PowerQuery-07: Power Query Merge / Join feature in Excel & Power BI

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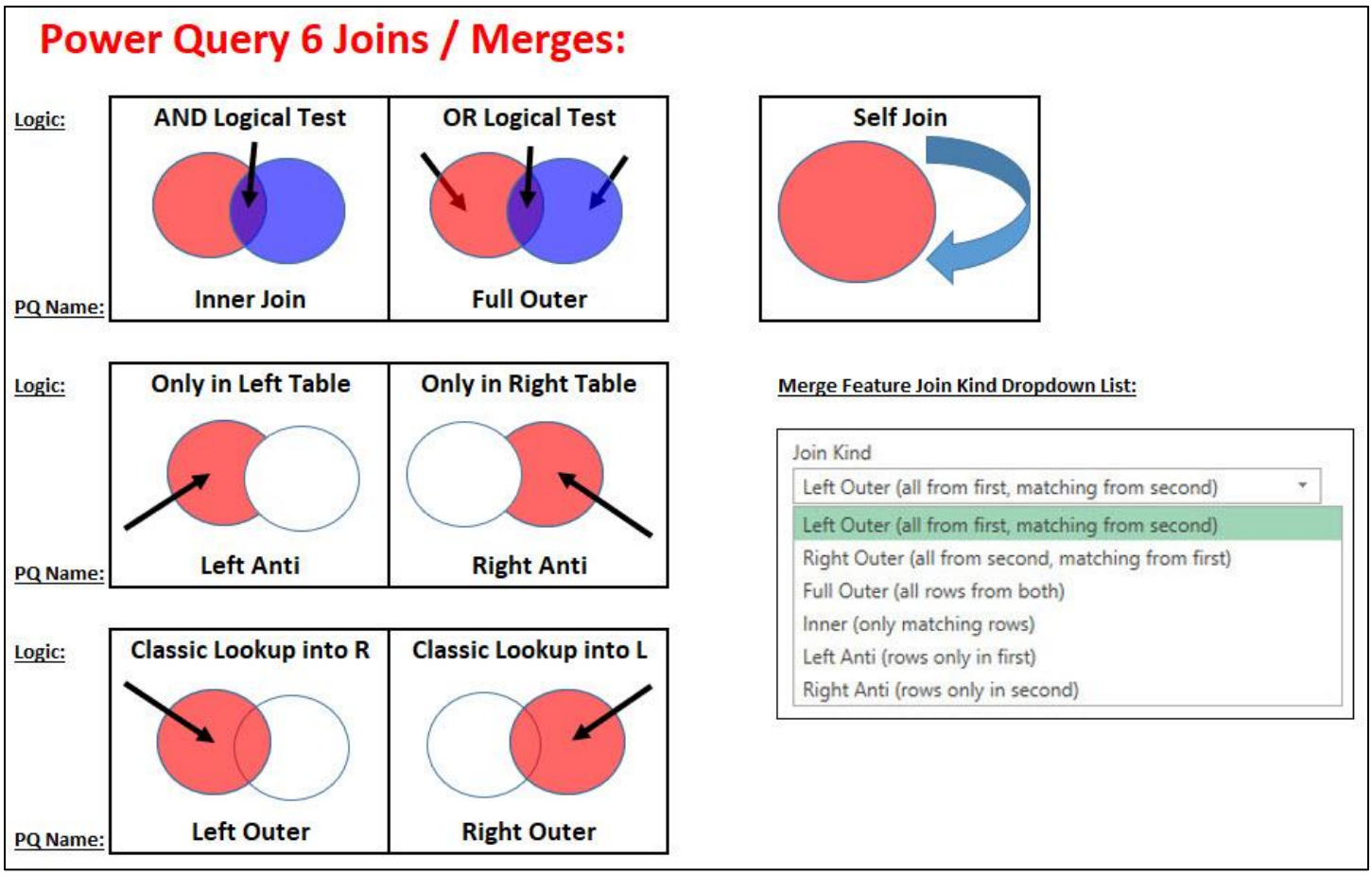
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Merge Feature and Join Kinds

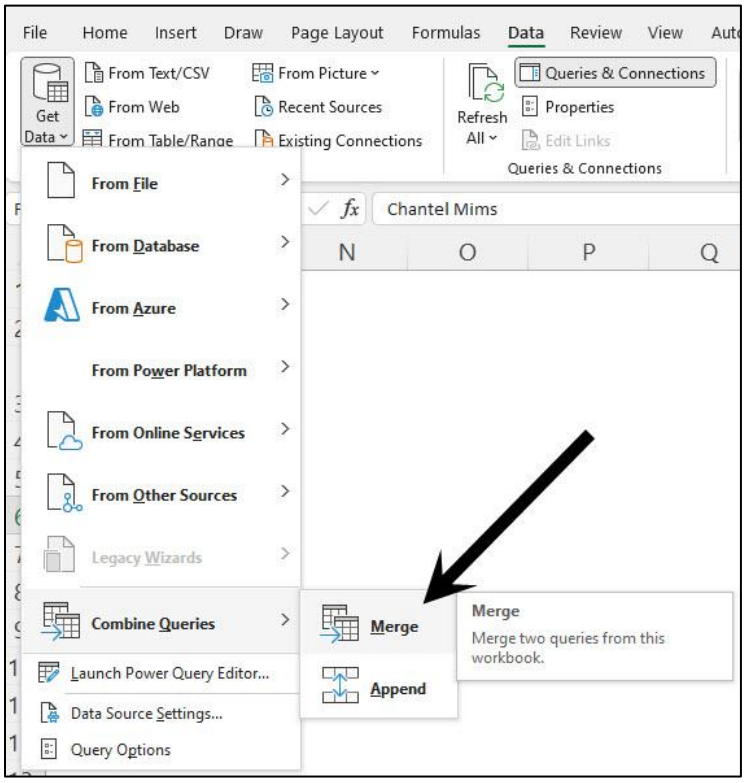
- Here are the types of Joins-Mergers we can do in Power Query:



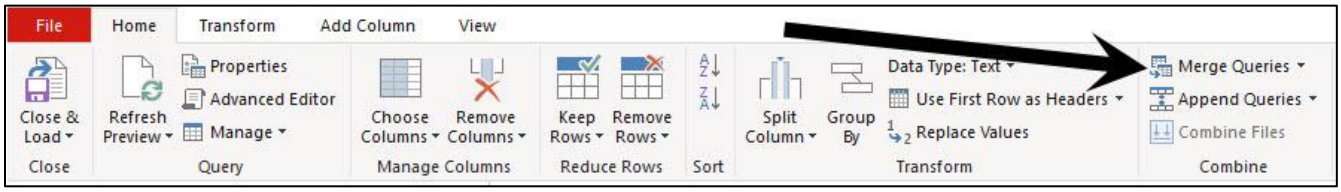
1. **What is a Merge / Join?**
    1) The term **Join** comes from the SQL (Structured Query Language) and means that two or more related columns from related tables are joined to create a merged result.
    2) The term **Merge** is used in Power Query to indicate that two or more related columns from related queries are joined to create a merged result.
    3) One query is used when you have a self-join.
2. **Requirements for a Merge**:
    1) The Merge feature only works on Queries. You cannot merge two Excel Tables from the worksheet unless they are first imported into Power Query as new queries.
    2) The Merge Feature works on Power Query Table Objects, not List Objects.
    3) Merges require related columns in one or more tables. For example, you can run a merge to bring the price of a product from a product table into a sales table based on the related column, Product, which exists in both tables.
3. **Power Query Merge is similar to XLOOKUP or Data Model Relationships or SQL Joins**
    1) XLOOKUP works with two related columns to pull items from one table into another table. It is similar to a Left Outer Join.
    2) The Data Model Relationship works across related columns so that you can lookup items up and create reports and visuals from more than one table. It is similar to a Left Outer Join.
    3) Inner, Left Outer, Right Outer, Union and Full Joins in an SQL Query are like the ones that we will see in Power Query.

4. Where is the Merge feature in Excel and Power BI?

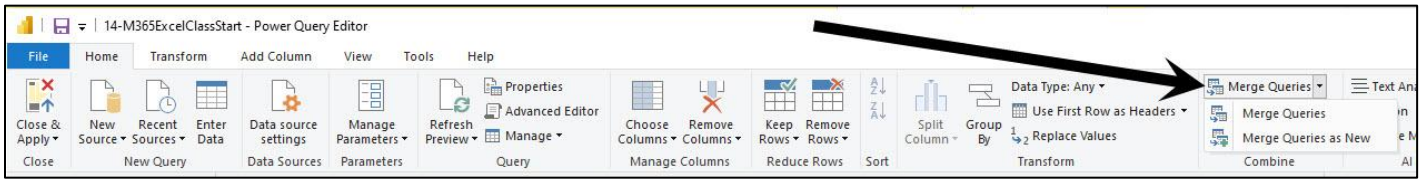
- **Excel**, Data tab in Excel Ribbon, Get & Transform Group Get Data dropdown, Combine Queries:



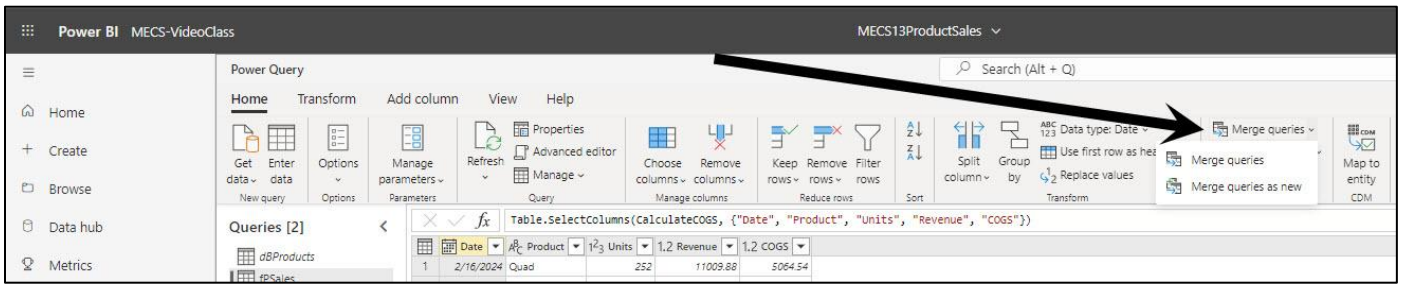
- **Excel**, Home tab in Power Query Ribbon, Combine Group:



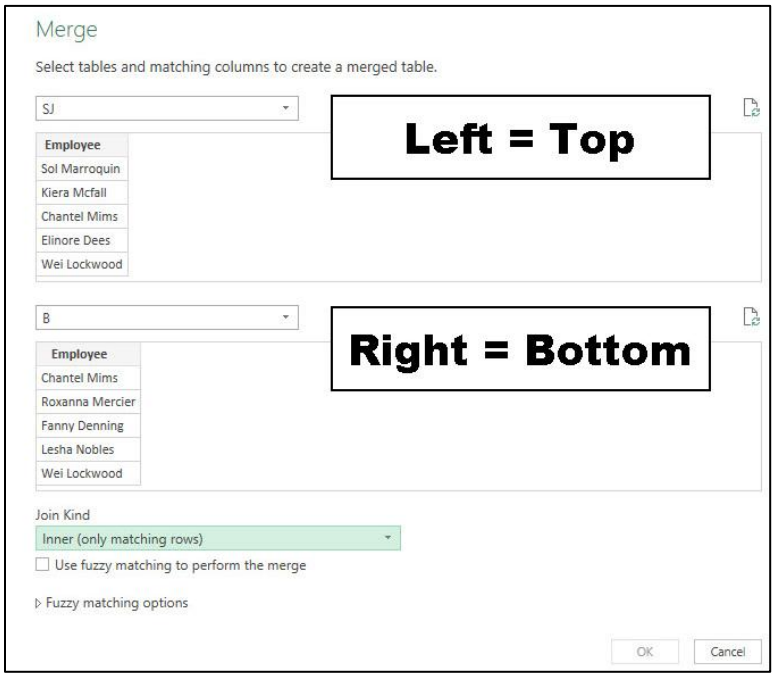
- **Power BI Desktop**, Home tab in Power Query Ribbon, Combine Group:



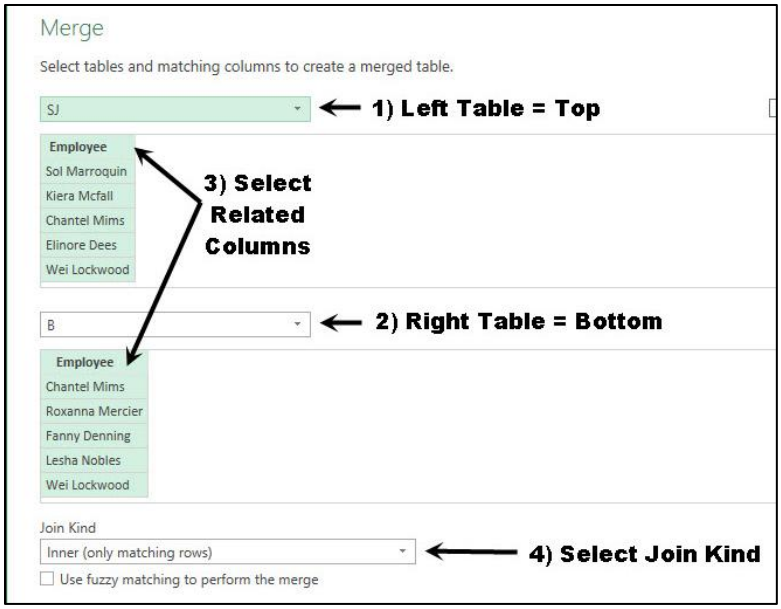
- **Power BI Online**, Dataflows (Power Query Online), Home tab, Combine Group:



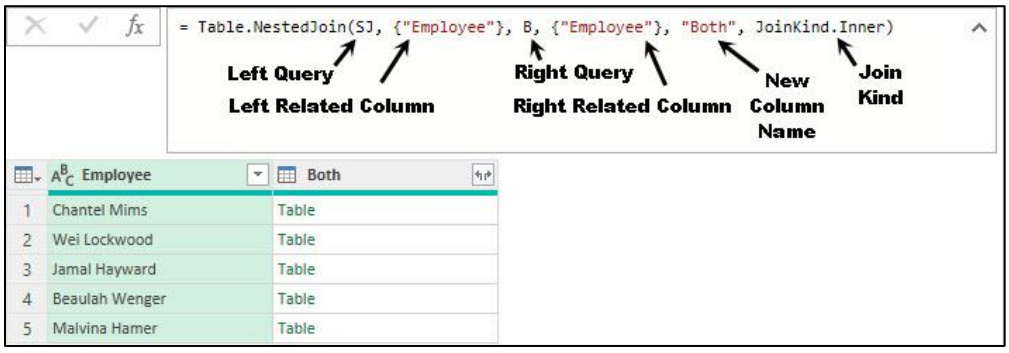
5. In Merge Dialog Box, Left = Top and Right = Bottom



6. Using Merge Dialog Box

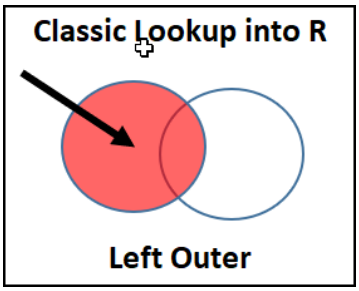


7. Table.NestedJoin M Code Function

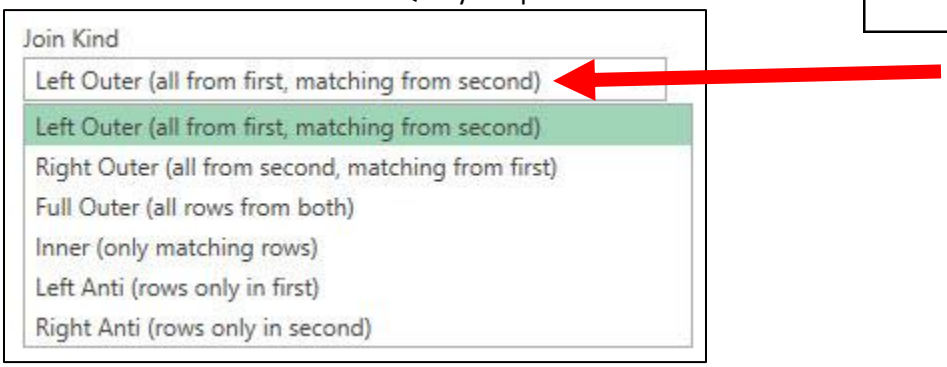


8. Left-Outer- Merge / Join

1) When we create a Left-Outer Merge / Join between tables we want to keep all items from the Related Column on the Left and retrieve only matching items from the Related Column on the Right. With a Left-Outer Join, we are asking the question: "Please give me all rows from the Left table and matching rows from the Right Table".
2) A Left-Outer Join can be thought of as a Classic Lookup situation like in Excel with XLOOKUP or in a Data Model with a One-To-Many Relationship. However, with a Left-Outer Join you an accomplish multiple look tasks that would take multiple Excel features to accomplish. A Left-Outer Join can lookup a price or use two lookup values to lookup a price, which is what the XLOOKUP worksheet function can do, but it can also perform a "one lookup value to return multiple records", which is what the FILTER worksheet function can do. In this way, a Power Query Left-Outer Join is more versatile that worksheet functions (DAX function too).
3) Synonyms for Left-Outer Join:
    i. Left
    ii. Left Join
    iii. Left Outer
    iv. Classic Lookup
    v. All from the first, matching from the second



4) Left Outer Join as seen in Power Query Dropdown List:



5) Although a Left-Outer Join can do more than a typical classic lookup, we can think of it as a classic lookup as an easy way to remember what it does. The Venn Diagram above illustrates the final Left-Outer-Join Merge:

Example from the video of looking up a price:

Left Table = tSales
Product = Foreign Key

Product	Units
Quad	48
Kangaroo	168
Carlota	132
Carlota	72
Sunshine	108
Quad	156
Carlota	96
Sunshine	60
Sunshine	24
Carlota	120
Quad	24

Right Table = dProductPrice
Product = Primary Key

Product	Price
Carlota	$26
Quad	$43
Sunshine	$19
Majestic Beaut	$27

Goal: Return Sales Table with new Price Column
Replaces LOOKUP or Realtionships (Classic Lookup)

Product	Units	Price
Quad	48	43
Carlota	132	26
Carlota	72	26
Kangaroo	168	
Sunshine	108	19
Quad	156	43
Carlota	96	26
Sunshine	60	19
Sunshine	24	19
Carlota	120	26
Quad	24	43

Example from the video of using two lookup values:

Left Table = fSalesColor
Product & Color = Foreign Key

Product	Color	Units
Quad	Red	48
Quad	Blue	156
Quad	Red	168
Carlota	Blue	132
Carlota	Blue	72
Sunshine	Red	108
Quad	Blue	156
Carlota	Red	96
Sunshine	Red	60
Sunshine	Blue	24
Carlota	Blue	120
Quad	Blue	24

Right Table = dProductColor
Product & Color = Primary Key

Product	Color	Price
Carlota	Red	$26.00
Quad	Red	$43.00
Sunshine	Red	$19.00
Carlota	Blue	$24.00
Quad	Blue	$41.00
Sunshine	Blue	$18.00

Goal: Return Sales Table with new Price Column
Replaces Two Lookup Values Formula

Product	Color	Units	Price
Quad	Red	48	43
Quad	Red	168	43
Quad	Blue	156	41
Quad	Blue	156	41
Sunshine	Red	108	19
Carlota	Blue	132	24
Carlota	Blue	72	24
Carlota	Red	96	26
Sunshine	Red	60	19
Sunshine	Blue	24	18
Carlota	Blue	120	24
Quad	Blue	24	41

Example from the video of performing a "one lookup value to return multiple records" type of lookup and then summing the multiple matched sales amount:

** Big Key: As shown in video, this feature should only be used on small data sets.

Left Table = InvoiceNo
Unique List of Invoice No.

Invoice No.	Discount%
4588	0.065
4589	0.0375
4590	0.12

Right Table = InvoiceDetail
Multiple Invoice No. to Lookup & Return.

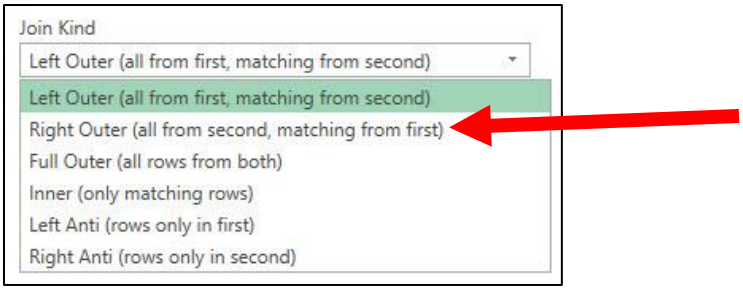
Invoice No.	Product	Sales
4588	Carlota	130
4588	Quad	559
4588	Sunshine	114
4589	Quad	559
4589	Sunshine	209
4590	Carlota	2869

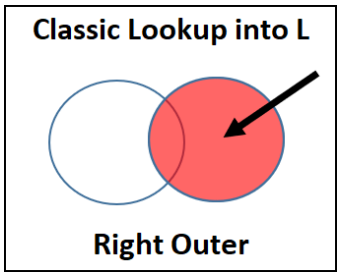
Goal: Lookup Multiple Invoice Line Items and return multiple items to a columns.
Replaces complicated Excel Solution for Single Lookup Value, Return Multiple Items

Invoice No.	Discount%	Sum of Sales
4588	0.065	803
4589	0.0375	768
4590	0.12	2869

9. Right-Outer Merge / Join

1) This Merge / Join works the same as a Left-Outer Merge / Join, except we keep all records form the right table and only matching from the left.
    i. In general, Right-Outer-Join Merge are rare because we can accomplish the same goal by using a Left-Outer-Join Merge and switching the Left Table for the Right Table.
    ii. All of the same concepts that we learned in the previous three examples for a Left-Outer-Join Merge also apply for a Right-Outer-Join Merge.
2) Synonyms for Right-Outer-Join Merge: Right, Right Join, Right Outer.
3) Left Outer Join as seen in Power Query Dropdown List:





4) Example from video that delivers a table that shows all suppliers (right table), but only related products (left table):

Left Table = dProductRightOuter
with Supplier ID Column (Foreign Key)

Product	SupplierID-P	Price	Cost
Aspen	CO	23	11
Carlota	GB	26	12.75
Majestic Beaut	GB	29	15.85
Quad	GB	43	22.5
Sunshine	CO	19	1.25
Kangaroo	CC	14	6.95

Right Table = dSupplierRightOuter
with Supplier ID Column (Primary Key)

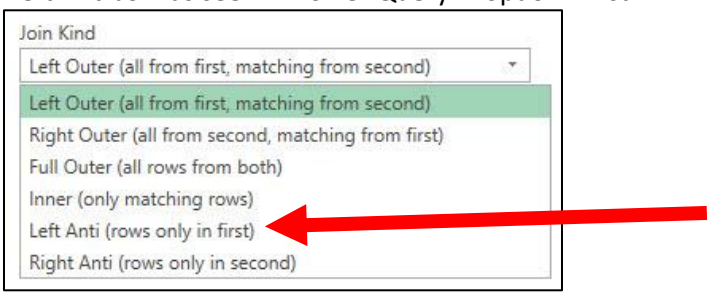
SupplierID-S	Name	City	State
CO	Colorado Boomerangs	Gunnison	CO
GB	Gel Boomerangs	Oakland	CA
DB	Darnell Booms	Manchester	MA

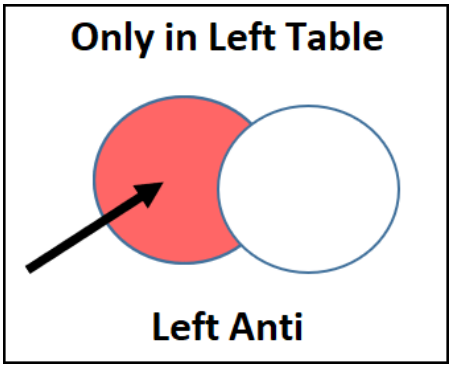
Goal: is to show all Suppliers from the Right Table and all of the Related Products,
but do NOT show Products without a Supplier

Product	SupplierID-P	Price	Cost	SupplierID-S	Name	City	State
Aspen	CO	23	11	CO	Colorado Boomerangs	Gunnison	CO
Carlota	GB	26	12.75	GB	Gel Boomerangs	Oakland	CA
Majestic Beaut	GB	29	15.85	GB	Gel Boomerangs	Oakland	CA
Quad	GB	43	22.5	GB	Gel Boomerangs	Oakland	CA
Sunshine	CO	19	1.25	CO	Colorado Boomerangs	Gunnison	CO
				DB	Darnell Booms	Manchester	MA

10.Left-Anti-Join Merge :

1) When we create a Left-Anti-Join Merge, we are asking the question: “Please give me all the items that are in Column 1 that are NOT in Column 2 and return the corresponding records.
2) A Left-Anti-Join could be thought of as an AND Logical Test where we ask: “Is item in Column 1 AND is item NOT in Column 2”.
3) In Relational Algebra when we create Set Operations, you can think of the Left-Anti-Join as a Difference, or Minus, or Except Operator, where Set 2 is subtracted from Set 1 and items a that are in both sets are dropped from the resulting set.
4) Synonyms for Inner Join:
    i. In Table 1, Not in Table 2.
    ii. Left-Anti.
    iii. Relational Algebra or Set Operator terminology:
        1. Except Set Operator.
        2. Difference Set Operator.
        3. Minus Set Operator.
    iv. All in First Table that are not in Second Table.
    v. Rows only in first.
5) Left Anti Join as seen in Power Query Dropdown List





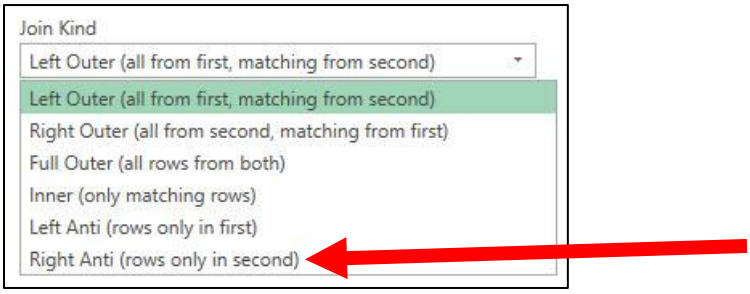
6) The above Venn Diagram illustrates that the overlap between the two tables is not included in the final Left-Anti-Join Merge.

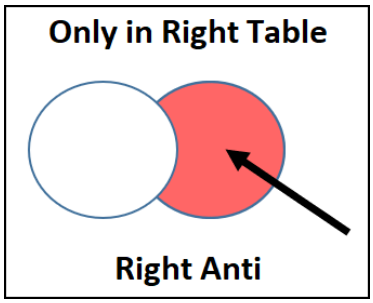
7) Example from video that shows employees that went to first conference, but not second:

	Left Table = Table 1 Employees who attended DAX Basics San Jose Conference	Right Table = Table 2 Employees who attended DAX Basics Bellevue Conference	Who Attended Only San Jose Conference? In Table 1, NOT in Table 2 Left-Anti Merge / Join
	EmployeeNameSanJose	EmployeeNameBellevue	EmployeeNameSanJose
	Sol Marroquin	Raven Beatty	Sol Marroquin
	Kiera Mcfall	Roxanna Mercier	Kiera Mcfall
	Raven Beatty	Fanny Denning	Elinore Dees
	Elinore Dees	Lesha Nobles	Donald Eldridge
	Wei Lockwood	Wei Lockwood	Claudio Beam
	Donald Eldridge	Gertrudis Fitzpatrick	Reyna Luke
	Claudio Beam	Angelita Packer	Vivan Keeney
	Angelita Packer	Beaulah Wenger	
	Reyna Luke	Malvina Hamer	
	Beaulah Wenger	Bernita Crutcher	
	Malvina Hamer	Shiela Anaya	
	Vivan Keeney	Yolonda Armstead	

11.Right-Anti-Join Merge :

1) When we create a Right-Anti-Join Merge, we are asking the question: “Please give me all the items that are in Column 2 that are NOT in Column 1 and return the corresponding records. A Right-Anti-Join could be thought of as an AND Logical Test where we ask: “Is item in Column 2 AND is item NOT in Column 1”.
2) In general, Right-Anti-Join Merge are rare because we can accomplish the same goal by using a Left-Anti-Join Merge and switching the Left Table for the Right Table. In fact, in the SQL language and in the DAX Function language code writers use the Except Set Operator or the EXCEPT DAX Function and simply switch the order of the tables when they want to do a Right-Anti-Join Merge.
3) Right Anti Join as seen in Power Query Dropdown List



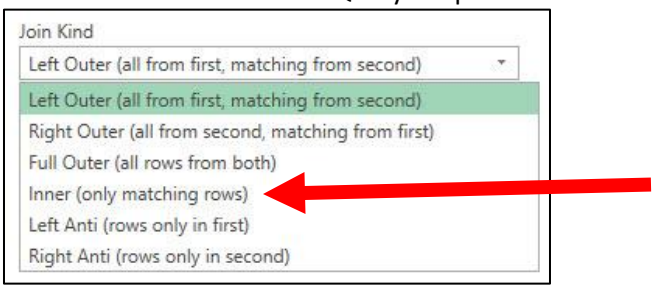


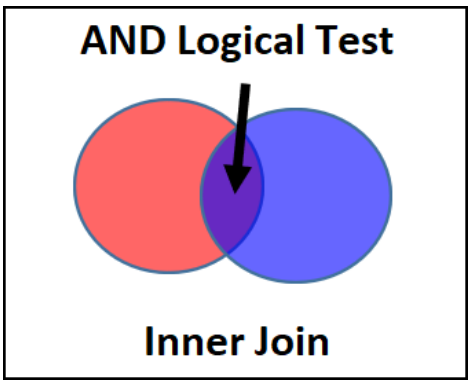
4) The above Venn Diagram illustrates that the overlap between the two tables is not included in the final Right-Anti-Join Merge.
5) Example from video that shows employees that went to second conference, but not first:

	A	B	C	D	E	F
1						
2		**Left Table = Table 1**		**Right Table = Table 2**		**Who Attended Only Bellevue Conference?**
3		**Employees who attended DAX Basics San Jose Conference**		**Employees who attended DAX Basics Bellevue Conference**		**In Table 2, NOT in Table 1 Right-Anti Merge / Join**
4						
5		**EmployeeNameSanJose**		**EmployeeNameBellevue**		**EmployeeNameBellevue**
6		Sol Marroquin		Raven Beatty		Roxanna Mercier
7		Kiera Mcfall		**Roxanna Mercier**		Fanny Denning
8		Raven Beatty		**Fanny Denning**		Lesha Nobles
9		Elinore Dees		**Lesha Nobles**		Gertrudis Fitzpatrick
10		Wei Lockwood		Wei Lockwood		Bernita Crutcher
11		Donald Eldridge		**Gertrudis Fitzpatrick**		Shiela Anaya
12		Claudio Beam		Angelita Packer		Yolonda Armstead
13		Angelita Packer		Beaulah Wenger		
14		Reyna Luke		Malvina Hamer		
15		Beaulah Wenger		**Bernita Crutcher**		
16		Malvina Hamer		**Shiela Anaya**		
17		Vivan Keeney		**Yolonda Armstead**		

12.Inner (AND Logical Test) Merge / Join

1) When we create an Inner Merge / Join, we run an AND Logical Test to check if there are equivalent values in both related columns, and if there are, the query returns records for the matching values. Records are returned only when there are matches in both columns. We are asking the question: "Are there matching items in both columns?"
2) Synonyms for Inner Join:
    i. AND Logic Test.
    ii. ALL TRUE.
    iii. Intersection or Concurrent or Joint.
    iv. Both.
    v. Inner or Inner Join or Natural Join.
    vi. Intersection Operator/Symbol: ∩.
    vii. Only Matching Rows.
3) Inner Join as seen in Power Query Dropdown List:





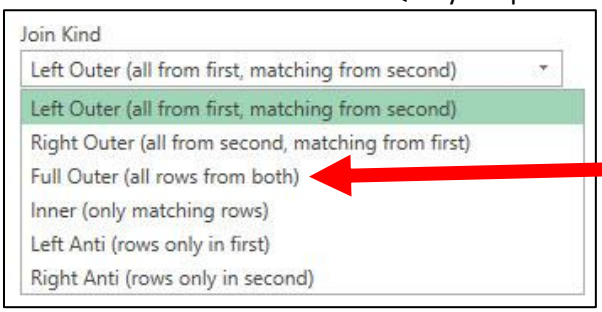
4) An AND Logical Test Venn Diagram below illustrates that it is only the overlap, or the items listed in both tables that will be part of the final Inner Join / Merge.

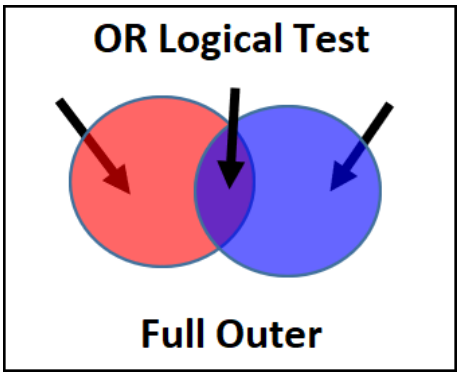
6) Example from video that shows employees that went to both conference:

	B	C	D	E	F
1					
2	**Left Table**		**Right Table**		**Who Attended Both Coferences?**
3	**Employees who attended DAX Basics San Jose Conference**		**Employees who attended DAX Basics Bellevue Conference**		**AND Logical Test (Inner Join)**
4					
5	**Employee**		**Employee**		**Employee**
6	Sol Marroquin		**Chantel Mims**		Chantel Mims
7	Kiera Mcfall		Roxanna Mercier		Wei Lockwood
8	**Chantel Mims**		Fanny Denning		Jamal Hayward
9	Elinore Dees		Lesha Nobles		Beaulah Wenger
10	**Wei Lockwood**		**Wei Lockwood**		Malvina Hamer
11	Donald Eldridge		Gertrudis Fitzpatrick		
12	Claudio Beam		**Jamal Hayward**		
13	**Jamal Hayward**		**Beaulah Wenger**		
14	Reyna Luke		**Malvina Hamer**		
15	**Beaulah Wenger**		Bernita Crutcher		
16	**Malvina Hamer**		Shiela Anaya		
17	Vivan Keeney		Yolonda Armstead		

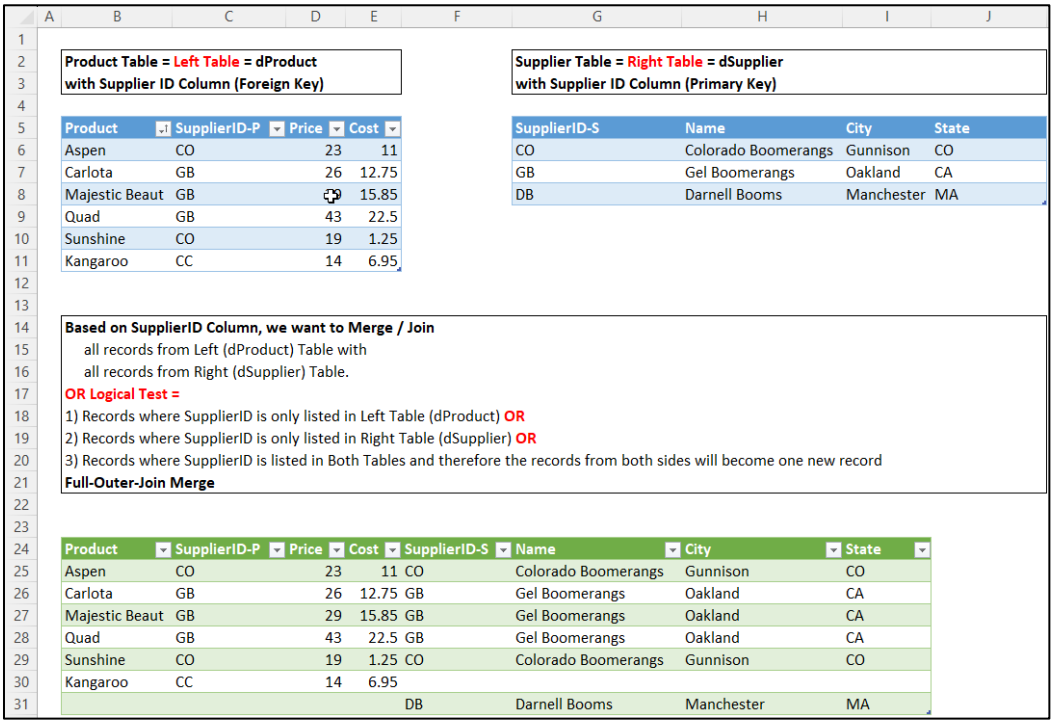
13.Full-Outer (OR Logical Test) Merge / Join

6) When we create a Full-Outer Merge / Join across related columns, we run an OR Logical Test that asks the question: “Are there matching values in the two related columns, or is there an unmatched value in the first column, or is there an unmatched value in the second column?” A Full-Outer Join will return all records from both tables and when there are records that do not have a corresponding value match in the other table, null values will be returned.
7) Synonyms for Full Outer Join:
    i. OR Logic Test.
    ii. Any TRUE.
    iii. Union.
    iv. Give Me All Items.
    v. OR.
    vi. Full Outer.
    vii. Union Operator/Symbol: ∪.
    viii. All Rows From Both.
5) Full Outer Join as seen in Power Query Dropdown List:





6) An OR Logical Test is used when we do a Full Outer Join or when we use the Union operation in Statistics or the SQL language. This means we want all the records from both tables, regardless of whether the Related Columns have matched items. The above Venn Diagram illustrates that all records from both tables will be part of the final Full-Outer Merge / Join.
7) Example from video that shows a Full Outer Join (OR Logical Test):



Product Table = Left Table = dProduct with Supplier ID Column (Foreign Key)

Product	SupplierID-P	Price	Cost
Aspen	CO	23	11
Carlota	GB	26	12.75
Majestic Beaut	GB		15.85
Quad	GB	43	22.5
Sunshine	CO	19	1.25
Kangaroo	CC	14	6.95

Supplier Table = Right Table = dSupplier with Supplier ID Column (Primary Key)

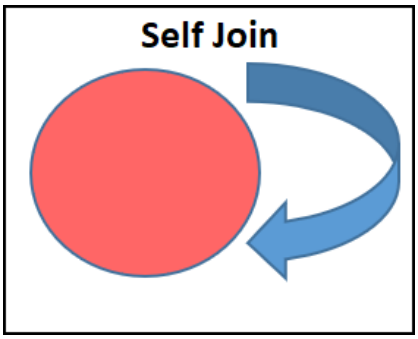
SupplierID-S	Name	City	State
CO	Colorado Boomerangs	Gunnison	CO
GB	Gel Boomerangs	Oakland	CA
DB	Darnell Booms	Manchester	MA

Based on SupplierID Column, we want to Merge / Join
all records from Left (dProduct) Table with
all records from Right (dSupplier) Table.
OR Logical Test =
1) Records where SupplierID is only listed in Left Table (dProduct) **OR**
2) Records where SupplierID is only listed in Right Table (dSupplier) **OR**
3) Records where SupplierID is listed in Both Tables and therefore the records from both sides will become one new record
Full-Outer-Join Merge

Product	SupplierID-P	Price	Cost	SupplierID-S	Name	City	State
Aspen	CO	23	11	CO	Colorado Boomerangs	Gunnison	CO
Carlota	GB	26	12.75	GB	Gel Boomerangs	Oakland	CA
Majestic Beaut	GB	29	15.85	GB	Gel Boomerangs	Oakland	CA
Quad	GB	43	22.5	GB	Gel Boomerangs	Oakland	CA
Sunshine	CO	19	1.25	CO	Colorado Boomerangs	Gunnison	CO
Kangaroo	CC	14	6.95				
				DB	Darnell Booms	Manchester	MA

14.Self- Join / Merge

1) Self-Join is the term used when a join is made between column in a table and another column in the same table.
2) For our example we will use the Employee table as shown in the picture below. Our goal is to add a column to the table that will be based on a Join between the column "Employee Who Referred New Employee" (Foreign Key) and the column EmployeeID (Primary Key) so that we see a name for the employee who referred the new employee rather than an Employee ID. We can use a Left Outer Join and use the "Employee Who Referred New Employee" column in the table as the left side of the join and the "EmployeeID" column in the table as the right side of the join.



3) Example from video where we needed to lookup the employee referral name:

Single Table = EmployeeTable
EmployeeID (Primary Key).
Employee Who Referred New Employee Column (Foreign Key)

Goal: Add new Column to Table that shows name of Employee who referred the new employee.
We will do a Self-Join.

EmployeeID	Name	Hire Date	Employee Who Referred New Employee
1488	Sioux Radcoolinator	3/14/2009	
1489	Catarina Rasmus	5/7/2009	
1490	Kenny Gersten	9/9/2009	1488
1491	Debrah Lukes	3/9/2010	1488
1492	Fletcher Tom	9/6/2010	1490
1493	Laticia Morra	8/18/2011	
1494	Sid Atchley	12/25/2013	1493

EmployeeID	Name	Hire Date	Employee Who Referred New Employee	ReferedBy
1488	Sioux Radcoolinator	3/14/2009		
1489	Catarina Rasmus	5/7/2009		
1490	Kenny Gersten	9/9/2009	1488	Sioux Radcoolinator
1491	Debrah Lukes	3/9/2010	1488	Sioux Radcoolinator
1492	Fletcher Tom	9/6/2010	1490	Kenny Gersten
1493	Laticia Morra	8/18/2011		
1494	Sid Atchley	12/25/2013	1493	Laticia Morra