

**MSc Data Science**  
**Academic Year 2021-2022**

**CMM531 Data Warehousing**

**HAND IN DATE:** 10<sup>st</sup> December 2021

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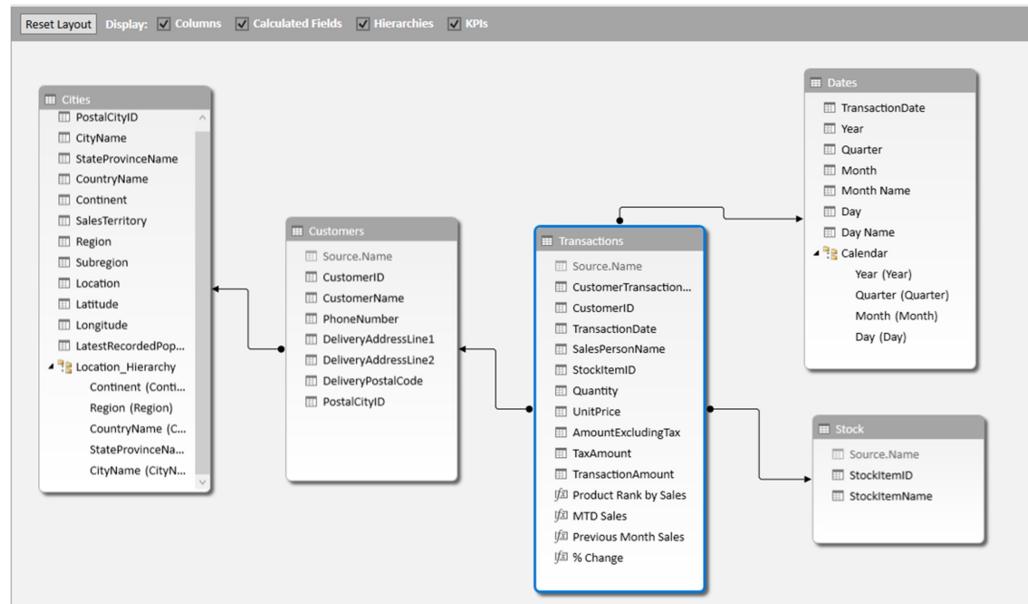
## Task 1 – In-Memory Data Modelling, ETL and Analysis

### Deliverables

#### a) Table 1

	Table Name	No.of Rows	Fact or Dimension	List of Columns(indicating PK,FK)	Hierarchy Name	Columns included in the hierarchy	
	Customers	663	Dimension	CustomerID (PK) CustomerName PhoneNumber DeliveryAddressLine1 DeliveryAddressLine2 DeliveryPostalCode PostalCityID(FK)			
	Transactions	228,265	Fact	(StockItemID + CustomerID)(PK) CustomerTransactionID SalesPersonName Quantity UnitPrice AmountExcludingTax TaxAmount TransactionAmount TransactionDate(FK) PostalCityID(FK)			
	Stock	227	Dimension	StockItemID(PK) StockItemName			
	Cities	655	Dimension	PostalCityID(PK) CityName StateProvinceName CountryName Continent SalesTerritory Region SubRegion Location Latitude Longitude LatestRecordedPopulation	Location_Hierarchy	Continent Region Subregion Country Name State Province Name City Name	
	Date	1069	Dimension	TransactionDate(PK) Year Quarter Month Month Name Day Day Name	Calendar	Year Quarter Month Day	

#### b) Star Schema



c) List of DAX Formulae

Measure name	Formulae
Product Rank by Sales	RANKX(ALL(Stock[StockItemName]),([Sum of TransactionAmount]))
Previous Month Sales	CALCULATE([Sum of TransactionAmount],DATEADD(Dates[TransactionDate],-1,Month))
MTD Sales	CALCULATE([Sum of TransactionAmount],DATESMTD(Dates[TransactionDate]))
% Change	(([Sum of TransactionAmount]-[Previous Month Sales])/[Previous Month Sales])

d) PivotTables

Table 1

Row Labels	Sum of TransactionAmount	Product Rank by Sales
Air cushion machine (Blue)	15167643.72	1
10 mm Anti static bubble wrap (Blue) 50m	9887220.33	2
32 mm Anti static bubble wrap (Blue) 50m	9725924.35	3
20 mm Double sided bubble wrap 50m	9686053.7	4
32 mm Double sided bubble wrap 50m	9456105.3	5
10 mm Double sided bubble wrap 50m	9219025.98	6
20 mm Anti static bubble wrap (Blue) 50m	9050701.3	7
32 mm Anti static bubble wrap (Blue) 20m	5943735.76	8
Void fill 400 L bag (White) 400L	5748948.6	9
10 mm Anti static bubble wrap (Blue) 20m	5339574.2	10
20 mm Anti static bubble wrap (Blue) 20m	5207788.52	11
Ride on big wheel monster truck (Black) 1/12 scale	4983097.7	12
20 mm Double sided bubble wrap 20m	4978217.3	13
Void fill 300 L bag (White) 300L	4949124.12	14
32 mm Double sided bubble wrap 20m	4759740.71	15
10 mm Anti static bubble wrap (Blue) 10m	4627746.19	16
32 mm Anti static bubble wrap (Blue) 10m	4600948.88	17

Table 2

Row Labels	Sum of TransactionAmount	MTD Sales
01/01/2018	8305.67	833,066
02/01/2018	529825.51	891,496
03/01/2018	44802.51	891,303
04/01/2018	374842.09	1,413,851
05/01/2018	26864.91	1,704,456
06/01/2018	57322.61	1,704,066
07/01/2018	377893.81	1,073,650
08/01/2018	308848.11	1,645,450
09/01/2018	689913.81	1,645,345
10/01/2018	945963.36	1,281,421
11/01/2018	945963.36	1,281,421
12/01/2018	945963.36	1,281,421
13/01/2018	945963.36	1,281,421
14/01/2018	103407.61	1,427,399
15/01/2018	103407.61	1,427,399
16/01/2018	12053.34	1,233,936
17/01/2018	544710	1,233,666
18/01/2018	97295.79	1,233,666
19/01/2018	206798.09	1,231,994
21/01/2018	455318.38	1,231,338
22/01/2018	53830.25	1,231,275
23/01/2018	76797.65	1,231,147.3
24/01/2018	413177.56	1,131,394.76
25/01/2018	81928.7	1,224,489
26/01/2018	44802.51	1,224,489
28/01/2018	748421.89	1,131,386.410
29/01/2018	942436.36	1,220,697
30/01/2018	483212.34	1,220,697
31/01/2018	594905.59	1,217,547.770
01/02/2018	719870.54	1,218,476
02/02/2018	83931.41	1,218,476
04/02/2018	620351.79	1,218,476
05/02/2018	174728.39	1,218,476

Table 3

Year	2020
January	£18,643,679
February	£17,755,678
March	£19,592,260
April	£21,820,828
May	£19,228,223
June	£19,228,584
July	£1,696,313
August	£16,765,436
September	£19,718,426
October	£19,190,717
November	£17,367,198
December	£18,954,928

e) Discussion

Strengths

- In memory database allows faster access to data, as this type of database keeps all its data in the RAM of a computer.
- Accessing data stored in memory eliminates the time needed to query data from a disk.
- It allows for additional Excel files to be added seamlessly, fulfilling KinetEco's requirement.
- This type of a database system can also act as a read-only analytic database that stores historical data on metrics for business intelligence applications. This eliminates data indexing, which reduces IT costs (OmniSci 2021).
- Power query allows to connect to a wide range of data sources and also data of all shapes and sizes. For fast and repetitive queries over any type and size of data source the tool is highly interactive and intuitive (Microsoft 2021).

Weakness:

- Potential loss of data.
- Limit on database size in Power query for Excel.

## Task 2: Data Modelling, ETL and Analysis with SSIS and SSAS

### Deliverables for Task 2.1

- a) SQL queries to create data warehouse

```
USE KinetEco_Coursework_JAli
```

```
GO
```

```
CREATE TABLE [dbo].[City](  
[CityKey] [int] PRIMARY KEY IDENTITY(1,1),  
[PostalCityID] [int],  
[CityName] [nvarchar](50) ,  
[StateProvinceName] [nvarchar](50) ,  
[CountryName] [nvarchar](50) ,  
[Continent] [nvarchar](50) ,  
[SalesTerritory] [nvarchar](50) ,  
[Region] [nvarchar](50) ,  
[Subregion] [nvarchar](50) ,  
[Location] [nvarchar](60) ,  
[Latitude] [int] ,  
[Longitude] [int] ,  
[LastestRecordedPopulation] [int]  
)
```

```
GO
```

```
CREATE TABLE [dbo].[Customer](  
[CustomerKey] [int] PRIMARY KEY IDENTITY(1,1),  
[CustomerID] [int],  
[CustomerName] [nvarchar] (40),  
[PhoneNumber] [nvarchar](20) ,  
[DeliveryAddressLine1] [nvarchar](60) ,  
[DeliveryAddressLine2] [nvarchar](60),  
[DeliveryPostalCode] [nvarchar](10) ,  
[PostalCityID] [int],  
[StartDate] [datetime],  
[EndDate] [datetime]  
)
```

```
GO
```

```
CREATE TABLE [dbo].[Time](  
[DateKey] [int] PRIMARY KEY IDENTITY(1,1) ,  
[Date] [date],  
[Year] [smallint] ,  
[Quarter] [smallint] ,  
[Month] [tinyint] ,  
[MonthName] [nvarchar](10),  
[Day] [tinyint] ,  
[DayName] [nvarchar](10)
```

)

GO

```
CREATE TABLE [dbo].[Transaction] (
    [CustomerTransactionID] [int],
    [CustomerID] [int],
    [TransactionDate] [date],
    [StockItemID] [int],
    [StockItemName] [nvarchar](100) ,
    [SalesPersonName] [nvarchar](40) ,
    [Quantity] [int] ,
    [UnitPrice] [money],
    [AmountExcludingTax] [int] ,
    [TaxAmount] [int] ,
    [TransactionAmount] [money] ,
)
```

GO

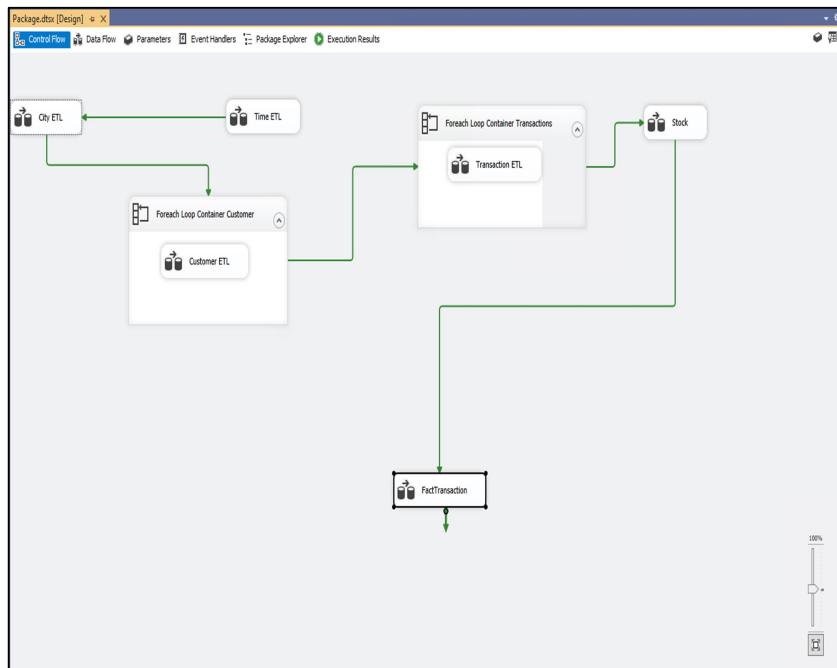
```
CREATE TABLE [dbo].[Stock](
    [StockKey] [int] PRIMARY KEY IDENTITY(1,1) ,
    [StockItemId] [int],
    [StockItemName] [nvarchar] (100)
)
```

Go

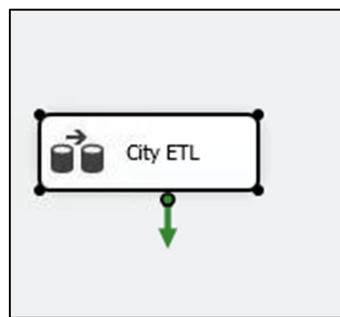
```
CREATE TABLE [dbo].[FactTransaction](
    [FactTransactionKey] [int] IDENTITY(1,1) PRIMARY KEY,
    [CustomerKey] [int] REFERENCES [dbo].[Customer] ([CustomerKey]),
    [CityKey][int] REFERENCES [dbo].[City] ([CityKey]),
    [DateKey] [int] REFERENCES [dbo].[Time] ([DateKey]),
    [StockKey] [int] REFERENCES [dbo].[Stock] ([StockKey]),
    [CustomerTransactionID][int],
    [Quantity][int] ,
    [UnitPrice] [money] ,
    [AmountExcludingTax] [money],
    [TaxAmount][money] ,
    [TransactionAmount] [money]
)
```

b) ETL workflows

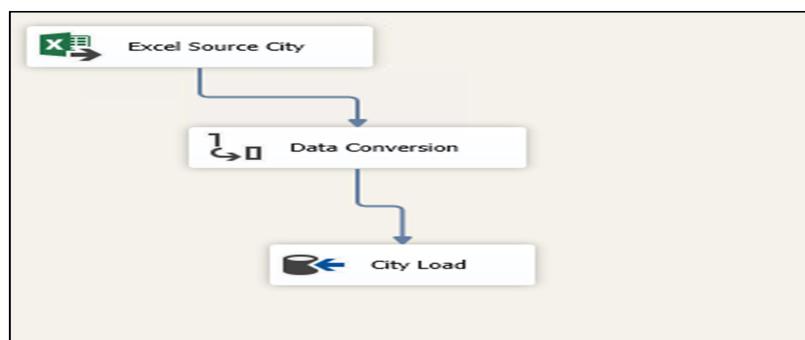
### Overall Flow



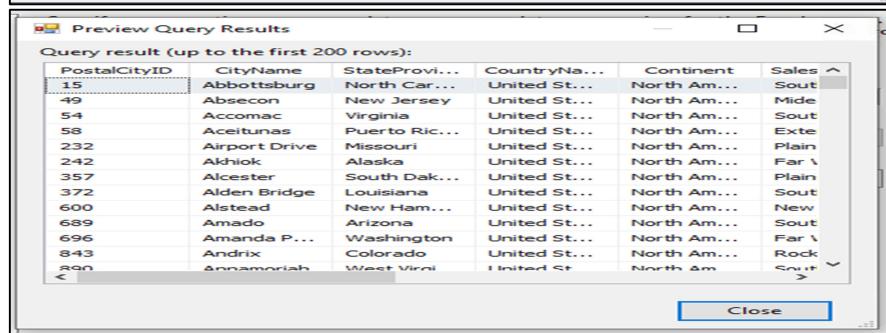
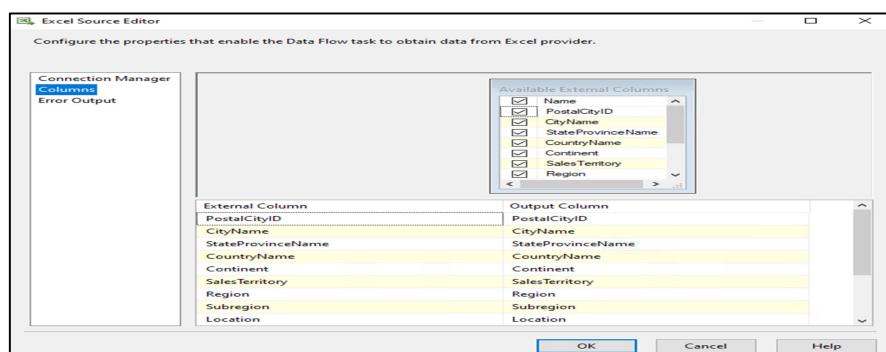
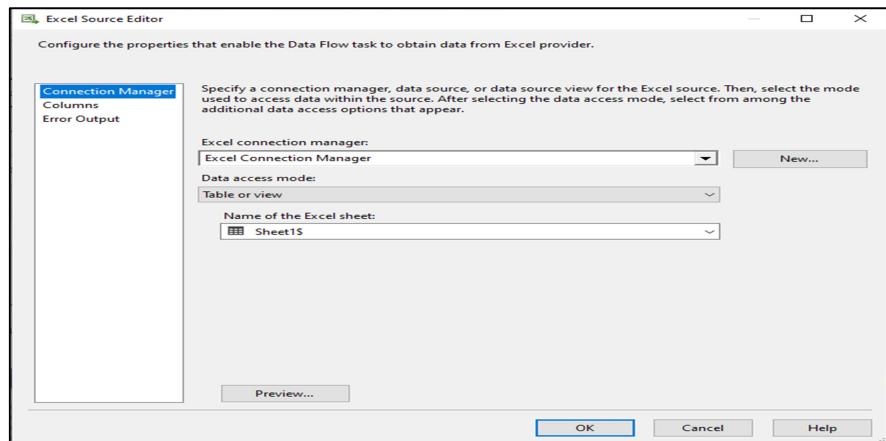
#### i. City ETL



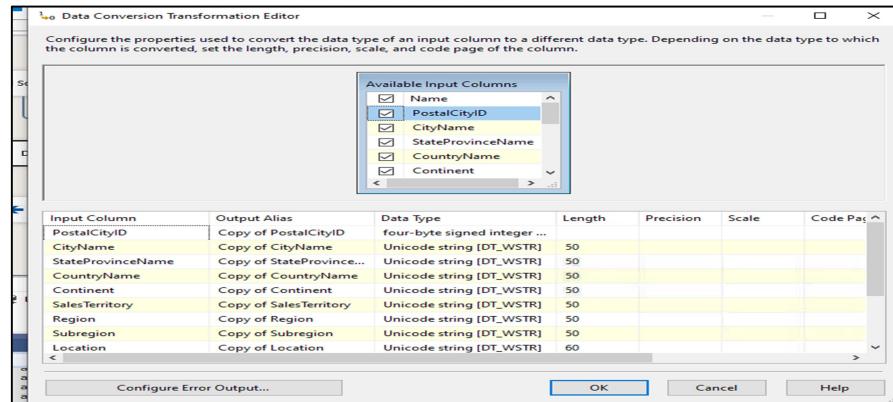
#### Data Flow Task Overview



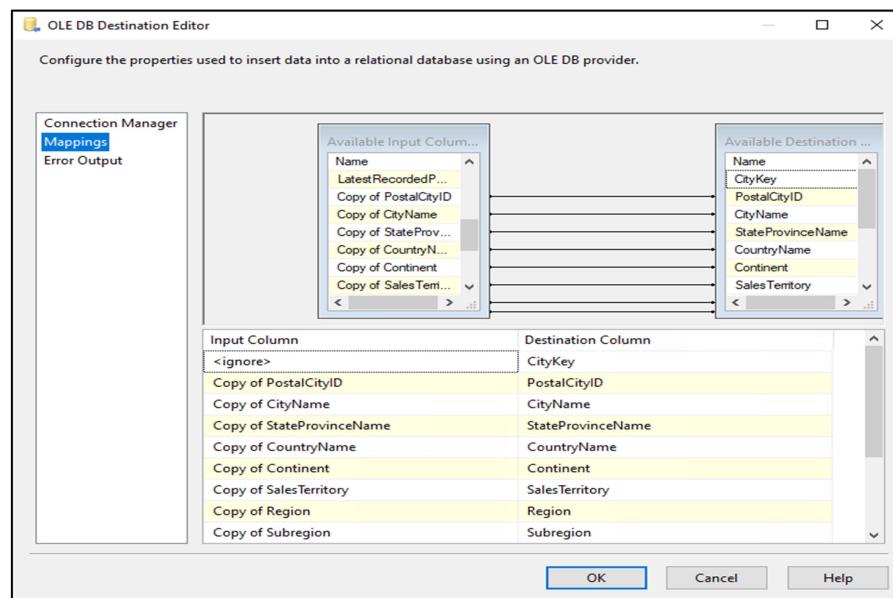
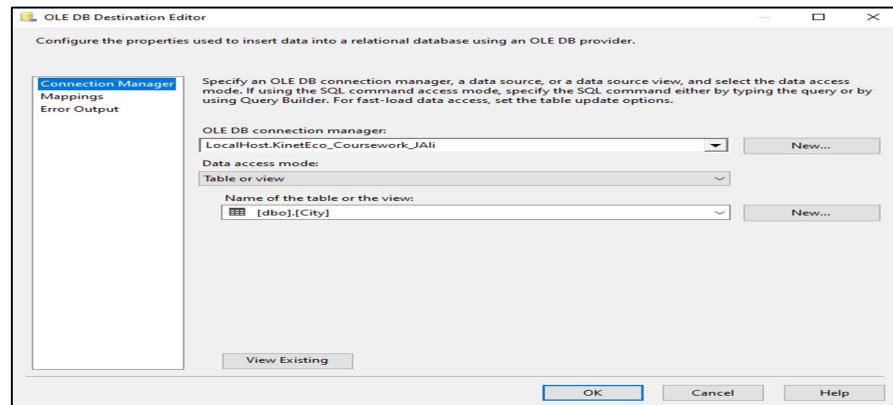
## Configuring Excel Source Editor



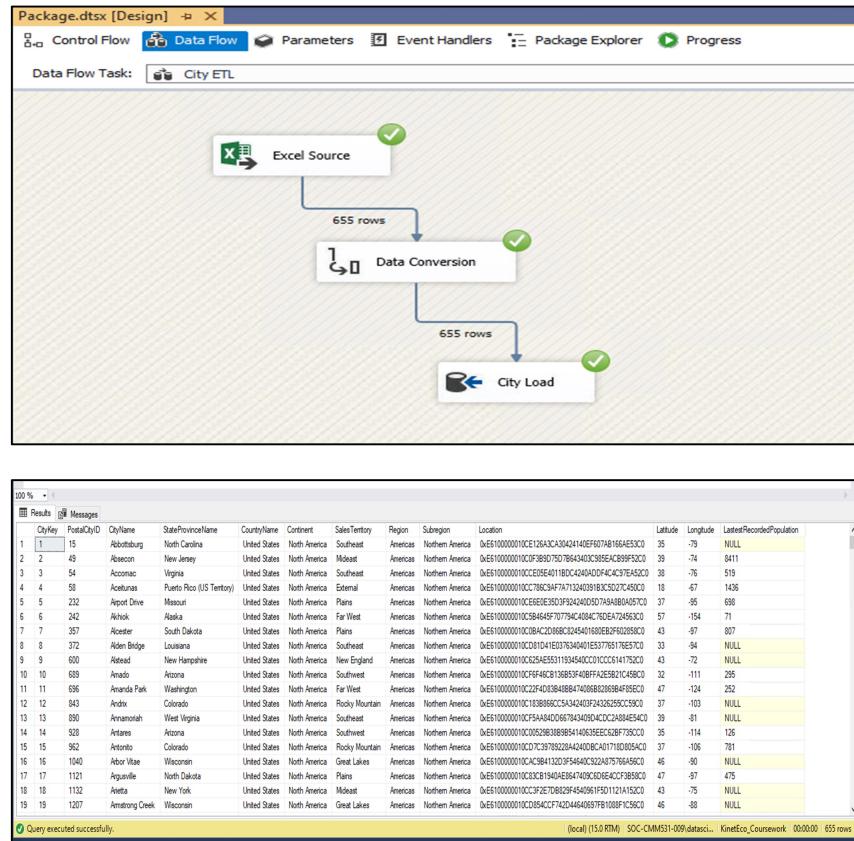
## Data Conversion



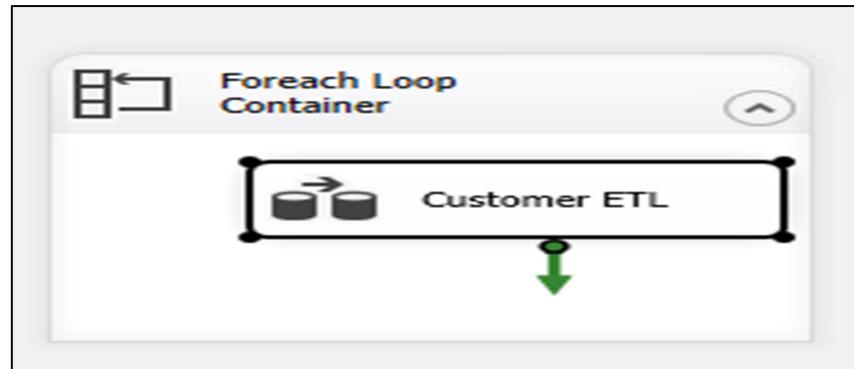
## Configuring Destination and Mapping Columns



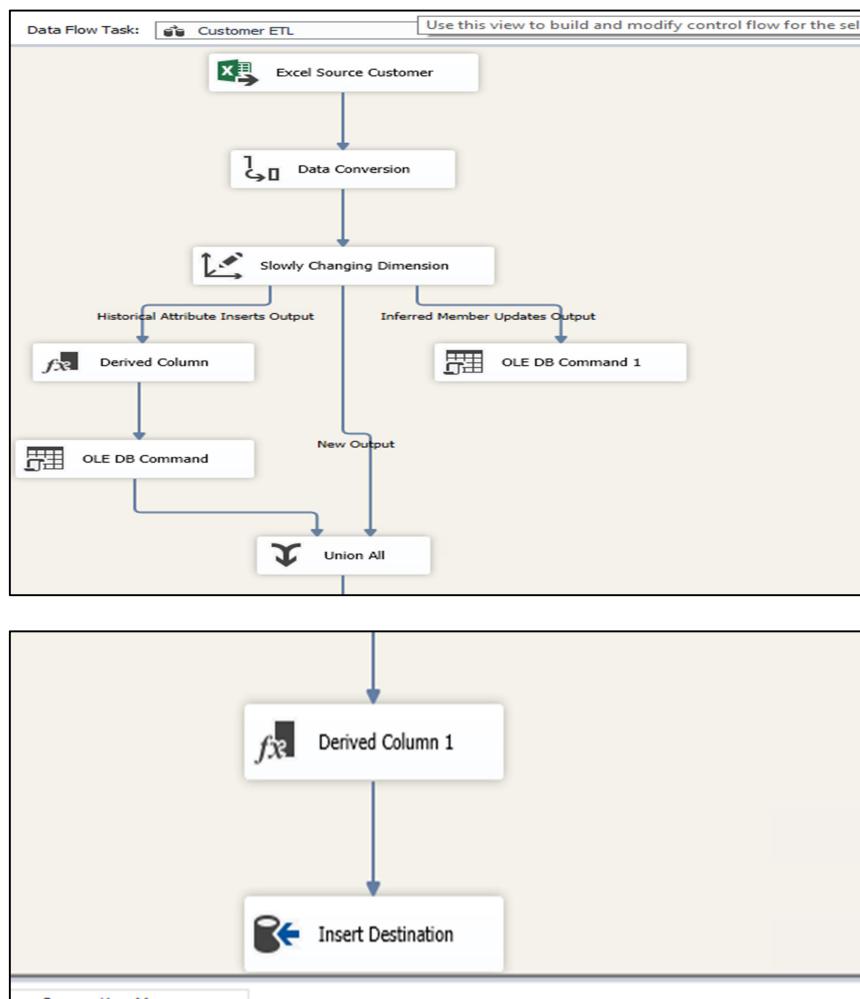
## Execution Results



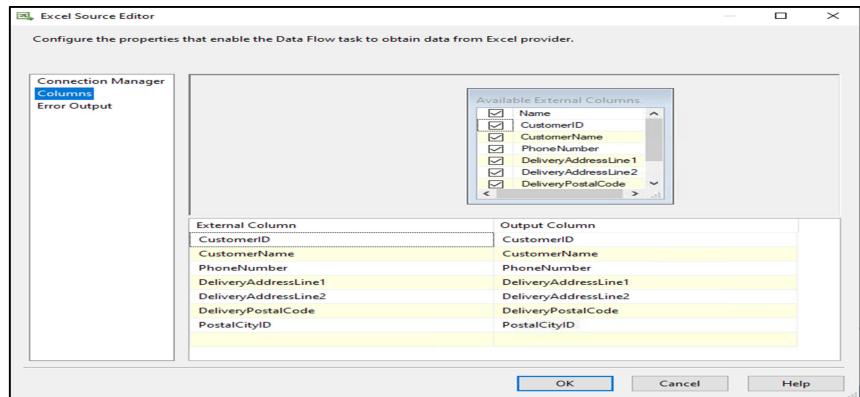
## ii. Customer ETL



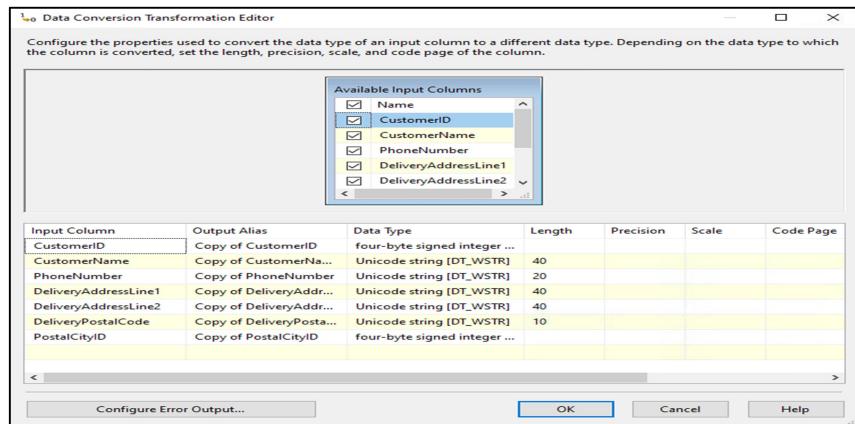
### Data Flow Task Overview



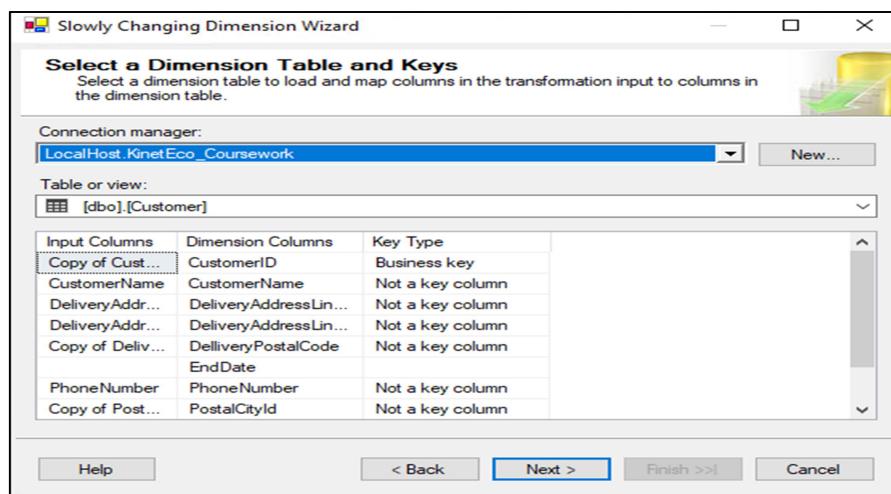
### Configuring Excel Source Editor

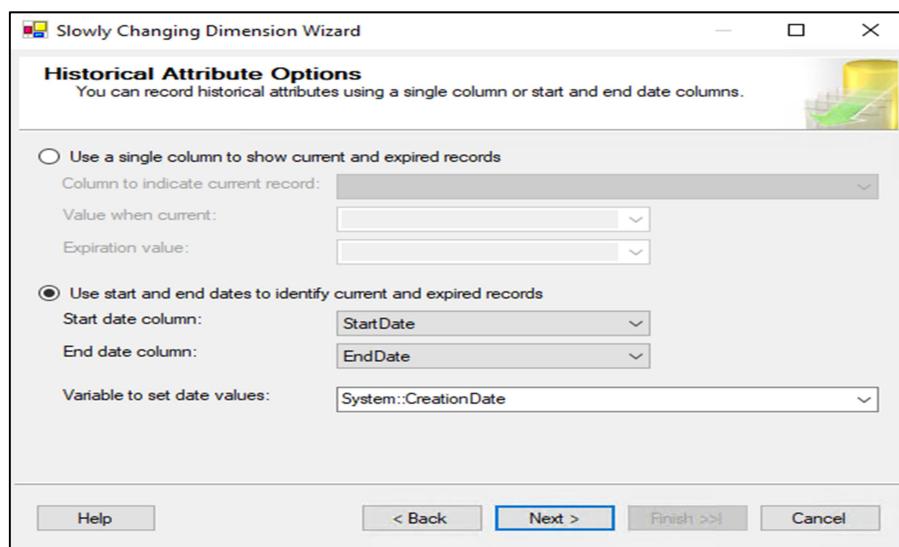
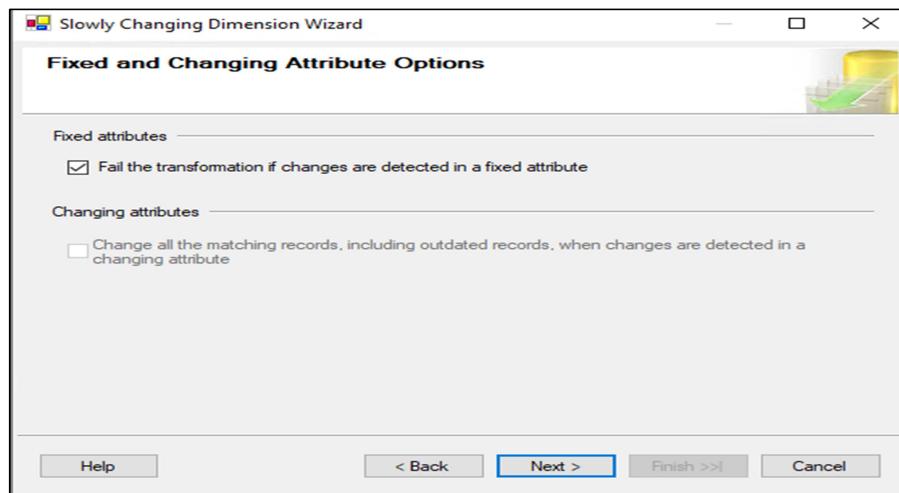
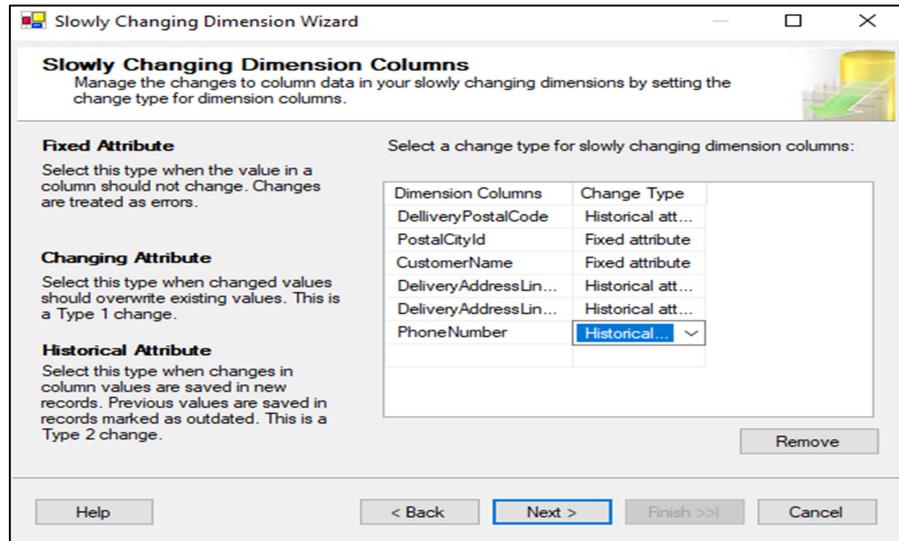


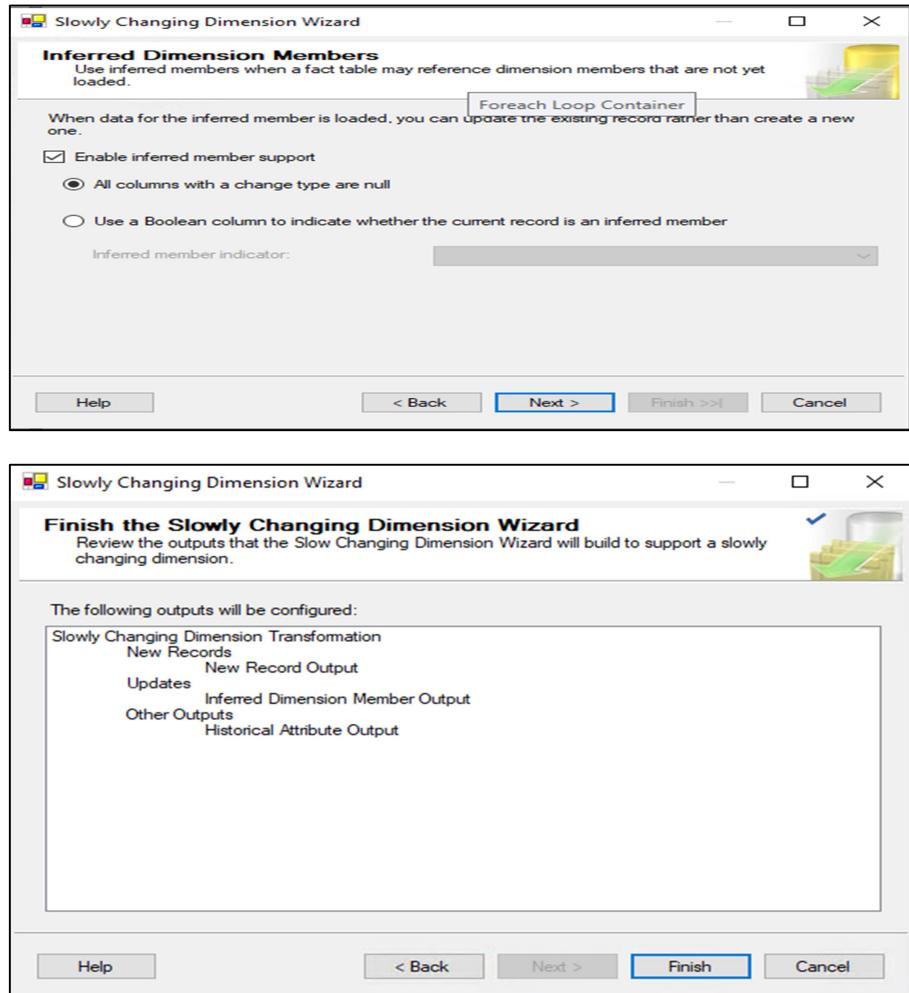
## Data Conversion



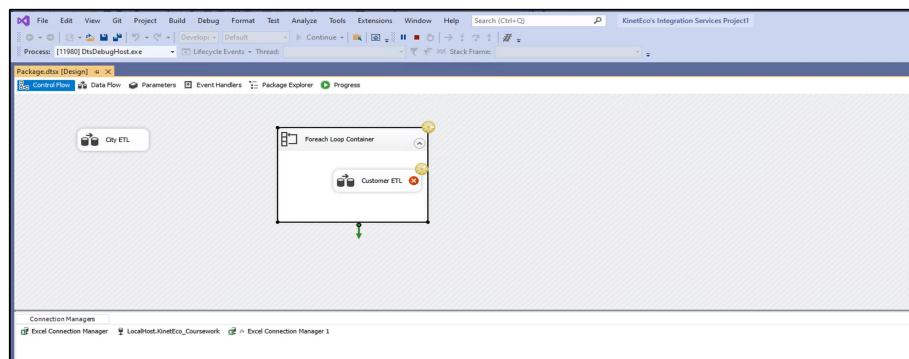
## Configuring Slowly Changing Dimension

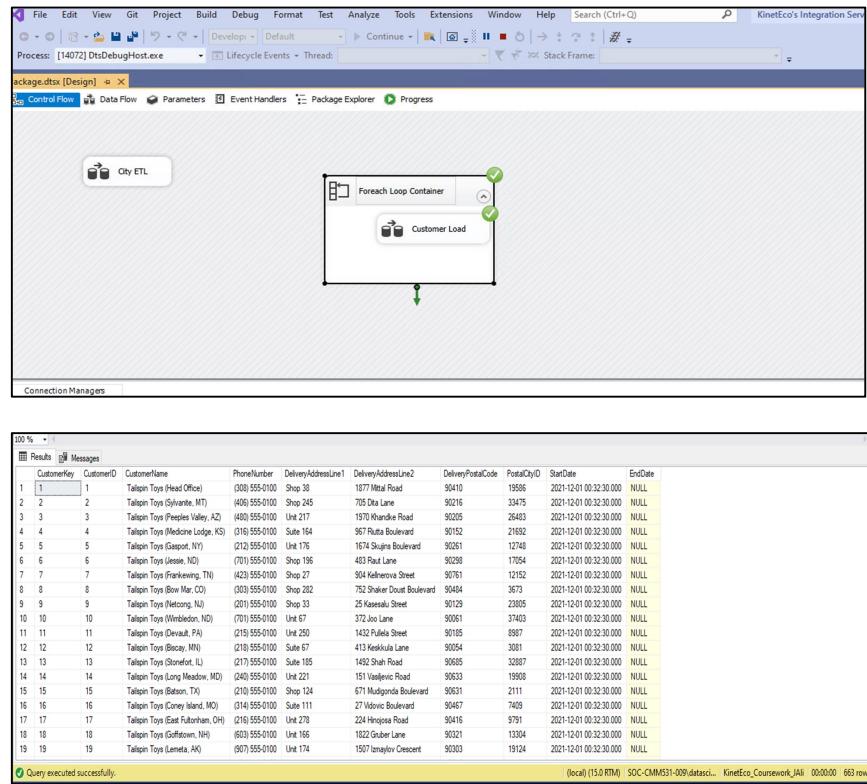






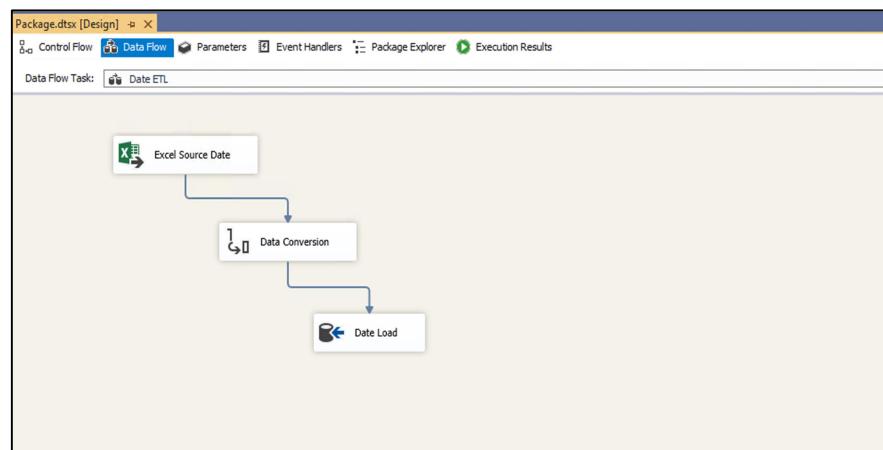
### Execution Results



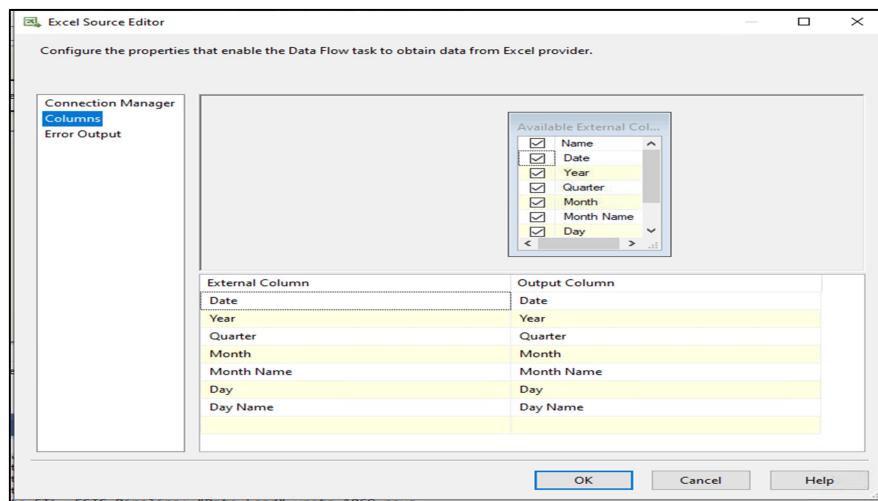
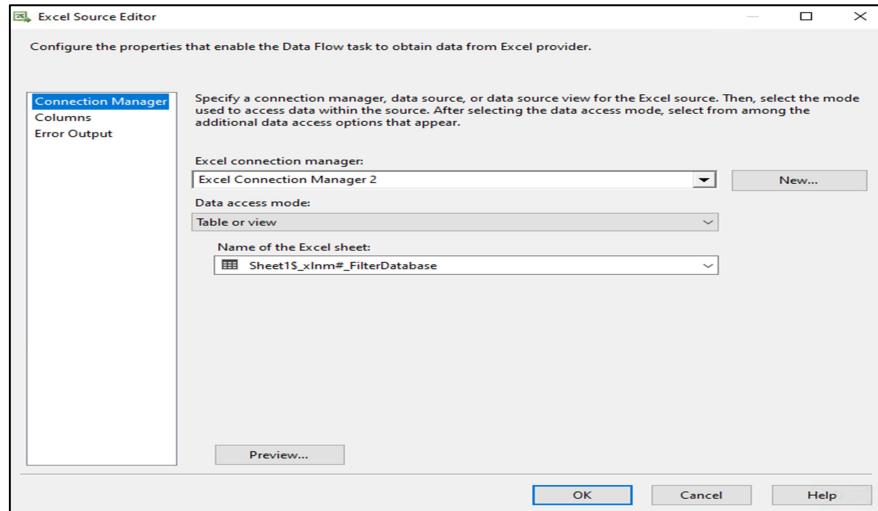


### iii. Date ETL

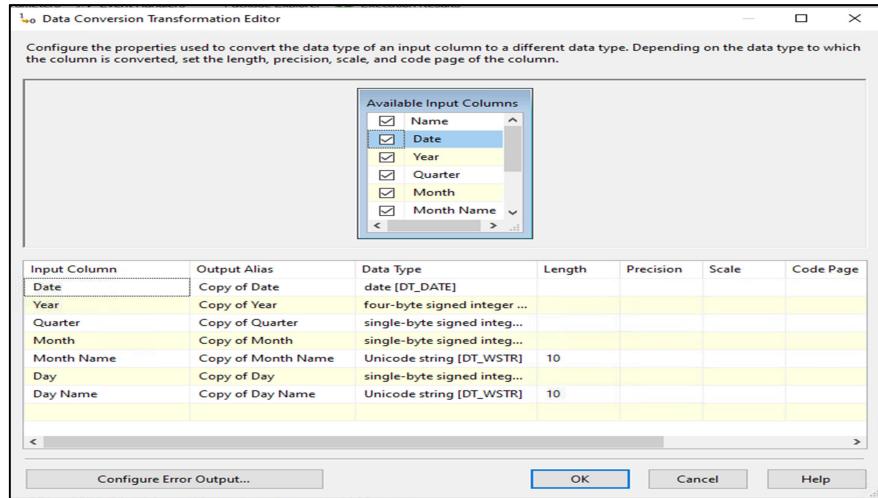
#### Data Flow Task Overview



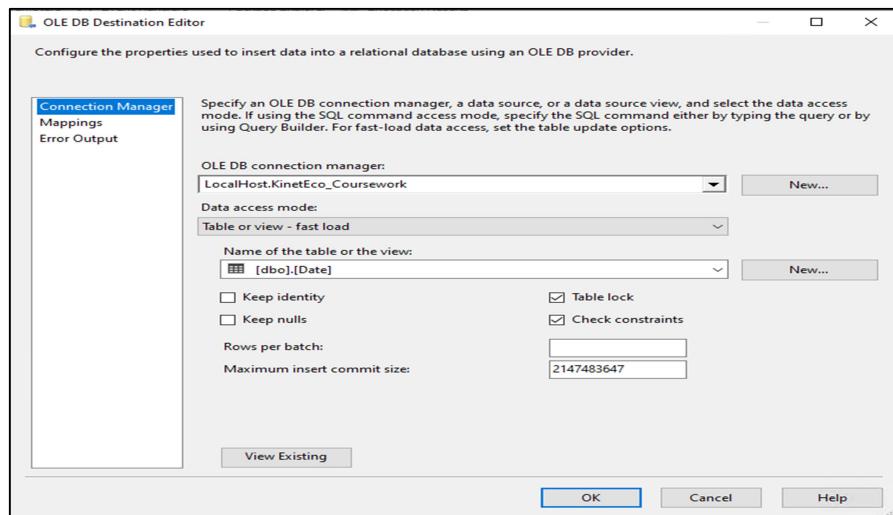
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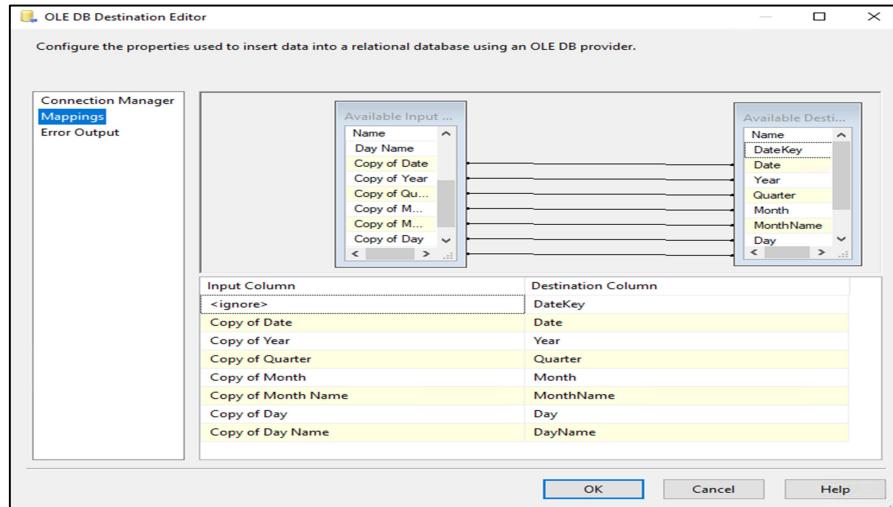


## Data Conversion

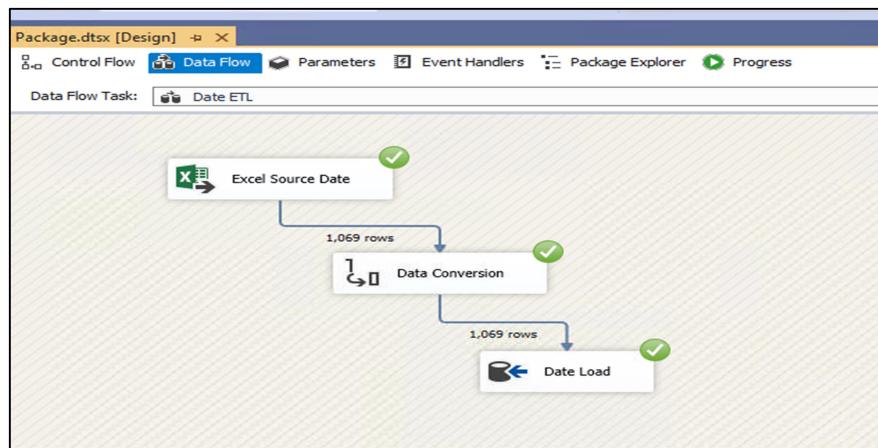


## Configuring Destination and Mapping Columns



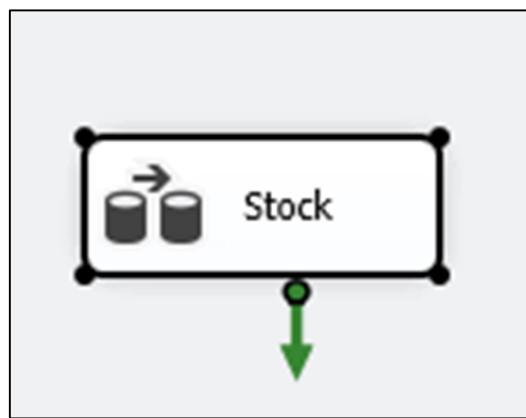


## Execution Results

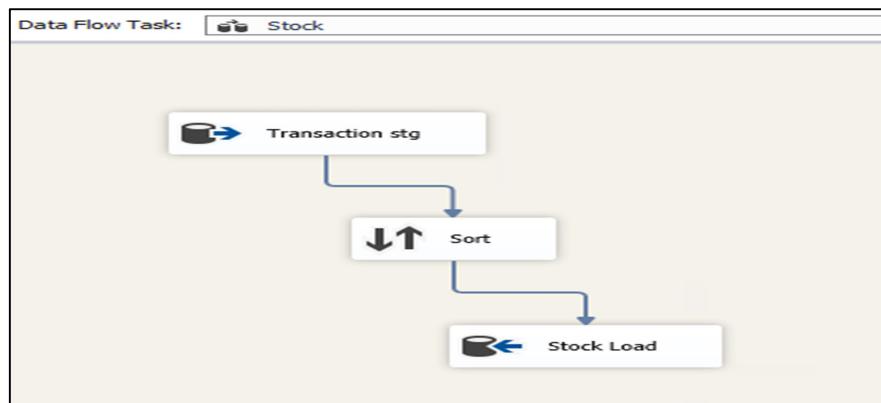


	DateKey	Date	Year	Quarter	Month	MonthName	Day	DayName
1	1	2018-01-01	2018	1	1	January	1	Monday
2	2	2018-01-02	2018	1	1	January	2	Tuesday
3	3	2018-01-03	2018	1	1	January	3	Wednesday
4	4	2018-01-04	2018	1	1	January	4	Thursday
5	5	2018-01-05	2018	1	1	January	5	Friday
6	6	2018-01-06	2018	1	1	January	6	Saturday
7	7	2018-01-07	2018	1	1	January	7	Sunday
8	8	2018-01-08	2018	1	1	January	8	Monday
9	9	2018-01-09	2018	1	1	January	9	Tuesday
10	10	2018-01-10	2018	1	1	January	10	Wednesday
11	11	2018-01-11	2018	1	1	January	11	Thursday
12	12	2018-01-12	2018	1	1	January	12	Friday
13	13	2018-01-13	2018	1	1	January	13	Saturday
14	14	2018-01-14	2018	1	1	January	14	Sunday
15	15	2018-01-15	2018	1	1	January	15	Monday
16	16	2018-01-16	2018	1	1	January	16	Tuesday
17	17	2018-01-17	2018	1	1	January	17	Wednesday
18	18	2018-01-18	2018	1	1	January	18	Thursday
19	19	2018-01-19	2018	1	1	January	19	Friday
20	20	2018-01-20	2018	1	1	January	20	Saturday
21	21	2018-01-21	2018	1	1	January	21	Sunday
22	22	2018-01-22	2018	1	1	January	22	Monday

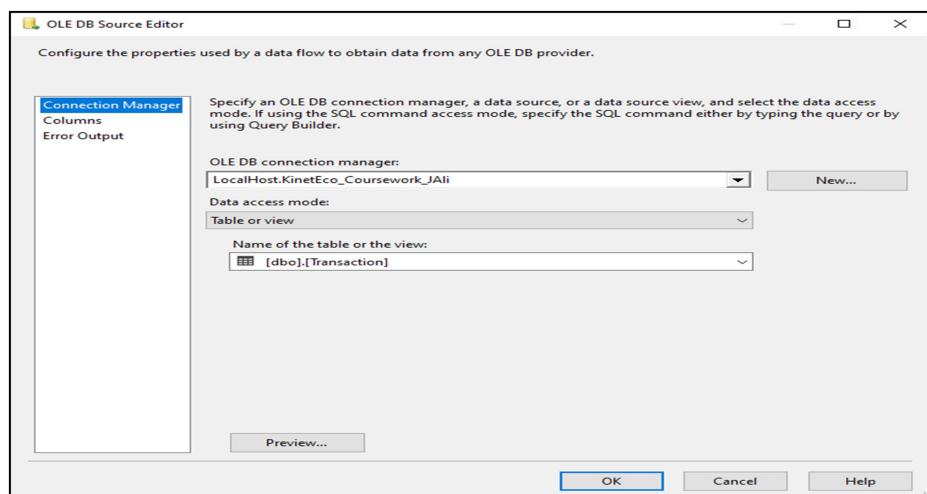
iv. Stock ETL

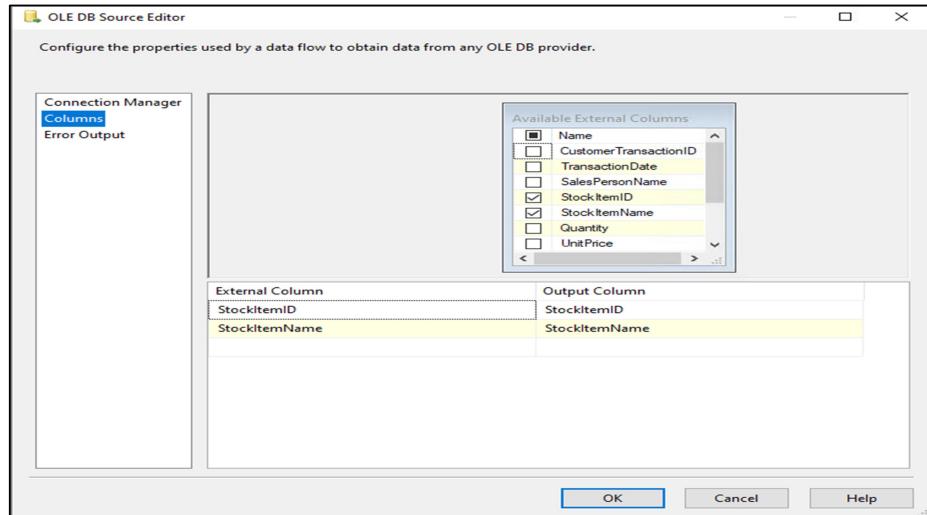


Data Flow Task Overview

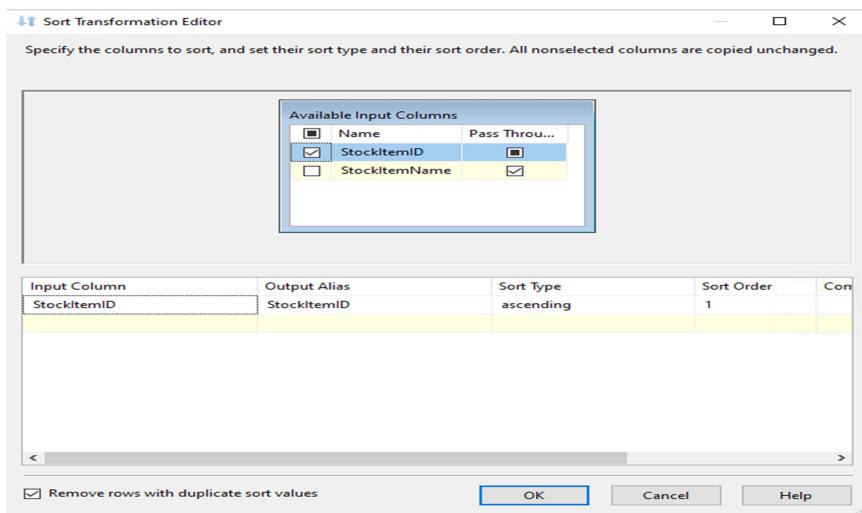


Configuring Excel Source Editor

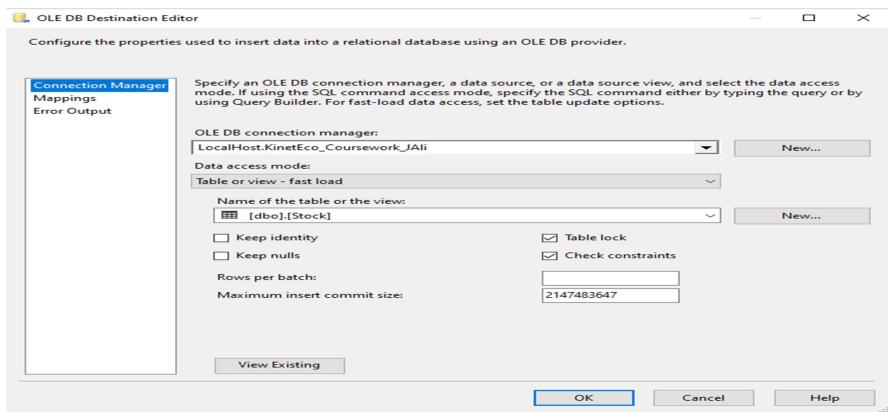


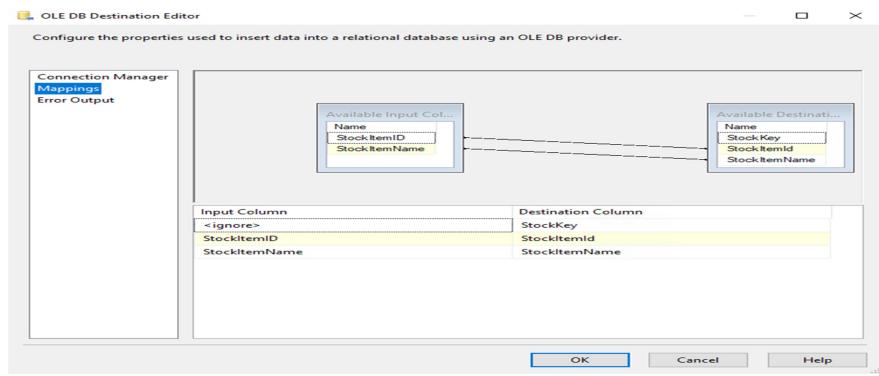


### Configuring Sort Transformation Editor

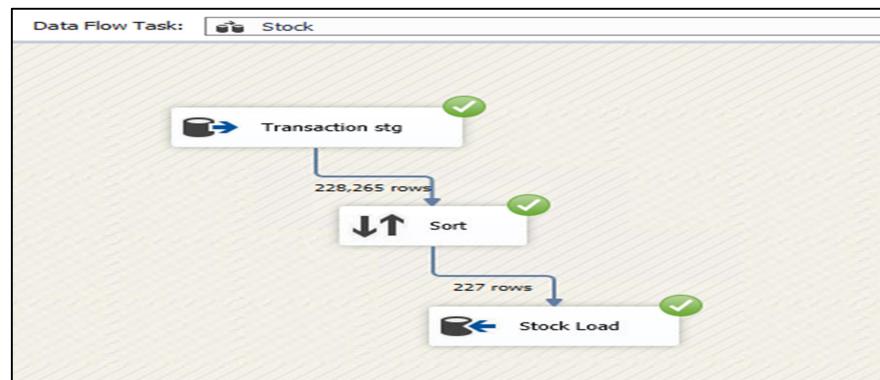


### Configuring Destination and Mapping Columns





### Execution Results

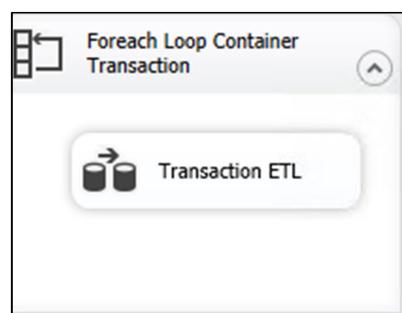


A screenshot of a database query results grid titled 'Results'. The columns are 'StockKey', 'StockItemId', and 'StockItemName'. The data shows 227 rows of stock items, including various USB drives and mugs. The last row is highlighted in yellow.

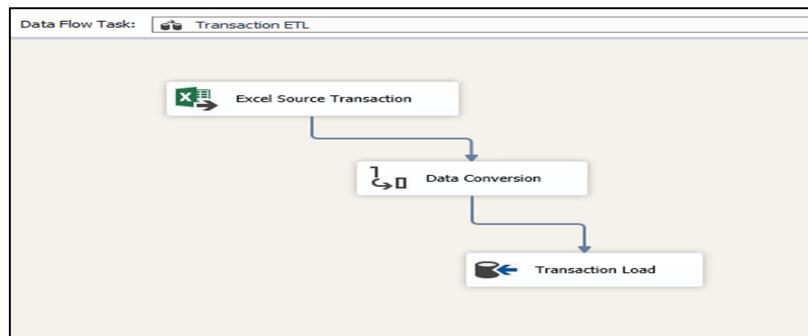
	StockKey	StockItemId	StockItemName
1	1	1	USB missile launcher (Green)
2	2	2	USB rocket launcher (Grey)
3	3	3	Office cube periscope (Black)
4	4	4	USB food flash drive -薯条
5	5	5	USB food flash drive -hamburger
6	6	6	USB food flash drive - hot dog
7	7	7	USB food flash drive - pizza slice
8	8	8	USB food flash drive - dm sun 10 drive variety ...
9	9	9	USB food flash drive -banana
10	10	10	USB food flash drive - chocolate bar
11	11	11	USB food flash drive - cookie
12	12	12	USB food flash drive - donut
13	13	13	USB food flash drive - shrimp cocktail
14	14	14	USB food flash drive - fortune cookie
15	15	15	USB food flash drive -dessel 10 drive variety p...
16	16	16	DBA joke mug - mind f i j on you? (White)
17	17	17	DBA joke mug - mind f i j on you? (Black)
18	18	18	DBA joke mug -daaaaasta (White)
19	19	19	DBA joke mug -daaaaasta (Black)

Query executed successfully. (local) (15.0 RTM) SOC-CMM531-009\datasci... KinetEco\_Coursework\_JAI 00:00:00 227 rows

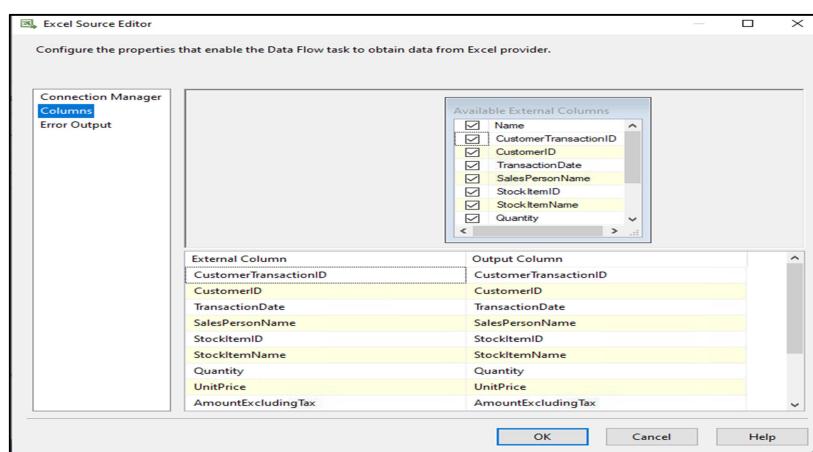
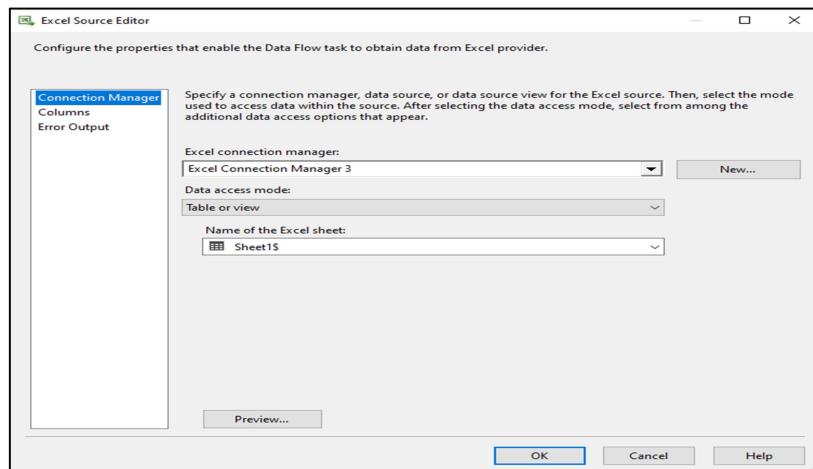
### v. Transaction ETL



## Data Flow Task Overview



## Configuring Excel Source Editor



Preview Query Results						
Query result (up to the first 200 rows):						
CustomerT...	CustomerID	Transactio...	SalesPerso...	StockItemID	Stoc	^
2	832	01/01/20...	Kayla Wo...	67	Ride	
5	803	01/01/20...	Anthony ...	10	USB	
5	803	01/01/20...	Anthony ...	50	Deve	
7	1	01/01/20...	Amy Trefl	114	Sup	
11	1	01/01/20...	Archer La...	206	Perm	
11	1	01/01/20...	Archer La...	130	Furn	
11	1	01/01/20...	Archer La...	50	Deve	
15	905	01/01/20...	Hudson O...	155	Larg	
15	905	01/01/20...	Hudson O...	128	Plush	
15	905	01/01/20...	Hudson O...	121	Dino:	
19	976	01/01/20...	Hudson H...	126	Plush	
19	976	01/01/20...	Hudson H...	40	Deve	
19	976	01/01/20...	Hudson H...	150	Park	

## Data Conversion

Data Conversion Transformation Editor

Configure the properties used to convert the data type of an input column to a different data type. Depending on the data type to which the column is converted, set the length, precision, scale, and code page of the column.

Available Input Columns
Name
<b>CustomerTransactionID</b>
CustomerID
TransactionDate
SalesPersonName
StockItemID

Input Column	Output Alias	Data Type	Length	Precision	Scale	Code Page
CustomerTransactionID	Copy of CustomerTra...	four-byte signed integer ...				
CustomerID	Copy of CustomerID	four-byte signed integer ...				
TransactionDate	Copy of TransactionD...	date [DT_DATE]				
SalesPersonName	Copy of SalesPersonN...	Unicode string [DT_WSTR]	40			
StockItemID	Copy of StockItemID	four-byte signed integer ...				
StockItemName	Copy of StockItemNa...	Unicode string [DT_WSTR]	100			
Quantity	Copy of Quantity	four-byte signed integer ...				
UnitPrice	Copy of UnitPrice	currency [DT_CY]				
AmountExcludingTax	Copy of AmountExclu...	currency [DT_CY]				

Configure Error Output... OK Cancel Help

## Configuring Destination and Mapping Columns

OLE DB Destination Editor

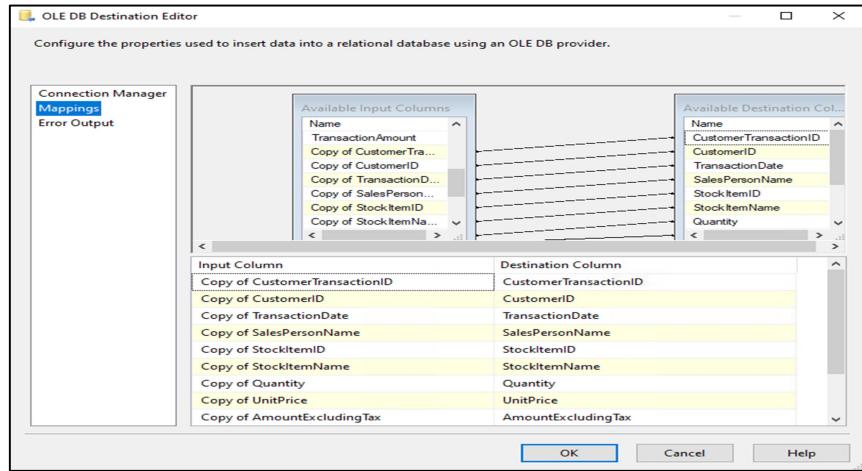
Configure the properties used to insert data into a relational database using an OLE DB provider.

Connection Manager
Mappings
Error Output

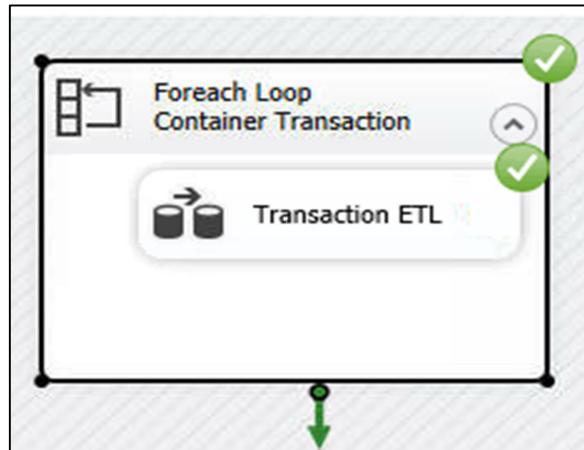
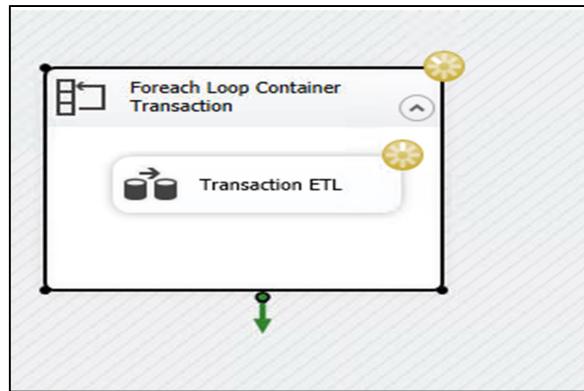
Specify an OLE DB connection manager, a data source, or a data source view, and select the data access mode. If using the SQL command access mode, specify the SQL command either by typing the query or by using Query Builder. For fast-load data access, set the table update options.

OLE DB connection manager: LocalHost.KinetEco\_Coursework  
Data access mode: Table or view - fast load  
Name of the table or the view: [dbo].[Transaction]  
Keep identity  
Keep nulls  
Rows per batch:  
Maximum insert commit size: 2147483647

View Existing OK Cancel Help

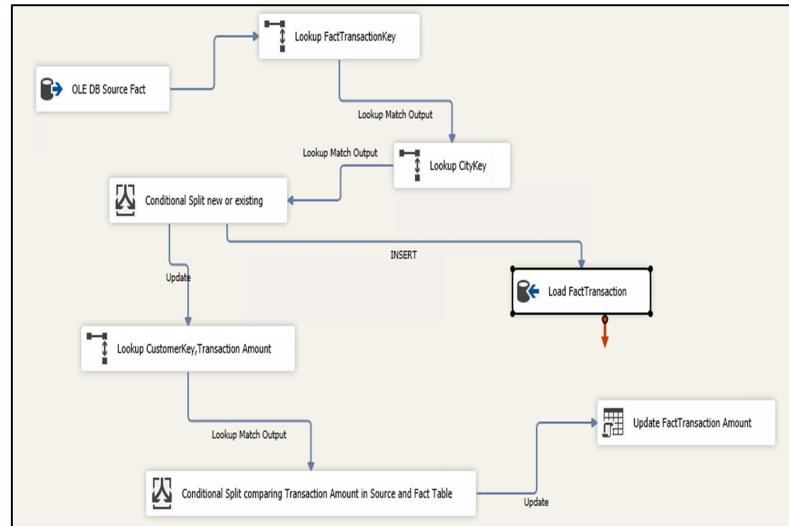


### Execution Results

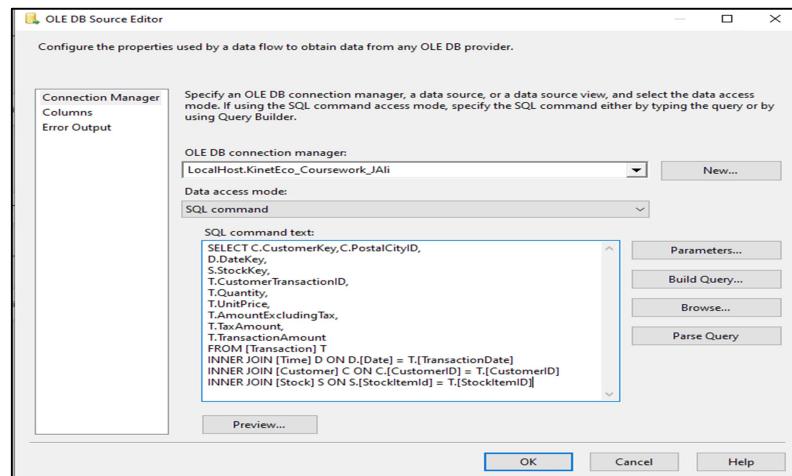


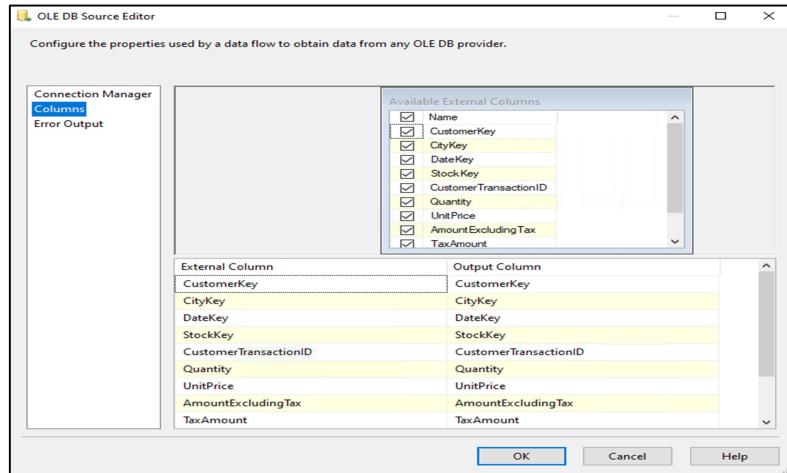
	CustomerTransactionID	CustomerID	TransactionDate	StockItemID	StockItemName	SalesPersonName	Quantity	UnitPrice	AmountExcludingTax	TaxAmount	TransactionAmount
1	25071	933	2018-04-19	95	The Gu red shirt XML tag t-shirt (Black) XL	Kayla Woodcock	84	18.00	1512	227	1738.80
2	25075	1	2018-04-19	108	Shipping carton (Brown) 457x457x477mm	Kayla Woodcock	175	2.10	660	59	758.43
3	25075	1	2018-04-19	150	Pack of 12 action figures (variety)	Kayla Woodcock	10	16.00	660	59	758.43
4	25075	1	2018-04-19	188	3kg Courier post bag (White) 300x190x95mm	Kayla Woodcock	200	0.66	660	59	758.43
5	25078	864	2018-04-19	49	Developer joke mug - this code was generated by...	Sophia Henton	2	13.00	566	85	650.90
6	25078	864	2018-04-19	159	20 mm Double sided bubble wrap 10m	Sophia Henton	30	18.00	566	85	650.90
7	25082	896	2018-04-19	101	The Gu red shirt XML tag t-shirt (Black) XL	Hudson Orslow	72	18.00	3456	518	3974.40
8	25082	896	2018-04-19	93	The Gu red shirt XML tag t-shirt (Black) M	Hudson Orslow	98	18.00	3456	518	3974.40
9	25082	896	2018-04-19	99	The Gu red shirt XML tag t-shirt (Black) SXL	Hudson Orslow	24	18.00	3456	518	3974.40
10	25086	891	2018-04-19	54	IT joke mug - that behavior by design (White)	Sophia Henton	8	13.00	13614	2042	15656.10
11	25086	891	2018-04-19	164	32 mm Double sided bubble wrap 50m	Sophia Henton	100	112.00	13614	2042	15656.10
12	25086	891	2018-04-19	160	20 mm Double sided bubble wrap 20m	Sophia Henton	70	33.00	13614	2042	15656.10
13	25091	1	2018-04-19	18	DBA joke mug - daaaaaaa (White)	Jack Potter	5	13.00	606	91	696.90
14	25091	1	2018-04-19	62	RC toy sedan car with remote control (Yellow) 1/5...	Jack Potter	8	25.00	606	91	696.90
15	25091	1	2018-04-19	59	RC toy sedan car with remote control (Red) 1/50 ...	Jack Potter	5	25.00	606	91	696.90
16	25091	1	2018-04-19	85	The Gu red shirt XML tag t-shirt (White) XL	Jack Potter	12	18.00	606	91	696.90
17	25095	1	2018-04-19	212	Large replacement blades 18mm	Sophia Henton	90	4.30	857	130	997.05
18	25095	1	2018-04-19	176	Bubblewrap dispenser (Red) 1.5m	Sophia Henton	1	240.00	857	130	997.05
19	25095	1	2018-04-19	15	USB food drive - dessert 10 drive variety pack	Sophia Henton	1	240.00	857	130	997.05

## vi. FactTransaction ETL

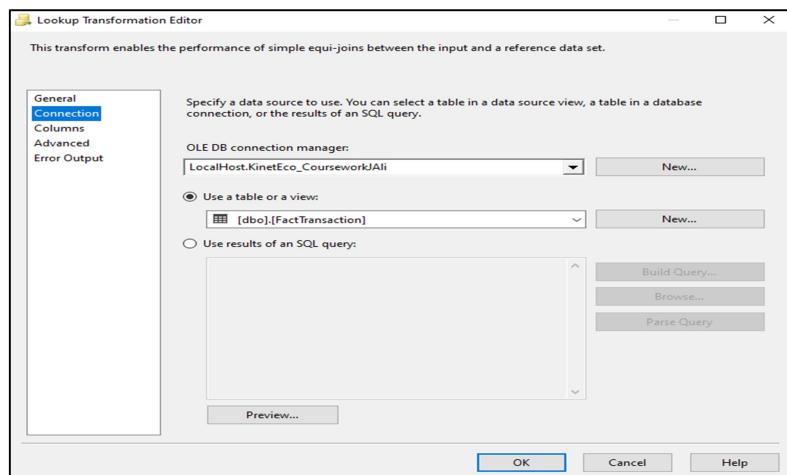
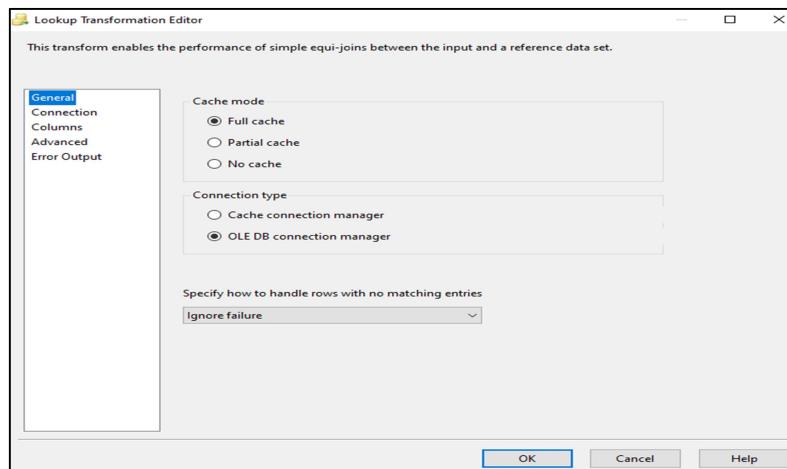


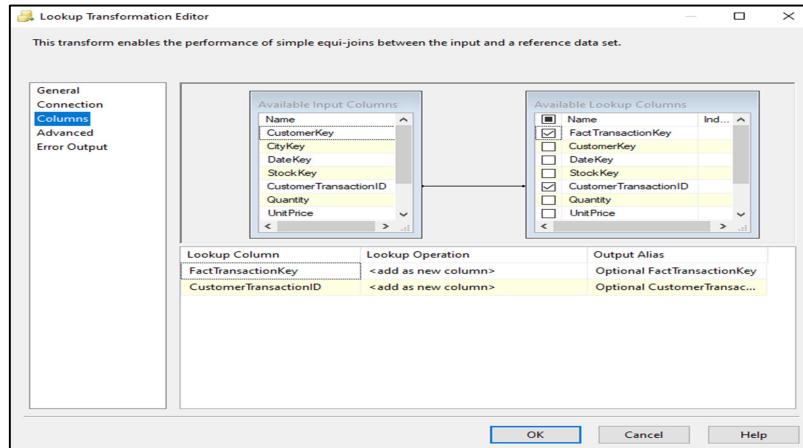
## Configuring Source Editor



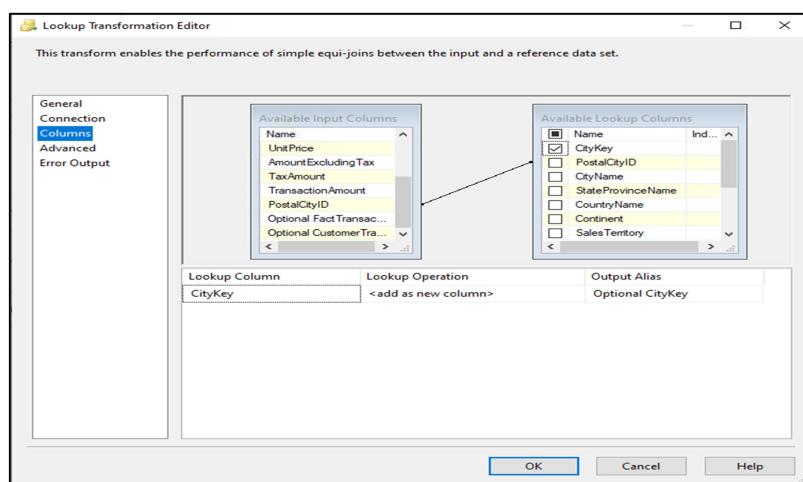
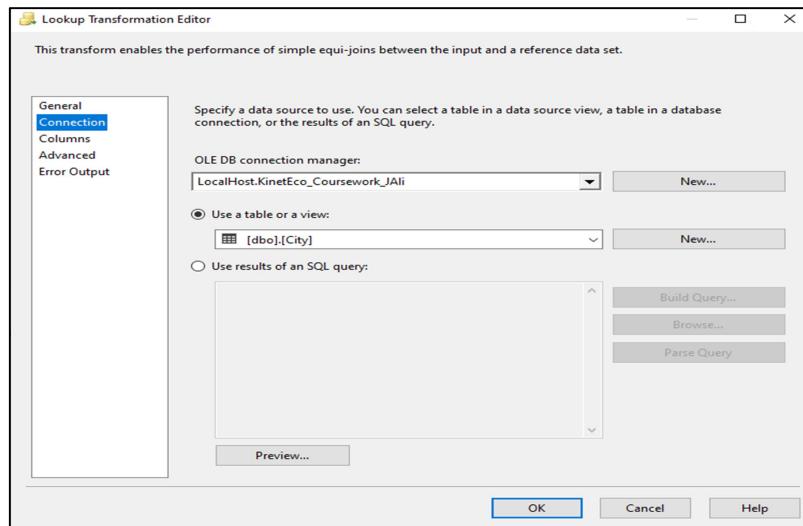


### Configuring Lookup - FactTransactionKey

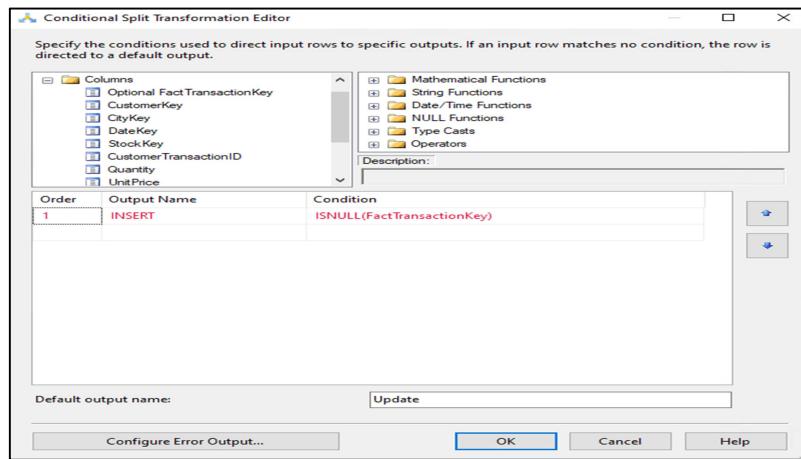




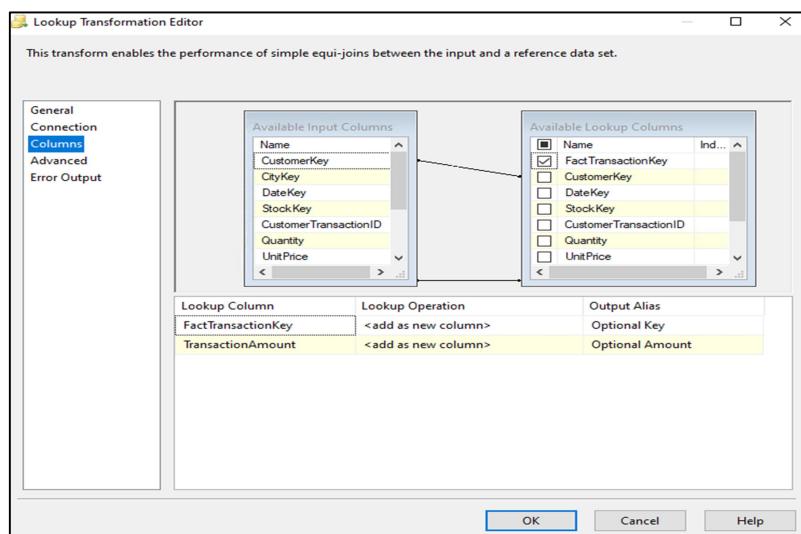
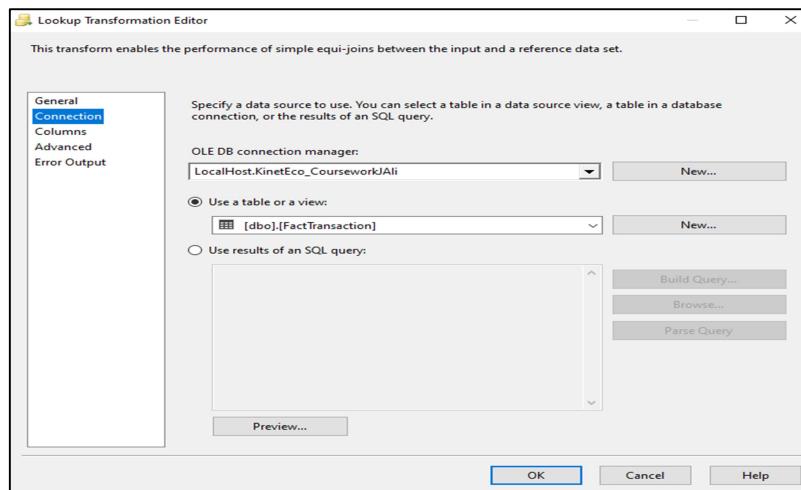
### Configuring Lookup - CityKey



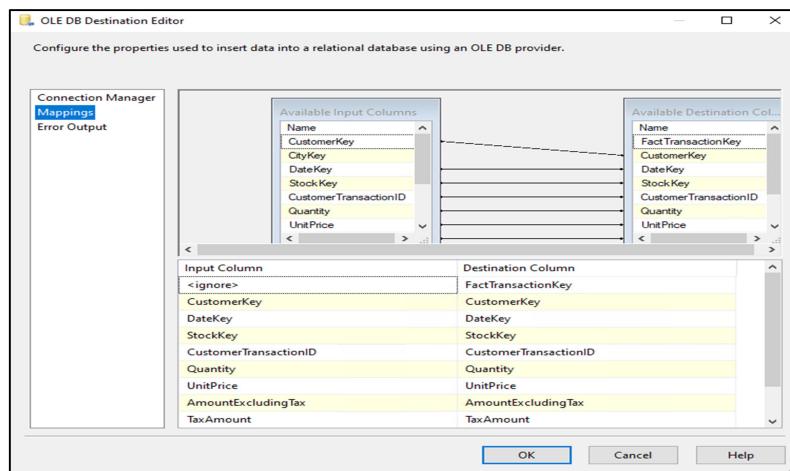
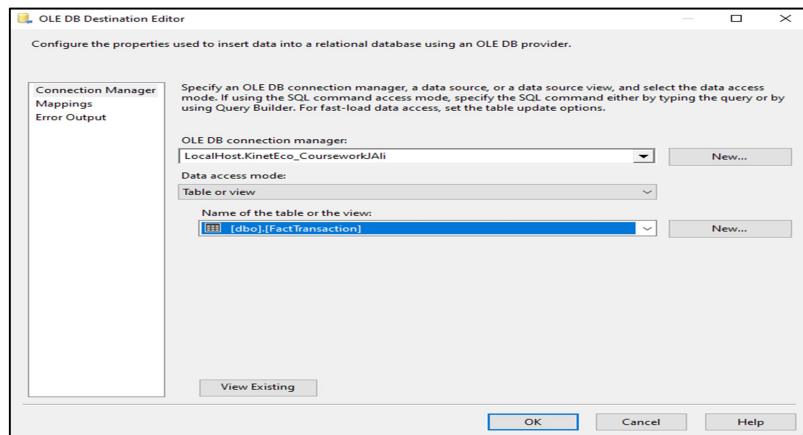
### Configuring Conditional Split



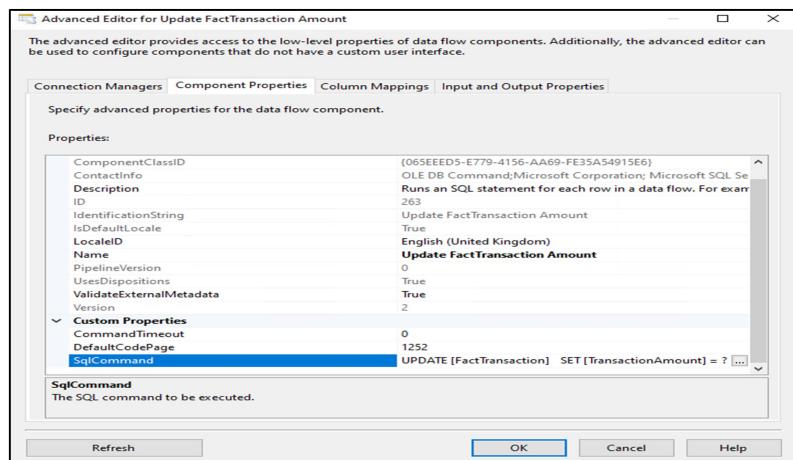
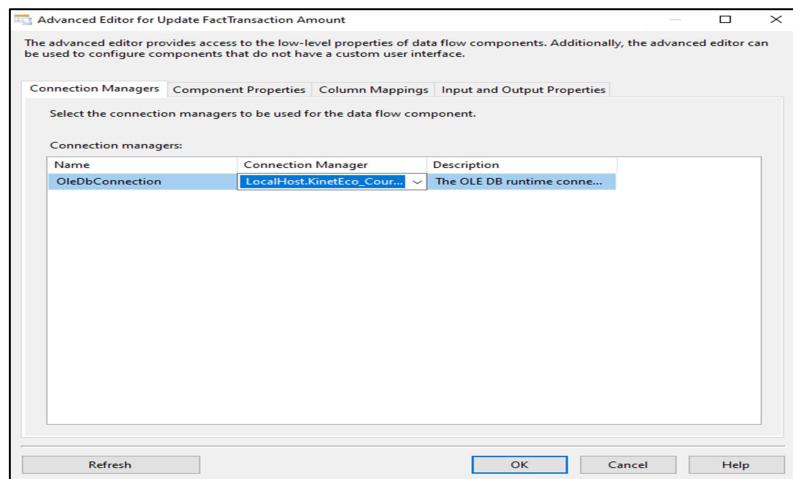
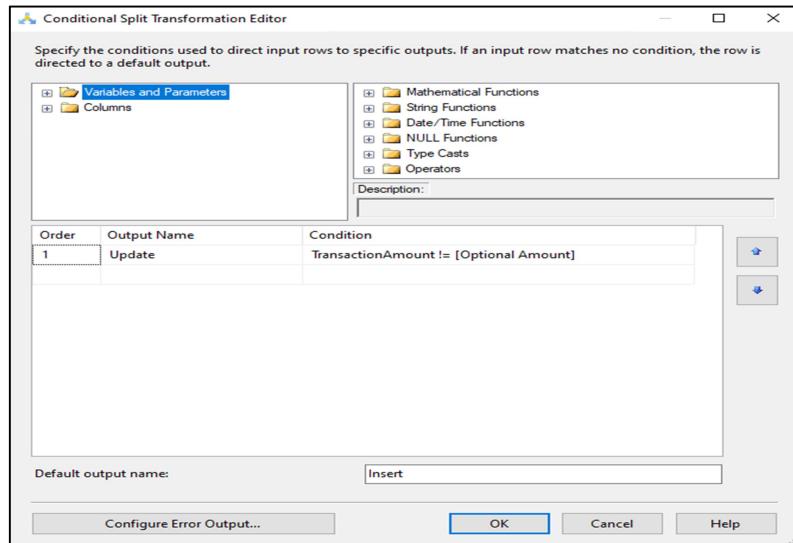
### Configuring Lookup – CustomerKey, TransactionAmount

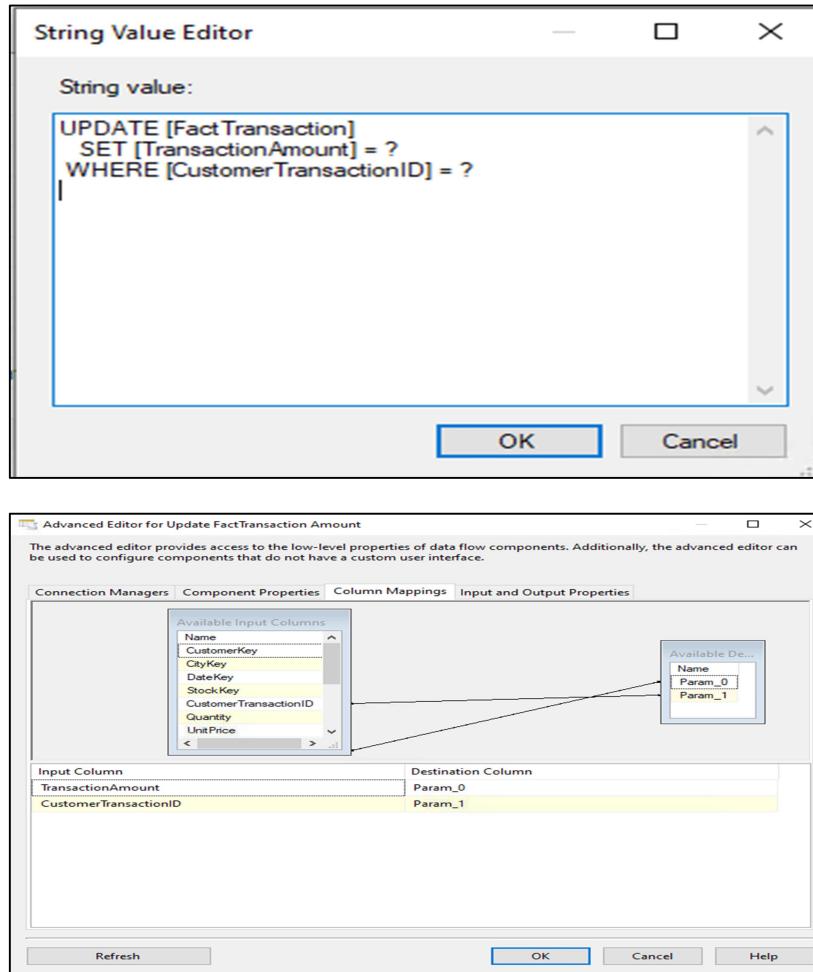


### Configuring Destination and Mapping Columns

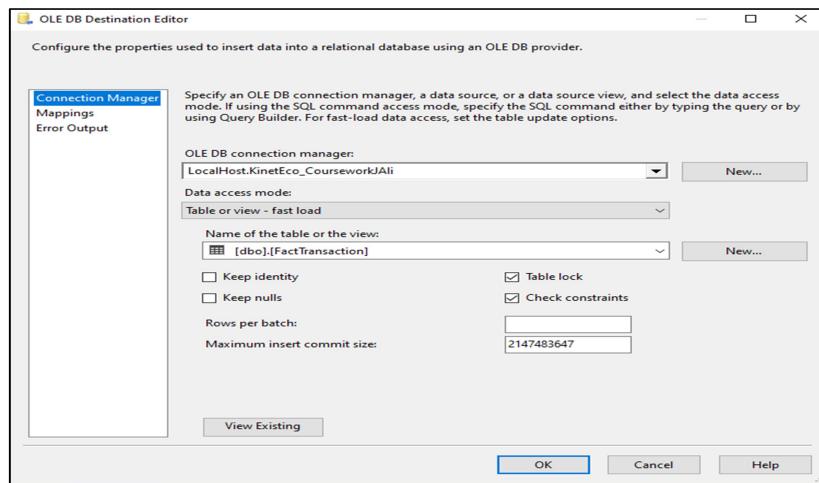


## Configuring Conditional Split

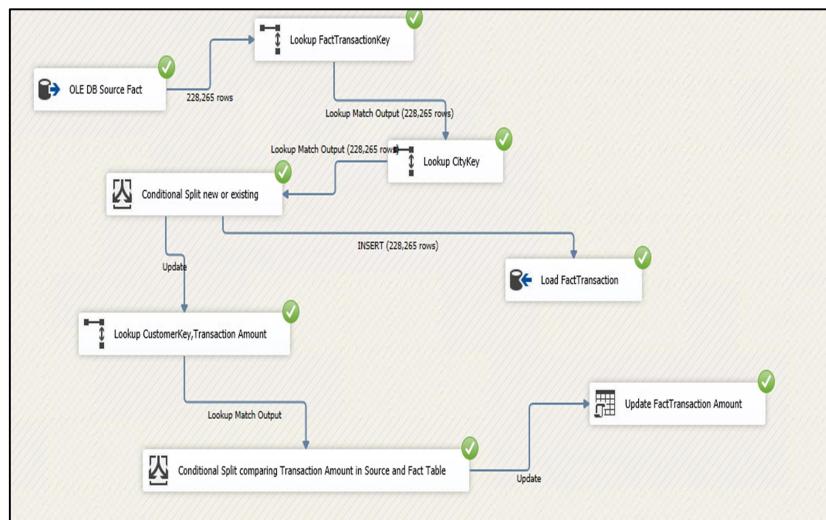
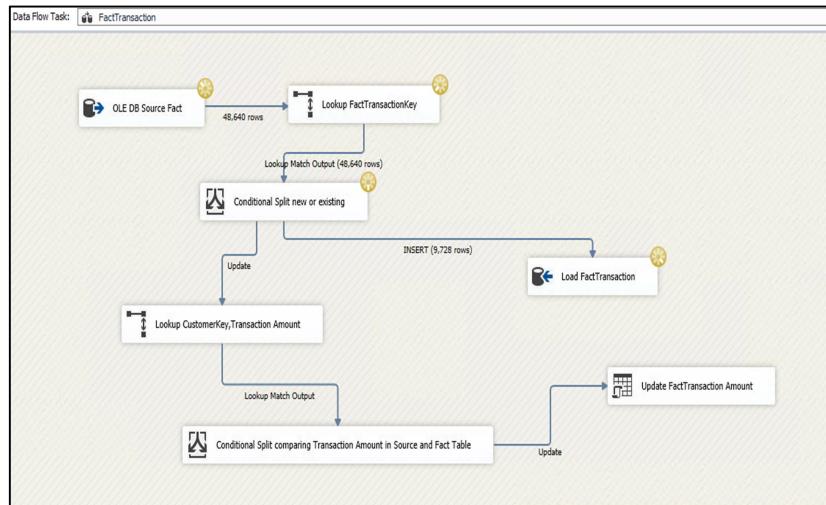




### Configuring Destination and Mapping Columns



## Execution Results

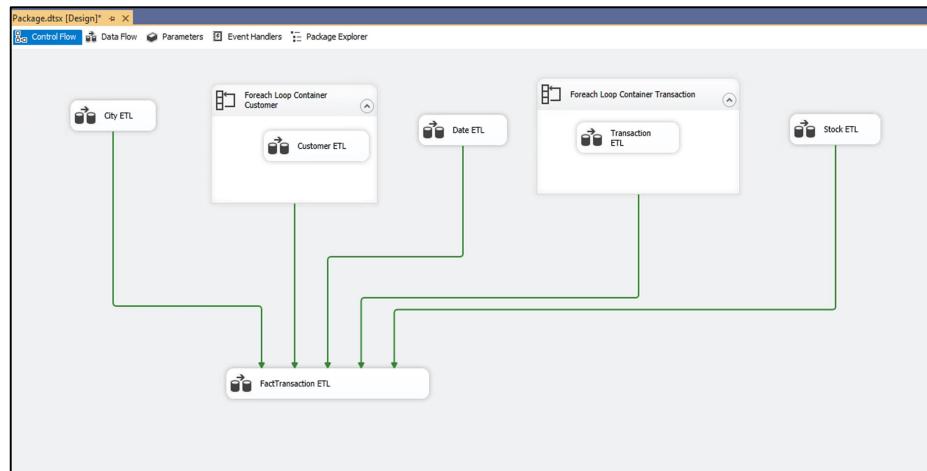


The screenshot shows the results of a query executed successfully. The results are displayed in a table with the following columns: FactTransactionKey, CustomerKey, CityKey, DateKey, StockKey, CustomerTransactionID, Quantity, UnitPrice, AmountExcludingTax, TaxAmount, and TransactionAmount. The data consists of 228,265 rows, matching the row count shown in the SSIS logs. The transaction amounts range from 0.65 to 1,738.80.

	FactTransactionKey	CustomerKey	CityKey	DateKey	StockKey	CustomerTransactionID	Quantity	UnitPrice	AmountExcludingTax	TaxAmount	TransactionAmount
1	1	157	94	95	25871	84	10.00	1512.00	227.00	1738.80	
2	2	1	335	94	108	25875	24	2.10	660.00	98.00	758.43
3	3	1	335	94	150	25875	10	16.00	660.00	98.00	758.43
4	4	1	335	94	188	25875	200	0.65	660.00	98.00	758.43
5	5	465	94	94	49	25870	2	13.00	566.00	85.00	650.90
6	6	465	94	94	159	25870	30	10.00	566.00	85.00	650.90
7	7	498	133	94	101	25882	72	10.00	3456.00	518.00	3974.40
8	8	498	133	94	93	25882	96	10.00	3456.00	518.00	3974.40
9	9	498	133	94	99	25882	24	10.00	3456.00	518.00	3974.40
10	10	493	518	94	54	25896	8	13.00	13614.00	2042.00	15656.10
11	11	493	518	94	164	25896	100	112.00	13614.00	2042.00	15656.10
12	12	493	518	94	160	25896	70	33.00	13614.00	2042.00	15656.10
13	13	1	336	94	18	25891	5	13.00	606.00	91.00	696.90
14	14	1	336	94	62	25891	8	25.00	606.00	91.00	696.90
15	15	1	336	94	59	25891	5	25.00	606.00	91.00	696.90
16	16	1	336	94	85	25891	12	10.00	606.00	91.00	696.90
17	17	1	336	94	212	25895	90	4.30	867.00	130.00	997.05
18	18	1	336	94	176	25895	1	240.00	867.00	130.00	997.05
19	19	1	336	94	15	25895	1	240.00	867.00	130.00	997.05

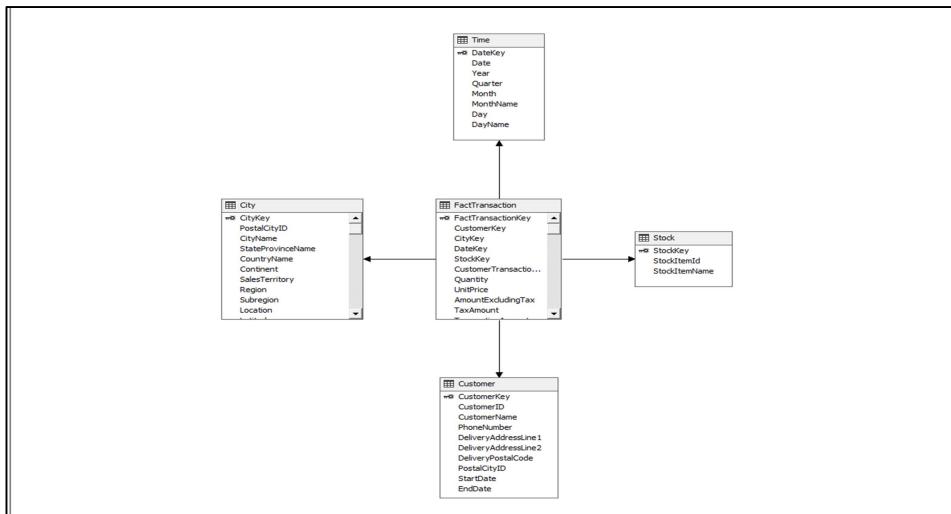
Query executed successfully. (local) [15.0 RTM] SOIC-CMM531-009\datasrc... Kinetic\_Coursework\_JA1 00:00:08 228,265 rows

## Overall SSIS Package Execution



## Deliverables for Task 2.2

### a) Data Source View



### i. City Dimension/Hierarchy

This screenshot shows the **City.dim [Design]** interface. On the left, the **Attributes** pane lists various attributes for the **City** dimension, including City Key, City Name, Continent, Country Name, Latitude, Longitude, Postal City ID, Region, Sales Territory, State Province Name, and Subregion. In the center, the **Hierarchies** pane displays a **Location Hierarchy** with levels: Continent, Region, Subregion, Country Name, State Province Name, City Name, and City Key. A note says "To create a new hierarchy, drag an attribute here." To the right, the **Data Source View** pane shows the **City** table with the same attributes as the dimension.

### Browser View

This screenshot shows the **City.dim [Design]** browser view. It displays a hierarchical tree under the heading "Current level: (All)". The tree starts with "North America", which branches into "Americas", "Northern America", "United States", "Alabama", "Alaska", "Arizona", "Arkansas", "California", "Colorado", "Connecticut", "Florida", "Georgia", "Hawaii", "Idaho", and "Illinois". Each location node is represented by a small circular icon with a dot.

## ii. Customer Dimension

The screenshot shows the 'Customer.dim [Design]' window with the 'Dimension Structure' tab selected. The interface is divided into three main sections: Attributes, Hierarchies, and Data Source View.

- Attributes:** A tree view under the 'Customer' node shows attributes like Customer ID, Customer Key, Customer Name, Delivery Address Line1, Delivery Address Line2, Delivery Postal Code, End Date, Phone Number, Postal City ID, and Start Date.
- Hierarchies:** A panel with the message "To create a new hierarchy, drag an attribute here."
- Data Source View:** A tree view showing the same attributes as the attributes pane, indicating they are mapped from the source table 'Customer'.

## iii. Time Dimension/Hierarchy

The screenshot shows the 'Time.dim [Design]' window with the 'Dimension Structure' tab selected. The interface is divided into three main sections: Attributes, Hierarchies, and Data Source View.

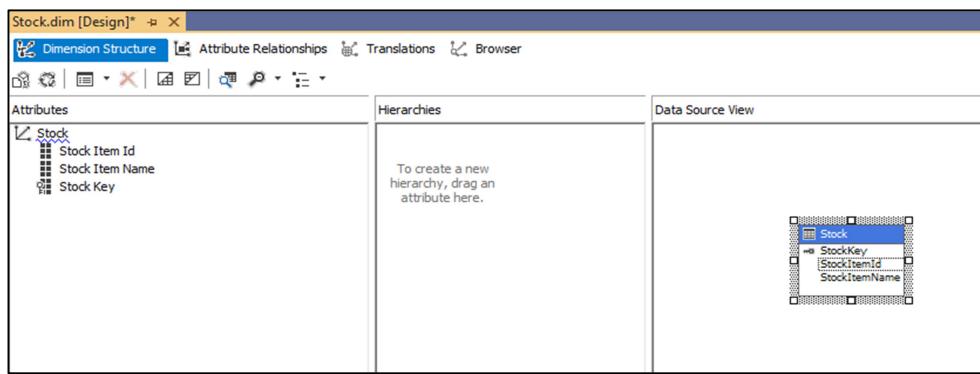
- Attributes:** A tree view under the 'Time' node shows attributes like Date, Date Key, Day, Day Name, Month, Month Name, Quarter, and Year.
- Hierarchies:** A panel titled 'Calendar' with a dropdown menu showing levels: Year, Quarter, Month, and Date Key. A note says "To create a new hierarchy, drag an attribute here."
- Data Source View:** A tree view showing attributes Date, Year, Quarter, Month, MonthName, Day, DayName, FullMonth, and FullQuarter.

### Browser View

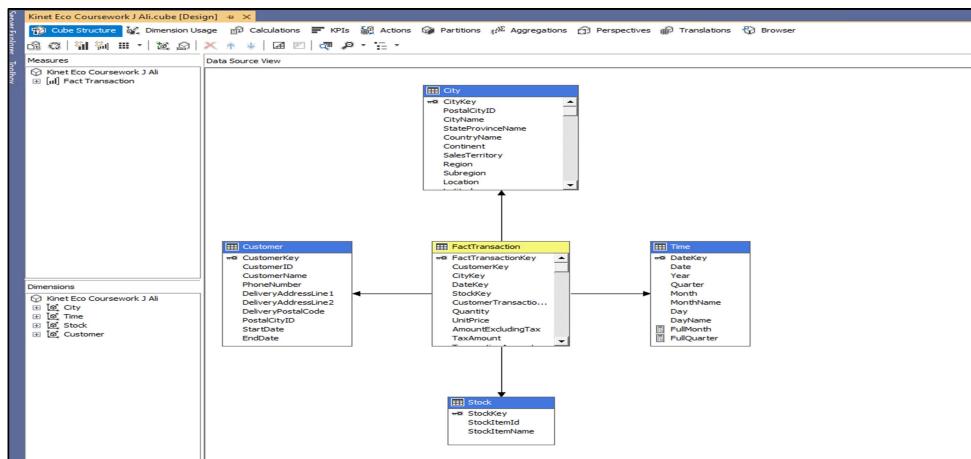
The screenshot shows the 'Time.dim [Design]' window with the 'Browser' tab selected. The interface displays a hierarchical tree of time periods and days.

- Current level:** (All)
- 2018:**
  - Q1 2018
    - January 2018
      - 1
      - 2
      - 3
      - 4
      - 5
      - 6
      - 7
      - 8
      - 9
      - 10
      - 11
      - 12
      - 13
      - 14
      - 15
      - 16
      - 17

#### iv. Stock Dimension



#### v. Cube



#### Browser View

Month	Transaction Amount
January 2018	15547729.71
February 2018	11755486.36
March 2018	16679763.84
April 2018	16798918.2300001
May 2018	18807084.5099999
June 2018	17362975.6899999
July 2018	18290327.7000001
August 2018	14741416.28
September 2018	16297119.9100001
October 2018	16017450.6
November 2018	16058941.33
December 2018	15218980.14

b) MDX Queries

Query 1:

```
WITH MEMBER Measures.MDXMTD AS
SUM(PERIODSTODATE([Time].[Calendar].[Month], [Time].[Calendar].CURRENTMEMBER), Measures.[Transaction Amount])
SELECT { Measures.[Transaction Amount], Measures.MDXMTD }
ON COLUMNS, [Time].[Calendar].[Date Key].MEMBERS ON ROWS
FROM "Kinet Eco Coursework J Ali" where [Time].[Year].[2018];
```

Date Key	Transaction Amount	MDXMTD
2018-01-01	83065.67	83065.67
2018-01-02	528630.59	611696.26
2018-01-03	449592.72	1061288.98
2018-01-04	374562.09	1435851.07
2018-01-05	268604.99	1704456.06
2018-01-07	975210.16	2679666.22
2018-01-08	377983.67	3057649.89
2018-01-09	588348.1	3645997.99
2018-01-10	689867.23	4335985.22
2018-01-11	945636.259999999	5281621.48
2018-01-12	342570.29	5624191.77
2018-01-14	803407.63	6427599.4
2018-01-15	1074800.16	7502399.56
2018-01-16	326536.24	7828935.8
2018-01-17	544730	8373665.8
2018-01-18	672529.72	9046195.52
2018-01-19	206798.09	9252993.61
2018-01-21	455339.28	9708332.89
2018-01-22	528342.22	10236675.11
2018-01-23	676797.630000001	10913472.74
2018-01-24	481287.94	11394760.68
2018-01-25	819928.699999999	12214689.38
2018-01-26	416899.02	12631588.4
2018-01-28	734821.890000001	13366410.29
2018-01-29	904286.360000001	14270696.65
2018-01-30	682127.13	14952823.78

Query 2:

```
WITH MEMBER Measures.LastMonth AS
FORMAT (((Measures.[Previous Month]-Measures.[Transaction Amount])/Measures.[Previous Month]), '#.##')
MEMBER Measures.[Previous Month] AS FORMAT
((Measures.[Transaction Amount], PARALLELPERIOD([Time].[Calendar].[Month], 1)), '#.##')
SELECT { Measures.[Transaction Amount], Measures.[Previous Month], Measures.LastMonth } ON COLUMNS,
[Time].[Calendar].[Month].MEMBERS ON ROWS
FROM "Kinet Eco Coursework J Ali" where [Time].[Year].[2020];
```

	Transaction Amount	Previous Month	Last Month
January 2020	18643679	£18,548,781	-0.51%
February 2020	17755677.89	£18,643,679	4.76%
March 2020	19592260.06	£17,755,678	-10.34%
April 2020	21820828.12	£19,592,260	-11.37%
May 2020	18983220.91	£21,820,828	13.00%
June 2020	19228854.12	£18,983,221	-1.29%
July 2020	21686311.48	£19,228,854	-12.78%
August 2020	16765435.53	£21,686,311	22.69%
September 2020	19718426.22	£16,765,436	-17.61%
October 2020	19190716.67	£19,718,426	2.68%
November 2020	17367197.93	£19,190,717	9.50%
December 2020	18954927.98	£17,367,198	-9.14%

### c) Discussion

Strengths:

This solution provides a platform for the user to do ETL (extract, transform, and load) operations, performing complex solution such as email a particular person or group on particular event, reading data from different sources including flat files, xls files, excel files, writing data to different sources is also possible.

- As the company grows and makes additional business acquisitions in future, the size of the database is also bound to grow, the solution allows to seamlessly include excel files in future. It also allows for large volumes of data to be loaded fast and easily.
- It allows to keep track of the history of changes made to the customer's phone and address information.
- It provides GUI, which helps users to create a package without coding.
- Data can be loaded in parallel to many different destinations.
- The SSAS, is useful to do multi-dimensional analysis- slicing, rolling, dicing etc. using different dimensions. It also, supports partitioning.
- It provides row level and dynamic security.

Weakness:

- Does not allow to merge data between Tabular and Multidimensional cubes
- If the requirements tend to change in the middle of the project, then Tabular cube proves to be risky.
- Once you select a path i.e. Tabular or Multidimensional, migration to the other version is not possible without starting over (Desai 2016) (Peterson 2121).

## References

- OmniSci, Inc., 2021. *In-Memory Database*. [online]. San Francisco: OmniSci, Inc. Available from: <https://www.omnisci.com/technical-glossary/in-memory-database> [Accessed 25/11/2021].
- Microsoft, 2021. *What is Power Query*. [online]. United States Microsoft. Available from: <https://docs.microsoft.com/en-us/power-query/power-query-what-is-power-query> [Accessed 25/11/2021].
- Desai, S., 2016. *What is SSIS? Its advantages and disadvantages*. [online]. India: Sarjen Systems. Available from: <https://www.sarjen.com/ssis-advantages-disadvantages/#> [Accessed 06/12/2021].
- Peterson, R., 2021. *SSAS Tutorial:What is SSAS Cube, Architecture& Types*. [online]. India: Guru99. Available from: <https://www.guru99.com/ssas-tutorial.html#9> [Accessed 06/12/2021].