

MASTER EXCEL

(THE ULTIMATE GUIDE)



TABLE OF CONTENTS



www.fmworldcup.com

1. Functions and Formulas
2. 5 Excel Features You Should Know
3. Excel Shortcuts
4. 12 Excel Mistakes to Avoid
5. 10 Common Excel Errors
6. 10 Reasons Why Excel is the Best Spreadsheets Tools
7. Excel Alphabet
8. Mastering Large Data Sets
9. Getting Started with Python in Excel
10. How ChatGPT Can Simplify Excel Workflow
11. History of Microsoft Excel



Follow Financial Modeling World Cup on LinkedIn



1. FUNCTIONS & FORMULAS

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

100 EXCEL FUNCTIONS



www.fmworldcup.com

MATH & TRIGONOMETRY

ABS	Returns the absolute value of a number.
ACOS	Returns the arccosine of a number.
COS	Returns the cosine of an angle given in radians.
EVEN	Rounds a number up to the nearest even integer.
EXP	Returns e raised to the power of a given number.
FACT	Returns the factorial of a number.
FLOOR	Rounds a number down to the nearest multiple of significance.
GAMMADIST	Returns the gamma distribution.
GCD	Returns the greatest common divisor of two or more integers.
HARMEAN	Calculates the harmonic mean of a dataset.
INT	Rounds a number down to the nearest integer.
LN	Returns the natural logarithm of a number.
LOG	Returns the logarithm of a number to a specified base.
LOG10	Returns the base-10 logarithm of a number.
LET	Defines variables and calculates a result based on given expressions.
MOD	Returns the remainder of a division operation.
ODD	Rounds a number up to the nearest odd integer.
PI	Returns the mathematical constant π.
POWER	Raises a number to a specified power.
RADIANS	Converts degrees to radians.
RAND	Returns a random number between 0 and 1.
SIGN	Returns the sign of a number.
SIN	Returns the sine of an angle given in radians.
SQRT	Returns the square root of a number.
TAN	Returns the tangent of an angle given in radians.
TRUNC	Truncates a number to a specified number of digits.

TEXT

ADDRESS	Returns the cell address as text.
CONCAT	Concatenates multiple text strings into one.
CONCATENATEX	Concatenates the result of an expression evaluated for each row in a table.
LEFT	Extracts a specified number of characters from the left side of a text string.
LEN	Returns the number of characters in a text string.
REPLACE	Replaces part of a text string with another text string.
RIGHT	Extracts a specified number of characters from the right side of a text string.
SEARCH	Finds one text string within another and returns the starting position.
SUBSTITUTE	Replaces existing text with new text in a text string.
TEXT	Formats a number as text using a specified format.
UPPER	Converts text to uppercase.
VALUE	Converts a text string that represents a number to a number.

DATE AND TIME

DATE	Returns the serial number of a date.
DAY	Extracts the day portion of a date.
DAYS	Calculates the number of days between two dates.
HOUR	Extracts the hour portion of a time.
MINUTE	Extracts the minute portion of a time.
MONTH	Extracts the month portion of a date.
NOW	Returns the current date and time.
SECOND	Extracts the second portion of a time.
TIME	Returns the serial number of a specific time.
TODAY	Returns the current date.
WEEKDAY	Returns the day of the week as a number.
YEAR	Extracts the year portion of a date.
YEARFRAC	Returns the fraction of the year represented by the number of whole days between two dates.

STATISTICAL

AGGREGATE	Performs various aggregation functions on a range of data.
AVERAGE	Calculates the average of a range of numbers.
CHIDIST	Returns the one-tailed probability of the chi-squared distribution.
COUNT	Counts the number of cells containing numbers in a range.
COUNTBLANK	Counts the number of blank cells within a range.
COUNTIFS	Counts the number of cells that meet multiple criteria.
DAVERAGE	Returns the average of selected database entries.
FREQUENCY	Calculates the frequency distribution of data.
FDIST	Returns the one-tailed F probability distribution.
LINEST	Calculates statistics for a line by using the least squares method.
MAX	Returns the largest value in a range of cells.
MEDIAN	Calculates the median of a dataset.
MIN	Returns the smallest value in a range of cells.
MDETERM	Returns the matrix determinant of an array.
NPV	Returns the net present value of an investment based on a series of cash flows.
NPER	Returns the number of periods for an investment based on periodic, constant payments and a constant interest rate.
QUOTIENT	Returns the integer portion of a division operation.
RANK	Returns the rank of a number in a list of numbers.
SLOPE	Calculates the slope of the linear regression line through a given set of data points.
STDEV	Estimates standard deviation based on a sample.
VAR	Calculates the variance of a dataset.
ZTEST	Calculates the one-tailed probability-value of a Z-test.

LOGICAL

AND	Returns TRUE if all its arguments are TRUE.
IF	Returns one value if a condition is true and another value if false.
IFERROR	Returns a value you specify if a formula evaluates to an error; otherwise, returns the result of the formula.
ISERR	Checks if a value is an error other than #N/A.
ISFORMULA	Checks if a cell contains a formula.
ISNONTEXT	Checks if a value is not text.
ISNUMBER	Checks if a value is a number.
NOT	Reverses the logical value of a statement.
OR	Returns TRUE if any argument is TRUE.
XOR	Returns TRUE if one argument is TRUE and the other is FALSE.

LOOKUP AND REFERENCE

INDEX	Returns the value of a cell in a specified row and column.
MATCH	Searches for a value in a range and returns its relative position.
OFFSET	Returns a reference offset from a starting cell.
VLOOKUP	Searches for a value and returns a corresponding result from a specified column.
HLOOKUP	Searches for a value and returns a value in the same column from a specified row.
XLOOKUP	Searches for a value and returns a result from another range or array.

FINANCIAL

PMT	Calculates the payment for a loan based on constant payments and a constant interest rate.
XNPV	Returns the net present value for cash flows at irregular intervals.
NPV	Returns the net present value of an investment based on a series of cash flows.
RATE	Calculates the interest rate per period of an annuity.
IRR	Calculates the internal rate of return for a series of cash flows that occur at regular intervals.

ARRAY

SEQUENCE	Generates a sequence of numbers in an array.
UNIQUE	Returns unique values from a range or array.

ERROR HANDLING

ERROR.TYPE	Returns a number corresponding to the type of error value.
IFERROR	Returns a value you specify if a formula evaluates to an error; otherwise, returns the result of the formula.

CUSTOM FUNCTIONS

LAMBDA	Defines a custom function in Excel.
LET	Defines variables and calculates a result based on given expressions.

EXCEL FUNCTIONS PYRAMID

5. Expert
4. Power User
3. Advanced
2. Intermediate
1. Basics

- Users at this level have a strong command over data manipulation and analysis.

- Users at this level are comfortable working with data from different angles.

LET,
LAMBDA,
Array Formulas,
FILTER, SORT,
Power Query, VBA

OFFSET, TRANSPOSE,
SEQUENCE, UNIQUE, TEXTSPLIT,
XIRR, XNPV

IFERROR, INDIRECT/ADDRESS,
SUMIFS, COUNTIFS, INDEX/MATCH,
XLOOKUP, SUMPRODUCT

VLOOKUP, HLOOKUP,
CONCATENATE, COUNTIF, SUMIF, EOMONTH

SUM, AVERAGE, COUNT, IF, ROUND, MIN, MAX

- Fundamental for any Excel user, forms the basis for more complex calculations.

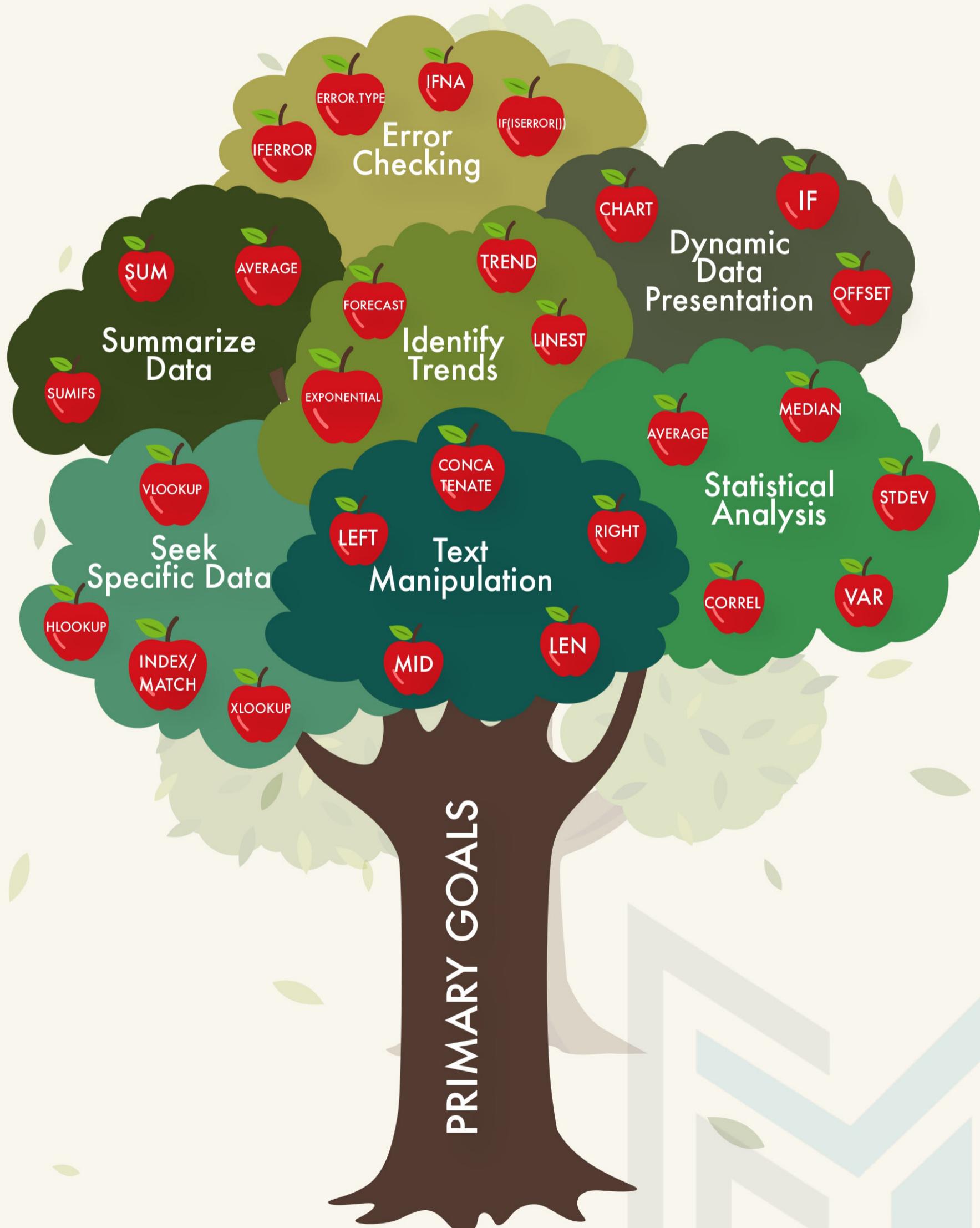
- Users demonstrate a mastery of Excel that extends beyond formulas



EXCEL FUNCTIONS DECISION TREE



www.fmworldcup.com



XLOOKUP GUIDE

www.fmworldcup.com

The **XLOOKUP** function in Excel is a powerful and versatile tool for searching a range, returning corresponding values, and handling various lookup scenarios.

• XLOOKUP Function Syntax

fx | =XLOOKUP(lookup_value, lookup_array, return_array, [if_not_found], [match_mode], [search_mode])

• Arguments

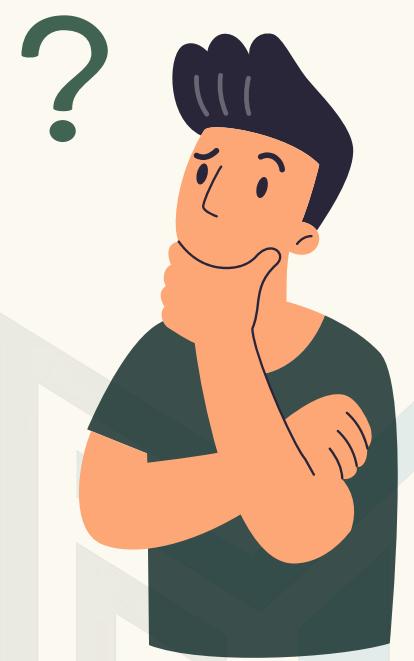
- a) **lookup_value**: The value you want to find in the lookup_array.
- b) **lookup_array**: The range of cells containing possible lookup values.
- c) **return_array**: The range of cells containing the values to be returned.
- d) **[if_not_found]**: Optional. Specifies the value to return if the lookup_value is not found. If omitted, #N/A is returned.
- e) **[match_mode]**: Optional. Specifies the type of match: 0 for an exact match, -1 for less than, and 1 for greater than.
- f) **[search_mode]**: Optional. Specifies the search mode: 1 for first to last, 2 for last to first, and 3 for a binary search.

• Examples

1. Basic XLOOKUP

fx | =XLOOKUP(lookup_value, A2:A10, B2:B10)

Searches for **lookup_value** in the range A2:A10 and returns the corresponding value from B2:B10.



XLOOKUP GUIDE

www.fmworldcup.com

- Examples

2. Handling not found

fx | =XLOOKUP(lookup_value, A2:A10, B2:B10, "Not Found")

Returns "Not Found" if the **lookup_value** is not found in the specified range.

3. Approximate Match

fx | =XLOOKUP(lookup_value, A2:A10, B2:B10, 0)

Performs an exact match lookup. Use 1 for greater than or -1 for less than.

4. Reverse Lookup

fx | =XLOOKUP(lookup_value, B2:B10, A2:A10)

Searches for **lookup_value** in the range B2:B10 and returns the corresponding value from A2:A10.



5. Handling Errors

fx | =IFERROR(XLOOKUP(lookup_value, A2:A10, B2:B10), "Not Found")

Uses **IFERROR** to handle errors and return a custom message for not found values.

XLOOKUP GUIDE

www.fmworldcup.com

- Examples

6. Binary Search

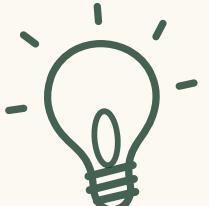
fx | =XLOOKUP(lookup_value, A2:A10, B2:B10, , , 3)

Performs a binary search for faster results (requires sorted data).

- Tips

1. Wildcard Characters:

- Use wildcard characters like * and ? in **lookup_value** for partial matches.



2. Array Mode:

- XLOOKUP supports array mode, allowing you to handle multiple lookup values at once.



3. Dynamic Arrays:

- XLOOKUP automatically spills results into adjacent cells for dynamic array functionality.

4. Error Handling:

- Use **IFERROR** or other error-handling functions to manage situations where values are not found.



VLOOKUP VS XLOOKUP

Stands for Vertical Lookup. It's a function used to search for a value in the first column of a range and return a value in the same row from another column.

Definition

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

Searches for a value in the leftmost column of a table and returns a value in the same row from a column you specify.

Supports only approximate match (TRUE) or exact match (FALSE).

Requires specifying the column index number where the return value is located.

May return errors if the lookup value is not found or if the table is not sorted (for approximate matches).

Available in older versions of Excel and widely used in legacy spreadsheets.

Known to be slower, especially with large datasets, due to its limitations and the need for sorted data.

Suitable for simple vertical lookups where data is sorted and the lookup value is in the leftmost column.

A newer function introduced in Excel that stands for Extended Lookup. It's designed to overcome some limitations of VLOOKUP and offers more flexibility and capabilities.

Syntax

`XLOOKUP(lookup_value, lookup_array, return_array, [if_not_found], [match_mode], [search_mode])`

Functionality

More versatile and can perform lookups in any direction (horizontal or vertical). It also allows for approximate and exact matches without sorting data.

Lookup Mode

Supports four search modes: exact match, exact match with wildcard characters, approximate match, and the ability to return the last matching item.

Column Indexing

Automatically returns values based on their position in the lookup and return arrays, eliminating the need for a separate column index number.

Handling Errors

Allows for customizable error handling with the [if_not_found] parameter, providing more control over error messages.

Compatibility

Available in Excel 365 and Excel 2021, so compatibility may be limited to newer versions unless using the XLOOKUP function backport.

Performance

Generally faster and more efficient, especially for unsorted data and complex lookup scenarios.

Use Cases

Ideal for more complex lookup scenarios, unsorted data, and when flexibility and efficiency are paramount.

Retrieve the name of the employee with ID "1003"

This formula searches for the value "1003" in column B, returns the corresponding value from column C (the second column of the range B2:C5), and uses an exact match (FALSE).

1001 John
1002 Alice
1003 Robert
1004 Emily
=VLOOKUP(1003, B2:C5, 2, FALSE)

Example

This formula searches for the value "1003" in the range B2:B5 (lookup_array), and returns the corresponding value from the range C2:C5 (return_array). XLOOKUP automatically performs an exact match.

1001 John
1002 Alice
1003 Robert
1004 Emily
=XLOOKUP(1003, B2:B5, C2:C5)

XLOOKUP VS FILTER



www.fmworldcup.com

XLOOKUP is used to search a range or an array and return an item corresponding to the first match it finds. It can replace VLOOKUP, HLOOKUP, and INDEX/MATCH functions.

Purpose

FILTER is used to return a filtered version of the data array, where the criteria match. It helps in extracting data that meets specified conditions.

`XLOOKUP(lookup_value,
lookup_array, return_array,
[if_not_found],
[match_mode],
[search_mode])`

Syntax

`FILTER(array, include,
[if_empty])`

- **Flexible Lookup Direction:** Can search from top-to-bottom or bottom-to-top.
- **Exact Match by Default:** Searches for an exact match unless specified otherwise.
- **Error Handling:** Allows specifying a custom message if the lookup value is not found.
- **Multiple Lookup Values:** Can search for multiple values at once.

Key Features

- **Dynamic Arrays:** Returns dynamic arrays that automatically spill over to adjacent cells.
- **Multiple Conditions:** Supports filtering based on multiple criteria.
- **Error Handling:** Allows specifying a custom message if no data meets the criteria.
- **Versatile:** Can be used to filter data both horizontally and vertically.

`=XLOOKUP("Apple", A2:A10,
B2:B10, "Not Found")`

This searches for "Apple" in the range A2 and returns the corresponding value from B2. If "Apple" is not found, it returns "Not Found".

Example

`=FILTER(A2:C10, B2:B10="Yes",
"No Data")`

This filters the range A2 and returns rows where the value in column B is "Yes". If no rows meet the criteria, it returns "No Data".

Ideal for situations where you need to find a specific piece of data in a table, such as looking up a price of a product or an employee's department based on their ID.

Use Cases

Perfect for extracting subsets of data that meet certain conditions, like filtering sales data to show only transactions from a particular region or date range.

SUMIFS CHEATSHEET



www.fmworldcup.com

SUMIFS is an **Excel** function designed for summing values based on multiple criteria. It allows users to specify different conditions in various ranges, summing only the values that meet all specified criteria. The syntax provides a sum range, multiple criteria ranges, and their corresponding conditions.

SYNTAX

=**fx** | =SUMIFS(sum_range, criteria_range1, criteria1, [criteria_range2, criteria2], ...)

sum_range:	The range of cells to sum.
criteria_range1:	The range to apply the first condition.
criteria1:	The condition to be met in criteria_range1.
[criteria_range2, criteria2]:	Additional ranges and their respective conditions.

EXAMPLES

1. Basic SUMIFS

Product	Sales (\$)
A	500
B	700
A	300
C	400
B	600

Result: \$800 – Sum of Sales where Product is A

2. Multiple Conditions

Region	Quarter	Revenue (\$)
North	Q1	1000
South	Q2	800
North	Q1	1200
East	Q2	1500
South	Q3	1100

Result: \$800 - Sum of Revenue where Region is South and Quarter is 2

3. Dynamic Date Range

Category	Type	Date	Value
A	X	01/01/2024	50
B	Y	03/01/2024	80
A	X	13/01/2024	60
B	Y	17/02/2024	90
A	X	13/02/2024	70
B	Y	31/01/2024	100
A	X	11/01/2024	40
B	Y	30/01/2024	110
A	X	01/02/2024	30

Result: 300 - Sum of Values where Category is B, Type is Y, and Date is within the last 30 days

Why SUMIFS instead of SUMIF?

SUMIFS

Allows for multiple criteria ranges.

More versatile with multiple conditions.

Supports AND logic for criteria.

Criteria columns are independent.

More flexible for complex conditions.

SUMIF

Only accommodates a single criteria range.

Suitable for simple, single-condition sums.

Operates on OR logic for multiple criteria.

Single criteria column is used for summing.

Limited flexibility due to single criteria.

IF FUNCTION CHEATSHEET



www.fmworldcup.com

SYNTAX

`fx =IF(logical_test, value_if_true, value_if_false)`

logical_test:	The condition you want to check.
value_if_true:	The result if the condition is true.
value_if_false:	The result if the condition is false.

COMMON USE CASES

BASIC IF

`fx =IF(A1>10, "Yes", "No")`

If the value in cell A1 is greater than 10, return "Yes"; otherwise, return "No"

NESTED IF

`fx =IF(A1>10, "High", IF(A1>5, "Medium", "Low"))`

If the value in cell A1 is greater than 10, return "High"; if it's between 5 and 10, return "Medium"; otherwise, return "Low".

ADVANCED OPTIONS

IF with OR

`fx =IF(OR(A1>10, B1="Approved"), "Yes", "No")`

If A1 is greater than 10 or B1 is "Approved", return "Yes".

IF with AND

`fx =IF(AND(A1>10, B1="Approved"), "Yes", "No")`

If A1 is greater than 10 and B1 is "Approved", return "Yes".

IF with ISBLANK

`fx =IF(ISBLANK(A1), "Blank", "Not Blank")`

Check if A1 is blank.

ERROR HANDLING

BASIC IF

`fx =IFERROR(formula, "Error Message")`

If the formula results in an error, display a custom error message.

NESTED IF

`fx =IFNA(formula, "Not Available")`

If the formula results in #N/A error, display a custom message.

TIPS AND TRICKS

Boolean Logic

`fx =IF(A1>B1, "True", "False")`

Compare the value in cell A1 with the value in cell B1. If A1 is greater than B1, it returns the text "True"; otherwise, it returns "False." This is useful for creating logical conditions based on numerical comparisons.

Text Values

`fx =IF(A1="Apple", "Fruit", "Not a Fruit")`

Check if the value in cell A1 is equal to the text "Apple." If true, it returns "Fruit"; otherwise, it returns "Not a Fruit." This is handy for categorizing or labeling data based on specific text values.

Date Comparison

`fx =IF(A1>TODAY(), "Future Date", "Past Date")`

Compare the date in cell A1 with the current date (TODAY()). If the date in A1 is in the future, it returns "Future Date"; otherwise, it returns "Past Date." This is a common scenario for tracking and categorizing dates based on their relationship to the current date.

Multiple Conditions

`fx =IF(AND(A1>10, B1="Approved"), "High", IF(AND(A1>5, B1="Pending"), "Medium", "Low"))`

This nested IF formula classifies values in cells A1 and B1 into categories (High, Medium, Low) based on multiple conditions. If A1 > 10 and B1 is "Approved," it's "High." If not, it checks if A1 > 5 and B1 is "Pending" for "Medium." Otherwise, it's "Low." Useful for tiered classification.

Checking Duplicates

`fx =IF(COUNTIF(A1:A100, A1)>1, "Duplicate", "Unique")`

Identify duplicate values in a range. If the value is a duplicate, return "Duplicate"; if not, then "Unique".

REMEMBER

Always Balance Parentheses:

Ensure that each opening parenthesis has a corresponding closing parenthesis.

Use Cell References:

Whenever possible, refer to cell values to make the formula dynamic.

Test in Steps:

Break down complex IF statements into simpler ones for easier troubleshooting.

XMATCH CHEATSHEET



www.fmworldcup.com

1. Function Name

XMATCH

2. Purpose

The XMATCH function searches for a specified value in a range or array and returns the relative position of the item found.

3. Function Name

XMATCH (lookup_value, lookup_array, [match_mode], [search_mode])

4. Arguments

lookup_value

The value you want to search for.

lookup_array

The range or array where the lookup value will be searched.

[match_mode] (optional)

Specifies the type of match. Default is 0 (exact match).

- 0 or omitted: Exact match.
- -1: Exact match or next smallest item.
- 1: Exact match or next largest item.

[search_mode] (optional)

Specifies the direction of the search. Default is 1 (search from top to bottom or left to right).

- 1 or omitted: Search from top to bottom or left to right.
- -1: Search from bottom to top or right to left.

5. Return Value

The position of the matched item relative to the lookup array.
Returns #N/A if no match is found.

6. Example

A	B	C
1	34	
2	75	
3	92	
4	84	
5	42	
6	98	
7	93	
8	74	
9	28	
10	48	=XMATCH(42,A1:A10,1)

Searches for the value 42 in cells A1:A10 using an exact match (match_mode = 0) and searches from top to bottom (search_mode = 1).

The value returned is 5 indicating the row in which the number is located.

7. Notes

- XMATCH is a newer version of the MATCH function in Excel, introduced in Excel 2019 and Excel for Microsoft 365.
- It offers more flexibility than the MATCH function by allowing for approximate matching and specifying the search direction.
- XMATCH can handle both vertical and horizontal lookup arrays.

8. Tips

- Use XMATCH for advanced lookup scenarios where you need more control over the matching criteria and search direction.
- Experiment with different match modes and search modes to tailor the function to your specific requirements.
- Combine XMATCH with other functions like INDEX and IFERROR for more powerful lookup formulas.

INDEX / MATCH CHEATSHEET



www.fmworldcup.com

DEFINITION

Index/Match is a combination of two functions in Excel used to look up values in a table.

PURPOSE

Index/Match is a combination of two functions in Excel used to look up values in a table.

INDEX FUNCTION		MATCH FUNCTION	
Syntax	<code>INDEX(array, row_num, [column_num])</code>	Syntax	<code>MATCH(lookup_value, lookup_array, [match_type])</code>
Purpose	Returns the value of a cell in a table based on the row and column number.	Purpose	Searches for a specified value in a range and returns its relative position.
Usage	Extracts data from a specified row and column in a table.	Usage	Finds the position of a lookup value within a range.
Example	If you have a data table with sales figures and want to retrieve a specific value based on its row and column position, you can use the Index function.	Example	When you need to find the position of a customer's name in a list to retrieve their corresponding sales data, you can use the Match function.

INDEX/MATCH COMBINATION

Purpose	Combines the Index and Match functions to perform flexible and dynamic lookups in Excel.
Advantages	Overcomes the limitations of VLOOKUP, such as the inability to search to the left of the lookup column and the requirement for exact matches.
Usage	By nesting the Match function within the Index function, you can perform lookup operations that are not possible with VLOOKUP.
Example	When you need to perform a two-way lookup to retrieve data based on both row and column criteria, Index/Match is the preferred method.

USEFUL TIPS

1. Using Index/Match for Flexible Lookups	2. Avoiding Errors with Match	3. Combining Index/Match with Other Functions	4. Using Exact Match
Unlike VLOOKUP, Index/Match allows you to perform lookups in any column, not just the leftmost one. This flexibility is useful when your lookup value doesn't reside in the first column of your table or when you want to return values from columns to the right of your lookup column.	MATCH function can return errors if the lookup value is not found in the search array. To handle this, use error handling functions like IFERROR or ISERROR to display custom messages or perform alternative actions when errors occur.	Index/Match can be combined with other Excel functions to perform more complex calculations or manipulations. For example, you can use it with IF function to perform conditional lookups or with SUM function to sum values returned by the Index/Match formula.	By default, MATCH performs approximate matches. To ensure an exact match, use the third argument of MATCH function and set it to 0 (zero). This tells Excel to find an exact match for the lookup value.
5. Understanding Array Formulas	6. Dynamic Ranges with Index/Match	3. Enhancing Performance	8. Using Index/Match with Wildcards
Index/Match can be used within array formulas to perform calculations across multiple cells or ranges. When using Index/Match in array formulas, remember to press Ctrl + Shift + Enter instead of just Enter to properly enter the formula as an array formula.	You can make your Index/Match formulas dynamic by using functions like OFFSET, INDIRECT, or dynamic named ranges. This allows your formulas to adjust automatically as your data changes or expands.	To improve the performance of your Index/Match formulas, minimize the use of volatile functions and unnecessary calculations. Additionally, try to limit the size of your lookup arrays to only include the necessary data.	Index/Match can be combined with wildcard characters like asterisks (*) or question marks (?) to perform partial matches or pattern-based lookups. This is helpful when you need to search for values that match a specific pattern or contain certain substrings within larger text strings.

EXAMPLES

1. Basic Index/Match

A	B	C
Name	Age	Grade
John	25	A
Alice	30	B
Emily	28	C
=INDEX(C2:C4, MATCH("Alice", A2:A4, 0))		
6		

Returns "B", Alice's grade

2. Multi-column Index/Match

A	B	C	D
Region	Product	Sales	
North	A	1500	
North	B	2000	
South	A	1450	
South	B	1890	
=INDEX(C2:C5, MATCH(1,(A2:A5="South")*(B2:B5="B"),0))			
7			

Returns 1890, sales figure for Product B in the South region

3. Advanced Index/Match

A	B	C	D
Date	Revenue		
01/03/2024	1400		
02/03/2024	5000		
03/03/2024	3800		
=INDEX(B2:B4, MATCH(MAX(B2:B4), B2:B4, 0))			
6			

Returns 5000, the highest revenue



2. **5 EXCEL FEATURES YOU SHOULD KNOW**

www.fmworldcup.com

5 EXCEL FEATURES YOU SHOULD KNOW



www.fmworldcup.com

1. DATA TABLE

A great tool for your what-if analysis. A range of cells in which you can change values in some of the cells and come up with different answers to a problem.

How to create it?

Instructions

1. Write down input data
2. Calculate the value you want to find out
3. Write down additional input data you want to test
4. Go to Data -> WhatIf Analysis -> Data Table
5. Put in row and column input cell that corresponds to the layout you have created in step #3 and press OK

Example

1. Write down input data such as Interest rate, number of periods, and starting amount if you want to see how your savings amount would change under different scenarios

Interest Rate	7%
Number of Periods	3
Starting Amount	\$ 2,000

2. Calculate the savings amount from the initial input data

3. Insert additional testable input data - changes in interest rate, starting amount.

4. Row input cell - interest rate from initial input data; Column input cell - starting amount from initial input data

5. By changing the initial input data, your data table will update too!

\$8,400	3.50%	6.00%	6.50%	7.00%	7.50%	8.00%	8.50%
\$ 1,000	\$ 4,752	\$ 4,775	\$ 4,799	\$ 4,822	\$ 4,846	\$ 4,870	\$ 4,893
\$ 1,500	\$ 7,129	\$ 7,066	\$ 7,129	\$ 7,048	\$ 7,189	\$ 7,234	\$ 7,279
\$ 2,000	\$ 1,088	\$ 9,612	\$ 9,489	\$ 9,460	\$ 9,492	\$ 9,523	\$ 9,546
\$ 2,500	\$ 1,455	\$ 7,790	\$ 7,759	\$ 7,781	\$ 7,823	\$ 7,864	\$ 7,907
\$ 3,000	\$ 1,822	\$ 6,649	\$ 6,679	\$ 6,650	\$ 6,681	\$ 6,714	\$ 6,746
\$ 3,500	\$ 2,189	\$ 5,517	\$ 5,547	\$ 5,518	\$ 5,550	\$ 5,581	\$ 5,613
\$ 4,000	\$ 2,556	\$ 4,385	\$ 4,415	\$ 4,386	\$ 4,418	\$ 4,450	\$ 4,481
\$ 4,500	\$ 2,923	\$ 3,253	\$ 3,283	\$ 3,254	\$ 3,286	\$ 3,317	\$ 3,348

2. PIVOT TABLE

A PivotTable is a powerful tool to calculate, summarize, and analyze data that lets you see comparisons, patterns, and trends in your data.

How to create it?

Instructions

1. Have an Excel table with data
2. Go to Insert -> PivotTable and choose a table or a range you want to analyze
3. Choose fields to summarize the data by
4. Go to PivotTable Analyze or Design tabs to customize the Pivot Table

Example

1. Store order history with customized ID, product ID, product price and product category

Product Sales Data	
Product Category	Total Sales Count of Product
Clothing	5,487
Footwear	5,486
Home & Garden	5,485
Pet Supplies	5,479
Overall Total	5,5486

2. Choose the table from step 1

3. Look at the total sales and count of products bought by product categories. Choose columns, Rows, Filters, Values – everything is customizable and you can play with the report!

4. Add a slicer, insert timeline, add subtotals and other things

3. DATA VALIDATION

Use data validation to restrict the type of data or the values that users enter into a cell. One of the most common data validation uses is to create a drop-down list.

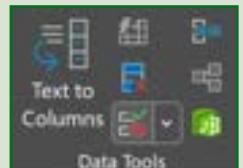
How to create it?

Instructions

1. Select the cell you want to create a drop-down list in
2. Select Data -> Data Validation
3. Choose what will the users be able to choose (numbers, dates, time, custom text, etc.)
4. Create Input Message so that users know what they are choosing
5. Link other data in your model to this dropdown list, so that values update automatically

Example

1. On your input data Excel sheet, create a cell where users will be able to choose between different store locations



2. Offer to choose from a list of store locations such as "USA, Spain, UK, Australia, Japan, Germany"

3. "Select Store Location"

Period	Country	Category	Subcategory	Item	Description
Q1	USA	Electronics	Smartphones	iPhone X	Apple iPhone X
Q1	USA	Electronics	Smartphones	Galaxy S9	Samsung Galaxy S9
Q1	USA	Electronics	Smartphones	Pixel 2 XL	Google Pixel 2 XL
Q1	USA	Electronics	Smartphones	OnePlus 6	OnePlus 6
Q1	USA	Electronics	Smartphones	Nexus 6P	LG Nexus 6P
Q1	USA	Electronics	Smartphones	HTC U11+	HTC U11+
Q1	USA	Electronics	Smartphones	Samsung Galaxy Note 8	Samsung Galaxy Note 8
Q1	USA	Electronics	Smartphones	Google Pixel 3	Google Pixel 3
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950	Microsoft Lumia 950
Q1	USA	Electronics	Smartphones	LG G5	LG G5
Q1	USA	Electronics	Smartphones	Samsung Galaxy S7 Edge	Samsung Galaxy S7 Edge
Q1	USA	Electronics	Smartphones	HTC 10	HTC 10
Q1	USA	Electronics	Smartphones	Google Pixel 2	Google Pixel 2
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL	Microsoft Lumia 950 XL
Q1	USA	Electronics	Smartphones	Samsung Galaxy S8	Samsung Galaxy S8
Q1	USA	Electronics	Smartphones	HTC U11	HTC U11
Q1	USA	Electronics	Smartphones	Google Pixel 3 XL	Google Pixel 3 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 Dual SIM	Microsoft Lumia 950 Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S9+	Samsung Galaxy S9+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12+
Q1	USA	Electronics	Smartphones	Google Pixel 4 XL	Google Pixel 4 XL
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10	Samsung Galaxy S10
Q1	USA	Electronics	Smartphones	HTC U12 Life	HTC U12 Life
Q1	USA	Electronics	Smartphones	Google Pixel 4	Google Pixel 4
Q1	USA	Electronics	Smartphones	Microsoft Lumia 950 XL Dual SIM	Microsoft Lumia 950 XL Dual SIM
Q1	USA	Electronics	Smartphones	Samsung Galaxy S10+	Samsung Galaxy S10+
Q1	USA	Electronics	Smartphones	HTC U12+	HTC U12



3. **EXCEL SHORTCUTS**

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

EXCEL SHORTCUTS CHEATSHEET



www.fmworldcup.com

GENERAL

Ctrl P	Print
Ctrl S	Save Workbook
Ctrl C	Copy
Ctrl X	Cut
Ctrl V	Paste
Ctrl Z	Undo
Ctrl Y	Redo
Ctrl E	Flash Fill
Ctrl K	Insert Hyperlink
Ctrl N	New workbook
Ctrl O	Open workbook
F11	Chart in new worksheet
F4	Repeat
Ctrl W	Close workbook
Alt F4	Close Excel

NAVIGATION

Alt PgDn	One screen right
Alt PgUp	One screen left
PgUp	One screen up
PgDn	One screen down
Ctrl →	Right edge of data region
Ctrl ←	Left edge of data region
Home	Beginning of row
Ctrl End	Last cell
Ctrl Home	First cell
Ctrl Tab	Switch Worksheets
Alt U , V	Toggle Full Screen

WORKBOOK

Shift F11	New worksheet
Ctrl PgDn	Next worksheet
Ctrl PgUp	Previous worksheet
F6	Next pane
Shift F6	Previous pane
Ctrl Tab	Next workbook
Ctrl Shift Tab	Previous workbook
Ctrl F9	Minimize workbook
Ctrl F10	Maximize workbook
Ctrl F6	Switch Between Open Workbooks

FORMATTING

Alt H A C	Align center
Alt H A L	Align left
Alt H A R	Align right
Alt H F G	Increase font size
Alt H F K	Decrease font size
Ctrl Shift \$	Currency Format
Ctrl Shift %	Percentage Format
Ctrl Shift ^	Scientific Nb Format
Ctrl Shift #	Date Format
Ctrl Shift @	Time Format
Ctrl Shift !	Number Format
Ctrl ;	Insert Current Date

FORMATTING

Ctrl :	Insert Current Time
Ctrl B	Bold
Ctrl I	Italic
Ctrl U	Underline
Ctrl Shift C	Format Painter
Ctrl +	Insert Rows/Columns
Ctrl -	Delete Rows/Columns
Ctrl 1	Format Cells Dialog Box
Ctrl D	Autofill Down
Ctrl R	Autofill Right
Ctrl Shift 7	Apply Cell Borders
Ctrl Shift -	Remove Borders

DATA ANALYSIS

Alt D , T	Data Table
Alt A , S , G	Goal Seek
Alt T , I	Solver Add-in
Alt A , B	Subtotal Function
Alt , L	Consolidate Data
Ctrl Q	Autofill Right
Alt A, C	Remove Filter



Most Used EXCEL Shortcuts

Sign up for MICROSOFT EXCEL WORLD CHAMPIONSHIP by October 6



GENERAL

Alt F1

Create embedded chart

F11

Create chart in new worksheet

Ctrl Shift F4

Find previous match

Shift F4

Find next match

Ctrl Alt V

Display the Paste Special dialog box

F4

Repeat last action

Ctrl W

Close current workbook

Alt F4

Close Excel

Ctrl N

Create new workbook

Ctrl O

Open workbook

NAVIGATION

Alt PgDn

Move one screen right

Alt PgUp

Move one screen left

PgUp

Move one screen up

PgDn

Move one screen down

Ctrl →

Move to right edge of data region

Ctrl ←

Move to left edge of data region

Home

Move to beginning of row

Ctrl End

Move to last cell in worksheet

Ctrl Home

Move to first cell in worksheet

FORMATTING

Alt H A C

Align center

Alt H A L

Align left

Alt H A R

Align right

Alt H F G

Increase font size one step

Alt H F K

Decrease font size one step

Ctrl Shift \$

Currency Format

Ctrl Shift %

Percentage Format

Ctrl Shift ^

Scientific Number Format

Ctrl Shift #

Date Format

Ctrl Shift @

Time Format

Ctrl Shift !

Number Format

Ctrl Shift -

Remove borders

Ctrl ;

Enter Current Date

Ctrl :

Enter Current Time

WORKBOOK

Shift F11

Insert new worksheet

Ctrl PgDn

Go to next worksheet

Ctrl PgUp

Go to previous worksheet

F6

Move to next pane

Shift F6

Move to previous pane

Ctrl Tab

Go to next workbook

Ctrl Shift Tab

Go to previous workbook

Ctrl F9

Minimize current workbook window

Ctrl F10

Maximize current workbook window

Order.co



www.fmwworldcup.com

EXCEL Shortcuts Alphabet



Enter



Q

Alt

F11

T

Ctrl

C

A

S

Alt

S

Shift

^
6

Sign up for MICROSOFT EXCEL WORLD CHAMPIONSHIP by October 6

Ctrl **A**

Select All

Ctrl **B**

Bold

Ctrl **C**

Copy

Ctrl **D**

Fill Down

Ctrl **E**

Flash Fill

Ctrl **F**

Find

Ctrl **G**

Go to

Ctrl **H**

Find & Replace

Ctrl **I**

Italic

Ctrl **J**

Justify

- Ctrl K** Hyperlink
- Ctrl L** Convert Data to Table Format
- Ctrl M** Indent the Selected Cells
- Ctrl N** New Workbook
- Ctrl O** Open Workbook
- Ctrl P** Print
- Ctrl Q** Quit Excel
- Ctrl R** Fill Right
- Ctrl S** Save Workbook
- Ctrl T** Create a Table

Ctrl**U****Underline****ctrl****v****Paste****ctrl****w****Close Workbook****Ctrl****x****Cut****ctrl****y****Redo****ctrl****z****Undo**

Order.co



www.fmwworldcup.com

EXCEL Ctrl + 0-9 Shortcuts



Sign up for MICROSOFT EXCEL WORLD CHAMPIONSHIP by October 6

- Ctrl 0 Hide the selected columns**
- Ctrl 1 Open the Format Cells dialog**
- Ctrl 2 Apply or remove Bold formatting to font
(CTRL+B)**
- Ctrl 3 Apply or remove Italics formatting to font
(CTRL+I)**
- Ctrl 4 Apply or remove Underline formatting to font
(CTRL+U)**
- Ctrl 5 Apply or remove strikethrough formatting to font**
- Ctrl 6 Switch between hiding objects, displaying objects,
and displaying placeholders for objects**
- Ctrl 7 None**
- Ctrl 8 Display or hide the outline symbols**
- Ctrl 9 Hide the selected rows**

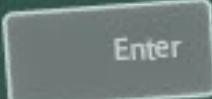
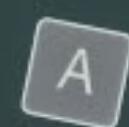
Order.co



www.fmwworldcup.com

EXCEL Ctrl + Shift Shortcuts

Sign up for MICROSOFT EXCEL WORLD CHAMPIONSHIP by October 6



Ctrl Shift

Ctrl+Shift, then scroll your mouse wheel up to go left, down to go right

Ctrl Shift A

Insert argument names and parentheses when the insertion point is to the right of a function name in a formula

Ctrl Shift F or P

Format fonts in the Format Cells dialog

Ctrl Shift G

Open the Workbook Statistics dialog

Ctrl Shift L

Apply / Remove Auto-filter

Ctrl Shift O

**Select all cells containing Notes
(earlier called comments)**

Ctrl Shift U

Apply / Remove Auto-filter

Ctrl Shift F2

**Insert a threaded comment /
Open and reply to a threaded comment**

Ctrl Shift F3

Open create name from selection dialog box

Ctrl Shift F6

Switches between all Excel windows

Ctrl **Shift** **F10**

Open the context menu

Ctrl **Shift** **F12**

Opens print worksheet dialog box

Ctrl **Shift** **+**

Open the Insert dialog to insert blank cells

Ctrl **Shift** **:**

Enter the current time

Ctrl **Shift** **-**

Remove the outline border from the selected cells

Ctrl **Shift** **~**

Apply the General number format

Ctrl **Shift** **=**

Insert Rows / Columns when row column is selected or display insert menu when cell is selected

Ctrl **Shift** **1**

Apply the Number format with two decimal places, thousands separator, and minus sign (-) for negative values

Ctrl **Shift** **2**

Apply the Time format with the hour and minute, and AM or PM

Ctrl **Shift** **3**

Apply the Date format with the day, month, and year

Ctrl **Shift** **4**

Apply the Currency format with two decimal places (negative numbers in parentheses)

Ctrl **Shift** **5**

Apply the Percentage format with no decimal places

Ctrl **Shift** **6**

Apply the Scientific number format with two decimal places

Ctrl **Shift** **7**

Apply an outline border to the selected cells

Ctrl **Shift** **8**

Select the current region around the active cell

Ctrl **Shift** **9**

Unhide Rows

Ctrl **Shift** **Space**

Select the entire worksheet (equivalent to CTRL+A) Select all objects on a worksheet when an object is selected

Ctrl **Shift** **PgDn**

Select the current and next sheet in a workbook

Ctrl **Shift** **PgUp**

Select the current and previous sheet in a workbook

Ctrl **Shift** **Home**

Extend the selection of cells to the beginning of the worksheet

Ctrl **Shift** **End**

Extend the selection of cells
to the last used cell on the worksheet

Ctrl **Shift** 

Extends the selection of cells to
the last nonblank cell in the same
column or row as the active cell, or
if the next cell is blank, extends the
selection to the next nonblank cell

Ctrl **Shift** **Tab**

Switches to the previous tab in a dialog,
or (if no dialog is open) switches
between all Excel windows

Ctrl **Shift** **Enter**

Confirm a formula as Array formula

Ctrl **Shift** **"**

Copy the value from the cell above the
active cell into the cell or the formula bar



4. 12 EXCEL MISTAKES TO AVOID

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

12 EXCEL MISTAKES TO AVOID



www.fmworldcup.com

1. Not using the correct data format

It's important to use the correct data type for each column in your spreadsheet, such as text, number, or date. Incorrect data types can result in unexpected errors and formatting issues.

2. Not using error-checking functions

Excel has several built-in error-checking functions, such as IFERROR, that can help you avoid common errors and provide more informative error messages.

3. Not using data validation

Data validation is a powerful tool that can help you ensure that data entered into your spreadsheet meets certain criteria. For example, you can use data validation to restrict the type of data that can be entered into a cell, or to limit the range of acceptable values.

4. Not using conditional formatting

Conditional formatting is a great way to highlight cells that meet certain criteria, such as cells that contain values that are above or below a certain threshold.

5. Not using keyboard shortcuts

Keyboard shortcuts can save you a lot of time when working with Excel. For example, you can use the Shift+Spacebar shortcut to select the row, Ctrl +- (plus minus) to delete the row, and Ctrl+Shift+"+" to add a row.

6. Not using named ranges

Named ranges make it easier to reference cells and ranges in your formulas and macros. By using named ranges, you can make your formulas more readable and easier to understand. It also speeds up your work. Important when competing in Excel Esports!

7. Not regularly saving your work

Failing to save your work frequently can result in loss of data if Excel crashes or if there is a power outage. Use the autosave feature and frequently press Ctrl+S to save your progress.

8. Incorrect use of absolute and relative cell references

Misunderstanding the difference between absolute (\$A\$1) and relative (A1) cell references can lead to errors in your formulas, especially when copying them across multiple cells.

9. Not keeping data clean

Failing to remove duplicates, handle missing values, and ensure consistency can result in inaccurate analysis and reporting. Regularly clean and validate your data to maintain its integrity.

10. Overcomplicating formulas

Using overly complex formulas can make your spreadsheet difficult to understand and maintain. Break down complex formulas into smaller, manageable parts or use helper columns.

11. Not leveraging advanced features

Features like Power Query, Power Pivot, and Macros can significantly enhance your productivity and data handling capabilities. Ignoring these advanced features can limit your efficiency.

12. Relying too heavily on manual data entry

Manual data entry is prone to errors and is time-consuming. Use data import features, data connections, and automation to minimize manual entry and improve accuracy.



5. 10 COMMON EXCEL ERRORS

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

COMMON EXCEL ERRORS



www.fmworldcup.com

1

#DIV/0!

Occurs when a formula attempts to divide a number by zero or an empty cell.

HOW TO SOLVE?

Check the divisor in your formula to ensure it's not zero or blank. Use IFERROR or IF to handle the potential division by zero.

fx | =IFERROR(A1/B1, "Division by zero error")

2

#VALUE!

Occurs when a formula has the wrong type of argument or operand.

HOW TO SOLVE?

Ensure all cells referenced in the formula contain the correct data type. Use TEXT or VALUE functions to convert data types if necessary.

fx | =VALUE(A1) + B1

3

#NAME?

Occurs when Excel doesn't recognize text in a formula.

HOW TO SOLVE?

Check for typos in function names and named ranges. Enclose text strings in quotes.

fx | =SUM(A1:A10)

4

#REF!

Occurs when a reference is invalid.

HOW TO SOLVE?

Update the formula to use the correct cell references. Use UNDO (Ctrl+Z) if you've accidentally deleted cells.

5

#N/A

Occurs when a value is not available to a function or formula.

HOW TO SOLVE?

Check the lookup value and the source range for correct references. Ensure data consistency in lookup operations.

fx | =IFERROR(VLOOKUP(A1, B1:C10, 2, FALSE), "Not found")

6

#NUM!

Occurs when there is a problem with a number in a formula or function.

HOW TO SOLVE?

Verify the numeric arguments in the formula. Adjust the formula to fit within Excel's numeric limits.

fx | =IF(A1>0, SQRT(A1), "Invalid input")

7

#NULL!

Occurs when you use an intersection of two ranges that don't intersect.

HOW TO SOLVE?

Use correct range references and ensure the intended ranges intersect.

fx | =SUM(A1:A10, B1:B10)

8

#SPILL!

Occurs when a formula returns multiple results, but Excel can't display them all.

HOW TO SOLVE?

Clear the obstructing data or move the formula to a new location. Check the intended range for sufficient empty cells.

9

#CALC!

Occurs when Excel encounters a calculation error.

HOW TO SOLVE?

Check the entire array formula for accuracy. Correct any issues in the source data.

10

#####

Occurs when the cell isn't wide enough to display the content.

HOW TO SOLVE?

Increase the column width. Use text wrapping or adjust the cell formatting.



6. **10 REASONS WHY EXCEL IS THE BEST SPREADSHEETS TOOLS**

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

10 REASONS WHY EXCEL IS THE BEST SPREADSHEET TOOL



www.fmworldcup.com

1

VERSATILITY

Excel is incredibly versatile, suitable for a wide range of tasks from simple calculations to complex data analysis, financial modeling, project management, and more. Its flexibility allows users to customize their spreadsheets according to their specific needs.

2

EXTENSIVE FORMULA LIBRARY

Excel boasts a vast library of built-in functions and formulas, covering a wide range of mathematical, statistical, financial, and engineering calculations. From simple arithmetic operations to complex mathematical modeling, Excel provides the tools necessary to perform calculations efficiently and accurately.

3

USER-FRIENDLY INTERFACE

Excel provides a user-friendly interface with familiar tools and functionalities that make it easy for beginners to get started. The ribbon toolbar organizes features logically, and there are extensive help resources available online.

4

ADVANCED FEATURES

Excel offers a wide range of advanced features such as pivot tables, data visualization tools, conditional formatting, macros, and VBA (Visual Basic for Applications) scripting. These features empower users to manipulate and analyze data in sophisticated ways.

5

MICROSOFT PRODUCT INTEGRATION

Excel seamlessly integrates with other Microsoft Office applications like Word, PowerPoint, Outlook, and Access. This integration makes it convenient to import and export data between programs, enhancing productivity and workflow efficiency.

6

COMPATIBILITY

Excel supports various file formats, including its native .xlsx format, as well as .csv, .xls, and more. It is compatible with both Windows and Mac operating systems, ensuring cross-platform usability.

7

COLLABORATION

Excel enables collaboration through features like real-time co-authoring, comments, and sharing options via OneDrive or SharePoint. Multiple users can work on the same spreadsheet simultaneously, enhancing teamwork and productivity.

8

SECURITY

Excel offers security features such as password protection, file encryption, and restricted access to cells, worksheets, or entire workbooks. These features help safeguard sensitive information and maintain data integrity.

9

CONTINUOUS IMPROVEMENT

Microsoft regularly updates Excel with new features, improvements, and bug fixes based on user feedback and technological advancements. This commitment to innovation ensures that Excel remains a cutting-edge tool for spreadsheet management and analysis.

10

TRAINING AND SUPPORT

Microsoft Excel offers extensive training and support resources for users at all skill levels. These resources include official documentation, tutorials, online courses, community forums, and user groups. Additionally, Microsoft offers certifications such as the Most Valuable Professional (MVP) certification for Excel, providing formal recognition of proficiency in using the software. These resources empower users to enhance their Excel skills and maximize their productivity.



Follow Financial Modeling World Cup on LinkedIn



7. **EXCEL** **ALPHABET**

www.fmworldcup.com

Follow Financial Modeling World Cup on LinkedIn

EXCEL ALPHABET

A

AutoSum

A quick way to sum a range of cells, usually located on the Home tab.

B

Borders

Lines you can add to the edges of cells to improve readability and organization.

C

Conditional Formatting

A feature that changes the appearance of cells based on specified conditions.

D

Data Validation

A feature that controls the type of data or values that can be entered in a cell.



Excel Table

A collection of data organized in rows and columns, with features like sorting, filtering, and automatic formatting.

F

Filter

A tool that allows you to display only the rows that meet certain criteria.

G

Goal Seek

A what-if analysis tool that finds the input values needed to achieve a specific goal.

H

HLOOKUP

A function that searches for a value in the top row of a table and returns a value in the same column from a specified row.

I

IF Function

A logical function that returns one value if a condition is true and another value if it is false.

J

Justify

Aligns text to distribute it evenly across the width of a cell or range.

K

Keyboard Shortcuts

Key combinations that perform specific commands more quickly.

L

Legend

A key that explains the symbols, colors, or patterns used in a chart.

M

Macro

A sequence of instructions that automates repetitive tasks, recorded and run in Excel.

N

Named Range

A defined name for a cell or range of cells, making it easier to reference in formulas.

O

OFFSET

Returns a reference to a range that is a specified number of rows and columns from a starting cell or range.

P

Pivot Table

A powerful tool for summarizing, analyzing, and exploring data in a worksheet.

Q

Quick Analysis

A tool that provides a fast way to analyze data, offering options like formatting, charts, and formulas.

R

Relative Reference

A cell reference that changes when a formula is copied to another cell.

S

Sparkline

A small, simple chart within a cell that provides a visual representation of data.

T

Transpose

A feature that switches rows and columns of a selected range of cells.

U

UNIQUE

A function that returns a list of unique values from a range.

V

VLOOKUP

A function that searches for a value in the first column of a table and returns a value in the same row from a specified column.

W

Watch Window

A tool that allows you to keep track of cells and their values as you work in different parts of your worksheet.

X

XLOOKUP

A function that searches a range or an array and returns an item corresponding to the first match it finds.

Y

YEAR

A function that returns the year corresponding to a given date.

Z

Zoom Slider

A tool at the bottom-right corner of the Excel window that allows you to quickly zoom in or out of the worksheet.

Sign up for the next Excel Esports Battle!



MICROSOFT EXCEL
WORLD CHAMPIONSHIP
SEASON 2024

BATTLE 5

May 30 | 4:30 PM London time



8. **MASTERING LARGE DATA SETS**

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

MASTERING LARGE DATA SETS

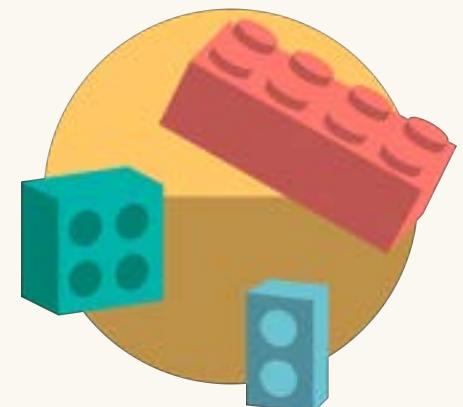
A Guide on How to Analyze Over 1 Million Entries in Excel

www.fmworldcup.com

1. Build an Emergency Fund:

a. Importing Data

- i. Utilize Excel's import data features for large datasets.
- ii. Use the Power Query Editor to clean and transform data during the import process.



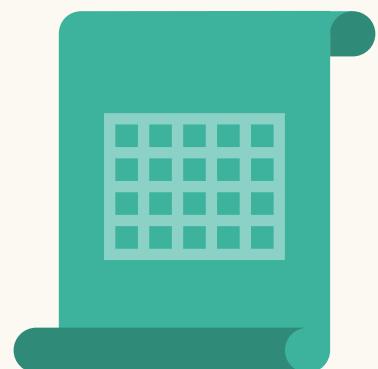
b. Data Cleaning and Formatting

- i. Identify and handle missing or erroneous data.
- ii. Format columns appropriately (text, date, numeric) for accurate analysis.

2. Optimizing Excel Performance

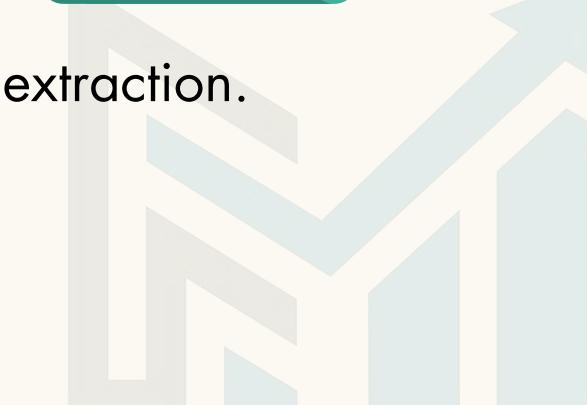
a. Data Model and PivotTables

- i. Create a data model to optimize memory usage.
- ii. Utilize PivotTables for dynamic and faster analysis.



b. Filtering and Sorting

- i. Use Excel's advanced filtering options for specific data extraction.
- ii. Sort data to make patterns and trends more apparent.



MASTERING LARGE DATA SETS

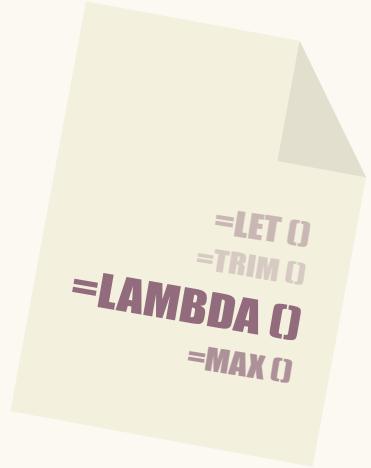
A Guide on How to Analyze Over 1 Million Entries in Excel

www.fmworldcup.com

3. Formulas and Functions

a. Array Formulas

- i. Master array formulas to perform calculations efficiently.
- ii. Apply array functions such as SUMIFS, AVERAGEIFS, and COUNTIFS.



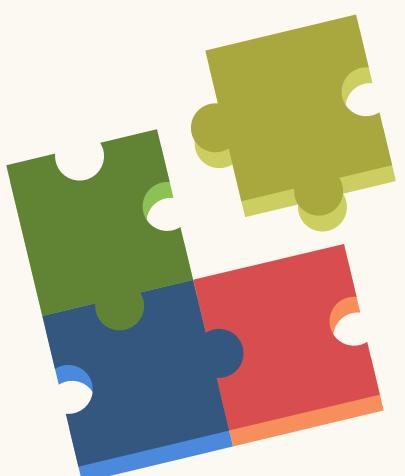
b. Use of INDEX and MATCH

- i. Replace VLOOKUP with INDEX and MATCH for faster and more flexible lookups.
- ii. Leverage OFFSET and INDIRECT functions for dynamic referencing.

4. Utilizing Excel Add-Ins

a. Power Pivot

- i. Integrate Power Pivot for enhanced data modeling and analysis.
- ii. Create relationships between tables to streamline complex analyses.



b. Filtering and Sorting

- i. Leverage Power Query for data cleaning, transformation, and merging queries.
- ii. Automate repetitive tasks to save time and reduce errors.



MASTERING LARGE DATA SETS

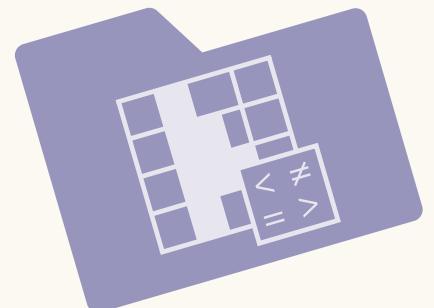
A Guide on How to Analyze Over 1 Million Entries in Excel

www.fmworldcup.com

5. Conditional Formatting and Visualization

a. Heat Maps and Color Scales

- i. Apply conditional formatting to highlight trends and anomalies.
- ii. Use color scales for a quick visual assessment of data distribution.



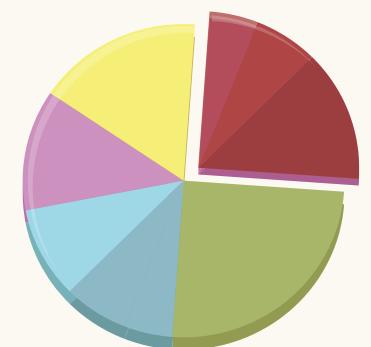
b. Charts and Graphs

- i. Create dynamic charts that update automatically with changes in data.
- ii. Opt for charts that represent the data comprehensively.

6. Data Sampling and Subsetting

a. Random Sampling

- i. Randomly sample a subset of data for initial analysis.
- ii. Ensure the subset is representative of the entire dataset.



b. Filtering Relevant Data

- i. Identify and analyze specific segments of the data using filters.
- ii. Focus on relevant subsets for targeted insights.





9. GETTING STARTED WITH PYTHON IN EXCEL

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

Python availability in Excel introduces a fresh realm of possibilities for data analysis that was once primarily accessible to data scientists and developers. Now, within the comfort of your well-known spreadsheet environment, you have the ability to tap into the capabilities of Python.

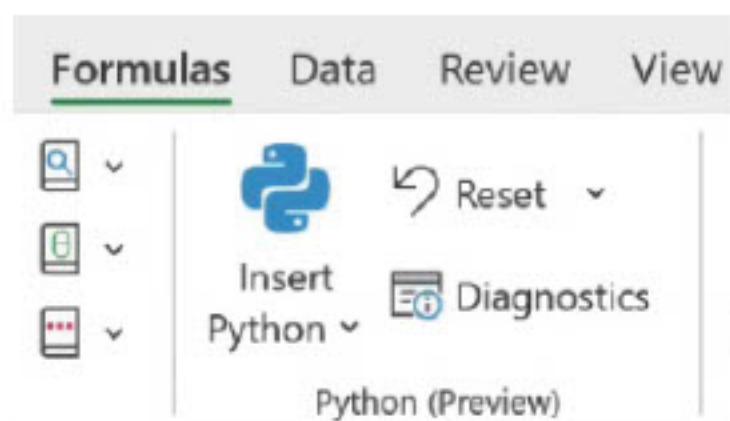
But how to start using Python in Excel and what functionalities does it offer?

Just type =PY()

Could it be simpler? Write =PY() and get started! After the formula the Excel cell will change and you can enter your Python code and see the visualizations or calculations right there in your Excel spreadsheet!



You can also find Python under the formulas section in Excel!



Ok, but what can I actually create with Python in Excel?

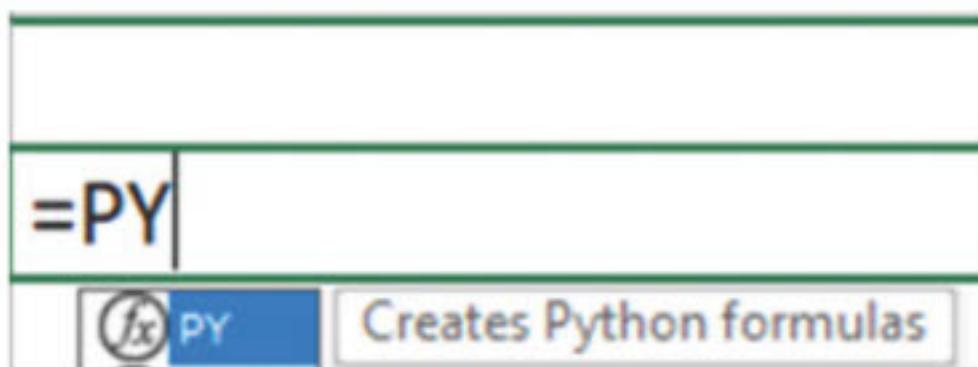
1. Creating a Data Frame

Python code runs in a controlled cloud container with limitations on its capabilities.

Python code lacks internet access and the ability to reach files on your local computer. The Excel workbook defines the boundaries of Python's reach.

With these constraints in mind, it's not surprising that creating a pandas DataFrame, for instance, often serves as the initial step when incorporating Python within Excel.

Constructing a pandas DataFrame from an Excel table is a clear process. The newly introduced PY() function facilitates the construction of Python formulas containing the necessary Python code.



Follow Financial Modeling World Cup on LinkedIn

2. Writing the Code

PY

```
xl("A2:D98", headers=True)
```

So, here's how the code works:

- 1 The xl() function is employed to extract data from Excel, generating a pandas DataFrame.
- 2 The initial parameter indicates the data's location, which in this instance refers to the Excel table within the range A2:D98.
- 3 The subsequent parameter informs the xl() function about the presence of headers (column names) within the data.
- 4 You can assign a variable name to your DataFrame like you were using named ranges or LET() function in regular Excel. You can subsequently access the DataFrame in subsequent Python formulas using the same variable name.

Press Ctrl+Enter to execute the Python formula. It might take a moment for the code to work. If your code is error-free, here's what will appear:

◇ DataFrame

Hover the mouse on the card icon to see a preview of the data within the DataFrame:

SalesOrderNumber	SalesOrderLineNumber	OrderDate
SO43697	1	12/29/2010
SO43698	1	12/29/2010
SO43699	1	12/29/2010
SO43700	1	12/29/2010
SO43701	1	12/29/2010
...
SO75122	1	1/28/2014
SO75122	2	1/28/2014
SO75123	1	1/28/2014
SO75123	2	1/28/2014
SO75123	3	1/28/2014

Source: Anaconda.com

The preview shows the first 5 and last 5 rows of the data.



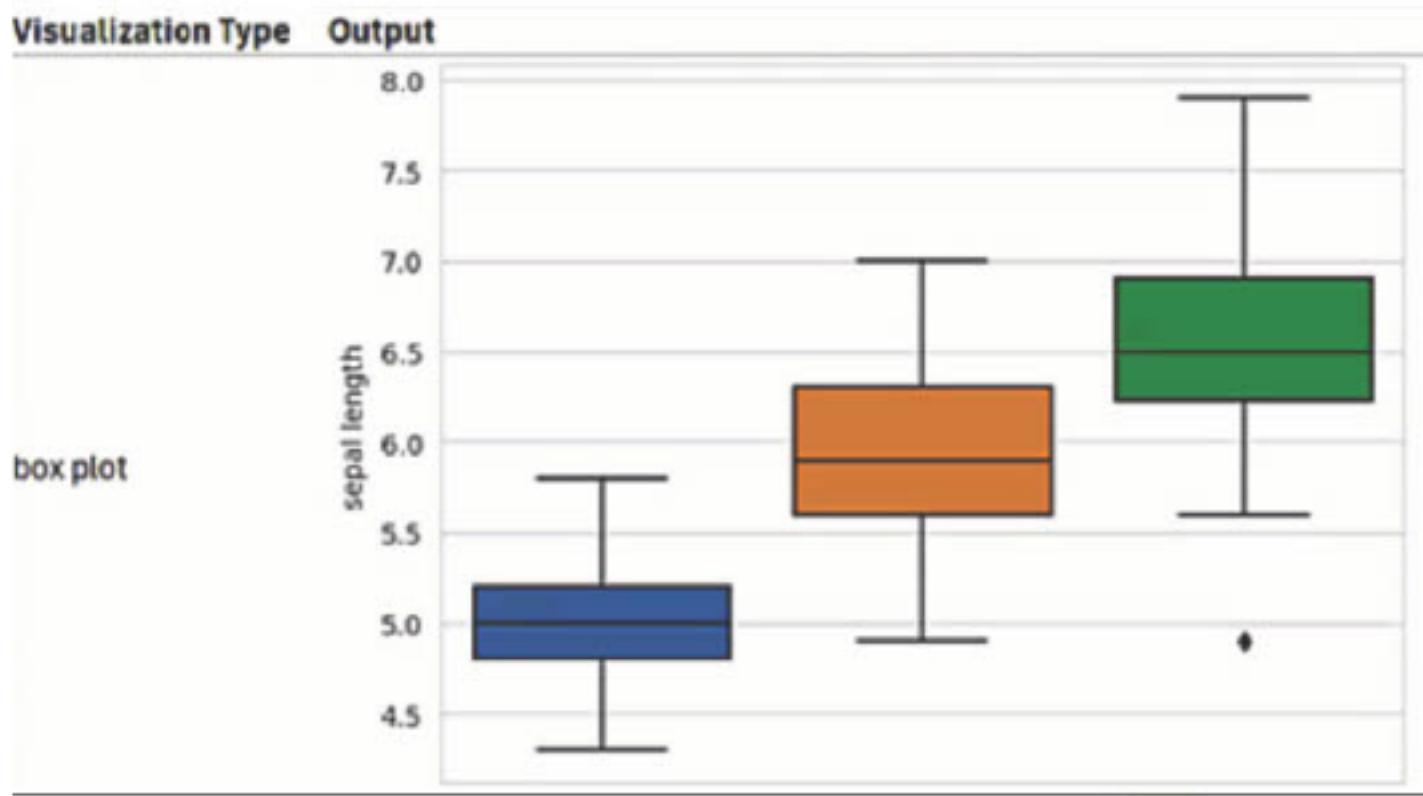
Follow Financial Modeling World Cup on LinkedIn

3. Advanced Data Visualizations

You can also use the powerful visualization libraries of Python, including Matplotlib and Seaborn, directly within your Excel workbook to achieve thorough and insightful data portrayal.

The new Image in Cell feature, specifically, the Create Reference option allows to create an image/shape over the cells that can be resized.

This has the capacity to lead to powerful interactive dashboards, offering a realm of opportunities alongside Python's data refinement capabilities.



Source: Anaconda.com

Follow Financial Modeling World Cup on LinkedIn

4. In-Depth Statistical Analysis

Enhance your analysis by harnessing the capabilities of Python's libraries like pandas and statsmodels. Conduct extensive statistical operations seamlessly within your Excel cells. You don't need advanced data science expertise—advanced analytics have become achievable for all. To get descriptive statistics table like the one below, use a formula name. `describe()`.

Output

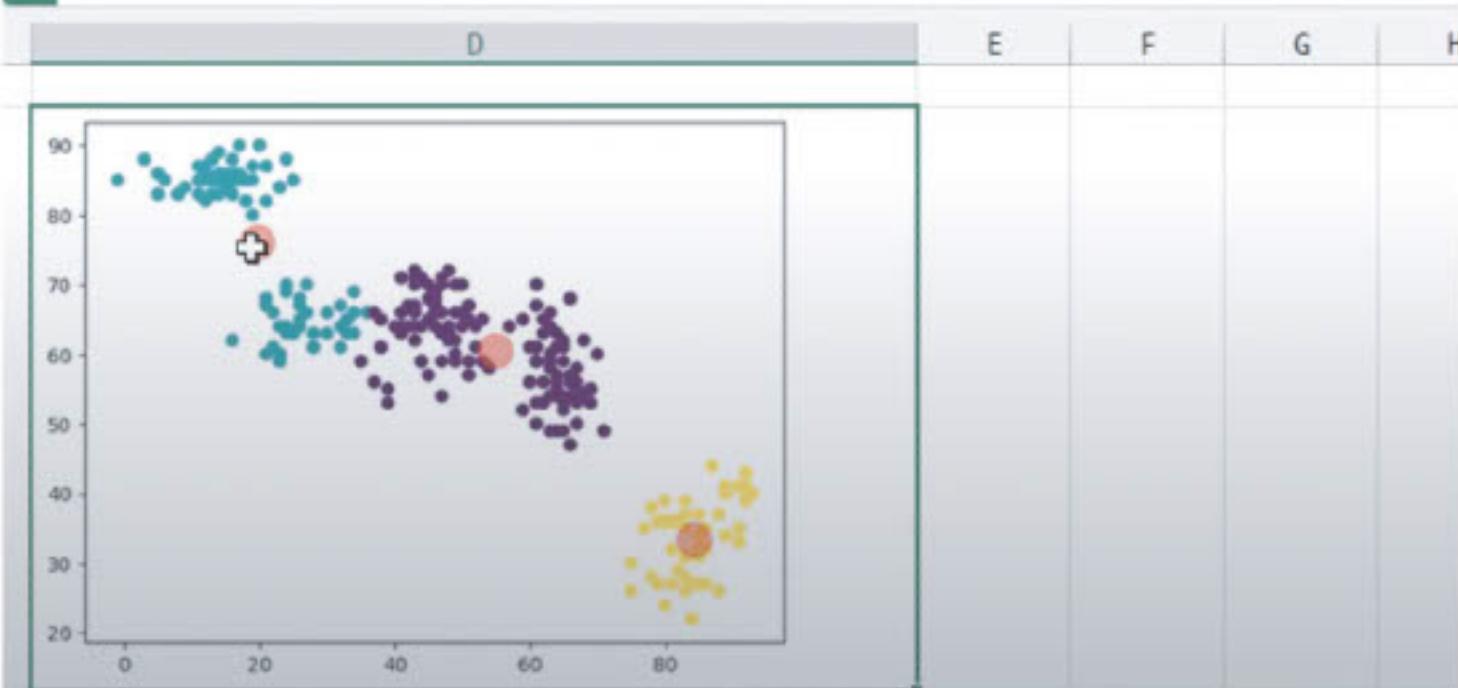
	sepal_length	sepal_width	petal_length	petal_width
count	150	150	150	150
mean	5.843333333	3.054	3.758666667	1.198666667
std	0.828066128	0.433594311	1.76442042	0.763160742
min	4.3	2	1	0.1
25%	5.1	2.8	1.6	0.3
50%	5.8	3	4.35	1.3
75%	6.4	3.3	5.1	1.8
max	7.9	4.4	6.9	2.5

Source: Anaconda.com

5.K-Means Clustering

You can also easily make clusters with Python in Excel which makes the work for data analysts a lot easier. This previously wasn't possible by default.

```
PY from sklearn.cluster import KMeans  
  
df=xl("A5:B256", headers=True)  
df_cluster = df[['x', 'y']]  
kmeans = KMeans(n_clusters=3)  
kmeans.fit(df_cluster)  
  
plt.scatter(df_cluster['x'], df_cluster['y'], c=kmeans.labels_, cmap='viridis')  
centers = kmeans.cluster_centers_  
plt.scatter(centers[:, 0], centers[:, 1], c='red', s=300, alpha=0.5)  
plt.show()
```

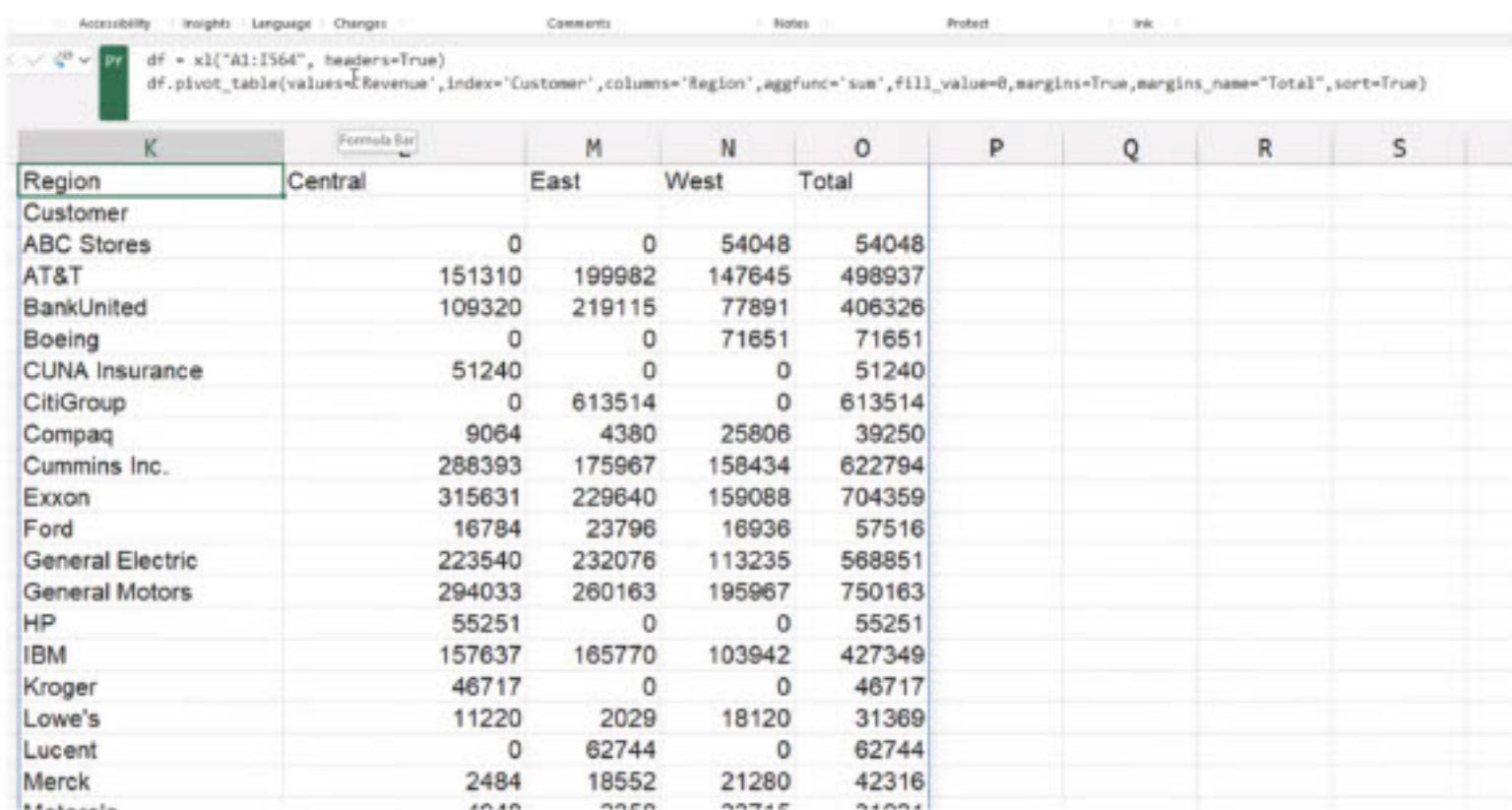


Source: Mr. Excel

Follow Financial Modeling World Cup on LinkedIn

6. Create Pivot Tables

With Python integration, you can also create an Excel-like Pivot Table in a DataFrame. Compared to the basic Excel Pivot Tables, these ones are easier to use since they do automatic recalculation without refreshing. As well as you can use Date Grouping for some more possibilities within your Pivot Table.



The screenshot shows a Microsoft Excel spreadsheet with a Pivot Table. The Pivot Table has 'Region' in the rows, 'Customer' in the columns, and categories 'Central', 'East', 'West', and 'Total'. The data includes revenue values for various companies like ABC Stores, AT&T, and Ford. The formula bar at the top contains Python code: `df = xl('A1:I564', headers=True)` and `df.pivot_table(values='Revenue', index='Customer', columns='Region', aggfunc='sum', fill_value=0, margins=True, margins_name="Total", sort=True)`.

Region	Central	East	West	Total				
Customer								
ABC Stores		0	0	54048	54048			
AT&T	151310	199982	147645	498937				
BankUnited	109320	219115	77891	406326				
Boeing	0	0	71651	71651				
CUNA Insurance	51240	0	0	51240				
Citigroup	0	613514	0	613514				
Compaq	9064	4380	25806	39250				
Cummins Inc.	288393	175967	158434	622794				
Exxon	315631	229640	159088	704359				
Ford	16784	23798	16936	57516				
General Electric	223540	232076	113235	568851				
General Motors	294033	260163	195967	750163				
HP	55251	0	0	55251				
IBM	157637	165770	103942	427349				
Kroger	46717	0	0	46717				
Lowe's	11220	2029	18120	31369				
Lucent	0	62744	0	62744				
Merck	2484	18552	21280	42316				
-----	-----	-----	-----	-----				

Source: Mr. Excel

7. Bring In External Data

External data can be pulled into Python in Excel workflows using Excel's connectors and Power Query.

Consider that the Python integration is available in preview form only on Windows for Microsoft 365 Insider beta channel members, and only the "Office 365" cloud version receives Python integration.



10. HOW CHATGPT CAN SIMPLIFY EXCEL WORKFLOW?

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

HOW CHATGPT CAN SIMPLIFY OUR EXCEL WORKFLOW



Let's analyze how ChatGPT can create an Excel macro

Here is an example of an Excel macro that can send emails with the specified subject and message, pulling the information from columns A and B:

```
Sub SendEmails()
    Dim OutApp As Object
    Dim OutMail As Object
    Dim cell As Range
    Dim subjectLine As String
    Dim messageBody As String

    subjectLine = "Kevin Cookie Company Invoice"
    Set OutApp = CreateObject("Outlook.Application")

    For Each cell In Columns("A").Cells.SpecialCells(xlCellTypeConstants)
        If cell.Value Like "?*@?*.?*" Then
            Set OutMail = OutApp.CreateItem(0)
            messageBody = "You owe us " & cell.Offset(0, 1).Value
            OutMail.Subject = subjectLine
            OutMail.Body = messageBody
            OutMail.Send
        End If
    Next cell
End Sub
```

This macro will loop through each cell in column A, checking if the value in the cell is in the form of an email address (i.e. if it contains the "@" symbol). If it is an email address, it will use the value in the corresponding cell in column B as the "X" in the message, and send the email to the address in column A.

You will need to make sure that the Outlook object library is referenced in the VBE, you can do that from Tools -> references, select Microsoft Outlook library.

Note that this is a simple example that might need some adaptions to fit your actual use case.

In a recent video, Excel MVP Kevin Stratvert uses ChatGPT to create an Excel macro that functions as an invoicing app, using customer email addresses and the amount they owe (with all the data found on an Excel sheet). Not only does ChatGPT create an Excel macro, it also gives a detailed explanation for how this macro works.

HOW CHATGPT CAN SIMPLIFY OUR EXCEL WORKFLOW



Simplify nested IF formulas with ChatGPT

MA

=IF(G7>0,G7,0) make a simpler formula in Microsoft Excel



The formula you provided is already quite simple, but you can simplify it further by using the MAX function:

=MAX(G7, 0)

You can also simplify work with nested IF formulas by using ChatGPT with Excel. Simply by typing in the description of the problem, ChatGPT will break it down into steps and provide the Excel formula necessary.

HOW CHATGPT CAN SIMPLIFY OUR EXCEL WORKFLOW



Can ChatGPT write Excel Power Query codes?



Here is the Power Query M code that appends Sheet1 from Workbook1 and Sheet2 from Workbook2 and removes duplicates from Column B:

```
less Copy code
let
    Source1 = Excel.Workbook(File.Contents("C:\Workbook1.xlsx"), null, true),
    Sheet1_Table = Source1{[Item="Sheet1",Kind="Sheet"]}[Data],
    Source2 = Excel.Workbook(File.Contents("C:\Workbook2.xlsx"), null, true),
    Sheet2_Table = Source2{[Item="Sheet2",Kind="Sheet"]}[Data],
    AppendedData = Table.Combine({Sheet1_Table, Sheet2_Table}),
    RemovedDuplicates = Table.Distinct(AppendedData, {"Column B"})
in
    RemovedDuplicates
```

Note: Please replace the file path `C:\Workbook1.xlsx` and `C:\Workbook2.xlsx` with the actual file paths of your workbooks. Also, make sure to replace `Column B` with the actual column name that you want to remove duplicates from.

Yes, it can. All you need to do is type in a command, for example: "Write an Excel Power Query M code to append sheet1 from workbook1 and sheet2 from workbook2 and remove duplicates from column B and ChatGPT will come back with an example of a Power Query M code that can be used. Also, ChatGPT gives a detailed explanation about the Power Query M code. Then, just copy and paste the code and you're good to go.

HOW CHATGPT CAN SIMPLIFY OUR EXCEL WORKFLOW



Analyzing .csv with ChatGPT

The screenshot shows a conversation between a user (E) and ChatGPT. The user asks if ChatGPT can understand a .csv file, and ChatGPT replies that it can, explaining the structure of the CSV data. The user then asks to show all people who work in the sales department, and ChatGPT provides a filtered CSV output containing one row of data.

E can you understand this .csv data?

Identifier;Access code;Recovery code;First name;Last name;Department;Location
9012;12se74;rb9012;Rachel;Booker;Sales;Manchester
2070;04ap67;jg2070;Laura;Grey;Depot;London
4081;30no86;cj4081;Craig;Johnson;Depot;London
9346;14ju73;mj9346;Mary;Jenkins;Engineering;Manchester
5079;09ja61;js5079;Jamie;Smith;Engineering;Manchester

E ok, please show me all people who work in sales department

To show all people who work in the Sales department, you could filter the data based on the value in the Department column. Here is the filtered data for people who work in the Sales department:

Identifier;Access code;Recovery code;First name;Last name;Department;Location
9012;12se74;rb9012;Rachel;Booker;Sales;Manchester

In this case, only one person, "Rachel Booker," works in the Sales department, as indicated by the value "Sales" in the Department column.

Let's say you need to find some very specific information that's located in an Excel sheet. This is another case when using ChatGPT could save you some time. Export your Excel sheet as a CSV file. Copy and paste some of the data into ChatGPT (unfortunately it's not possible to copy and paste the whole thing as there's still some content limitations to what ChatGPT can digest).

ChatGPT will explain the data and now you can start asking questions to help locate specific information that you need. ChatGPT can successfully locate and show you the information you are looking for, possibly saving you time and a headache doing the same with Excel.

Even though ChatGPT is super powerful and useful – the data or solutions it provides can sometimes be inaccurate. We advise you to always double-check and see if the answers provided are correct (and don't rely on ChatGPT for everything just yet!)



11. **HISTORY OF MICROSOFT EXCEL**

www.fmworldcup.com



Follow Financial Modeling World Cup on LinkedIn

HISTORY OF MICROSOFT EXCEL

1982

Microsoft launched Multiplan, a spreadsheet program, a competitor to Lotus 1-2-3.

1985

Birthday of Microsoft Excel on Mac

1987

Excel 2.0: Birthday of Microsoft Excel on Windows

1990

Excel 3.0 Included toolbars, drawing capabilities, outlining, add-in support, 3D charts, and many more new features

1992

Excel 4.0 Introduced auto-fill. Also, an easter egg in Excel 4.0 reveals a hidden animation of a dancing set of numbers 1 through 3, representing Lotus 1-2-3, which is then crushed by an Excel logo.

1993

Excel 5.0: Introduction of Visual Basic for Applications (VBA), taking Excel to unprecedented levels of functionality

1997

Excel 97: Introduced the Office Assistant (Clippy) and included improvements to VBA.

HISTORY OF MICROSOFT EXCEL

1999

Excel 2000: Introduced the Clipboard feature, allowing users to interact with and use multiple objects simultaneously.

2002

Excel XP (Part of office XP): Featured a new task pane, improved data validation, and added the AutoRecover function for better data protection.

2003

Excel 2003: Introduction of the List feature (precursor to Tables), which enabled easier data management, and improvements to data analysis tools.

2007

Excel 2007: Introduced the Ribbon interface, named variables, and Open Office XML file formats.

2010

Excel 2010: Introduced Power Query (add-in), enabling users to work with larger datasets, as well as Excel Web App and mobile version for Windows 7.

2013

Excel 2013: New start screen, 50 new functions, Flash Fill tool, recommended charts, and three new chart tools; design, layout, and format.

HISTORY OF MICROSOFT EXCEL

● 2016

Excel 2016: Added the Ink Replay button, Shared with Me feature, and integration with Power BI for advanced analytics.

● 2017

Office 365 including Excel 365 version introduced which had all updates automatically incorporated once they are released.

● 2018

The release of Excel 2019 introduced new functions like CONCAT and TEXTJOIN, improved the Power Query Editor with M Intellisense, and added new data visualization options such as funnel charts and map charts. Introduction of the Dynamic Arrays for Office 365 users.

● 2021

Excel 2021, new functions introduced: LAMBDA & LET to define your own formulas.

● 2022

Release of additional dynamic array function kit (MAP, LAMBDA, SCAN, etc.)

● 2023

IMAGE function released, waiting: Microsoft Copilot for Excel (aka Clippy AI?)