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Chapter 1 : PowerPivot DAX: CALCULATE is a supercharged SUMIF - PowerPivotPro

Excel Replace Calculated Fields with DAX This page created on Tuesday, November 15, by Bill Jelen This page is an advertiser-supported excerpt of the book, Power Excel from MrExcel - Excel Mysteries Solved.

Quickly create relationships between data tables, similar to a database. Analyze your data with Pivot Tables in Excel, an environment you are familiar with. Create advanced formulas and measures to analyze data like never before. Link Excel files directly to your databases and data sources to quickly refresh your reports. There are many more features of Power Pivot, and this list is just meant to give you an idea of what it can do. But you will see how Power Pivot makes it much faster and easier to create and maintain relationships between data sets in your Excel files. So there is no risk in trying it out. A Common Reporting Process Does the following process look familiar to you? This is a common process we go through to summarize and analyze a data set: Copy or import a set of data into Excel. In this example we are going to use a set of sales data. Then we will be able to create a report using a Pivot Table that shows the sales by Category. The question then becomes, how much is this relationship costing you? Excel Tables and structured reference formulas resolve a lot of these issues and I highly recommend learning about Tables Adding an additional column to lookup table means the column index argument needs to be updated. You either know it so well that you keep a checklist of potential problems along with your toolbox in the back of the truck, just in case something goes wrong errors. Power Pivot allows you to create relationships between tables with a simple drag-and-drop. This means there is NO formula to maintain here, and it is much faster and easier to build relationships between your tables. But all I have to do is drag-n-drop the field names between tables, and the relationship is created. The PowerPivot Pivot Table Once we create the relationships between the Data table and lookup tables, we can then summarize the data with a Pivot Table. As you can see, it looks very similar to a normal Pivot Table. This makes it easier to understand and work with. Some examples of these measures could include: It will take you to new places that you only dreamed of before. It is still very useful, and one that every analyst should know. This new technology will really take your work, and career, to the next level. Just like Excel, Power Pivot is not something you are going to master overnight. Personally, I have read books, taken courses, and done a ton of Google searches to learn Power Pivot. I will definitely be writing more in-depth articles in the future. Fortunately there are some great resources available that are making Power Pivot easier to learn. She is also offering a new course on Pivot Tables if you want to learn the basics first. For a limited time I am offering a huge bonus when you sign-up for any of her courses through me. This includes my new Tab Hound add-in, a book on Excel Tables, and more. What Do You Think? Could Power Pivot help you with some of your financial models? Please leave a comment below with any questions. If you have used Power Pivot, please let us know how your journey is going. Jon Acampora Welcome to Excel Campus! I am excited you are here. My name is Jon and my goal is to help you learn Excel to save time with your job and advance in your career. I am also a Microsoft MVP. I try to learn something new everyday, and want to share this knowledge with you to help you improve your skills. I read the forum and blog posts below and found out that: Let me know if you have any suggestions.

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Chapter 2 : Excel: Replace Calculated Fields with DAX - Excel Articles

Excel , Power BI for Office Preview, Power Pivot in Excel Is there a excel solution. I have tried calculations in DAX, but most of the time the field is not allowed in the values filed when I attempt to drag it down within the pivot table.

PowerPivot for Excel 5 3. Samples â€" Contoso Database 8 D. DAX Goals 9 2. DAX Syntax 13 4. DAX uses PowerPivot data types 13 5. Simple DAX Functions 16 1. Row Context and Filter Context 24 1. Row Context 24 3. Relationships and Filter Context 27 4. Measures and Filter Context 27 G. More DAX Functions 28 1. Time Intelligence Functions 36 1. Concepts and Best Practices 36 2. Functions that return a single date 38 3. Functions that return a table of dates 42 Year over Year Growth 43 Calculating many time periods within a single measure formula 44 4. Functions that evaluate expressions over a time period 49 I. Sample Formulas 50 2. Executive Summary There are millions of Microsoft Excel users who are familiar with using Excel formulas to perform calculations. Those calculations may be as simple as adding up a column of numbers, or they may be far more complex simulations of various business models. But in every case, each formula is built using a combination of basic operators and functions that are provided within Excel as the building blocks for such formulas. PowerPivot for Excel provides the building blocks needed to build business intelligence solutions, whether those solutions use simple calculations or something significantly more complex. The building blocks include the ability to import data tables from a wide variety of data sources, the ability to perform calculations on large volumes of in-memory data quickly, the ability to author custom calculations using the DAX Data Analysis Expressions language, and the ability to use the result of those calculations in Excel PivotTables. Data Analysis Expressions are very similar to Excel formulas, and there is considerable overlap between the list of DAX functions and Excel functions. These functions are designed to offer capabilities that focus on data analysis, particularly for related tables of data, and for dynamic analysis. The ability to define calculations that will be evaluated dynamically in many different contexts is a powerful tool, and prior to PowerPivot and DAX, these sorts of calculations often involved more complex multi-dimensional concepts and languages. With Data Analysis Expressions, it is our hope that Excel users will be able to easily learn how to perform data analysis, using DAX formulas that look a lot like Excel formulas, but that provide additional capabilities, and that are much easier to learn and use than the multi-dimensional constructs more generally used by IT professionals to perform this sort of data analysis. In addition to covering the functions themselves, there is a discussion of the important concepts that any PowerPivot user will want to know. It is hoped that this paper might be a good way to become familiar with the basics of the DAX formula language.

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Chapter 3 : Calculated Columns and Measures in DAX - SQLBI

To learn more, see Calculated Columns in Power Pivot. In the table you want to add the new column to, scroll to and click the right-most column. In the formula bar, type a valid DAX formula, and then press Enter.

For example, Wednesday, March 12, The d character displays the day in a user-defined date format. The t character displays AM or PM values for locales that use a hour clock in a user-defined time format. For example, March The M character displays the month in a user-defined date format. The m character displays the minutes in a user-defined time format. For example, Wed, 12 Mar The formatted date does not adjust the value of the date and time. The s character displays the seconds in a user-defined time format. For example, For example, Wednesday, March 12, 6: For example, March, The Y and y characters display the year in a user-defined date format. Remarks Formatting strings are case sensitive. Different formatting can be obtained by using a different case. For example, when formatting a date value with the string "D" you get the date in the long format according to your current locale. However, if you change the case to "d" you get the date in the short format. Also, unexpected results or an error might occur if the intended formatting does not match the case of any defined format string. In some locales, other characters may be used to represent the time separator. The time separator separates hours, minutes, and seconds when time values are formatted. In some locales, other characters may be used to represent the date separator. The date separator separates the day, month, and year when date values are formatted. Also used to indicate that a single-letter format is read as a user-defined format. See what follows for additional details. M Displays the month as a number without a leading zero for example, January is represented as 1. MMM Displays the month as an abbreviation for example, Jan. H Displays the hour as a number without leading zeros using the hour clock for example, 1: HH Displays the hour as a number with leading zeros using the hour clock for example, For example ff displays hundredths of seconds, whereas ffff displays ten-thousandths of seconds. You may use up to seven f symbols in your user-defined format. For locales that use a hour clock, displays nothing. LEFT Returns the specified number of characters from the start of a text string. Whereas Microsoft Excel contains different functions for working with text in single-byte and double-byte character languages, PowerPivot for Excel works with Unicode and stores all characters as the same length; therefore, a single function is enough. The text string containing the characters you want to extract, or a reference to a column that contains text. Returns a text string. Example The following example returns the first five characters of the company name in the column [ResellerName] and the first five letters of the geographical code in the column [GeographyKey] and concatenates them, to create an identifier. For example, the column [GeographyKey] contains numbers such as 1, 12 and ; therefore the result also has variable length. LEN Returns the number of characters in a text string. Whereas Microsoft Excel has different functions for working with single-byte and double-byte character languages, PowerPivot for Excel uses Unicode and stores all characters with the same length. Therefore, LEN always counts each character as 1, no matter what the default language setting is. If you use LEN with a column that contains non-text values, such as dates or Booleans, the function implicitly casts the value to text, using the current column format. The text whose length you want to find, or a column that contains text. Spaces count as characters. Example The following formula sums the lengths of addresses in the columns, [AddressLine1] and [AddressLine2].

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Chapter 4 : Power Pivot and Power Query for Excel | Power BI | Global Knowledge

Add a Calculated Field in PowerPivot Excel PowerPivot Basics # DAX Formulas Can Be Easier & Faster Than Array Formulas Calculated Column and Fields in Power Pivot - Duration.

Learn how to calculate the average of a daily total amount across month, quarters, years, or even categories with a pivot table. Intermediate Watch on YouTube and give it a thumbs up. Download the Excel File You can download the Excel files below. In this case his data set contained a sales transaction in each row. There are multiple sales per day, so the dates will repeat in the Date column. If we use the regular Average calcluation type in the pivot table, the result will be the average amount per transaction. This is NOT what we want. Instead, we want to see the average daily total across a larger time period like months quarters or years. Why Analyze Daily Averages? The daily average metric can be useful in comparing trends for daily totals across time period months, quarters, etc. We can use a line chart or column chart to quickly see how the daily average changes over time. You will need Excel or later for Windows for this method. This includes Office Unfortunately, this will not work on Excel , or the Mac versions of Excel. This can be any amount numeric value. It does NOT have to be sales data. We are going to create explicit measures for three calculations: Total Sales In the Formula box type: The measure will be created and added to the bottom of the Fields List. Repeat the steps above for the other two measures. Implicit vs Explicit Measures For the first two formulas we could also create the calculations by dragging the Amount and Date fields into the Values area, then changing the calculation type as need. These are know as implicit measures when we use Excel to create the measure by dragging and dropping fields. The other option is to write the formulas in the Measure window, like we did above. These are known as explicit measures because we clearly explained or defined them in the formula editor. One advantage of the explicit measures is that we can continue to use them in other formulas or pivot tables. Now that we have defined the Total Sales measure, it will be available in all new pivot tables from the data model. We can also re-use the Total Sales measure, as we did in the Daily Average measure, and continue to build more complex formulas with it. This saves time and makes formula writing more efficient in the long run. There are also advantages when using Power BI and bringing the data model back into Excel. Add the Measures to the Pivot Table The next step is to add the measure fields to the Values area of the pivot table. You do NOT need to add all of the measure fields to the pivot table. The calculations will still work even if you only add the Daily Average field to the Values area. Calendar tables allow us to create relationships between different data sources. They can also be used if your company is on a fiscal calendar. Here is a screenshot that shows how to turn the subtotals on. To turn the Subtotals on in a pivot table: Select a cell inside the pivot table. Select the Design tab in the ribbon. You should now see the subtotal calculations for the row area groupings year, quarter, month. Analyze the Trends Finally we can add a quick pivot chart to analyze the trends of the daily averages. We can see that the North region did better than the South in the last two months of the year. And the South had a declining trend after March. DAX measures are amazingly powerful, and this simple example only scratches the surface of their capabilities. Please leave a comment below and let us know. During this 60 minute training I explain the critical steps to building pivot tables to prevent errors and truly understand how they work. We also talk about getting the source data in the right layout, which is the most critical step to building a pivot table.

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Chapter 5 : Excel Power Pivot Basics of DAX

In Power Pivot, one of the major and more powerful feature are Measures.. Measures (also known as Calculated Fields in Excel) are formulas/calculations that are added to a Pivot Table.

What is a Measure? A measure is a formula for the values area of Power Pivot table. A measure can be implicit or explicit. Implicit measures are created automatically when you drag and drop a field in to Power Pivot values area. You can also create a measure in the Power Pivot window. Calculated Fields They both refer to the same thing in the context of Power Pivot. Starting Excel , Measures became Calculated Fields. So what is DAX then? It is a special language we use to create measures in Power Pivot. Although it is a special language, it looks exactly like our regular Excel formulas. That means you can easily learn the DAX basics and create measures in no time. An upgraded version of Excel formulas that can handle power pivot data and give you the calculations you want. Lets create a measure Step 1: Decide what the measure should do The first step is to figure out the need for a measure. Lets say we want a measure to sum up total sales. Launch New Measure screen In Excel Excel looks almost similar. Give our measure a name Lets call it Total Amount Step 4: When you press OK, a new measure Total Amount will be created and attached to the Sales table in your power pivot data model. It looks like this, Step 5: Add this measure to your Power Pivot report Just drag and drop this measure in to values area of your pivot report. Instantly total sales amount will be calculated based on your report set up. Why bother creating a measure for such simple thing as SUM? I know you would be asking this. It seems like a lot of trouble to create a measure, to just show the sum of sales amount. The power of DAX formula engine is truly phenomenal. To prove it, lets play a small game. Imagine how much time you would take to write a regular Excel formula or setting up a regular Pivot report to answer each of these questions: And the beauty is, once we have a measure that tells us sales made in weekends, we can use it in any report: I made a video 30 mins explaining below topics:

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Chapter 6 : When to Use Measures vs. Calc Columns - PowerPivotPro

So - in Excel they called Measures and in Excel they are called Calculated Fields. Okay, so at left is a Pivot Table based on the same table in the Calculated Column section. I have added a Measure Calculated Field: Total Value:= SUM(Table1[Value]).

So, here goesâ€¦ the only reason I am writing this post is so that I can link to itâ€¦ from over on the Mr Excel Forums. While a bunch of my posts have been very not targeted at brand new folks, the people asking questions on the forum tend to be completely new to Power Pivot. Or at least, that is what they are doing in my head. So, I am going to step back a bit and cover this basic concept. Sorry about calling you a red head. Unless you are a red head. Calculated Columns Of the two, this one is probably easier to understand. Calculated Columns areâ€¦ um, wellâ€¦ they are columns that areâ€¦ umâ€¦ calculated? They show up in a different color, and they are based on a formula. This does exactly what you expect, returning 3 times whatever was in the [Value] column into the new column. This calculation happens only during data refresh. It is not dynamic at all. They can be used as a filter. You can put the values on slicers, on rows, on columns, etc. They can be weird For proof, you can go look at this post. Calculated Fields First of all, you have to understand that all cool people call them Measures. This is what they were called before Microsoft decided to make me sad and change the name. All the old timers still call them Measures, and I have no stinking idea why they changed the name. Okay, so at left is a Pivot Table based on the same table in the Calculated Column section. I have added a Measure Calculated Field: Calculated Fields are evaluated dynamically and frequently. Then similar for the green row. Then the red row. Then the grand total row. Calculated Fields can not be placed on rows, columns or slicers. Calculated Fields always operate in aggregate. Which is to say they take a collection of rows ie, a table â€¦ and return a single value. There is a whole table of values! Which To Choose Meh. Second things second is that even a saying? If your name is Marco Russo , just kidding. You can imagine it all you want. But, the vast majority of the timeâ€¦ because you will save memory by not storing the calculated values and because computers are really stupid fast at math, but much slower at retrieving memory your model will be faster using a calculated measure. Hopefully next time I ask you this question, you will look like Ron on the left. If you look like Ron on the rightâ€¦ maybe hit me up in the comments, and we will get you straightened out!

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Chapter 7 : Getting Started with DAX in Power Pivot â€“ Devin Knight

Excel reverted back to "measures", which is the term used in DAX and originally used in Power Pivot for Excel , too. In the previous example you learned how to define the GrossMargin column in the Sales table to compute the gross margin amount.

One of the first concepts to learn in DAX is the difference between calculated columns and measures. This article shortly recaps the differences and describes when to use each one. The content of the columns is defined by a DAX expression evaluated row by row. The user interface is different depending on the tools you use. You can rename the new column before or after defining the expression by right-clicking the new column and selecting the Rename Column menu item. In Power BI Desktop, you have a different user interface. You have to click the New Column button in order to create a new column. The new column name is part of the formula you write in the formula textbox. The user interface allows you to simply define a new column, but we talk about calculated column to make a distinction between native columns those read from the data source or evaluated by a query written in Power Query or Power BI and calculated columns those created extending a table in the data model. A calculated column is just like any other column in a table and you can use it in any part of a report. You can also use a calculated column to define a relationship if needed. The DAX expression defined for a calculated column operates in the context of the current row across that table. Any reference to a column returns the value of that column for the current row. You cannot directly access the values of other rows. One important concept that you need to remember about calculated columns is that they are computed during the database processing and then stored in the model. This might seem strange if you are accustomed to SQL-computed columns â€” not persisted â€” which are computed at query time and do not use memory. In data models for DAX, however, all calculated columns occupy space in memory and are computed during table processing. This behavior is helpful whenever you create very complex calculated columns. The time required to compute them is always process time and not query time, resulting in a better user experience. Nevertheless, you must always remember that a calculated column uses precious RAM. If, for example, you have a complex formula for a calculated column, you might be tempted to separate the steps of computation in different intermediate columns. Although this technique is useful during project development, it is a bad habit in production because each intermediate calculation is stored in RAM and wastes precious space. For convenience, when writing a formula for a calculated column in an article or in a book, we use the following convention: Depending on the tool you use, you have to omit the table name or both table name and column name in the formula you enter in the user interface. For example, consider the following expression in an article: These calculations are measures. In the previous example you learned how to define the GrossMargin column in the Sales table to compute the gross margin amount. However, what happens if you want to show the gross margin as a percentage of the sales amount? You could create a calculated column with the following formula: Nevertheless, when computing the aggregate value of a percentage, you cannot rely on calculated columns. Instead you need to compute the aggregate value as the sum of gross margin divided by the sum of sales amount. Therefore, in this case, you need to compute the ratio on the aggregates â€” you cannot use an aggregation of calculated columns. In other words, you compute the ratio of the sums, not the sum of the ratio. You cannot use a calculated column for this operation. If you need to operate on aggregate values instead of on a row-by-row basis, you must create measures. For convenience, when writing a formula for a measure in an article or in a book, we use the convention: Depending on the tool you use, you have to use a different syntax when entering the formula in the user interface. For example, consider the correct implementation for the GrossMarginPct defined as a measure: This convention makes it easier to differentiate between measures and columns in code. Measures and calculated columns both use DAX expressions. The difference is the context of evaluation. A measure is evaluated in the context of the cell evaluated in a report or in a DAX query, whereas a calculated column is computed at the row level within the table it belongs to. The

context of the cell depends on user selections in the report or on the shape of the DAX query. So when you use SUM Sales[SalesAmount] in a measure, you mean the sum of all the cells that are aggregated under this cell, whereas when you use Sales[SalesAmount] in a calculated column, you mean the value of the SalesAmount column in the current row. A measure needs to be defined in a table. This is one of the requirements of the DAX language. However, the measure does not really belong to the table. In fact, you can move a measure from one table to another one without losing its functionality. Choosing between calculated columns and measures Even if they look similar, there is a big difference between calculated columns and measures. The value of a calculated column is computed during data refresh and uses the current row as a context; it does not depend on user interaction in the report. A measure operates on aggregations of data defined by the current context, which depends on the filter applied in the report â€" such as slicer, rows, and columns selection in a pivot table, or axes and filters applied to a chart. At this point, you might be wondering when to use calculated columns over measures. Sometimes either is an option, but in most situations your computation needs determine your choice. You have to define a calculated column whenever you want to do the following: Place the calculated results in a slicer, or see results in rows or columns in a pivot table as opposed to the values area , or in the axes of a chart, or use the result as a filter condition in a DAX query. Define an expression that is strictly bound to the current row. Categorize text or numbers. For example, a range of values for a measure, a range of ages of customers, such as 0â€"18, 18â€"25, and so on. However, you must define a measure whenever you want to display resulting calculation values that reflect user selections and see them in the values area of a pivot table, or in the plot area of a chart â€" for example: When you calculate profit percentage on a certain selection of data. When you calculate ratios of a product compared to all products but keeping the filter both by year and region. You can express some calculations both with calculated columns and with measures, even if you need to use different DAX expressions in these cases. For example, you can define the GrossMargin as a calculated column: This becomes more crucial with large datasets. When the size of the model is not an issue, you can use the method you are more comfortable with. You should consider that usually you can avoid calculated columns as intermediate calculations for a measure. For example, if you have to create a measure based on the result of a product made row-by-row, you can define a calculated column and then a measure as follows: For example, we created the following calculated columns and measure in the previous example: Calculated columns in DAX are useful whenever you have to use data from other tables in the data model, or consider aggregated data in a computation. Two examples where the calculated columns are very useful are the Static Segmentation and the ABC Classification patterns. Learning DAX from scratch?

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Chapter 8 : DAX Formulas for PowerPivot - Recommended Excel Book

PowerPivot - New Measure - Calculated Field - Two Tables Hello, I am using Excel and have difficulties to do a calculation (whether using measure or column).

Measure, or Calc Column? Guideline 1 â€" When a desired number is a fixed property of a single row, calc columns are usually appropriate. You have a Sales table, in which every row is a separate transaction. The table has [ProductCost] and [SalesAmount] columns and you want to know how much Margin Profit is made on each transaction. It is perfectly reasonable and desirable to add a calc column that calculates this for you: And that margin amount is NOT something that is subject to change. Another example would be in a Calendar table where each row is a single day , adding a column like IsWeekday or, in the example below, YearMonth: So use a calc column or a regular column of course. There is no way to put a measure anywhere in a pivot except the Values area. I need to use it on a pivot before I get any insight from it. So am I breaking the rules if I create a calc column and then add it to Values? No, not at all. More accurately, I think the question people struggle with the most is this: In those cases, using a calc column and then adding to Values, or even writing a Measure that references the column is perfectly OK. I think that matches the instincts of anyone who has worked with traditional pivots. What I am telling you is that you need NOT feel guilty about trusting those instincts! And you write lots of calc columns but never write measures. Are you doing it wrong? No, the things you are doing, you are probably doing correctly. And those things are some of the most magical things in PowerPivot. In short, you write measures to do things that no calc column CAN do. Most of the book is spent on that in fact. Your average selling price across all transactions for instance. Numbers that need to change as you rearrange the pivot â€" technically speaking, you CAN write aggregate formulas in calc columns. I have a SalesTerritory table that is related to my Sales table. I can certainly write a calc column, in the SalesTerritory table, that determines the average SalesAmt per transaction for each territory: When I put that calc column on my pivot I get the same numbers as in the table above: Calc Column Results are Forever. Until the Next Data Refresh Anyway. Again, this is really nothing new. Traditional pivots work the same way. Wrapping Up So, we use calc columns in PowerPivot just like we did in traditional pivots. We use measures to do magical things that we could not have done in traditional pivots, like Average Sales per Day, or Sales vs. To those DAX monsters, I say: But those still largely go over my head, and might remain that way for some time. And yes, if you can calculate a column in the source database rather than in PowerPivot, there are benefits that I highly recommend. Nothing in this post changes that for me.

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Chapter 9 : Data Analysis Expressions (DAX) in Power Pivot - Excel

In Excel , it was renamed to Calculated Field, still available via PowerPivot ribbon: Anyway, I downloaded your data and created new measures (= calculated fields) for all of your columns, which was the key.

You can nest up to 64 levels of functions in calculated columns. However, nesting can make it difficult to create or troubleshoot formulas. Many PowerPivot functions are designed to be used solely as nested functions. These functions return a table, which cannot be directly saved as a result to the PowerPivot workbook; it must be provided as input to a table function. Some limits on nesting of functions exist within measures, to ensure that performance is not affected by the many calculations required by dependencies among columns. DAX Data Types You can import data into a PowerPivot worksheet from many different data sources that might support different data types. When you import or load the data into a workbook and then use the data in calculations or in PivotTables, the data is converted to one of the PowerPivot data types. The table data type is a new data type in DAX that is used as the input or output to many new functions. For example, the FILTER function takes a table as input and outputs another table that contains only the rows that meet the filter conditions. By combining table functions with aggregation functions, you can perform complex calculations over dynamically defined data sets. Formulas and the Relational Model The PowerPivot window is an area where you can work with multiple tables of data and connect the tables in a relational model. Within this model, tables are connected to each other by relationships, which let you create correlations with columns in other tables and create more interesting calculations. For example, you can create formulas that sum values for a related table and then save that value in a single cell. Or, to control the rows from the related table, you can apply filters to tables and columns. Because you can link tables by using relationships, your PivotTables can also include data from multiple columns that are from different tables. However, because formulas can work with entire tables and columns, you need to design calculations differently than you do in Excel. In general, a DAX formula in a column is always applied to the entire set of values in the column never to only a few rows or cells. Tables in PowerPivot must always have the same number of columns in each row, and all rows in a column must contain the same data type. When tables are connected by a relationship, you are expected to make sure that the two columns used as keys have values that match, for the most part. Because PowerPivot does not enforce referential integrity, it is possible to have non-matching values in a key column and still create a relationship. However, the presence of blank or non-matching values might affect the results of formulas and the appearance of PivotTables. When you link tables in your workbook by using relationships, you enlarge the scope, or context, in which your formulas are evaluated. For example, formulas in a PivotTable can be affected by any filters or column and row headings in the PivotTable. You can write formulas that manipulate context, but context can also cause your results to change in ways that you might not anticipate. Introduction to Context Formulas in PowerPivot can be affected by the filters applied in a PivotTable, by relationships between tables, and by filters used in formulas. Context is what makes it possible to perform dynamic analysis. Understanding context is important for building and for troubleshooting formulas. There are different types of context: Row context can be thought of as "the current row. Query context refers to the subset of data that is implicitly created for each cell in a PivotTable, depending on the row and column headers. Filter context is the set of values allowed in each column, based on filter constraints that were applied to the row or that are defined by filter expressions within the formula. Updating the Results of Formulas Data refresh and recalculation are two separate but related operations that you should understand when designing a data model that contains complex formulas, large amounts of data, or data that is obtained from external data sources. Refreshing data is the process of updating the data in your workbook with new data from an external data source. You can refresh data manually at intervals that you specify. Or, if you have published the workbook to a SharePoint site, you can schedule an automatic refresh from external sources. Recalculation is the process of updating the results of formulas and calculated columns in your workbook to

reflect any changes to the formulas and to reflect changes in the underlying data. Recalculation can affect performance in the following ways: For a calculated column, the result of the formula must always be recalculated for the entire column, whenever you change the formula. For a measure, however, the results of a formula are not calculated until the measure is placed in the context of the PivotTable or PivotChart. The formula will also be recalculated when you change any row or column heading that affects filters on the data or when you manually refresh the PivotTable.