

SUMMARY: LOOKUPS IN MS EXCEL

SESSION OVERVIEW:

By the end of this session, the students will be able to:

- Understand **VLOOKUP** function in detail which will include the importance, drawbacks and the syntax of VLOOKUP.
- Understand **HLOOKUP** function in brief.
- Understand **INDEX-MATCH** functionality in excel.

KEY TOPICS AND EXAMPLES:

1. VLOOKUPs IN EXCEL:

a. Introduction (5 min):

In the previous lecture while working with the ABC company's datasets, we noticed that it was difficult to work on those tables without merging both the tables. Thus, we will be understanding ways by which we can merge two or multiple tables for the ease of understanding the datasets as a whole, get accurate insights and many more.

VLOOKUP is an abbreviation for vertical lookup. It is a powerful function in Microsoft Excel used to search for a value in the first column of a table or range, and then return a value in the same row from a specified column. It is one of the most commonly used functions for data lookup and retrieval tasks in Excel.

b. Importance of VLOOKUP (5 min):

- **Data Retrieval:** VLOOKUP allows users to quickly retrieve specific information from large datasets. This is particularly useful when dealing with databases or spreadsheets with numerous records, as it eliminates the need for manual searching.
- **Efficiency:** Using VLOOKUP saves time and effort by automating the process of finding and retrieving data. Instead of manually scanning through rows and columns, users can simply input the lookup value, and Excel will handle the rest.
- **Accuracy:** VLOOKUP helps ensure accuracy in data retrieval by minimizing the risk of human error. Since the function performs the lookup process based on predefined criteria, there is less chance of mistakes compared to manual methods.
- **Versatility:** VLOOKUP can be applied to various scenarios across different industries and functions. Whether it's analyzing sales data, managing inventory, or organizing employee information, the function provides a versatile solution for data lookup tasks.
- **Integration with Other Functions:** VLOOKUP can be combined with other Excel functions to perform more complex operations. For example, it can be used in conjunction with IF functions to create dynamic lookup formulas that return different results based on specified conditions.

- **Scalability:** VLOOKUP is scalable and can handle large datasets with ease. Whether you're working with hundreds or thousands of records, the function can efficiently retrieve the required information without compromising performance.
- **Ease of Use:** Despite its powerful capabilities, VLOOKUP is relatively easy to understand and use, even for users with basic Excel skills. This makes it accessible to a wide range of users and allows for quick adoption in various business environments.

c. **Syntax of VLOOKUP with examples (5 min):**

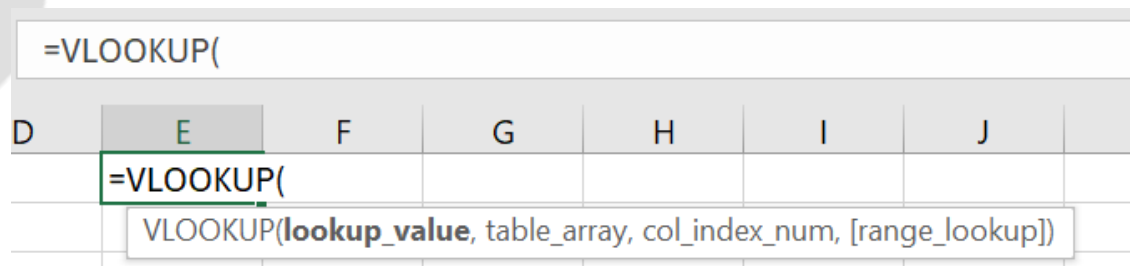


Figure: Represents the components in the VLOOKUP function in MS Excel

Parameters:

1. **lookup_value:** The value to search for in the first column of the table or range.
This is the value you want to search for in the first column of your table or range. It could be a number, text, or reference to a cell containing the value.
2. **table_array:** The table or range of cells where the data is stored. This should include the column where the lookup value is found and the column from which to retrieve the data.
This is the range of cells containing the data you want to search through. The lookup value must be in the first column of this range.
3. **col_index_num:** The column number in the table_array from which to retrieve the data. The first column in the table_array is 1.
For example, if the data you want is in the third column of the table array, the column index number would be 3.
4. **range_lookup (optional):** A logical value that specifies whether to perform an exact or approximate match. If TRUE or omitted, an approximate match is performed. If FALSE, an exact match is required.

Example:

```
=VLOOKUP(A2, EmployeeTable, 2, FALSE)
```

In this example:

- The cell 'A2' contains the employee ID you want to look up.
- EmployeeTable is the range of cells containing the employee ID in the first column and their names in the second column.

- 2 specifies that you want to retrieve the name from the second column of the EmployeeTable.
- FALSE specifies that you want an exact match for the employee ID.

d. Different types of VLOOKUPs in MS Excel (10 min):

i. VLOOKUP from same sheet:

Example: This [dataset](#) will be used to showcase the VLOOKUP function from the same sheet.

For this type of VLOOKUP, we can directly mention the formula that we have used above.

ii. VLOOKUP from another worksheet, same workbook:

The most common way VLOOKUP is done is when the data is present in two different sheets in the same workbook. To do VLOOKUP from a different sheet - We put the worksheet's name followed by an exclamation mark in the table_array argument before the range reference.

If the spreadsheet name contains spaces or is non-alphabetical characters, it must be enclosed in single quotation marks, e.g., 'Price list'!\$A\$2:\$C\$9.

Formula: =VLOOKUP(lookup_value, 'Sheet2'!cell range, 2, False)

To lock any cell value or any column, we do this by using the "\$" sign to lock any cell value or any column.

STEPS:

- Click on the first cell of your target column (where you want the VLOOKUP results to appear).
- Type =VLOOKUP, followed by opening parentheses.
- Next, select the cell containing the value you want to lookup
- Select the second sheet tab. Select the range of cells that you want VLOOKUP to search in. The range of cells that we will be referencing to need to be absolute, means addition of the \$ sign is required. Example, if we have a range of cells A2:E40, to apply absolute referencing we it must be \$A\$2:\$E\$40.
- Put a comma, followed by the index of the column that contains the values you want to retrieve
- Finally, close the parentheses.

This [Dataset-1](#) (contains table-1 and the final table after merging) and [dataset-2](#) (contains table-2 which was merged with table-1) can be used to showcase the VLOOKUP function from another sheet but the same workbook.

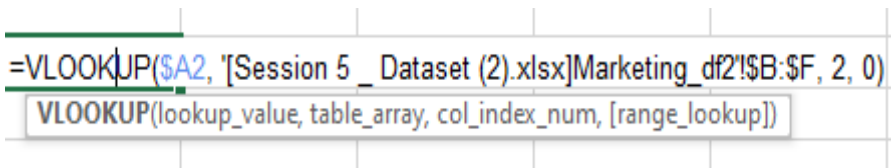
iii. VLOOKUP from another workbook:

(Dataset)

STEPS:

- Click on the first cell of your target column (where you want the VLOOKUP results to appear).
- Type =VLOOKUP, followed by opening parentheses.
- Next, select the cell containing the value you want to lookup

- Open the second workbook. Select the range of cells that you want VLOOKUP to search in. The range of cells that we will be referencing to need to be absolute, means addition of the \$ sign is required.
- Put a comma, followed by the index of the column that contains the values you want to retrieve.
- Finally, close the parentheses.



=VLOOKUP(\$A2, [Session 5 _ Dataset (2).xlsx]Marketing_df2!\$B:\$F, 2, 0)

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

NOTE: This is how the formula looks when we merge two tables from two different workbooks.

[datasets.](#)

e. **Possible errors that can occur (5 min):**

- #REF!** - If your function's Col_Index_Num is larger than the number of columns in your Table_Array, your VLOOKUP function will return a #REF! error.
- #VALUE!** - If your function's Col_Index_Num is less than 1, your VLOOKUP function will return a #VALUE! error.
- #N/A** - If you input FALSE (or 0) for your Range_Lookup parameter and no exact match can be found, your VLOOKUP function will return a #N/A error.

f. **Drawbacks of VLOOKUPs in MS Excel (10 min):**

- **Limited to Vertical Lookup:** VLOOKUP only allows users to search for values in the first column of a table or range and retrieve corresponding values from adjacent columns to the right. This limitation restricts its flexibility in certain scenarios where data is organized differently.
- **Exact Match Requirement:** By default, VLOOKUP performs approximate matches, meaning it looks for the closest value to the lookup value if an exact match is not found. This can lead to unexpected results if users forget to specify an exact match by setting the range_lookup argument to FALSE.
- **Column Index Dependency:** When using VLOOKUP, the column index number must be manually adjusted if the structure of the table array changes. If a new column is inserted or deleted, the column index number in the formula may become outdated, potentially leading to errors in the lookup results.
- **Not Dynamic:** VLOOKUP formulas are not dynamic by default, meaning they do not automatically adjust if the table array expands or contracts. Users must manually update the range references in the formula to accommodate changes in the dataset, which can be cumbersome in dynamic environments.
- **Performance Issues with Large Datasets:** VLOOKUP may experience performance issues when used with very large datasets, particularly if the

table array contains a significant number of rows. In such cases, users may experience slower calculation times, especially if the formula is used extensively throughout a workbook.

- **Inability to Look Left:** Unlike HLOOKUP (Horizontal Lookup), which searches for values in the first row of a table array and retrieves values from rows below, VLOOKUP cannot perform leftward lookups. This means users cannot retrieve values from columns to the left of the lookup column without restructuring the data.

2. HLOOKUPs IN EXCEL(10 min):

a. Introduction:

HLOOKUP stands for Horizontal Lookup and can be used to retrieve information from a table by searching a row for the matching data and outputting from the corresponding column.

b. Syntax of HLOOKUP with example:

HLOOKUP function in Excel comes with the following arguments:

=HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])

Example: (Dataset)

Let's consider the example mentioned below.

STUDENT NAME	A	B	C	D	E
ACCOUNTS	75	65	70	60	59
ECONOMICS	65	72	78	89	67
MANAGEMENT	70	68	90	72	58
MATHEMATICS	80	90	75	65	87

Now if our objective is to fetch the data for the student D in management then we can use HLOOKUP as follows:

STUDENT NAME	A	B	C	D	E
ACCOUNTS	75	65	70	60	59
ECONOMICS	65	72	78	89	67
MANAGEMENT	70	68	90	72	58
MATHEMATICS	80	90	75	65	87
Marks of D in management	=HLOOKUP(HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])				

Now, to populate the desired variables in the formula, we will select variables as follows:

STUDENT NAME	A	B	C	D	E
ACCOUNTS	75	65	70	60	59
ECONOMICS	65	72	78	89	67
MANAGEMENT	70	68	90	72	58
MATHEMATICS	80	90	75	65	87
Marks of D in management	=HLOOKUP(E1, A1:F5, 4, 0)				
	HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])				

The output for the following will be as follows:

=HLOOKUP(E1, A1:F5, 4, 0)					
A	B	C	D	E	F
STUDENT NAME	A	B	C	D	E
ACCOUNTS	75	65	70	60	59
ECONOMICS	65	72	78	89	67
MANAGEMENT	70	68	90	72	58
MATHEMATICS	80	90	75	65	87
Marks of D in management	72				

c. **Why HLOOKUPs are less widely used in industry:**

- **Data Organization**: In most business scenarios, data is typically organized in a vertical format, with each row representing a record or transaction, and each column representing a different attribute or variable. As a result, VLOOKUP is more aligned with the structure of business data and is easier to implement for data analysis tasks.
- **Performance**: VLOOKUP tends to perform better than HLOOKUP, especially with large datasets. HLOOKUP requires searching through a horizontal row, which can be slower and less efficient compared to the vertical search performed by VLOOKUP.

3. **INDEX-MATCH (25 min):**

a. **Introduction and syntax:**

- **Flexibility**: Unlike VLOOKUP and HLOOKUP, which are limited to vertical and horizontal searches respectively, INDEX-MATCH provides the flexibility to perform both vertical and horizontal lookups. This versatility is invaluable when dealing with datasets that are not structured in a strictly vertical or horizontal manner.
- **Improved Performance**: INDEX-MATCH often outperforms VLOOKUP and HLOOKUP in terms of speed and efficiency, especially with large datasets. This is because INDEX-MATCH doesn't rely on column or row

indices like VLOOKUP and HLOOKUP, but instead uses a more dynamic and efficient matching mechanism.

- **No Limitation on Lookup Column:** VLOOKUP restricts the lookup value to the leftmost column of the lookup range, while HLOOKUP restricts it to the top row. INDEX-MATCH imposes no such limitation, allowing users to search for values in any column or row within the specified range.
- **Better Handling of Dynamic Data:** VLOOKUP and HLOOKUP struggle with dynamic datasets where the lookup value's position may change. INDEX-MATCH excels in such scenarios, as it dynamically adjusts to changes in the dataset without requiring manual adjustments.
- **Enhanced Accuracy:** INDEX-MATCH eliminates the risk of selecting incorrect columns or rows, a common pitfall with VLOOKUP and HLOOKUP, as it directly references the target cell based on matching criteria, rather than relying on fixed indices.

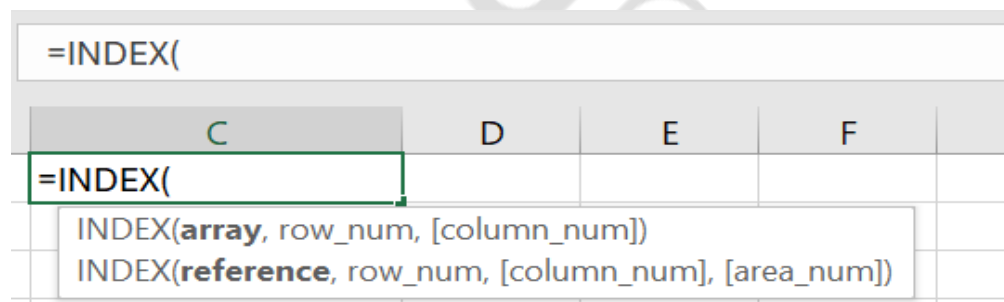
The INDEX-MATCH formula is a combination of two formulas, INDEX function and MATCH function.

=INDEX() returns the value of a cell in a table based on the column and row number.

=MATCH() returns the position of a cell in a row or column.

b. **INDEX function:**

The INDEX function in Excel is used to retrieve a value from a specified range of cells based on its row and column numbers. It's particularly useful for dynamic data retrieval and manipulation.



***Figure:** Represents the index function in MS Excel*

Let's consider the following example to understand INDEX: ([Dataset](#))

c. **MATCH function:** ([Dataset](#))

The MATCH function in Excel is used to find the relative position of a specified value within a range of cells. It's commonly used in conjunction with other functions, such as INDEX or VLOOKUP, to perform advanced data retrieval and manipulation tasks.

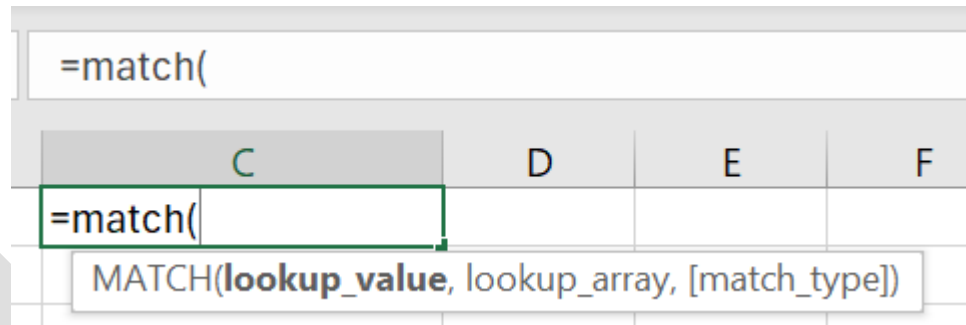


Figure: Represents the MATCH function in Excel

d. **Combination of INDEX-MATCH functionality: (Dataset)**

The combination of the INDEX and MATCH functions in Excel is a powerful tool for performing advanced data retrieval and manipulation tasks. This combination allows you to dynamically look up values within a range based on specific criteria.

```
=INDEX(return_range, MATCH(lookup_value, lookup_range, [match_type]))
```

- **return_range:** This is the range of cells from which you want to retrieve the result.
- **lookup_value:** This is the value you want to find within the lookup_range.
- **lookup_range:** This is the range of cells where you want to search for the lookup_value.
- **[match_type]:** [Optional] This argument specifies the type of match you want to perform, similar to the MATCH function.

[dataset](#)

4. **Merging the ABC DATASETS (20 min):**

This [Dataset](#) will be used to explain the merging of both datasets in ABC company.

[dataset](#)