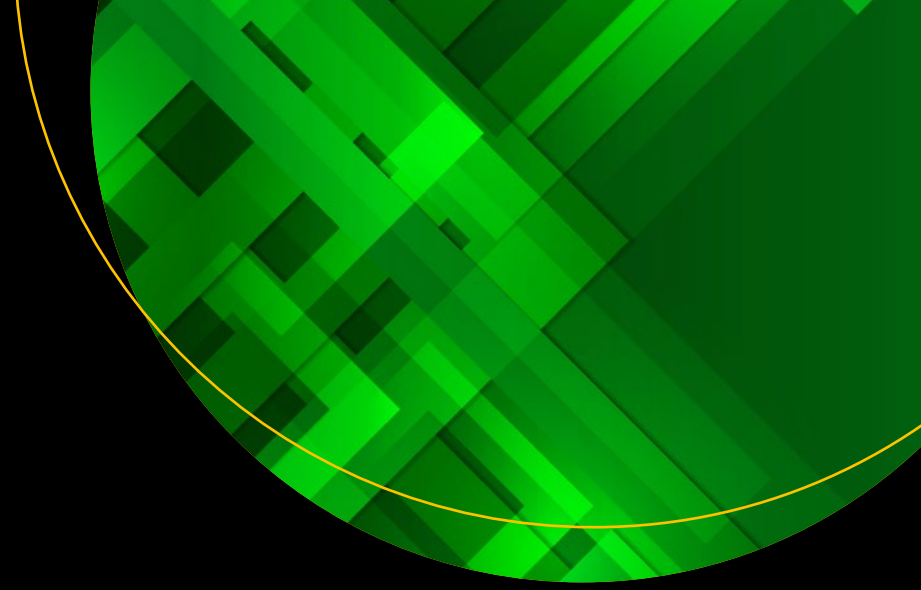

Advanced Excel Formulas

Unleashing Brilliance with Excel Formulas

Alan Murray

Apress®

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To my children, George and Lily.
And to all the Excel functions. I love you all. And without you, there would be no book.

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About the Author

Alan Murray is a Microsoft MVP and Excel trainer. He has been helping people in Excel for over 20 years. He loves training and the joy he gets from knowing he is making people's working lives easier.

Alan runs his own blog – Computergaga (https://computergaga.com) – and writes for multiple other websites. His YouTube channel has over 550 videos and over 30 million views.

He organizes a free monthly Excel meetup in London where anyone can come learn Excel, chat, and enjoy each other's company (www.meetup.com/London-Excel-Meetup-Group/).

About the Technical Reviewer

Mark Proctor is a senior finance professional, qualified accountant, and blogger who has been applying spreadsheet-based solutions to solve real-world problems for the last 20 years. He has built a variety of Excel-based reporting, predictive, decision-making, and automation tools for achieving process efficiency in multinational companies in the media, food, retail, and manufacturing sectors.He is also the owner of Excel Off The Grid (https://excelofffthegrid.com), one of the most popular Excel blogs on the Internet, which focuses on teaching intermediate and advanced Excel techniques.

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The MAX thank you goes to the Excel community. Together, we help and inspire each other to get the best from the behemoth that is Excel. A beautiful collection of millions of cells that invite us to calculate, analyze, track, and model our data however we choose. We often encounter cute and not-so-cute problems in the pursuit of our Excel dreams. The help of others to find the solution to these problems is vital, and the Excel community is very generous with their support.

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A LARGE thank you to team Excel at Microsoft. They listen to our feedback (for the most part anyhow) and push Excel to be a better product every day. During the writing of this book, functions were being developed and changed. This makes the task of teaching and producing learning content very difficult, but also exciting, and I wouldn't have it any other way.

Finally, as always, thank you to my children, George and Lily. I'm very lucky.

Introduction

Formulas are what made me fall in love with Excel. How is that for an opening line?

They are the muscles and the connective tissue of your workbooks. Making decisions, performing calculations, linking cells, converting data types, and so much more. And boy, they are fun.

Advanced Excel Formulas is a comprehensive book containing more than 500 Excel formula examples. It is also fully updated to include the new functions released in recent years including more than ten functions released in 2022.

This book will benefit anyone who works with Excel regularly. The focus is on users who understand formulas but want to push their skills to the next level and fill any gaps in their knowledge.

When your company sends you for Excel training (if they do), you are normally taught functions such as VLOOKUP, IF, and SUMIFS. And this book covers those functions too because they are fantastic. But it also goes far beyond, venturing down the less trekked path to the functions such as AGGREGATE, SEQUENCE, VSTACK, SWITCH, and many more. In fact, more than 150 Excel functions are demonstrated in this book.

And do not be mistaken. This is not just a cursory look at the different functions. You will see multiple "real-world" examples of the different functions, fully explained, with "pro" tips to get the maximum out of them.

Advanced Excel Formulas is divided into 15 chapters:

- **Chapter 1:** The first chapter is a primer on Excel formulas. It explains the anatomy of formulas and functions and the role of the different characters in Excel formulas. This is an advanced formulas book, but this chapter is included to lay a strong base and reference point for the coming chapters.
- **Chapter 2:** This chapter explores the logical functions of Excel. This includes IF, IFS, SWITCH, AND, OR, XOR, IFERROR, and IFNA. These are key decision-making functions to automate our Excel models and reports.

- **Chapter 3:** In this chapter, we explain defined names in depth. This little-known feature has huge benefits in how we use and deploy ranges and formulas in Excel. The importance of this feature has grown further with the recent changes to the calculation engine of Excel.
- **Chapter 4:** This chapter is about using tables in Excel. It covers the many benefits of using tables instead of ranges and explains how to use them effectively.
- **Chapter 5:** This chapter is all about the text functions of Excel. Use these functions to extract, combine, replace, and format text.
- **Chapter 6:** In this chapter, we work with the many date and time functions of Excel. Almost every user has a need to perform calculations or analysis based on date or time values. Fortunately, Excel has the functions to achieve these tasks.
- **Chapter 7:** In this chapter, we learn the VLOOKUP function. Incredibly popular among Excel users and very useful. We will cover this function inside-out and explain it like you have never heard before. We will also cover insider tricks to avoid common VLOOKUP limitations and mistakes.
- **Chapter 8:** This chapter focuses on two of the most useful functions of Excel – SUMIFS and COUNTIFS. A variety of examples are shown to fully appreciate these gems. The chapter will also cover the AVERAGEIFS, MAXIFS, and MINIFS functions.
- **Chapter 9:** This chapter is all about the SUMPRODUCT and AGGREGATE functions of Excel. These are next-level aggregation functions. They are very powerful, and SUMPRODUCT is especially useful for users not on Excel 365.
- **Chapter 10:** In this chapter, you will learn how to efficiently use the dynamic array formulas of Excel. It is important to know how to best use these formulas and how they change the way spreadsheets calculate in modern Excel.

- **Chapter 11:** This chapter dives further into the world of lookup formulas in Excel. INDEX, INDIRECT, OFFSET, CHOOSE, VSTACK, and more are covered to extend your lookup formula arsenal.
- **Chapter 12:** This chapter covers the new XLOOKUP function. This is a complete lookup formula with many options. Numerous examples are shown in this chapter to showcase its power.
- **Chapter 13:** In this chapter, we cover the FILTER function. This function is a real game changer. A lookup formula that can handle complex lookup criteria and return multiple results.
- **Chapter 14:** In this chapter, we will learn the rich data types in Excel and how to access and analyze their data using formulas. A recently added feature enabling multiple columns to be stored in a single cell. Data types are incredible. The new STOCKHISTORY and FIELDVALUE functions are covered in this chapter too.
- **Chapter 15:** This chapter covers the new LET and LAMBDA functions. They provide the ability to break down complex formulas and even create your own custom functions. Very cool and incredibly powerful.

Notation

You can expect the following notation in this book:

- The name of a button, keystrokes, or tab of the Ribbon or a window that we click will be in **bold** text. For example, click the **Formulas** tab of the Ribbon.
- Titles and other text that you see on screen and are referenced in the book will be shown in *italics*. For example, in the *Name Manager* window.
- Names of files, sheet tabs, tables, or columns will be shown with square brackets. For example, on the [Report] sheet.
- Written text will be enclosed in double quotations. For example, type "chart_labels" in the box.

Excel Versions

Excel is constantly evolving and improving. Because of this, we should be aware of the version of Excel that we are using and bear in mind the versions that others we collaborate with use when sharing files.

Regarding Excel versions, please note the following:

- All screenshots and step-by-step processes shown in the book are performed using Excel for Microsoft 365.
- Whenever a new function is introduced, a listing of the Excel versions that it is available is shown.
- When the availability of a function is labeled as "all versions," the cut-off point is Excel 2010 and Excel for Mac 2011. So, for clarity, if a function was released in a version prior to these, it is stated as being available in "all versions."

Download the Example Files

You are encouraged to download the example files used by me throughout the book to practice on. The best way of learning is by doing. Follow along, and this will benefit your learning greatly.

You can download the example files from the Apress GitHub page (`https://github.com/Apress/advanced-excel-formulas`).

The files are organized into folders that match the chapters of this book.

CHAPTER 1

Excel Formulas: A Quick Primer

This is a short chapter to lay a solid foundation on using formulas in Excel before we get to the really exciting stuff.

Although this is an advanced Excel formulas book, I felt this chapter would be useful to plug any gaps that may exist in your knowledge. Also, it can serve as a reference point that you can revisit to help understand some of the formulas later.

This chapter will begin by explaining the anatomy of formulas and the use of the different characters, for example, !, $, >. We then explain the use of workbook and worksheet references and absolute addresses. It then concludes with the different types of errors and other alerts you experience when using Excel formulas.

Anatomy of an Excel Formula

Now, let's begin with a question that you may be surprised to read in this book: What exactly is an Excel formula?

An Excel formula is an expression that returns a result. In Excel, this result can be a value (number, string, or Boolean), multiple values, or a range. Excel formulas always begin with =.

Formulas cannot delete, unhide, or format. They return something. However, they can be used with other Excel features to perform actions such as format or chart.

Breakdown of a Function

The terms formula and function are often used interchangeably. However, they are different. A function is a prewritten expression. It has a name and a purpose. A function can be included as part of a formula.

A. Murray, *Advanced Excel Formulas*, https://doi.org/10.1007/978-1-4842-7125-4_1

There are many functions in Excel. They each have their own unique characteristics. The good news – they all follow the same syntax.

The syntax of an Excel function is

```
=FunctionName(argument1, argument2, ...)
```

A function always has brackets after its name. This is true even when it has no arguments. The best example of this is probably the TODAY function:

```
=TODAY()
```

Its job is to return today's date. It does this by using the system date and therefore requires no information from the user. However, you must still enter brackets after its name.

Most functions will prompt for arguments. An argument is information that the function needs to fulfill its purpose. Figure 1-1 shows the arguments of the SUM function.

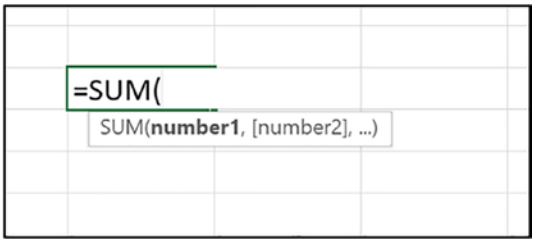

Figure 1-1. *The arguments of the SUM function*

The SUM function prompts for one or multiple values. It needs values to fulfill its purpose, which is to sum.

The second argument is enclosed in square brackets: `[number2]`. This indicates that it is an optional argument.

Figure 1-2 shows the VLOOKUP function and its arguments. You can see that the first three arguments are mandatory, and the last argument is optional.

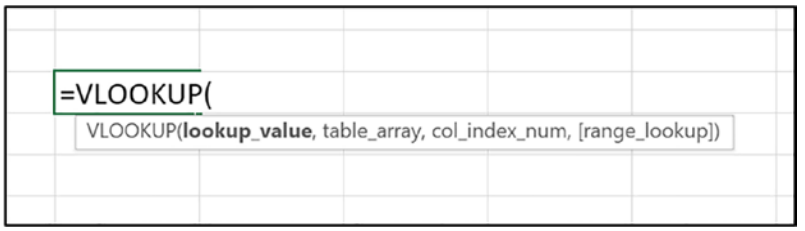

Figure 1-2. *The arguments of the VLOOKUP function*

Arguments are separated by a comma, and your position in the syntax is highlighted in bold.

Note In regions where a comma is used as a decimal separator, a semicolon ";" is used as the function argument separator.

Table of Formula Characters

Table 1-1 is a list of the different characters used in Excel formulas. This book includes examples that demonstrate the use of all these characters.

Table 1-1. *Table of formula characters*

Characters	Name	Description
=	Equals	All formulas start with =. The equal is also the logical operator for equal to.
( )	Brackets or parentheses	Used to enclose the arguments of a function. Also, used to specify the order of calculation in a formula.
,	Separator or union operator	Primarily used to separate the arguments of a function. Also, creates a range from multiple references. For example, `=SUM(A2:A5,C2:C5)`.
:	Range operator	Creates a range of all cells between two references. For example, `=SUM(A2:A5)`.

(*continued*)

Table 1-1. (*continued*)

Characters	Name	Description
Space	Intersection operator	Creates a range from the intersection of two references. For example, `=SUM(A2:A5 A3:D3)` would result in `=SUM(A3)`.
+	Addition	The operator to add values.
-	Subtract	The operator for subtracting values.
*	Multiply or asterisk	This symbol is most used as the multiply operator. It is also a wildcard character. It is used to replace unknown characters when performing partial text matches.
/	Divide	The operator to divide values.
%	Percent	Used in a formula to represent a number as a percentage.
>	Greater than	Logical operator to test if the first value is larger than the second value.
>=	Greater than or equal to	Logical operator to test if the first value is larger than or equal to the second value.
<	Less than	Logical operator to test if the first value is less than the second value.
<=	Less than or equal to	Logical operator to test if the first value is less than or equal to the second value.
	Not equal to	Logical operator to test if a value is not equal to another value.
{ }	Array	Curly braces around a formula indicate an array formula. They are generated automatically by Excel on pressing **Ctrl + Shift + Enter**. For example, `{=SUM(A2:A5*B2:B5)}`.
{1,2,5} or {1;2;5}	Array of values	This could be values returned by part of a formula or entered as an array of constants. A comma is used to separate columns and a semicolon to separate rows.
“”	Double quotes	Denotes a text string.

(*continued*)