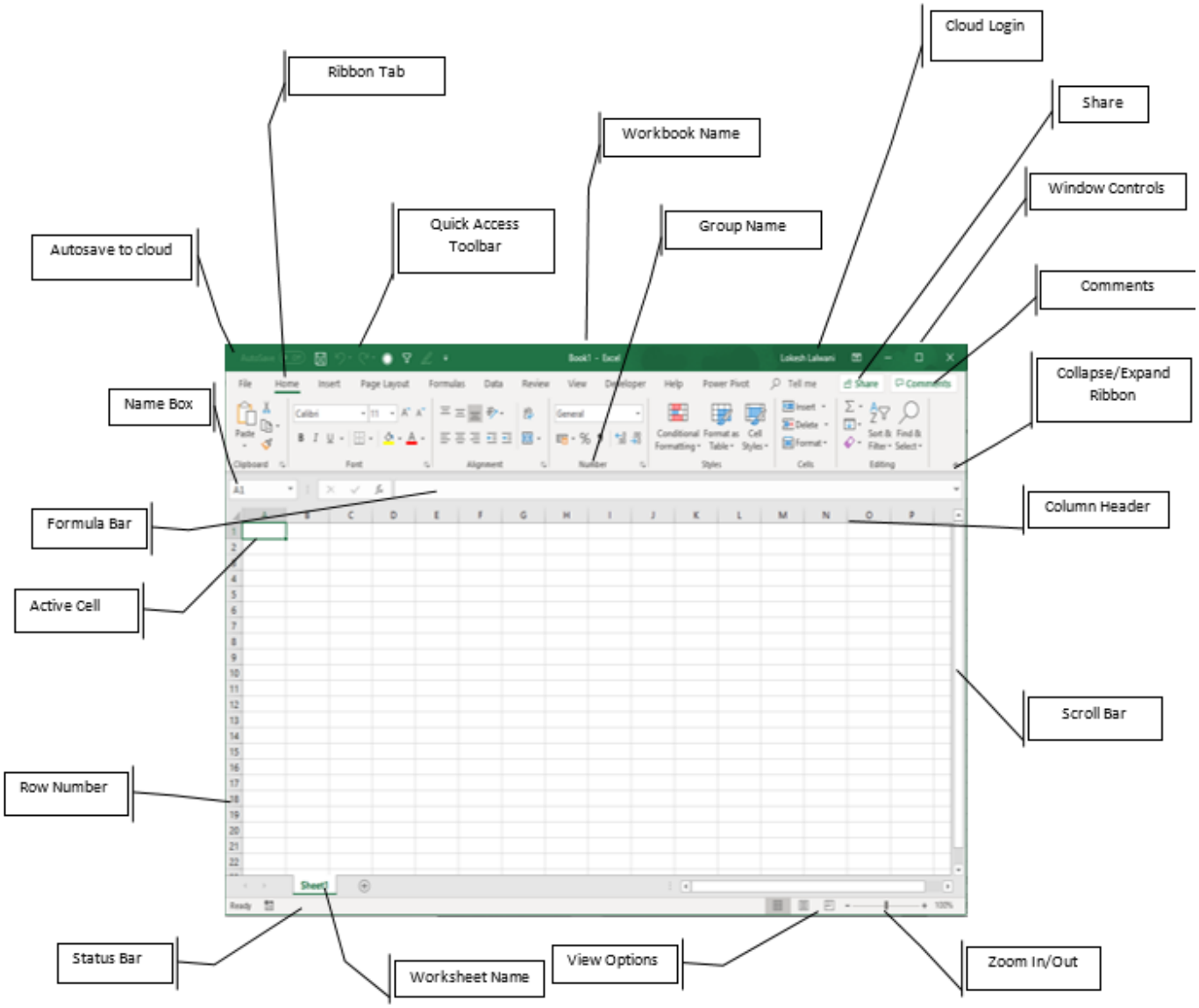
Microsoft Excel

Excel is, by far, the most preferred spreadsheet program in the world. People love it because of its simplicity and easy user interface. The primary focus of Excel is to perform basic to advanced level numeric calculations. Every industry, department, and role is dependent on Excel to perform day-to-day duties as well as data analysis and visualization.

Excel Interface:



Why use Excel

Excel can be used for following purposes:

Data entering/capturing: In Excel, data can be entered manually or captured into using **Get Data** group. In Excel 2019/Office 365, data can be captured from many sources like another file (for example. another Excel workbook, Text/CSV, XML, JSON, Folder, and so on), database (for example. SQL Server, Microsoft Access, Analysis Services, SQL Server Analysis Services), online services (for example Facebook), other sources (from example Table/Range, Web, Microsoft Query, OData Feed, ODBC, OLEDB, Blank Query) or by combining Queries (Merge Query, Append Query).

Data cleaning: Sometimes capturing the data from a non Microsoft application may corrupt the data which needs to be clean first before any analysis can be done on the same. For this Excel provides some very strong and easy to use data cleaning options such as Text to Columns, case change (for example, UPPER, LOWER, PROPER), data extraction from cells (LEFT, RIGHT, MID, FIND, SEARCH), data concatenation (CONCATENATE, &, TextJoin).

Data Management: Although it is important to understand that Excel is not a Database Management System (DBMS) like Microsoft Access, it still gives us many data management tools like Lookup functionality (VLOOKUP, HLOOKUP, LOOKUP, INDEX, and MATCH, and so on), Sort & Filter, Advanced Filter, Date & Time functions, conditional calculations, financial functions, Statistical functions, and so on.

Data analysis: Microsoft Excel provides a variety of options for analyzing. data. Few of the most commonly used options are pivot table and/or Power Pivot, Analysis toolpak, and What-If Analysis.

Data visualization: Microsoft Excel improved its data visualization immensely in Excel 2019/Office 365. The bucket of charts has some new ones in this latest version like Map and Funnel Charts, apart from Waterfall, Histogram, Sunburst, and TreeMap, which were introduced in the earlier version. Sparkline, Slicer, Timeline, PivotChart and conditional formatting are also a part of data visualization.

Data extraction: Data can be extracted directly on a paper using print command or in soft form as an Excel Workbook, PDF, Microsoft Word, CSV, XML, Web Page, Text, Add-In or XPS, or uploaded to Power BI for further analysis and visualization.

Automation: Almost every Excel user performs some repetitive tasks daily, weekly, bi-weekly, monthly, quarterly, half-early, or yearly. Sensing the need to have some automation solution Microsoft introduced the concept of Macros, where tasks that need to be done more than once can be recorded and let Excel do the same next time.

Autosave to cloud: While using Office 365, being logged in to Microsoft account will autosave the workbook and any changes made to it. Fear of losing data will be eliminated with this autosave option.

Name Box: This box always shows the active cell address. Any name can be assigned to a cell or a range and can be used in the reference of the same.

Formula Bar: It shows the content of the active cell. It may contain a formula/function, text, or a number that can directly be edited here.

Active Cell: A cell is formed from the intersection of a row and column.By default Excel shows all the cells in gridlines. A green color border on a cell shows that it is active.

Row Number: There are over one million rows and each row is assigned a number.

Column Header: Excel has over sixteen thousand columns in each worksheet. Each column is assigned an alphabet. This can also be changed to numbers through the File tab but the alphabet is a favorite among Excel users.

Status Bar: This shows the current status of Excel. Also, by default, it shows the basic calculation of the selected range of cells.

Worksheet Name: This states the name of the worksheet. Default names are sheet1, sheet2, sheet3, and so on. which can be renamed by right clicking on the Worksheet Name | Rename.

View Options: An Excel Worksheet has few view options which can be accessed from here, such as Normal, Page Layout, and Page Break Preview.

Zoom In/Out: Zooming in and out of the worksheet can be accessed from the View tab or can be quickly accessed from here.

Scroll Bar: The size of the scroll bar decreases with an increase in the data in the worksheet. Page down (Pgdn) or Page up (Pgup) keys can be used as shortcuts to scroll up and down a page at a time.

Collapse/Expand Ribbon: This can be used to pin up the expansion of the ribbon. It is quite handy to have an expanded ribbon.

Comments: This is an Office 365 feature where comments can be added to an Excel file (unlike to a cell).

Window Controls: Excel windows can be minimized, resized or closed using the options in this set of controls.

Share: Multiple users can edit the same workbook/worksheet at a time using this feature. Their names can also be seen along the cursors in the sheet.

Cloud Login: Logging in will enable several features like Autosave, Share, Comments, and so on.

Workbook Name: This feature displays the name of the workbook.

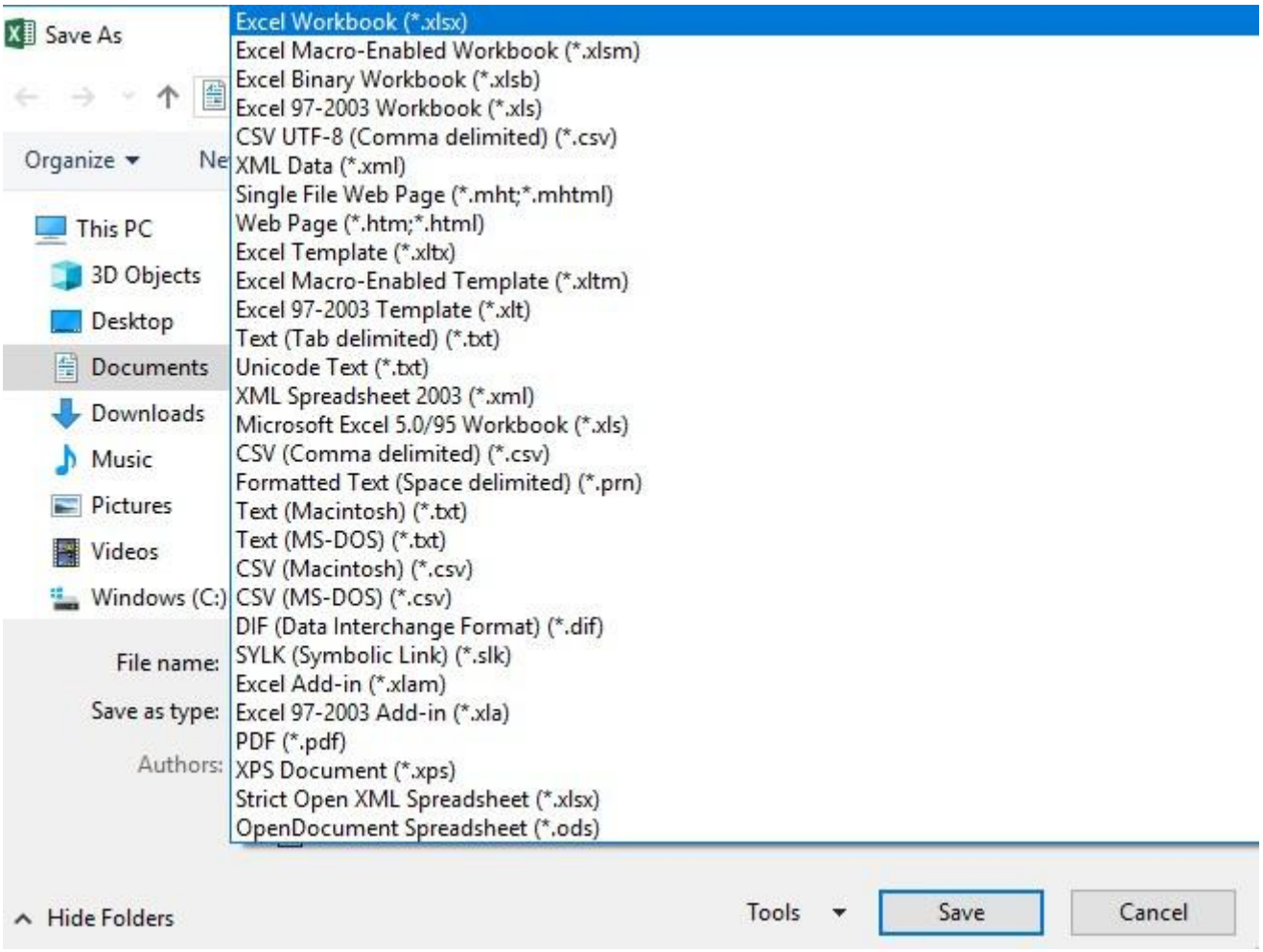
Quick Access Toolbar (QAT): This toolbar is very handy as here one can place their regularly used features of Excel. One can use the same through the Alt key and add any function/feature of Excel using a little dropdown in QAT.

Ribbon Tab: By default, Excel provides a set of tabs, and if needed, these can be customized by right clicking on the tab name.

Group Name: Each tab in the ribbon has a certain group that in turn contains a set of options.

Workbooks and Worksheets

An Excel workbook is just a notebook, while an Excel worksheet is like the sheets in that notebook. We can have any number of workbooks we need, and keep them all open simultaneously. A workbook contains worksheets, chart sheets, and macro sheets. We can have an unlimited number of sheets in a workbook. By default, the file extension of an Excel workbook is .xlsx. An excel workbook can be saved in several file formats.



A worksheet is a combination of columns and rows and the intersection of the same is called a cell. A worksheet has over a million rows and over sixteen thousand columns, giving us billions of cells. The moment you delete columns, rows, or cells, Excel will insert those many fresh columns, rows, or cells, thus maintaining their default number.

A worksheet can be renamed by double or right clicking and typing in the new name.

CONCAT

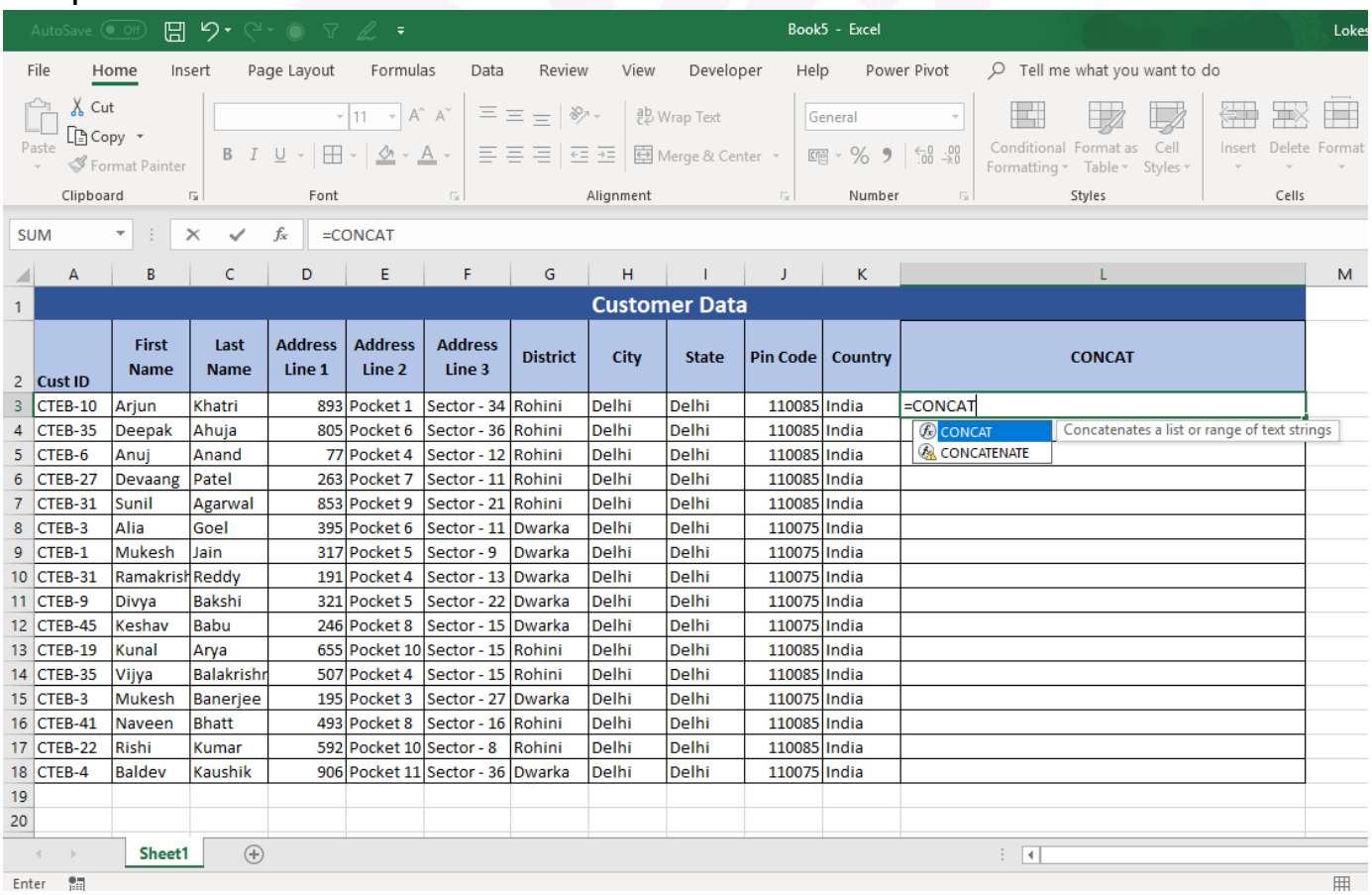
Unlike CONCATENATE function, CONCAT has the capability to join multiple cells at one go, in other words, instead of referring to single cells, you can give a range of cells and the content of all the cells within that range will be moved to one cell. This function has replaced CONCATENATE, but it is still available for compatibility with previous versions.

Syntax:

CONCAT(text1, [text2],....)

- text1 (required): It could be text, a cell, or even a range of cells.
- text2 (optional): Additional text that needs to be joined with text1. This could be text, a cell, or even a range of cells.

Example:



Let's take an example of customer data where the customer address is mentioned in multiple columns, and that needs to be concatenated so that a single address line can be printed on a letter to be mailed to the customer. Let's open the function

Text Join

This is an advanced CONCAT function that can join text from multiple cells and even it can accept a delimiter. In the previous example, we used CONCAT to join different address line items but it was without a separator (delimiter). TEXTJOIN gives us the option to set a delimiter when concatenating text from different cells.

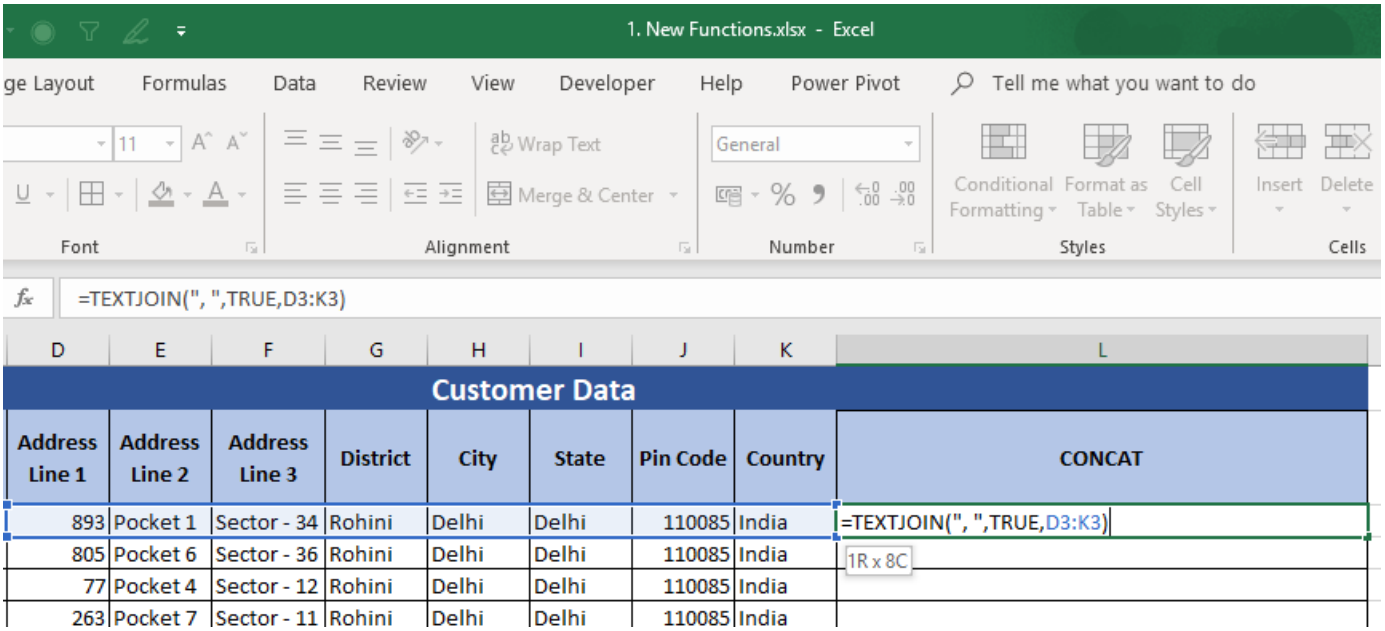
Syntax:

TEXTJOIN(delimiter, ignore_empty, text1, [text2], ...)

- delimiter: This is the required term. It is a common character(s) that needs to be added after each cell/text in the range.
- ignore_empty: This is the required term. This will ignore all the empty cells in the selected range.
- text1: This is the required term. This could be text, a cell, a range, or a range of cells
- text2: This is optional. This is the next cell, text, or range that needs to be joined with the text1 argument.

Example:

Let's take the same data that we used in the example for CONCAT function (that is, Figure 1.8). Here, we have used the TEXTJOIN function along with "." (comma followed by space) as a delimiter. Ignoring any blank cells, a range of cells is selected



The result of TEXTJOIN function will as follows:

893, Pocket 1, Sector 34, Rohini, Delhi, Delhi, 110085, India

SWITCH

It evaluates an expression against a list of values and gives a result corresponding to the first match in the data. In other words, the SWITCH function will match all the values in its Value arguments with the expression argument and return the result accordingly.

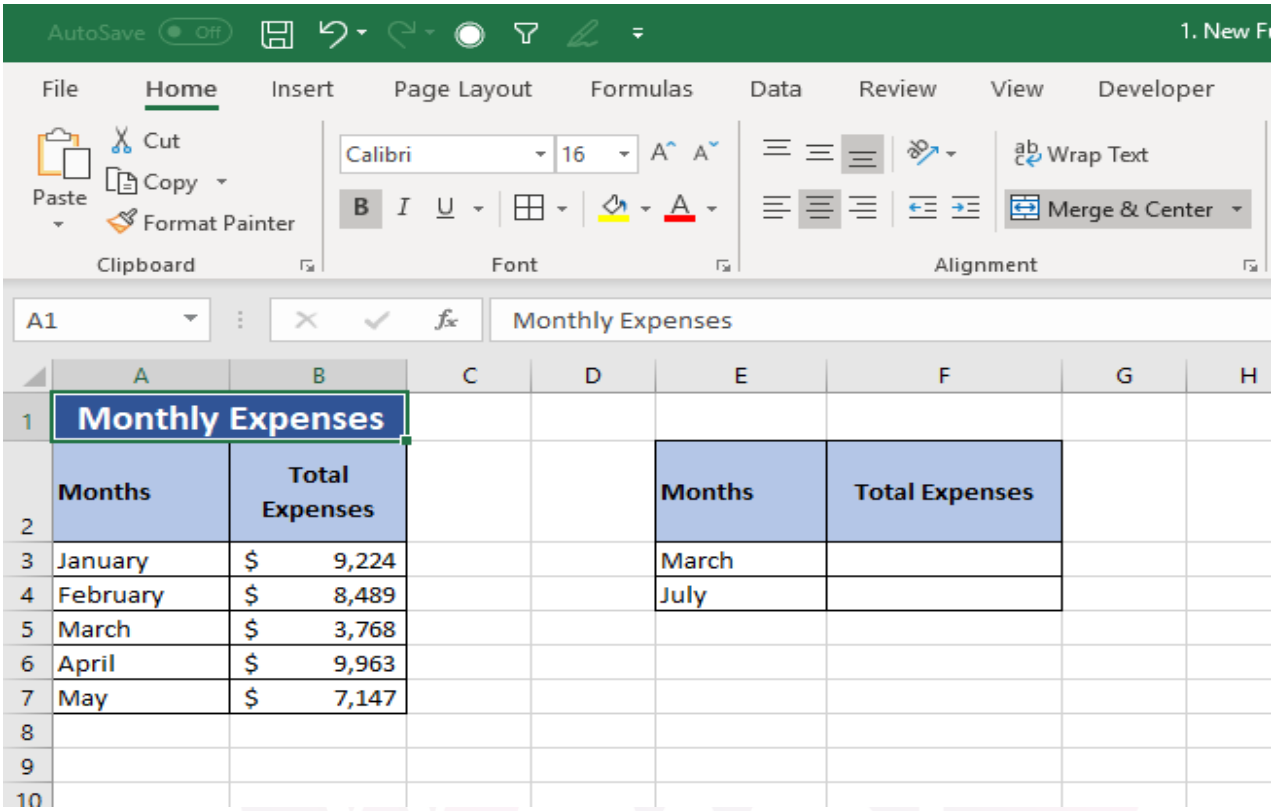
Syntax:

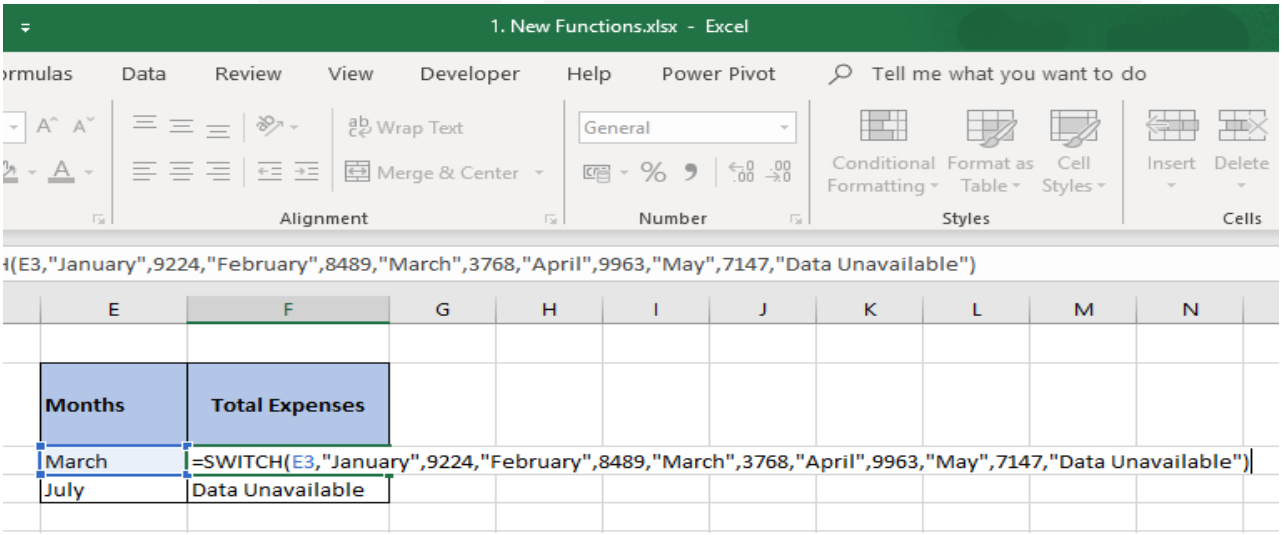
=SWITCH(expression, value1, result1, [value2, result2]....)

- Expression: This is a required argument. It can be a constant, a cell reference or reference to a cell having formula that will return a value.
- Value 1: This is a required argument. It's a value that needs to be matched with the expression.
- result1: This is the required argument. If Value1 matches with the expression then this function will return the value placed in this argument.
- Value2: This is an optional argument. If there is more than one value to be matched with the expression, then it can be entered in Value2, Value3, and so on.
- result2: This is an optional argument. If more than one value needs to be matched with the expression, then the subsequent results need to be entered in these arguments.

Example:

The following table shows a list of months and the respective monthly expenses. On the right-hand side, March and July months are listed to match with the Monthly Expenses table and enter the expenses under the Total Expenses column. So, let's use the SWITCH function in column F, that is, Total Expenses, to obtain the value from column B.





Here, the result for this function for March is 3768. But for July it is Data Unavailable because the month of July is not mentioned in this function and so it will assign it the last argument, that is, Data Unavailable.

MAXIFS

It returns the maximum value out of a range on the basis of one or more criteria

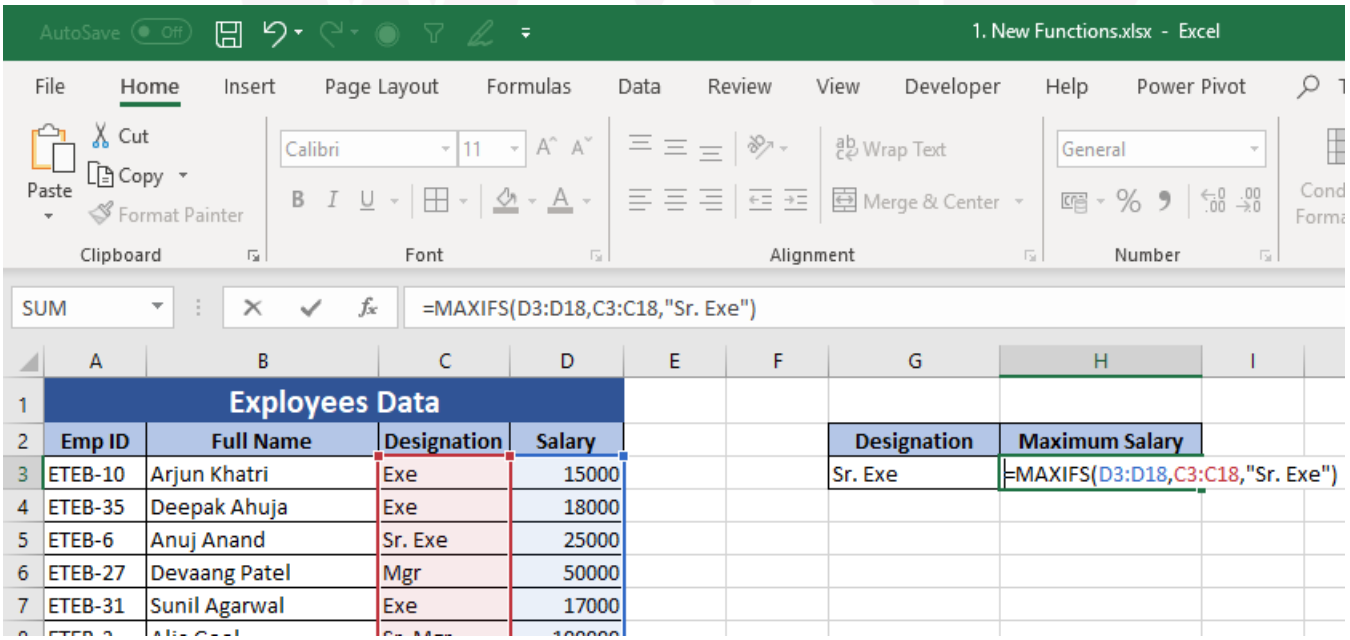
Syntax:

=MAXIFS (max_range, range1, criteria1, [range2], [criteria2], ……)

- max_range: This is a required argument. This is a range of cells from which one needs to find the maximum value.
- range1: This is a required argument. This is the range for the first criterion range
- criteria1: This is the required argument. The first criterion needs to match in range1.
- range2: This is an optional argument for subsequent criteria range.
- criteria2: This is an optional argument for subsequent criteria that will fall in range2.

Example:
In the following Figure 1.15, shows a list of all the employees of a company. Their designations and salaries are mentioned. On the right-hand side, we need to find the maximum Salary of only Sr. Exe designation:

If we use the MAX function here, it will return the maximum possible value from the complete range, ignoring the designation. So, here we can use MAXIFS to get the maximum value from the Salary column for the Sr. Exe designation.



Ultimately it will fetch the maximum salary being paid to any Sr. Exe in the company as $28,000.

MINIFS

It returns the minimum value from a range on the basis of one or more criteria

Syntax:

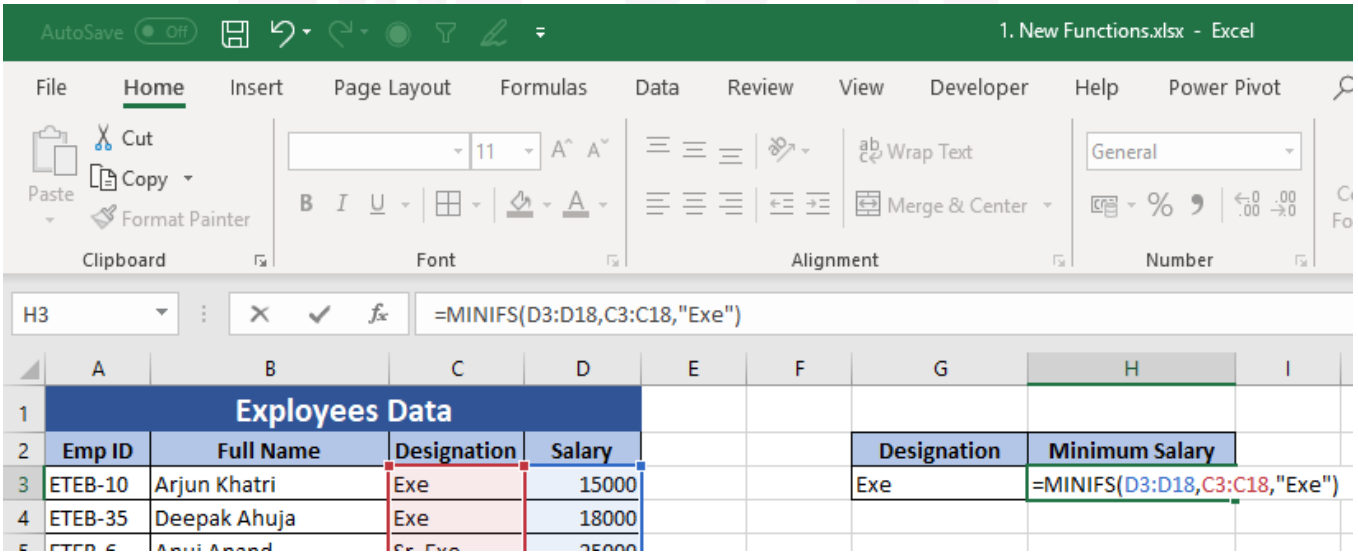
=MINIFS (min_range, range1, criteria1, [range2], [criteria2], ……)

- min_range: This is a required argument. This is a range of cells from which one needs to find the minimum value.
- range1: This is a required argument. This is the range for the first criterion.
- criteria1: This is a required argument. The first criterion needs to match in range1.
- range2: This is an optional argument for subsequent criteria range.
- criteria2: This is an optional argument for subsequent criteria that will fall in range2.

Example

In the following Figure 1.18, shows a list of all the employees of a company. Their designations and salaries are mentioned. On the right-hand side, we need to find the minimum Salary of only Exe designation:

If we use the MIN function here, it will return the minimum possible value from the complete range, ignoring the designation.So, here we can use MINIFS to get the minimum value from the salary column for the Exe designation.



Ultimately it will fetch the minimum salary being paid to any Exe in the company as $14,000

IFS

It is a replacement for Nested IF, which is very popular among users of Excel . The IFS function helps in evaluating multiple conditions without the need for the Nested IF function . IFS is much easier to write and read.

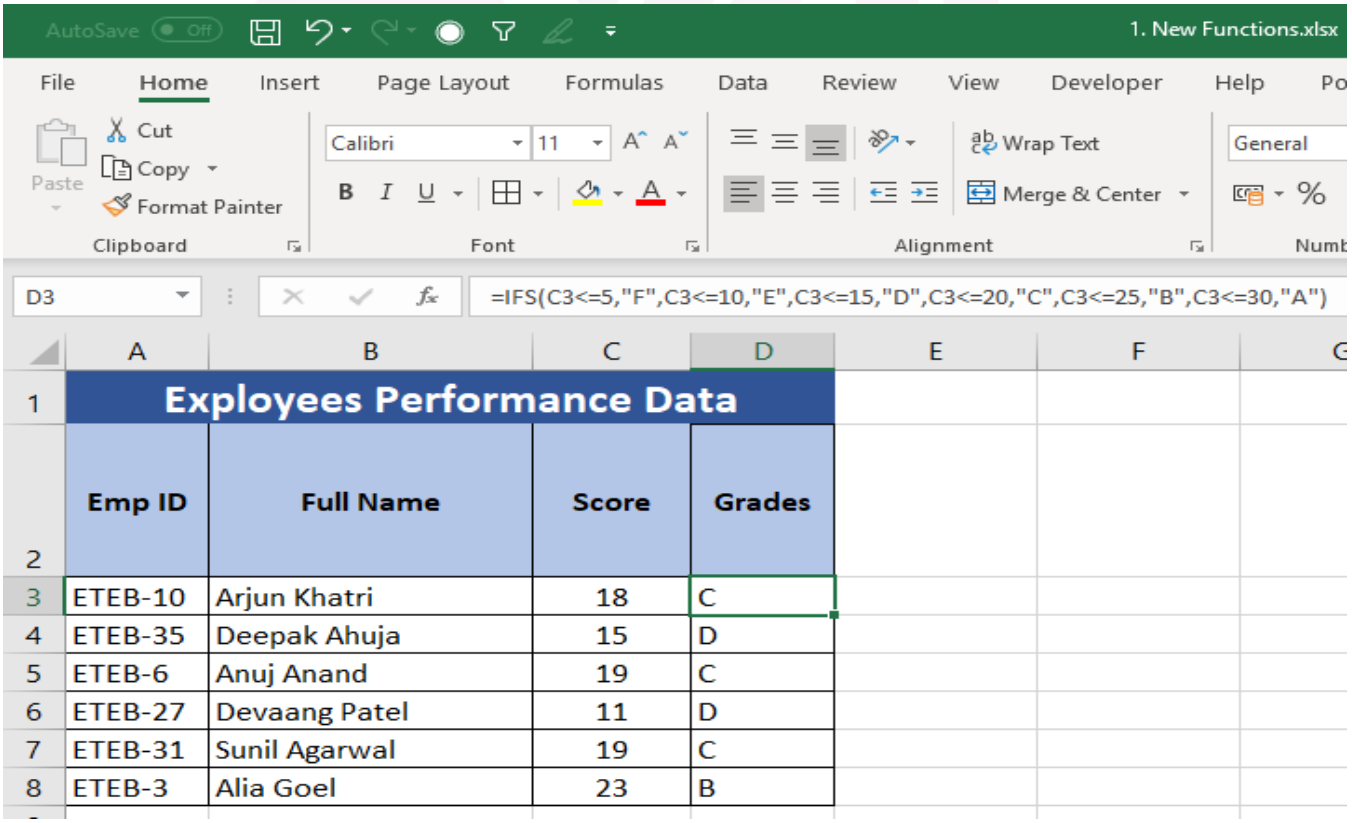
Syntax:

=IFS (logical_test1, value_if_true1, [logical_test2, value_if_true2]....)

Arguments:

- logical_test1: It is the required argument. It is the first condition/ criterion that needs to be judged.
- value_if_true1: This is a required argument. It's the value that the IFS function will return if logical text1 is true.
- logical_test2: This is an optional argument. If logical_test1 is false then the IFS function will jump onto this argument that will check the condition as per this argument.
- value_if_true2: This is an optional argument. This value will be shown if logical_test2 is true else the function will jump to the next argument.

Example:



	A	B	C	D	E	F
1	Exployees Performance Data					
2	Emp ID	Full Name	Score	Grades		
3	ETEB-10	Arjun Khatri	18	C		
4	ETEB-35	Deepak Ahuja	15	D		
5	ETEB-6	Anuj Anand	19	C		
6	ETEB-27	Devaang Patel	11	D		
7	ETEB-31	Sunil Agarwal	19	C		
8	ETEB-3	Alia Goel	23	B		

Here we have a list of employees and their performance scores are mentioned. We need to assign grades to them on the basis of their scores as per the grades table given on the right side.

The IFS function will be applied in column D to get the grades.

=IFS (C3<=5, "F", C3<=10,"E", C3<=15, "D",C3<=20, "C", C3<=25,"B",C3<-30,"A")

After applying the preceding function, we will obtain the following results.

Entering Data In Excel

Excel is all about data capturing, data transformation, data analysis and data visualization. In this chapter, we will discuss data capturing. Excel gives us two comprehensive ways to enter data in any Worksheet/Workbook, that is, either by entering the data manually or by extracting from other sources that can either be online or offline, on-premise or off-premise. Let's begin by exploring these ways one by one.

- Entering data manually
- Entering data using data form
- Importing data using Get and Transform
- Applying data validation

Entering data manually

This is one of the common ways to enter data in an Excel worksheet/workbook.

Just like in a raw field where one can just go and start sowing seeds to get the crop later, here you can just use your fingers and the keyboard to punch in the data. Entering data into an Excel cell is slightly different from other MS Office applications. When typing something in a cell, pressing the Enter key or Tab key or clicking away from that cell will only commit the cell with the content that we were typing (unlike MS Word).

The major types of data that can be accepted by an Excel cell can be categorized as follows:

- Numeric data
- Text
- Date & Time
- Formulas or Functions

Let's take an example of a data set and start discussing the same having all the preceding mentioned data types and see how Excel reacts to them. Assume we are working in the HR (human resources)

department of a company and need to enter data related to each of its employees. First, let's open an Excel workbook. now click on cell A1 and type a suitable title for the data, that is, Employee Data.

As you may have noticed, it seems as if the title Employee Data is taking over B1 cell also. However, that is not the case. As there is nothing in cell B1 and the width of column A is small, Excel is just trying to use the onscreen space to show the complete content in cell A1. But once we enter some data into cell B1, you will see text limited to only cell A1. To solve this problem, you can either expand the width of column A or you can also merge the cells (which we will apply here). Now, we will start entering the column headers for the data that needs to be captured .

After filling in the dummy data, the sheet will look like as shown.

Here, the text and numbers are entered in the same manner. Type the formula =E3*5% in cell F3 under the Bonus column. Then copy and paste the same formula for all the cells below and the bonus will get calculated for all those cells. Merge cells from A1 to F1 by selecting them and then by going to the Home tab and selecting Merge & Center. Apply a style to the selected range of cells by clicking on the Home tab and then Select Cell Styles, then Data and Model and then Check Cell.

Next, apply a style to cells A2 to F2 by clicking on the Home tab and then selecting cell styles, then Data and Model and then Output:

Apply cell border to cells A3 to F14 through the Home tab; Font group, then bottom border, and then All Borders.

Now you will get the employee data in a well-arranged and formatted manner.

Entering data using data form

Another way of entering data in Excel is through data form. A data form is useful when you have multi column data, where we face the common problem of scrolling through each column. Using data forms, you can enter data for up to 32 columns in a single frame without scrolling within the sheet. Let's first enter the headers of the data in a worksheet.

First let's add a data form to the QAT (Quick Access Toolbar):

1. Click on the arrow in QAT.
2. Click on **More Commands**.
3.In **Choose commands from** select **All Commands**.
4. Search for Form... and Click **Add** >> and then click **OK**.

Now, select the header row and click on the Form icon in the QAT. Excel will launch the data form and treat the selected row as the header in the form.

Now, you can just start entering the data by using the Tab key to go to the next cell. After filling in the required data, you can either hit the Enter key or click on the New button.

Whenever you want to apply a formula to a range of cells, enter the formula in a cell first and then Excel will capture it automatically in the Data Form.

Importing Data using Get & Transform data

Importing data into Excel has never been so comfortable and dynamic. Through this new option of Get & Transform, you can get data from any source that is supported by Excel. Excel opens the Query Editor where the data is transformed, for example, displaying it in a form that can be analyzed without changing the data at the source and then combined with other data sources by creating a data model using the Relationship Building feature. Lastly, the query can also be saved, shared and in fact used for other workbooks too.

Let's classify the preceding statement into broad steps:

1. Connect: The first step is to connect with one or multiple data sources. No matter where your organization is maintaining the data, you will find the source here. Microsoft has added several data sources in Excel to connect with.

    - From File: Excel Workbook, Text/CSV, XML, JSON or any folder.
    - From Database: SQL Server, MS Access, Analysis Services or SQL Server Analysis Services.
    - From Online Services: Facebook
    - From Other Sources: Table/Range, Web, MS Query, OData Feed, ODBC, OLEDB, or a Blank Query.

2. Transform: As soon as you connect to a database, Query Editor opens up and records each step, including the one of connecting with the database, so that these recorded steps can help in refreshing the data. At the backend, Query Editor uses M language.

    In the environment of Query Editor, you can transform the data, for example, clean up all the unwanted columns, add calculated columns or Measures using Data Analysis Expressions (DAX), change data types, merge tables, and so on. Transformation done in the editor will not disturb the data lying at the source.

3. Combine and share: After transforming the data, it can be combined with other data sources. A data model can be built from multiple databases and ultimately a unique view can be generated. Once a query is completed the same can be saved or shared.

Applying Data Validation

Manual entry usually results in some amount of invalid data. MS Excel offers an amazing tool to restrict the entry of invalid data. For example, if we try to sign up on any online portal by entering an email ID without the @ symbol, the site will not accept it and treat it as invalid. The same functionality is adopted in Data Validation in Excel. Let's understand it with an example. Suppose you would like to capture the employee data of an organization under the fields mentioned in following Figure:

Suppose, in the organization, the Employee ID is a 6-character number/code. Therefore, a data validation rule needs to be entered here that will allow only a 6 character Employee ID. Follow the below steps to apply the rule:

1. Select all the cells under Employee ID.
2. Go to the Data tab, select Data Tools Group and then click on Data Validation.
3. Go to the Settings tab and click on Allow and then on Whole number.
4. Set Data as between to100000 to 999999
5. Input Message, this is optional. (A comment on the data validated cell will show the types of messages that can be accepted into these cells). For example, you can type the message "Please enter a 6 character employee ID".
6. Error Alert: If a user enters data that is not aligned with the data validation rule, then an error message will pop up. Selecting Stop under Style will allow only those entries that align with the rule, whereas selecting Warning or Information will permit anything beyond the rule too. Title and Error message are again optional.
7.Click OK.

Now, let's test the rule. Type in the number 485 and hit the Enter key. You will see an error message.

Data validation also supports drop-down lists. we can create one for the Department column.

1. Select all the cells under **Department**.
2. Go to the Data tab, and select **Data Tools Group** and then **Data Validation.**
3. Under the **Settings** tab, go to **Allow** and then select List.
4. You can either use the elements of the list (if already mentioned in Excel), or you can type them (each element of the list must be separated by a comma). As we don't have a list here, we will type them in.

As input message is optional, we will keep it blank. In the Error Alert, let's go with warning this time.

This will create a drop-down list as shown.

You can select an option from the drop-down list. As we have selected Warning as an error alert style, even if we enter something that is not a part of the list, it will get accepted as a temporary entry (but will not become a part of the list) and Excel will show the following message

Transforming and managing data

Once the data is captured, it's now time to transform and, clean it to make it ready for analysis. Thus, transform and managing the data becomes one of the most important steps here . Excel provides us

some beautiful tools such as the Sort feature for arranging the data either in ascending or descending order in a customized order, or filtering it whenever required . In this we will discuss such tools which we can use to easily transform and manage the data that we have captured or recorded in Excel so far.

Sort, Filter and Advanced filter

These are the most commonly used features of Excel to get the data into a format where analysis can be done. Sorting helps in arranging the data in the desired order, filter helps in slicing off the unwanted data either based on single or multiple items and even sometimes based on conditions. When it comes to filtering the data based on complex conditions then Advanced Filter is what comes into the picture.

Sorting data in Excel

Sorting in Excel is all about arranging data in ascending or descending order, or in a customized order. Sorting can also be done either vertically or horizontally.

Sorting by Number: Let's sort the data for salary in an ascending order using the following steps:

1. Select the complete data including headers.
2. Under the Data tab select Sort. This will open a dialog box for customized sorting
3. Choose Salary in **Sort by**, cell in **Sort on** and smallest to largest as the **Order.**
4. Click OK.

Sorting by Text: Data can also be sorted on the basis of text. Let's take the previous example again. Here, we will sort the data by "Department" in Z to A order as follows:

1. Select the complete data including headers.
2. Under the Data tab select Sort. This will open the Sort dialog box again.
3. Choose Department in sort by, cell values in Sort On and Z to A as the Order.
4. Click OK.

Sorting by cell color: We can sort data by Cell color or Font color. Some of the employees IDs have been highlighted in yellow color.
We will sort this data in such a way that all the employees with highlighted Emp. ID will come at the top.

1. Select the complete data including headers.
2. Under the Data tab select sort. This will open the sort dialog box.
3. Choose Emp. ID in Sort by, Cell color in Sort on and the color you want as the order

4. Click OK.

Sorting by Font Color: Sorting can also be done on the basis of Font color. some of the numbers under the Bonus column are in red font:

Now follow these steps to sort the employee data such that the numbers in red font appear at the top under the Bonus column:

1. Select the complete data including headers.

2. Under the Data tab select Sort. This will open the Sort dialog box.

3. Choose Bonus in Sort by, Font Color in Sort On and the color you want in Order.

4. Click OK

Multi-Level sorting: So far, we have discussed single level sorting. Using multi- level sorting, employee data in the previous example can be sorted Department wise in an ascending order and at the same time Salary wise in a descending order. Add level feature is also available under the Sort dialog box.

Priority of sorting will be given in the level of orders mentioned in the Sort dialog box. For example, in this case, Department column will be given the first priority as it is set as the first level of sorting.

1. Select the complete data including headers.

2. Under the Data tab select Sort. This will open the Sort dialog box.

3. Choose Department in Sort by, Cell Values in Sort On and A to Z as the Order.

4. Click on Add Level.

5. Choose Bonus in Sort by, Cell Values in Sort On and Largest to Smallest as the order.

In this manner, you can add up to 64 levels. Levels can also be deleted or copied.

Sorting by Custom List: Excel allows customized sorting too. For example, if you want to sort the preceding data by Designation column in such a way that the entries should appear in the order of Exe, then Mgr, and then Sr. Mgr, that is, not in an alphabetical order. So a customized order needs to be created here. Let's take the same example as before and follow the steps to sort the data in a customized order.

1. Select the complete data including headers.

2. Under the Data tab select Sort. This will open the Sort dialog box.

3. Choose Designation in Sort by, Cell Values in Sort On and Custom List... as the Order.

The preceding action will immediately trigger another dialog box where you can either choose from the pre-defined custom lists or create your own

As you can see, the pre-defined lists are generic and none of them matches with our current data set. Therefore, we need to create a list from scratch by typing the same under the List entries: box on the right.

Sorting horizontally: So far, we have discussed column wise sorting. The same can be done row-wise also, that is, left to right. Consider the monthly sales of a company as an example. Here the months are listed randomly (not in order). Let's arrange the complete table in such a way that all the columns are arranged in Monthly Sales order.

1. Select the complete data including headers.

2. Under the Data tab select Sort. This will open the Sort dialog box.

3. Click on Sort Options, then select Sort left to right, and then click Ok

4. Select Row 2 (row containing the headers, that is, months) in Sort by, Cell Values in Sort On and Custom Lists as the Order:

5. From Custom Lists, select the one matching our data, that is, the list of all the months written in full

Filtering Data in Excel

Data filtering is done when you want to display only those fields from the data that meet a certain condition. Let's consider the example of online shopping. When you wish to buy a pair of shoes from any e-commerce website, you apply filters such as Shoes, Gender, Color, etc. to the product category. Similarly, Excel offers an amazing option to filter data on the basis of criteria such as number, text, cell color, font color, etc. Let's discuss the features in detail.

Number Filter: As Excel is all about playing around with numbers, the Number filter plays a very vital role in transforming and managing data. Let's consider the same example of employee data as in the Sorting section. Now from this list of all the employees, let's list only those employees whose salary is between 30,000 to 60,000.

1. Select the complete data including headers.

2. Under the Data tab select Filter. This will apply a drop-down list on each column header.

3. Click on the drop-down icon in the Salary column. Choose Number filter (Note: This Number filter option is available because Excel has detected out that this active column has numbers) Then choose Between; this will open a dialog box. Type 30000 in front of is greater than or equal to and 60000 in front of is less than or equal to

Text Filter: If the data to be filtered is text, then Excel will show us the Text filter option. Now let's list only those employees who are either Mgr or Sr. Mgr.

1. Select the complete data including headers.

2. Under the Data tab select Filter. This will apply a drop-down list on each column header.
3. Click on the drop-down icon in the Department column. Choose Text filter (Note: Text filter option is available because Excel has detected that this active column has text). Then choose contains; this will open a dialog box. Type Mgr

Cell Color Filter Data can also be filtered on the basis of cell color. Sometimes we use colors to mark cells for later reference. Now instead of going through the entire data set looking for the colored cells, you can use the Cell Color filter to display only those cells. In Figure 3.25 below, some of the cells containing employee IDs have been filled with yellow color. Let's see how to filter and display only those employees whose employee IDs are colored.

We will follow the steps to filter the data on the said condition:

1. Select the complete data including headers.

2. Under the Data tab select Filter. This will apply a drop-down list on each column header.

3. Click on the drop-down icon on the Emp. ID. column. Choose Filter by Color (Note: Filter by Color option is active because Excel has detected that this active column has cell/font colors). Then choose Filter by Cell's Color | Choose the respective color.

4. Data will get filtered accordingly

Font color filter: Let's see how to filter data on the basis of font color. Some of the employees' names are in red color font.

1. Select the complete data including headers.

2. Under the Data tab select Filter. This will apply a drop-down list on each column header.

3. Click on the drop-down icon in the Name column. Choose Filter by Cell Color (Note: Filter by color option is active because Excel has detected that this active column has cell/font colors). Then choose Filter by Font Color and then choose the respective color.

Applying Advanced Filter

Advanced filter is used when we have a set of complex criteria or more than one criteria on a single data field. The filter discussed in the previous section cannot accept two filtering criteria simultaneously (for example, showing employees whose salary is greater than 25000, along with those employees whose salary is between 25000 and 45000 and are from the sales department). Let's see how the Advanced filter can solve this problem.

Before enabling the Advanced filter option, first you need to create a Criteria Range, that is, a list of all the criteria.

Here, first the required headers are copied and then I have listed down both the conditions. I had the respective column. One can create these criteria anywhere in the sheet because a reference to be given in the Advanced filter option.

Under the Data tab, select Sort & Filter, and then Advanced Filter (this will trigger a dialog box).

2. Under List range, select the complete data set including headers.

3. Under Criteria range, select the complete criteria range including header.

4. Select either Filter the list, in-place or Copy to another location. If you select the Filter the list, in-place option then Excel will filter the original database to show only those rows which match with the given criteria, whereas in the case of Copy to another location, you can assign a location, where the filtered data will be displayed and the original database will remain unaltered.

5. Check on Unique records only (if there are duplicate data records it's better to check this option to get only unique data)

Filtered data will be displayed at the copy to another location.
The preceding outcome has all the records that match with the criteria listed in the Criteria range.

Converting data into table

Excel offers a feature to convert any data set into a table format. Converting a data set into a table automatically turns on features like grand Total rows, AutoFilter and Sort, Banded Rows/Columns, and so on. It also helps to create additional columns or rows in a very easy manner. Using a simple data set, let's understand the features you get on converting it into a table.

Creating a table

To convert a dataset into a table

1. Select the data

2. Under the Insert Tab select the table. This will trigger a dialog box

3. Click OK

Choosing the correct design

As mentioned earlier, once you convert a data set into a table, Excel automatically applies a default table style. But you can change it in a snap. Whenever you use a table feature and if your active cell is somewhere in the table then Excel will display an additional section in the ribbon as Table Tools.
Under the Table Tools tab, Select the Design tab and then Table Styles Options. You will find plenty of table styles to choose from.
Here you can also create our own style using the New Table style option.

Adding columns and rows

In a table, adding a new column or row is a breeze. Just type the first instance of the new column or row and the Table format will detect that the user would like to add another column or row and will immediately assist us in the same and make it a part of the table. For example, in the sample data set, you want to create a column showing the taxes on each employee's salary. So, first enter the header of the column, Taxes, in cell G2 and hit Enter. As soon as you do so, Excel will make it a part of the table and apply all its handy features automatically
Next, set the first cell in the Taxes column, that is, cell G3, as 10% of the Salary column that is, =E3*10%. As soon as you hit Enter, Excel will fill the entire column with the same calculation and will change the cell references accordingly

Similar to a new column, you can also add a new row and Excel will automatically detect it and apply all the table features to it. As soon as you type the first instance in a row and hit the Enter or Tab key, Excel will create a new row automatically

Deleting Columns or rows

The easiest way to delete a row or column is to just right click on it, go to delete menu, and then select Table column or Table row

Enabling total row

When using the table format, Excel offers an option to sum up all the rows at the bottom of the table, thus eliminating the need to do so manually. To enable Total Row, place the cursor anywhere in the table, and then select the Table Tools section in the ribbon. Under the Design tab go to Table Style Options and check on the Total Row option
This will add a total row at the bottom of the table

Sorting in a Table:

Sort feature is enabled the moment you apply a Table feature. As all the sorting features that have already been discussed in the beginning of this section are available here, it's just a matter of right-clicking on any cell of the column by which we would like to sort the table. For example, if you want that the complete table to be sorted by Salary in an ascending order then right-click on any cell of the Salary column, then select Sort, and then select Sort Smallest to Largest

Filtering in a table

Filtering is also an easy task to perform in a table. So far you may have already noticed that the moment we convert a data set into a table, Excel automatically applies filter to the headers
Let's take an example where you want to see only the data for the Finance department employees.

1. Click on the drop-down in icon of the Department column.
2. Check only Finance and leave the rest of the items unchecked
3. Data will get filtered.

Converting header row to column title

This is another amazing feature of an Excel table, where it automatically converts the header row to column title as you scroll down, thus helping you keep track of the column label

Reconverting table to data set

A table can be reconverted to a data set again in a single click. Following steps will do the job:

1. Keep the cursor in the table area.
2. Under the Table Tools section in ribbon, select the Design tab, then Tools, and then Convert to Range. This step will trigger an information dialog box, asking your permission for the same

Our table is now back to a normal data set.

Formulas and Functions

Calculations, formulas, and functions are at the heart of Excel program. To perform a calculation, an Excel user can either write a formula or use a built-in function. Formulas are all about using mathematical operators such as "+", "-", "*",and so on, and symbols to perform calculations, while functions are built-in formulas with a label. Most Excel users prefer to use a formula or function as a label for both manually written and built-in calculation expressions.

Writing Excel formulas and functions

Formulas use calculation operators such as +, -, *, and /. Whether it's a formula or a function, always start with the"=" is equal to the symbol.

Summing values:

Let’s adopt a practical approach. Here we have a small dataset of products and their sales across multiple locations.
Let's find the total sales for each product by summing the entries in the respective rows. This can be done using the + symbol, but there are two ways to perform such a calculation.

1. You can write a formula to sum the sales for product A as = 500+608+597, which will give you a correct outcome but there are two drawbacks in this approach:

- You can't copy and paste this formula to get the sum of all the products.
- If any of the sales amount changes, then the result , that is , sum will not change accordingly.

2. You can write the formula by referring to the cells containing the sales amount, for example, =B3+C3+D3. This will overcome the preceding two drawbacks.
Thus, it’s better to use the second method to perform calculations.

Subtracting values

Consider a data set containing product wise sales and cost to find the profit per product.
Again, you can use the - sign to subtract the values and get the profit. For example , to find out the profit for product A, you can write the formula as =B3-C3.
You can further copy and paste this formula to find the profit or loss for the rest of the products.
Rest of the calculations such as "/" division," multiplication, "%" percentage, ”^” and exponential can be performed similarly.

Understanding syntax and arguments

Every function has its own syntax and every syntax has its own arguments. Excel has over 200 built-in functions, and so it's next to impossible to memorize their syntax and arguments. Nonetheless, once you learn the important logic for each syntax, it is very easy to write almost any function in Excel.

So let's understand how to write a function in Excel. Figure 4.5 below shows invoice numbers, office location, and the invoice amount. We will apply the SUM function and understand its syntax and arguments of this function:

Let's apply the SUM function in cell D14. Start by writing the function as =SUM. Then you can either press the Tab key or select the function from the list by left-clicking the mouse twice. Excel will open the function, with an opening parenthesis, and show the syntax

Syntax:
Sum(number1, [number2],...)

- number1: This argument is in bold font indicating that this argument is active right now.
- [number2]: This argument is in square brackets indicating that this argument is optional, that is, even if you omit this argument, the function will still give you the result based on previous arguments.

Note: It's always important to remember that number1, number2, etc. are just labels to an argument. It doesn't mean that the argument can have only one number; it can contain a range also, and a range can contain multiple cells.

Consider the example below, where instead of filling up each argument one by one, we will use a complete range having all the amounts.

Basic calculations

You now know the basic difference between a formula and a function, although you can use these terms interchangeably. Here onwards, you will feel a great need to apply basic calculation functions such as:

- Sum
- Count functions (COUNT, CountA, CountBlank)

- Average
- Max
- Min

Let's understand these functions in detail and then we will move forward towards some advanced functions. We have already discussed the SUM function, so now let's cover the rest of the functions individually.

COUNT functions (COUNT, CountA, CountBlank)

To simply count the cells without any condition, use the following functions in Excel:

COUNT:

The COUNT function can count only those cells that contain numeric values.

COUNT(value1, [value2], ….)
Syntax:

- value1: This is the required argument. The first item, cell reference, or range within which you want to count numbers.
- value2: This is an optional argument. Up to 255 additional items, cell references, or ranges within which you want to count numbers.

Let's use the same example as previously. You can apply the COUNT function only on the Amount column.

COUNTA

This function counts cells that contain numbers as well as text.

Syntax:
COUNTA(value1, [value2], ...)

- value1: This is the required argument. The first argument represents the values you want to count.
- value2: This is the optional argument. These are Additional arguments representing the values that you want to count, up to a maximum of 255 arguments.

Using the same database again, you can apply this function to any of the columns to get a count of cells.

COUNTBLANK

This function can count all the blank cells in a range. This is useful especially in the case of a large data set.

Syntax:
COUNTBLANK(range)

- range: This is the required argument. The range in which you want to count the blank cells.

Let's take an example of a data set with some blank cells.
Conditional calculation

When working on a data set in real life, things are not as straightforward as discussed in previous examples. We are required to analyze data on the basis of certain conditions. In Excel, condition stands for IF. Excel provides us some really smart conditional calculation functions. For example, to calculate sum on the basis of certain condition, you can use SUMIF or SUMIFS. Let's explore them.

SUMIF

This is one of the most useful functions in Excel. It is used to sum values on the basis of certain conditions (e.g., total sales for a particular region, total expenses in one branch of a company, total salary paid to a particular department, and so on.

Syntax:
SUMIF(range, criteria, [sum_range])

- range: This is the required argument. This is the range of cells you want evaluated by criteria. The cells in this range must have numbers or names, arrays, or references that contain numbers. Blank and text values are ignored. The selected range may contain dates in standard Excel format (following examples).

- Criteria: This is the required argument. This in the form of a number, an expression, a cell reference, text, or a function that defines which cells will be added. For example, criteria can be expressed as 32, ">32", B5, "32", "apples", or TODAY().

- sum_range: This is an optional argument. This is used to specify the actual cells you want to add, if you want to add cells other than those specified in the range argument. If the sum_range argument is omitted, Excel adds the cells that are specified in the range argument (the same cells to which the criteria is applied).

You can use wildcard characters, such as the question mark (?) and asterisk (*), as the criteria argument. A question mark matches any single character; an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (~) preceding the character.
Let's again consider the previous example. Here, let's sum the amount of only those invoices that belongs to Delhi office.

SUMIFS

Unlike SUMIF, SUMIFS can support more than one criteria/condition

Syntax:
SUMIFS(sum_range, criteria_range1, criteria1, [criteria_range2, criteria2], …..)

- sum_range: This is the required argument. This is the range of cells to sum.

- criteria_range1: This is the required argument. This range is tested using criteria1. The criteria_range1 and criteria1 set up a search pair whereby a range is searched for specific criteria. Once the items in the range are found, their corresponding values in sum_range are added.
- criteria1: This is the required argument. This criteria defines which cells in criteria_range1 will be added. For example, criteria can be entered as 32, ">32", B4, apples, or "32".
- criteria_range2, criteria2: This is the optional argument. These are additional ranges and their associated criteria. You can enter up to 127 range/criteria pairs.

COUNTIF

This function is used to count cells on the basis of only one condition.

Syntax:
COUNTIF(range,criteria)

- range: This is the required argument. This is the group of cells you want to count. It can contain numbers, arrays, a named range, or references that contain numbers. Blank and text values are ignored.
- criteria: This is the required argument. This is a number, an expression, a cell reference, or a text string that determines which cells will be counted.

For example, you can use a number such as 32, an expression such as ">32", a cell reference such as B4, or a text string such as apples.

COUNTIF uses only a single criteria. Use COUNTIFS if you want to use multiple criteria.

Here we have the same set of invoices and now let's count only those invoices that belong to Delhi.

COUNTIFS

Use this function to count cells on the basis of more than one condition

Syntax:
COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2],....)

- criteria_range1: This is the required argument. This is the first range in which to evaluate the associated criteria.
- criteria1: This is the required argument. This is criteria in the form of a number, an expression, a cell reference, or a text that defines which cells will be counted. For example, criteria can be expressed as 32, ">32", B4, apples, or 32.
- criteria_range2, criteria2: This is the optional argument. These are additional ranges and their associated criteria. Up to 127 range/criteria pairs are allowed.

Using the previous example, let's now count the total number of invoices for product Bike at Delhi office.

AVERAGEIF

Similar to previous calculations, average can also be calculated on the basis of certain conditions.

Syntax:
AVERAGEIF(range, criteria, [average_range])

- range: This is the required argument. This is the range of one or more cells to average, including numbers or names, arrays, or references that contain numbers.
- Criteria: This is the required argument. This is criteria in the form of a number, an expression, a cell reference, or a text that defines which cells are averaged. For example, criteria can be expressed as 32, "32", ">32", apples, or B4.
- Average range (Optional). This is used to specify the actual set of cells to be averaged. If omitted, range is used.

Let's calculate the average invoice amount for the Kolkata office.

AVERAGEIFS

Using this function for calculating average on the basis of more than one condition/ criteria.

Syntax:
AVERAGEIFS(average_range, criteria_range1, criteria1, [criteria_range2, criteria2], ...)

- average_range: This is the required argument. This is the range of one or more cells to average, including numbers or names, arrays, or references that contain numbers.
- Criteria_range1, criteria_range2: criteria_range1 is required, while the subsequent criteria_ranges are optional. There are 1 to 127 ranges in which to evaluate the associated criteria.
- criteria1, criteria2: criteria is required, and subsequent criteria are optional. There are 1 to 127 criteria in the form of a number, an expression, a cell reference, or text that define which cells will be averaged. For example, criteria can be expressed as 32, "32", ">32", apples, or B4.

Let's calculate the average invoice amount for Accessories at the Kolkata office using AVERAGEIFS

Logical functions

These functions are the backbone of Excel, and are used to assign status on the basis of certain conditions. Further , calculation can also be done depending on the status. Let's dive deep in the world of logical functions and explore them one by one

IF

This function is all about either this or that based on certain conditions. For example, if you choose heads when a coin is tossed, and it lands showing heads up, win, else you lose, this is an IF condition.

Syntax:
=IF(logical Test, Value_if_true,Value_if_False)

- logical_Test: This is the condition for the present scenario.
- Value_if_true: This is the value or calculation to be shown if logical_Test is True.
- Value_if_False: This is the value or calculation to be shown if logical_ Test is False.

Let's consider a suitable example. Below is a list of students and their scores. Let's assume that the passing marks are 33. So the condition is that if a student's score is greater than or equal to 33, then that student has passed else he/she has failed.

AND

You can use this function when you want to check if all the conditions are True.

Syntax:
AND(logical1, [logical2], ...)

- logical1: This is the required argument. This is the first condition to be evaluated (it could either be TRUE or FALSE).
- logical2: This is the optional argument. These are additional conditions to be evaluated to either TRUE or FALSE; there can be up to a maximum of 255 conditions.

Suppose, you want to evaluate the scores of multiple students for multiple subjects. This condition is that if a student scores 33 or more in all the subjects, only then he/she will be considered to have passed, else the student has failed.
Using the AND function alone will give the result either TRUE or FALSE, but if we nest IF and AND , we have our desired result as Pass or Fail. Just to keep things simple, let's first use the AND function alone .

OR

The OR function will give the result true if any one out of a set of conditions is True.

Syntax:
OR(logical1, [logical2], ...)

The arguments are explained as follows:

- logical1: This is the required argument. This is the first condition that you want to evaluate to be either TRUE or FALSE.
- logical2: This is the optional argument. These are additional conditions that you want to evaluate to be either TRUE or FALSE. There can be up to a maximum of 255 conditions.

Let's assume that now a student will be considered as "Pass" if he/she gets 33 or more in any one of the subjects.
The OR function will look similar to an AND function.

NOT

The NOT function simply returns the opposite of the given logical condition.

Syntax:
=NOT(logical)

- Logical: It is a value or logical expression that can be evaluated as TRUE or FALSE

Consider the same example we used to discuss the IF function, but this time let's reverse it using the NOT function. The actual condition is to check whether the value is greater than or equal to 33 or not, but the NOT function will reverse the outcome (which is a bit illogical, but this is just to understand the function).

Text functions

Excel is not a Database Management System (DBMS) that is; it is only used to analyze data that is extracted from other sources. As a result, the extracted data isn't always in the desired form. It needs to be cleaned first, and that is where these Text functions come into play. Let's understand their practical use one by one.

UPPER, LOWER and PROPER
The following three functions help in converting unsymmetrical text into symmetrical one.

UPPER: It will convert the text into upper-case
Syntax:
UPPER(text)

LOWER: It will convert the text into lower-case.

Syntax:
LOWER(text)

PROPER: It will capitalize the first character of the text and change the rest of the characters to lower case. It will repeat this after each blank space.

Syntrax:
PROPER(text)

LEFT, RIGHT and MID

These functions help in fetching characters from left, right, or middle of the content of a cell. These are commonly used for symmetrical data such as employee ID, SSN number, and vehicle number that comprise a fixed number of characters. Important data can be extracted using these functions.

LEFT: This function is used to fetch characters from the left side of the cell as per the number of characters you specify.

Syntax:
LEFT(text,[num_chars])

Right: This function is used to fetch characters from the right side of the cell as per the number of characters you specify.

Syntax:
RIGHT(text,[num_chars)

MID: Use this function to fetch characters starting from the character you specify and the number of characters you specify.

Syntax:
MID(text, start_num, num_chars)

CONCATENATE, “&”:
Concatenate is used to join content/ cells whereas “&” is just a substitute of CONCATENATE.

Syntax:
CONCATENATE(text1, [text2], ….)

TRIM

It is quite common to end up having data with unwanted spaces. As the name suggests, the TRIM function simply trims them out.

Syntax:
TRIM(text)

FIND, and SEARCH

These functions help in finding a character or a text string present in a cell. If a character or text string appears multiple times in the cell, you can define the position from where you want to find

FIND: This function helps in finding a character or text string present in a cell, and it is case sensitive.

Syntax:
FIND(find_text, within_text, [start_num])

- find_text: This is the required argument. This is the text you want to find.
- within_text: This is the required argument. This is the text containing the text you want to find.
- start_num: This is the optional argument. This specifies the character at which to start the search. The first character in within_text is character number 1. If you omit start_num, it is assumed to be 1.

SEARCH: This function also helps in finding a character or text string present in a cell,but it is not case sensitive.

Syntax:
SEARCH(find_text, within_text, [start_num])

Lookup functions

Lookup functionality is one of the most commonly used buckets of functions. These functions are used to fetch details of columns corresponding to common columns. It's also very useful in comparing two sets of data. For example, if we have similar data for two different customers in a database, we can use these functions to update the data accordingly. Let's consider some real-life, practical examples to understand

these functions. But before we do so, first we need to understand how to freeze a cell reference, that is, the use of $ sign, because this will play a vital role in using these functions.

Understanding references and use of $ sign:
Let's understand some most important types of cell reference and the use of $ sign one by one.

Relative reference: Whenever we copy a cell reference and paste it in another cell the cell content will change accordingly. Excel by default works on this reference. This is actually the strength of Excel; it is because of only this feature that you need to apply a function or a formula only once, and thereafter, you can just copy and paste it throughout, to get the results for all. In Figure 4.46 below, let's find the profit for each sales transaction. You can simply subtract the purchase amount from the sales amount. But you will get profit/loss for the rest of the transactions only if the cell reference changes for all the cells:

Absolute reference: This reference is an opposite of relative reference. Sometimes in a calculation, we would like to freeze a certain cell reference. For this, we use the $ sign as a symbol before and after the cell reference. Let's take an example where a fixed tax rate and different unit prices are given. You want to calculate the tax for each product unit by multiplying the fixed tax rate (given in a cell) by each unit price (given in multiple cells). Without the use of $ sign, you will have to apply the same calculation for all the unit prices individually But by using the $ sign before and after the cell reference, i.e., column H and row 3, you can freeze the tax rate completely. See the following Figure 4.47 to understand how to freeze a cell reference using the $ sign:

Mixed Reference: Using $ either before a column or row is known as mixed reference. Sometimes it becomes important to take reference from both column and row, out of which either of them needs to freeze. Given below is a list of sales persons and their target sales amount, along with the target percentage they are supposed to achieve every month for the next 6 months. If we don't use mixed reference here then it would be difficult to get the correct result. Let's see how we can apply the same.

VLOOKUP
VLOOKUP function is used to look up values on a vertical table array.

Syntax:
VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

- lookup_value: This is the required argument. This is the value you want to look up. The value you want to look up must be in the first column of the range of cells you specify in table-array.
- table_array: This is the required argument. This is the range of cells in which the VLOOKUP will search for the lookup_value and the return value.
- col_index_num: This is the required argument. This is the column number (starting with 1 for the left-most column of table-array) that contains the return value.
- range_lookup: This is the optional argument. This is a logical value that specifies whether you want VLOOKUP to find an approximate or an exact match:

If TRUE then the first column in the table is sorted either numerically or alphabetically, and VLOOKUP will then search for the closest value. This is the default method if you don't specify one.

If FALSE then VLOOKUP searches for the exact value in the first column.

VLOOKUP False case: Let's first understand how VLOOKUP works for an exact match.
On the left side of Figure 4.49 below are invoices for different products. However, their prices are missing. On the right side of the sheet we have products and their prices. Now let's use the VLOOKUP function to fetch the price from the product and price table to our invoices table. Because a product name is unique and it is exactly available in both the tables, it is considered as lookup_value. The table on the right, from where we will fetch the price, will be our Table array (we will freeze it as absolute reference too. Because we need to take the values from the second column, that is, Price so col_Index_num will be 2. And finally, as mentioned previously, as the lookup value (product name) is an exact match in both the tables, range_lookup will either be False or 0.

VLOOKUP True case: When range_lookup is set to True, VLOOKUP will try to find an approximate match. Let's understand the same with a sample data set. Below is a list of products and their prices. On the right side of the sheet is another table containing the price slab and discount (%). The discount increases with the price. Here lookup_ value will be the price on the left-hand side table. table_array is the right side table. col_index_num" is 2 because discount (%) is in the second column of table_array and range_lookup will be either True or 1 as prices are not unique and are given in the form of numerals in table_array.

HLOOKUP
This function works exactly like VLOOKUP except it works horizontally rather than vertically

Syntax:
HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])

- lookup_value: This is the required argument. This is the value to be found in the first row of the table. lookup_value can be a value, reference, or text string.
- table_array: This is the required argument. This is the table from which data is looked up. Use a reference to a range or a range name. The values in the first row of table_array can be text, numbers, or logical values.
- row_index_num: This is the required argument. This is the row number in table_array from which the matching value will be returned. A row_ index_num of 1 returns the first row value in table_array, row_index_num of 2 returns the second row value in table_array, and so on.
- range_lookup: This is the optional argument. It is a logical value that specifies whether you want HLOOKUP to find an exact match or an approximate match. If TRUE or omitted, an approximate match is returned.

HLOOKUP False case: In the example shown below (Figure 4.51), month-wise sales data is shown for each sales representative. Let's fetch the sales amount for one of the sales representatives and for a particular month. Here, lookup_value will be the name of that sales representative. table_array will the horizontally placed sales data at the top of the sheet. row_index_num will be the row number of the month for which we are looking up and finally range_lookup will be false or 0 as names are unique in this data set:

HLOOKUP True case: To understand this consider the same example sales representatives with their sales amount mentioned. Now let's assign a respective commission rate based on the table given on the

right side of the sheet. Here, lookup_value will be the sales amount of each representative. table_array will be the commission rate table on the right side of the sheet. row_index_num will be 2 because commission rate is mentioned in the second row of table_array. range_lookup will be True or 1 as sales values are not unique.

LOOKUP
The advantage of using LOOKUP is that it can look up values vertically as well as horizontally. Also, it can look up in any direction of the data unlike VLOOKUP that can look up only towards the right or HLOOKUP that can look up only downwards. The only disadvantage of LOOKUP (that cannot be ignored) is that it can only work for an approximate match.

Syntax:
LOOKUP(lookup_value, lookup_vector, [result_vector])

- lookup_value: This is the required argument. This is a value that LOOKUP searches for in the first vector. lookup_value can be a number, text, a logical value, or a name or reference that refers to a value.
- lookup_vector: This is the required argument. This is a range that contains only one row or one column. The values in lookup_vector can be text, numbers, or logical values.
- result_vector: This is the optional argument. This is a range that contains only one row or column. The result_vector argument must be the same size as lookup_vector.

Let's take the same sample data set we used to understand the Vlookup True case but with a small change; table_array lookup values are on the right and resulting cells are on the left (which VLOOKUP cannot fetch). Here, lookup_value is same as before, price. lookup_vector the price range given in the table on the right, and result_vector will be the discount (%) in the table.

INDEX and MATCH

Any limitations in the previous Lookup functions are overcome using the INDEX and MATCH functions, as this combinations can look up in any direction and can work for an exact match too.

MATCH: This function helps in finding the position of a value in a range.

Syntax:
MATCH(lookup_value, lookup_array, [match_type])

- lookup_value: This is the required argument. This is the value that you want to match in lookup_array. It can be a value (number, text, or logical value) or a cell reference to a number, text, or logical value.
- lookup_array: This is the required argument. This is the range of cells being searched.
- match_type: This is the optional argument. This is a number whose value can be -1, 0, or 1. The match_type argument specifies how Excel matches lookup_value with values in lookup_array. The default value for this argument is 1.

INDEX: This function can fetch values across a table for a given row and column number.

Syntax:
INDEX(array, row_num, [column_num])

- array: This is the required argument. This is a range of cells or an array constant. If array contains only one row or column, the corresponding row_num or column_num argument is optional. If array has more than one row and column, and only row_num or column_num is used, INDEX returns an array of the entire row or column in array.
- row_num: This is the required argument. This selects the row in array from which to return a value. If row_num is omitted, column_num is required.
- column_num: This is the optional argument. This selects the column in array from which to return a value. If column_num is omitted, row_num is required.

Let's consider the example of a bank's database. It contains account numbers and the respective balance available in each account type, that is, Current, Savings, Recurring, or FD. Let's find the balance amount for a given Account Number and a given Account Type. As it's a two-way lookup, we will nest the MATCH function inside the INDEX function to get the desired result. Let's start with the INDEX function, where the array will be the complete table. For row_num (as it contains a dropdown list of all the account numbers) we will apply the MATCH function, where lookup_value will be the account number currently selected from the drop-down list. lookup_array will be column A that has all the account numbers, and match_type will be False or 0. For col_num argument of the Index function we will again use the MATCH function, because it is again a drop-down list of all the account types and you can change it anytime. lookup_value will be the account type that is currently selected from the dropdown list. lookup_array will be the headers, data and match type will be either exact match or 0.