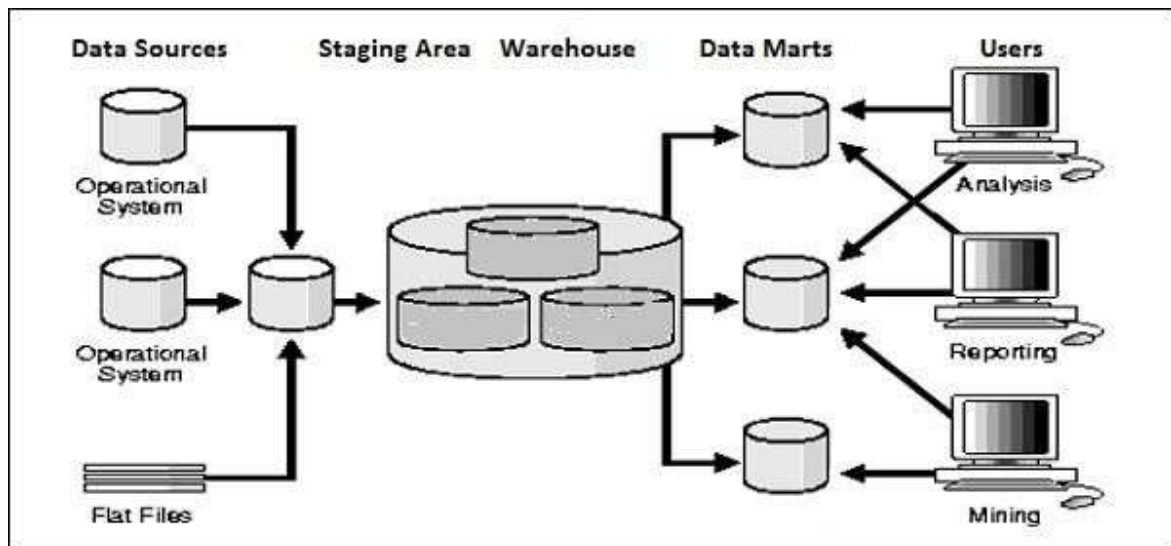
Theory:

What does ETL mean?

ETL stands for Extract, Transform and Load. An ETL tool extracts the data from different RDBMS source systems, transforms the data like applying calculations, concatenate, etc. and then load the data-to-data Warehouse system. The data is loaded in the DW system in the form of dimension and fact tables.

Extraction

- A staging area is required during ETL load. There are various reasons why staging area is required.
- The source systems are only available for specific period of time to extract data. This period of time is less than the total data-load time. Therefore, staging area allows you to extract the data from the source system and keeps it in the staging area before the time slot ends.
- Staging area is required when you want to get the data from multiple data sources together or if you want to join two or more systems together. For example, you will not be able to perform a SQL query joining two tables from two physically different databases.
- Data extractions' time slot for different systems vary as per the time zone and operational hours.
- Data extracted from source systems can be used in multiple data warehouse system, Operation Data stores, etc.
- ETL allows you to perform complex transformations and requires extra area to store the data.



Transform

In data transformation, you apply a set of functions on extracted data to load it into the target system. Data, which does not require any transformation is known as direct move or pass-through data.

You can apply different transformations on extracted data from the source system. For example, you can perform customized calculations. If you want sum-of-sales revenue and this is not in database, you can apply the **SUM** formula during transformation and load the data.

For example, if you have the first name and the last name in a table in different columns, you can use concatenate before loading.

Load

During Load phase, data is loaded into the end-target system and it can be a flat file or a Data Warehouse system.

Tool for ETL: *RAPID MINER*

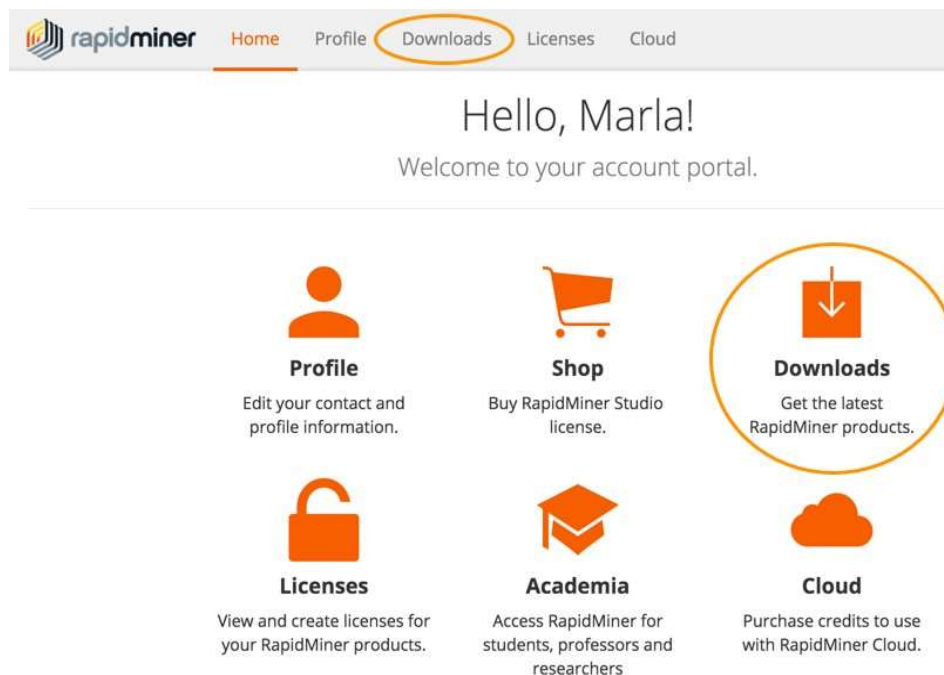
Rapid Miner is a world-leading open-source system for data mining. It is available as a stand-alone application for data analysis and as a data mining engine for the integration into own products. **Rapid Miner is now Rapid Miner Studio** and Rapid Analytics is now called Rapid Miner Server.

In a few words, Rapid Miner Studio is a "downloadable GUI for machine learning, data mining, text mining, predictive analytics and business analytics". It can also be used (for most purposes) in batch mode (command line mode)

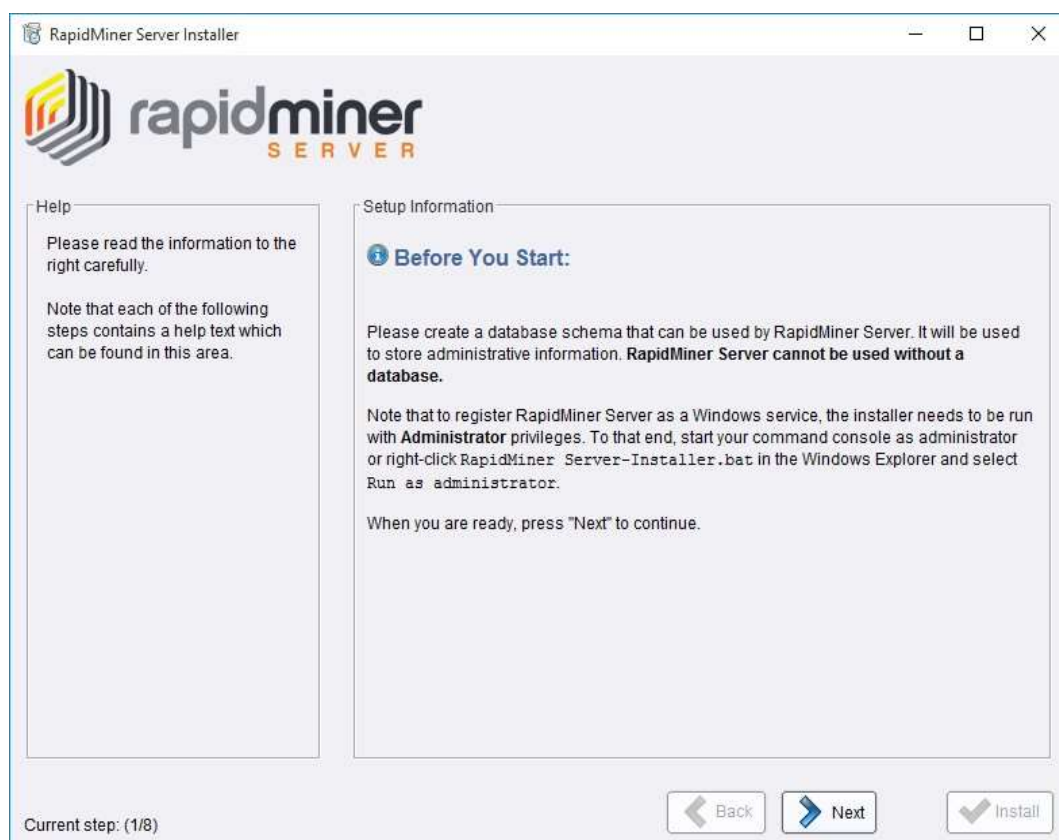
Rapid Miner Support to Nominal, Numerical values, Integers, Real numbers, 2-value nominal, multi-value nominal etc.

STEPS FOR INSTALLATION:

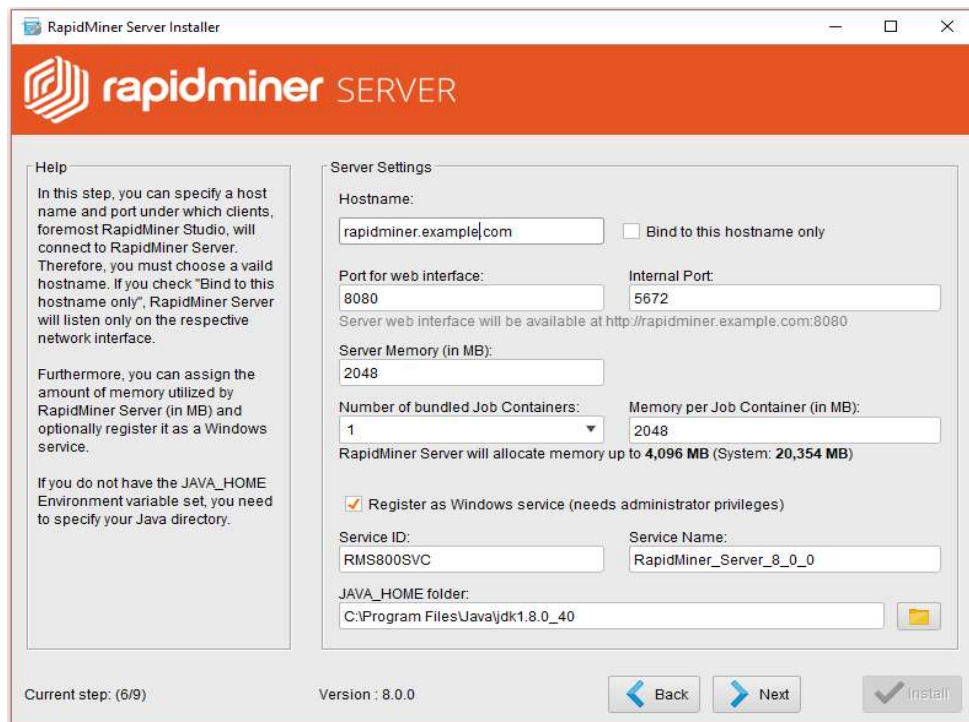
1. Downloading Rapid Miner Server



2. Installing Rapid Miner Server



3. Configuring Rapid Miner Server settings



The screenshot shows the 'RapidMiner Server Installer' window, specifically the 'Server Settings' step (6/9). The window has a red header with the RapidMiner logo and 'SERVER' text. On the left, a 'Help' section provides instructions on specifying a host name and port, and assigning memory. The main area contains several input fields: 'Hostname' (rapidminer.example.com), 'Port for web interface' (8080), 'Internal Port' (5672), 'Server Memory (in MB)' (2048), 'Number of bundled Job Containers' (1), and 'Memory per Job Container (in MB)' (2048). A note indicates the server will allocate memory up to 4,096 MB. There is a checkbox for 'Register as Windows service (needs administrator privileges)' which is checked. Below this are fields for 'Service ID' (RMS800SVC) and 'Service Name' (RapidMiner_Server_8_0_0). At the bottom, there is a field for 'JAVA_HOME folder' (C:\Program Files\Java\jdk1.8.0_40) and a folder selection icon. Navigation buttons 'Back', 'Next', and 'Install' are at the bottom right. The status bar shows 'Current step: (6/9)' and 'Version: 8.0.0'.

Help

In this step, you can specify a host name and port under which clients, foremost RapidMiner Studio, will connect to RapidMiner Server. Therefore, you must choose a valid hostname. If you check "Bind to this hostname only", RapidMiner Server will listen only on the respective network interface.

Furthermore, you can assign the amount of memory utilized by RapidMiner Server (in MB) and optionally register it as a Windows service.

If you do not have the JAVA_HOME Environment variable set, you need to specify your Java directory.

Server Settings

Hostname: rapidminer.example.com ☐ Bind to this hostname only

Port for web interface: 8080 Internal Port: 5672
Server web interface will be available at http://rapidminer.example.com:8080

Server Memory (in MB): 2048

Number of bundled Job Containers: 1 Memory per Job Container (in MB): 2048
RapidMiner Server will allocate memory up to **4,096 MB** (System: 20,354 MB)

☒ Register as Windows service (needs administrator privileges)

Service ID: RMS800SVC Service Name: RapidMiner_Server_8_0_0

JAVA_HOME folder: C:\Program Files\Java\jdk1.8.0_40

Current step: (6/9) Version: 8.0.0 Back Next Install

4. Configuring Rapid Miner Server's database connection



The screenshot shows the 'RapidMiner Server Installer' window, specifically the 'Database Configuration' step (7/8). The window has a light blue header with the RapidMiner logo and 'SERVER' text. On the left, a 'Help' section provides instructions on configuring the database connection. The main area contains several input fields: 'Database host' (localhost), 'Database port' (3306), 'Database schema' (rapidminer_server), 'Database username' (rmUser), and 'Database password' (masked with dots). There is an information icon and a note about the MySQL JDBC driver. Below this are fields for 'JDBC Driver location' (C:\Apps\mysql-connector-java-5.1.38\mysql) and 'Database system' (MySQL). There is a checkbox for 'Use relative path' which is unchecked. Below this is a dropdown for 'JDBC driver class' (com.mysql.jdbc.Driver) and a 'Test Connection' button. Navigation buttons 'Back', 'Next', and 'Install' are at the bottom right. The status bar shows 'Current step: (7/8)'.

Help

In this step you can configure your Database connection which RapidMiner Server should use. You will need to enter the host or URL as well as the port and the desired DB schema. Username and Password can be filled in as needed. Then just select the appropriate JDBC driver and choose the driver class via the Dropdown menu. After you have set everything up, you can test the connection to the Database by clicking the Test Connection button.

Database Configuration

Database host: localhost Database port: 3306

Database schema: rapidminer_server

Database username: rmUser Database password:

MySQL JDBC driver is not shipped with RapidMiner Server. Please click [here](#) for more information!

JDBC Driver location: C:\Apps\mysql-connector-java-5.1.38\mysql Database system: MySQL

☐ Use relative path

JDBC driver class: com.mysql.jdbc.Driver

Test Connection

Current step: (7/8) Back Next Install

5. Installing Radoop Proxy



6. Completing the installation

Once logged in, complete the final installation steps.

1. From the **SQL Dialect** pull-down, verify that the database type displayed is the one you used to create the Rapid Miner Server database.
2. Verify the setting for the integrated Quartz scheduler, which is enabled by default.
3. Specify the path to the plug-in directory. You can install additional RapidMiner extensions by placing them in, or saving them to, this directory. Note that all extensions bundled with RapidMiner Studio are also bundled with Rapid Miner Server (no installation is necessary). These bundled extensions are stored in a separate directory that is independent of the path specified here. Be sure that you have write permission to the directory.
4. Specify the path to upload directory. This is the directory where RapidMiner Server stores temporary files needed for processes. The installation process creates a local uploads directory in the installation folder. However, if you install Rapid Miner Server on a relatively small hard disk and, for example, use many file objects in processes or if you have large resulting files, consider creating a directory elsewhere in the cluster to store the temporary files. Be sure that you have write permission to the directory.
5. Click **Start installation now**.
6. Installation gets completed.

Data Warehousing Schemas

1. Star Schema
2. Snowflake Schema
3. Fact Constellation

Star Schema

For example, as you can see in the above-given image that fact table is at the center which contains keys to every dimension table like Deal_ID, Model ID, Date_ID, Product_ID, Branch_ID & other attributes like Units sold and revenue.

Characteristics of Star Schema:

- Every dimension in a star schema is represented with the only one-dimension table.
- The dimension table should contain the set of attributes.
- The dimension table is joined to the fact table using a foreign key
- The dimension table are not joined to each other
- Fact table would contain key and measure
- The Star schema is easy to understand and provides optimal disk usage.
- The dimension tables are not normalized. For instance, in the above figure, Country_ID does not have Country lookup table as an OLTP design would have.
- The schema is widely supported by BITools

Snowflake Schema

A Snowflake Schema is an extension of a Star Schema, and it adds additional dimensions. It is called snowflake because its diagram resembles a Snowflake.

The dimension tables are normalized which splits data into additional tables. In the following example, Country is further normalized into an individual table.

Characteristics of Snowflake Schema:

- The main benefit of the snowflake schema it uses smaller disk space.
- Easier to implement a dimension is added to the Schema
- Due to multiple tables query performance is reduced
- The primary challenge that you will face while using the snowflake Schema is that you need to perform more maintenance efforts because of the more lookup tables.

Star Schema	Snow Flake Schema
Hierarchies for the dimensions are stored in the dimensional table.	Hierarchies are divided into separate tables.
It contains a fact table surrounded by dimension tables.	One fact table surrounded by dimension table which are in turn surrounded by dimension table
In a star schema, only single join creates the relationship between the fact table and any dimension tables.	A snowflake schema requires many joins to fetch the data.
Simple DB Design.	Very Complex DB Design.
Denormalized Data structure and query also run faster.	Normalized Data Structure.
High level of Data redundancy	Very low-level data redundancy

Single Dimension table contains aggregated data.

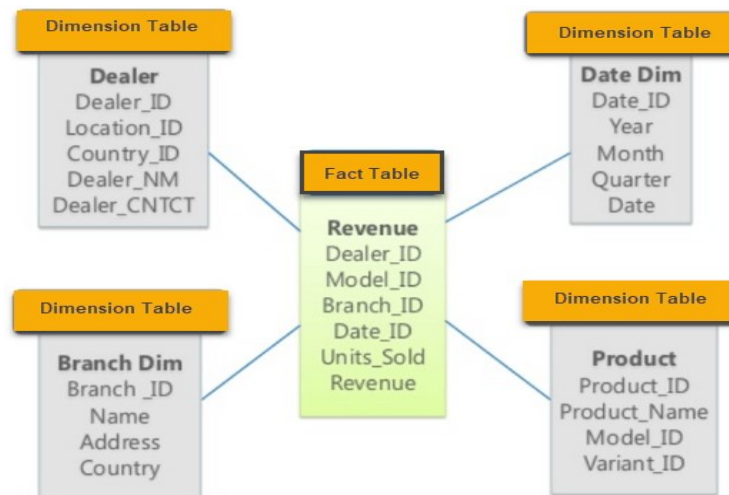
Data Split into different Dimension Tables.

Cube processing is faster.

Cube processing might be slow because of the complex join

Offers higher performing queries using Star Join Query Optimization. Tables may be connected with multiple dimensions.

The Snow Flake Schema is represented by centralized fact table which unlikely connected with multiple dimensions.

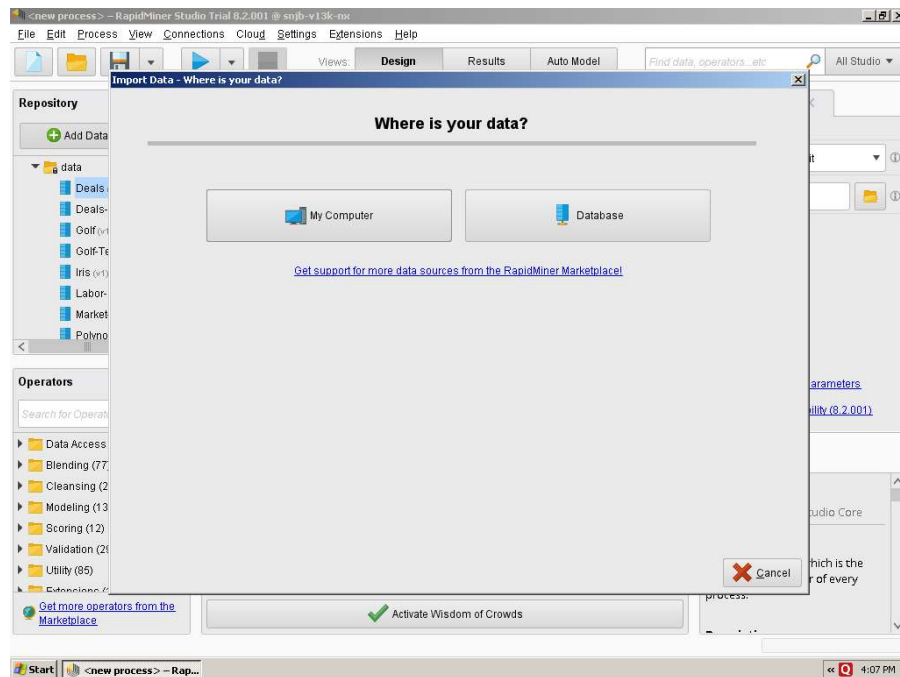


Star Schema

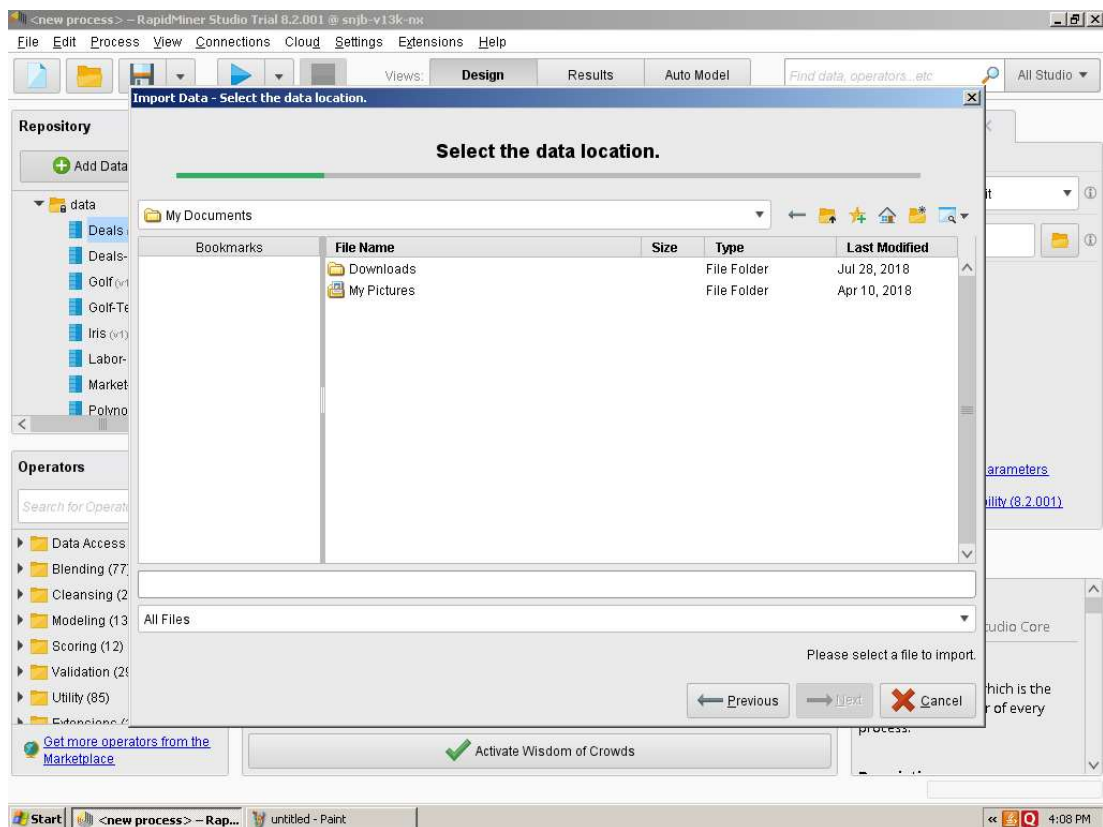
1. Design Model



Step-1 Import Data from Source



Step-2 Select Data Location



Step-3 Open Sample Data Set e.g. Iris dataset available inbuilt with tool

ExampleSet (150 examples, 2 special attributes, 4 regular attributes) Filter (150 / 150 examples): all

Row No.	id	label	a1	a2	a3	a4
1	id_1	Iris-setosa	5.100	3.500	1.400	0.200
2	id_2	Iris-setosa	4.900	3	1.400	0.200
3	id_3	Iris-setosa	4.700	3.200	1.300	0.200
4	id_4	Iris-setosa	4.600	3.100	1.500	0.200
5	id_5	Iris-setosa	5	3.600	1.400	0.200
6	id_6	Iris-setosa	5.400	3.900	1.700	0.400
7	id_7	Iris-setosa	4.600	3.400	1.400	0.300
8	id_8	Iris-setosa	5	3.400	1.500	0.200
9	id_9	Iris-setosa	4.400	2.900	1.400	0.200
10	id_10	Iris-setosa	4.900	3.100	1.500	0.100
11	id_11	Iris-setosa	5.400	3.700	1.500	0.200
12	id_12	Iris-setosa	4.800	3.400	1.600	0.200
13	id_13	Iris-setosa	4.800	3	1.400	0.100
14	id_14	Iris-setosa	4.300	3	1.100	0.100
15	id_15	Iris-setosa	5.800	4	1.200	0.200
16	id_16	Iris-setosa	5.700	4.400	1.500	0.400
17	id_17	Iris-setosa	5.400	3.900	1.300	0.400

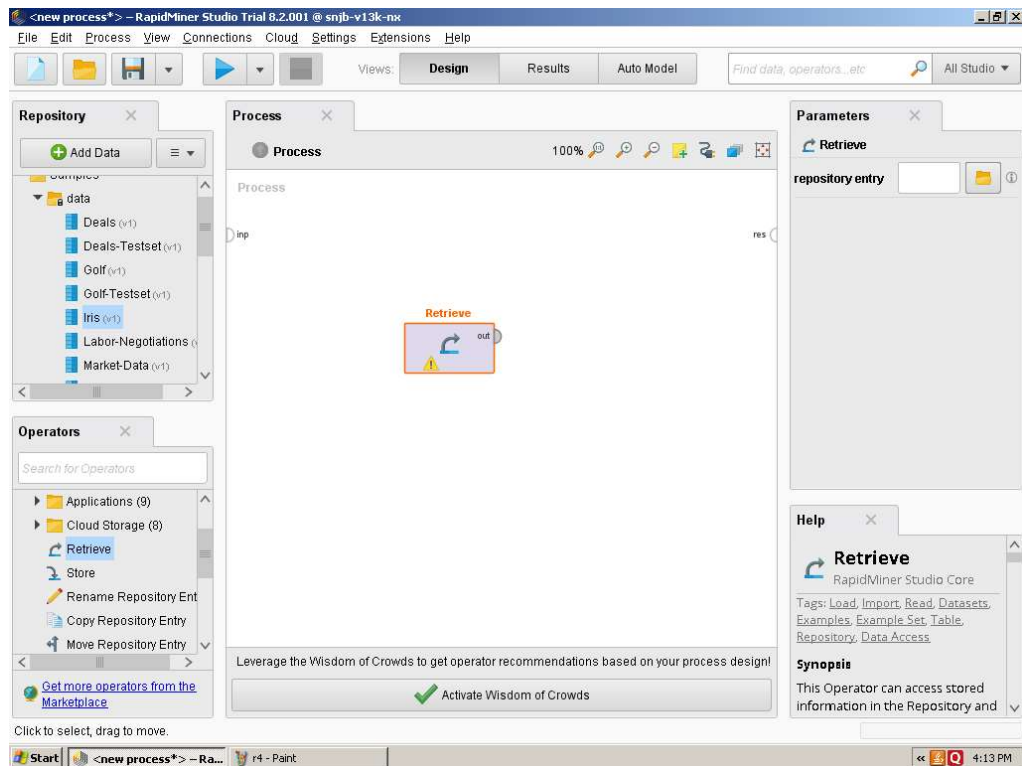
Step-4 Click on retrieve Operator Drag in Process View

Retrieve
Reads an object from the data repository.
Press "F3" for focus.

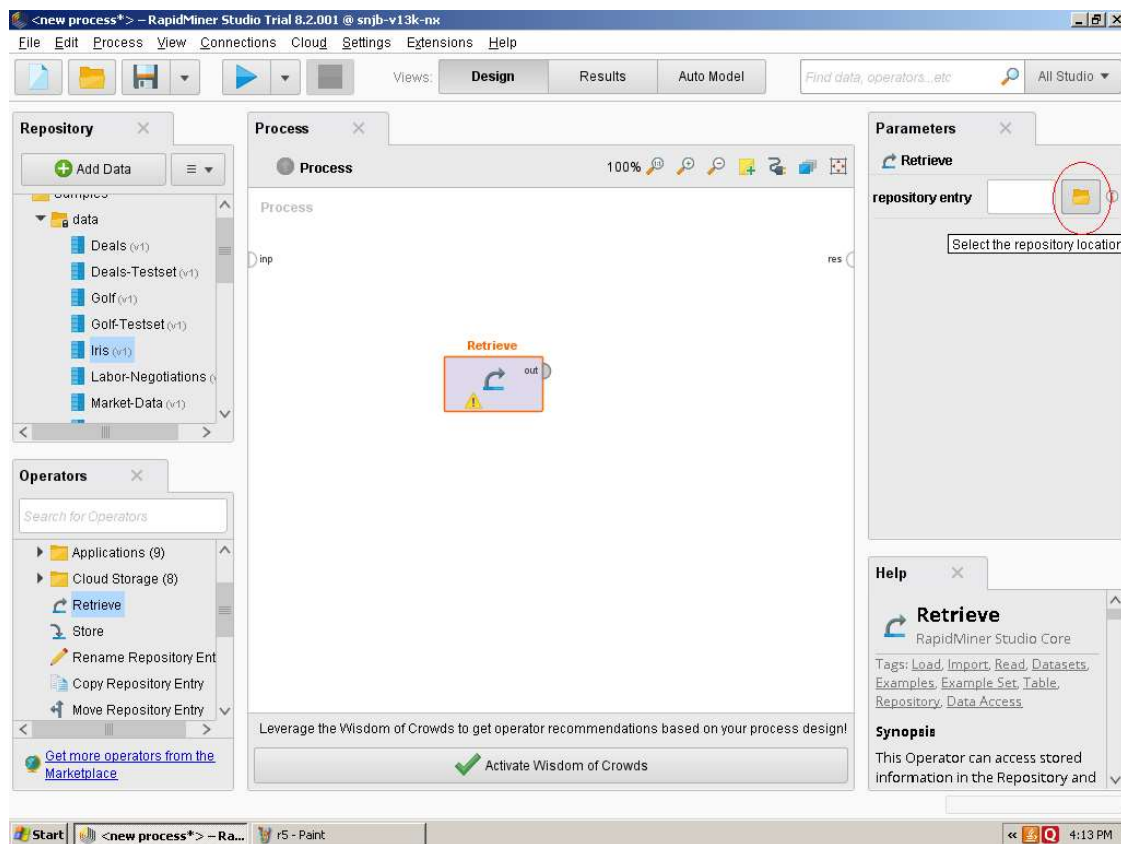
Parameters
Process
logverbosity: init
logfile: [empty]
[Show advanced parameters](#)
[Change compatibility \(8.2.001\)](#)

Help
Process
RapidMiner Studio Core
Synopsis
The root operator which is the outer most operator of every process.

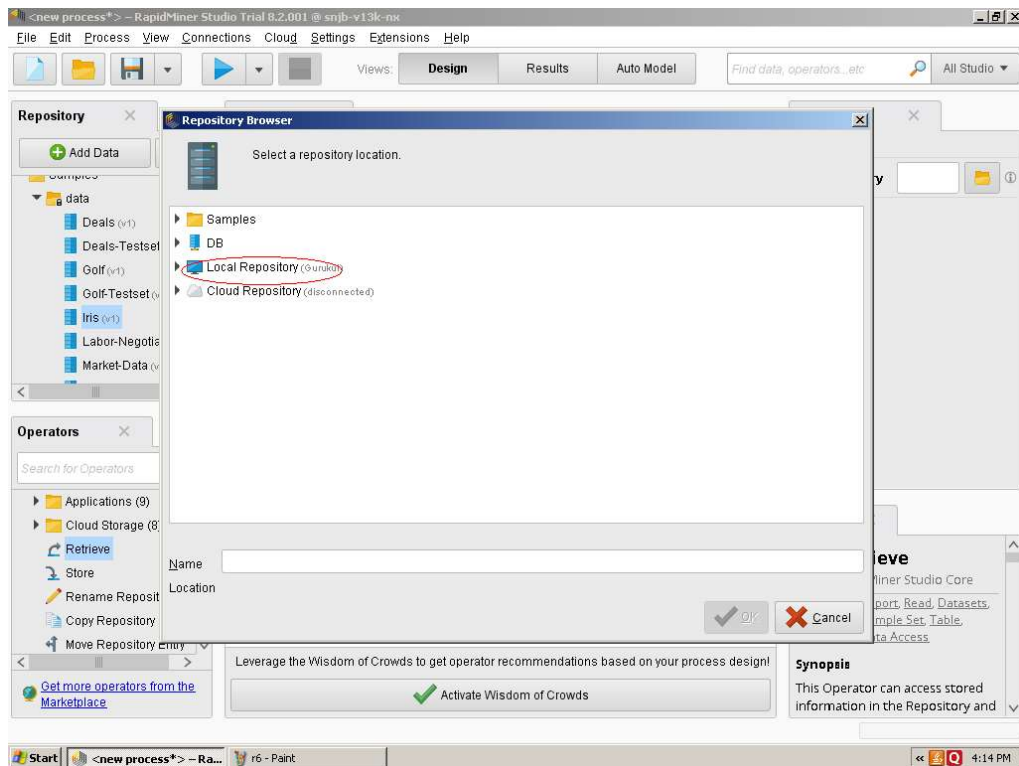
Step-5 Retrieve icon shows in Process View it has input and out Operator



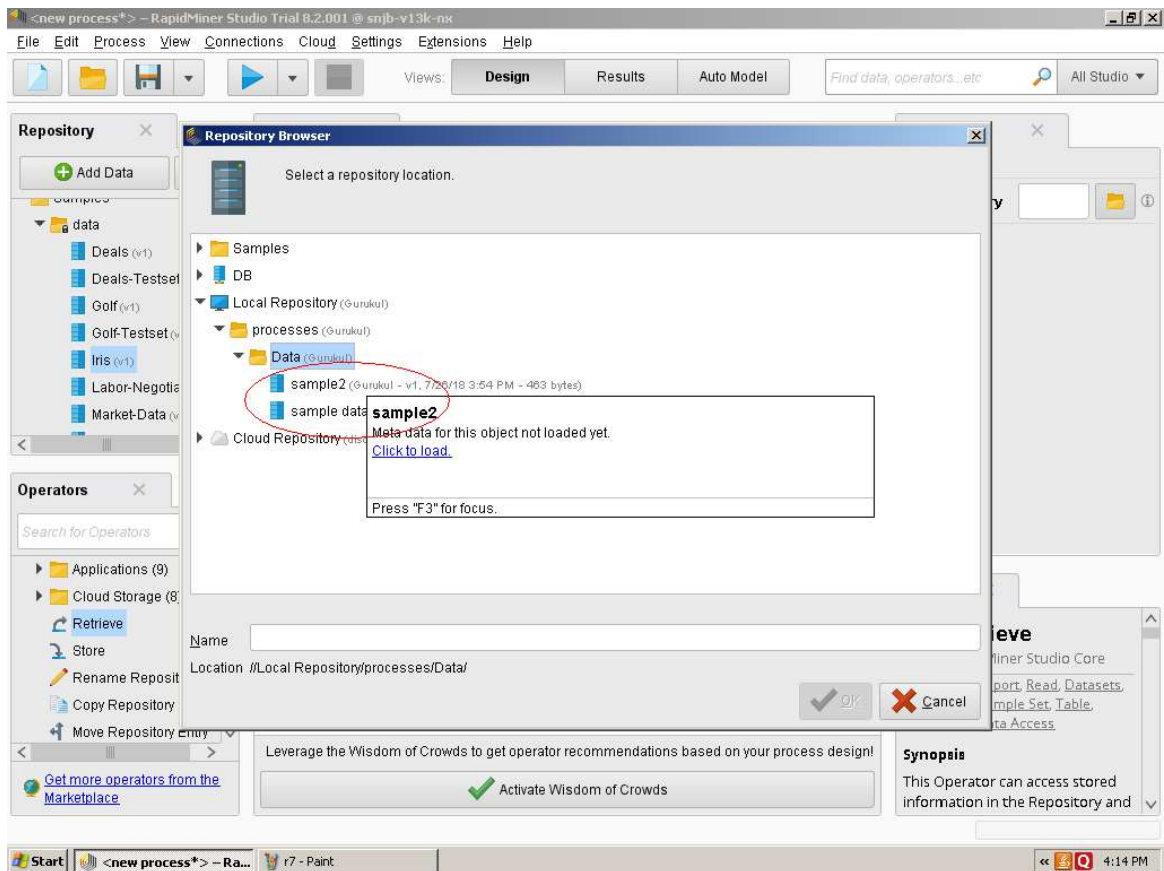
Step-6 Click on repository entry



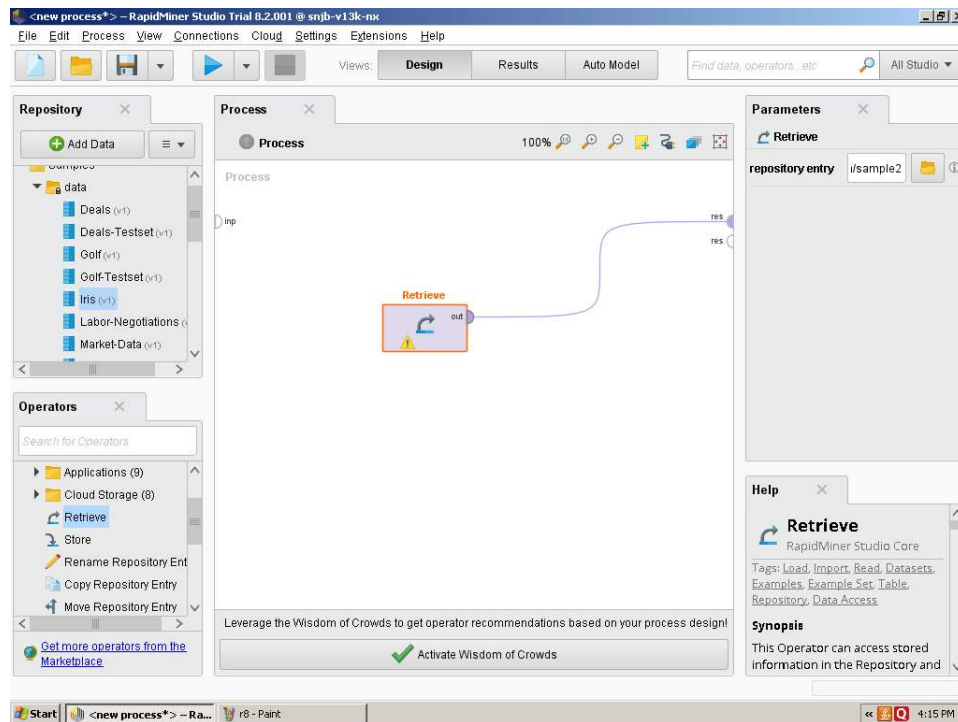
Step-7 Select Local Repository



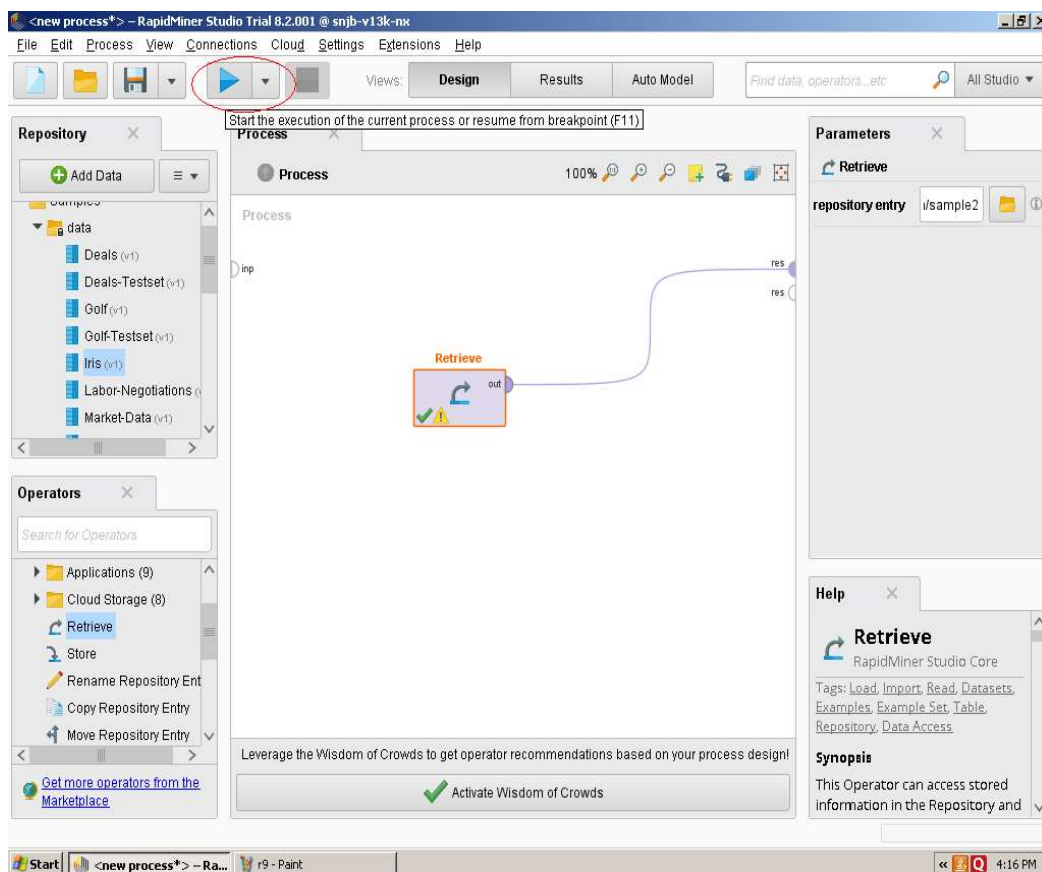
Step-8 Select Sample file



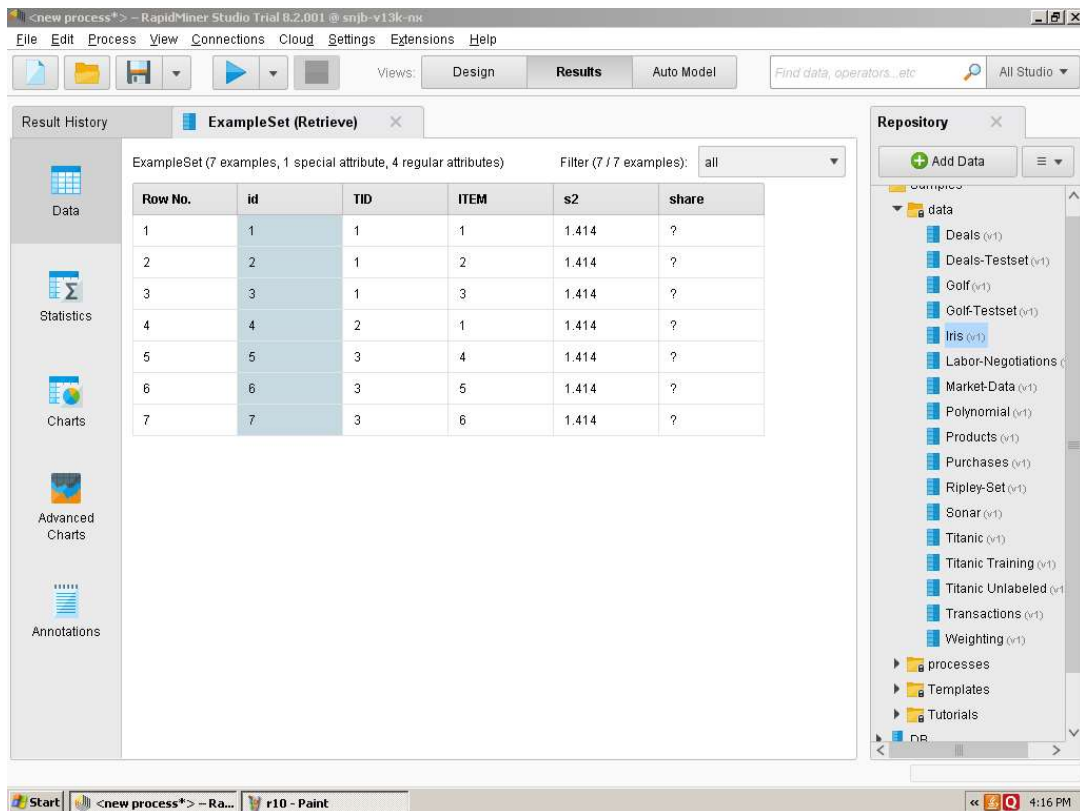
Step-9 Join Out Operator to result Operator



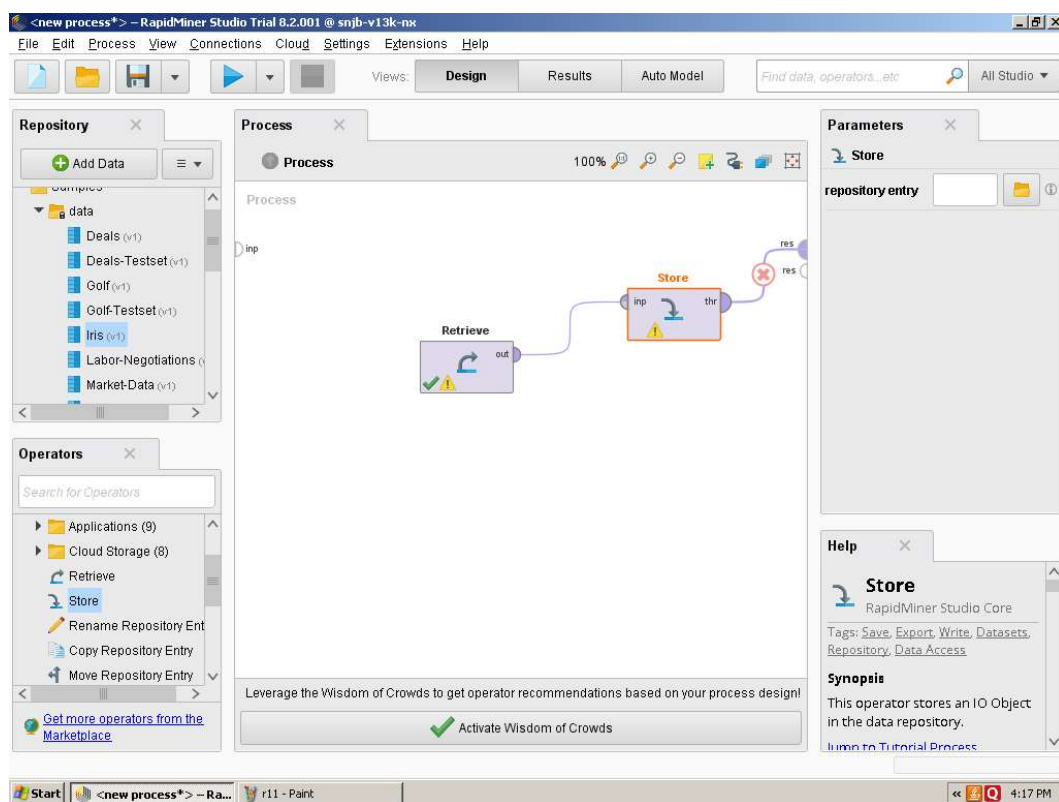
Step-10 Start Execution of Current Process



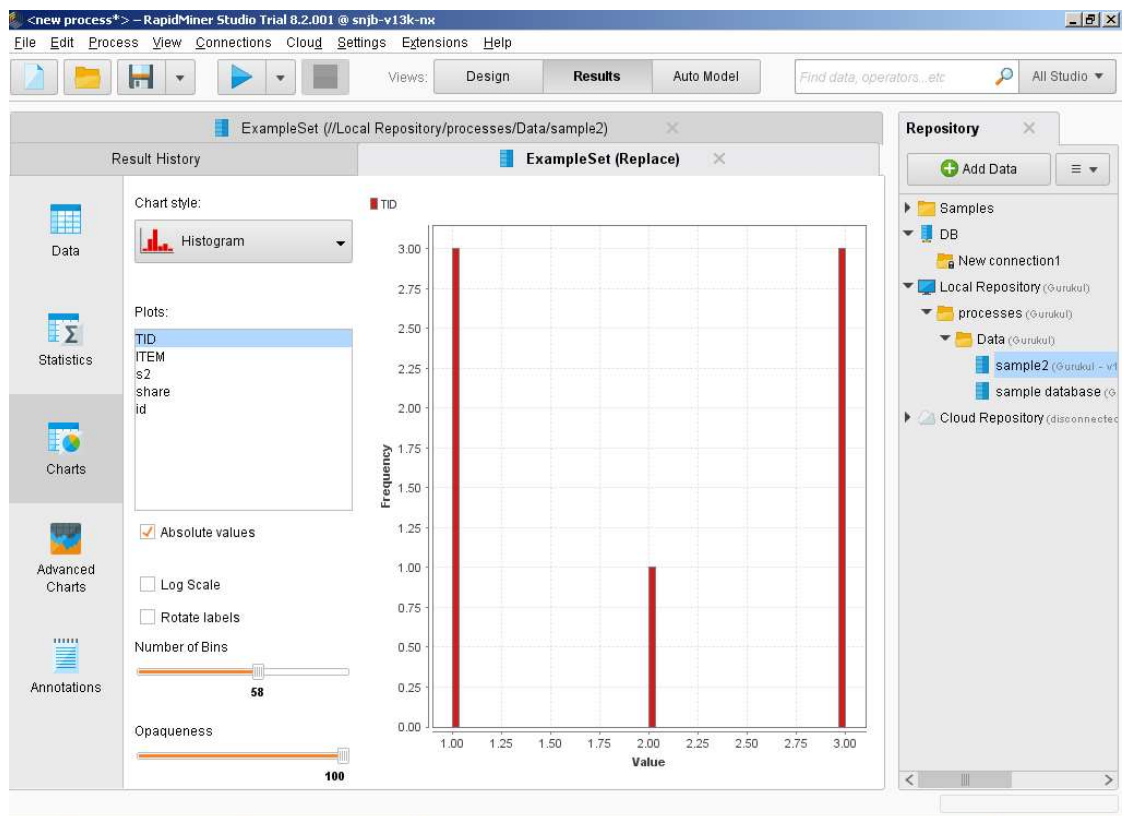
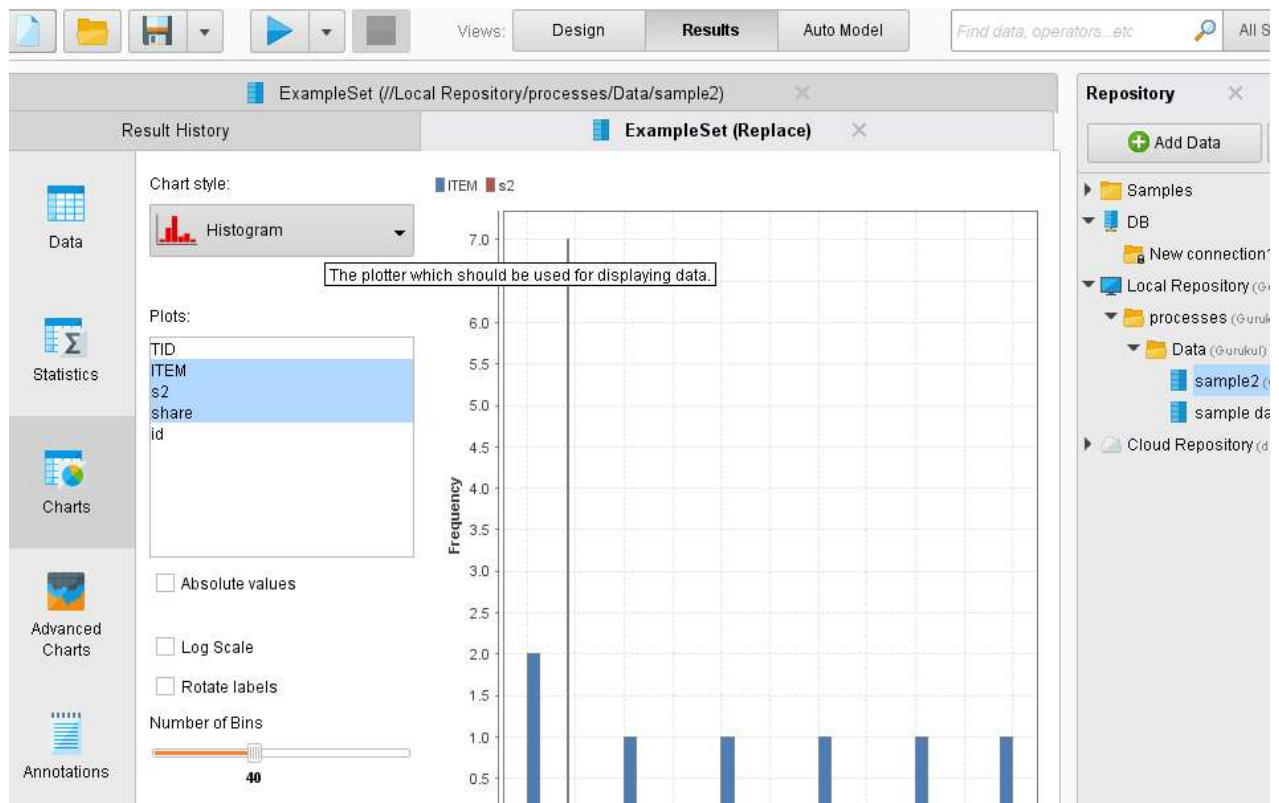
Step-11 Output Result Generated after Execution of Current Process



Step-12 Now you can add Store Operator and connect to result operator



Step-13 You can also plot Charts of Sample Data set



A nice functionality for data preparation, called RapidMiner Turbo Prep, is where you simply drag and drop

data to create amazing interfaces.

Conclusion:

Hence, we are able to study RapidMiner Tools us can Perform ETL operations on Sample Data sets and can perform analysis on sample data sets.