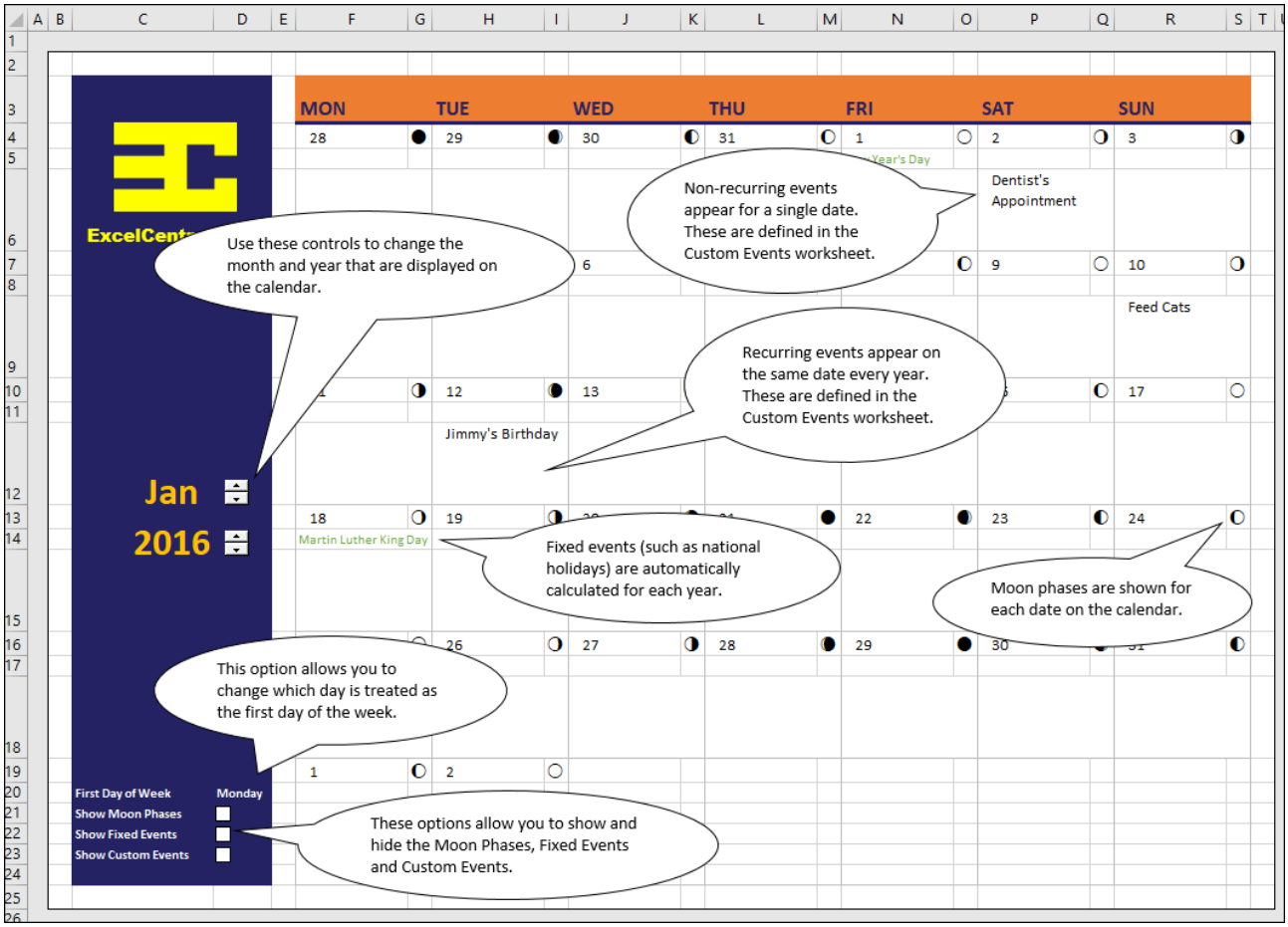
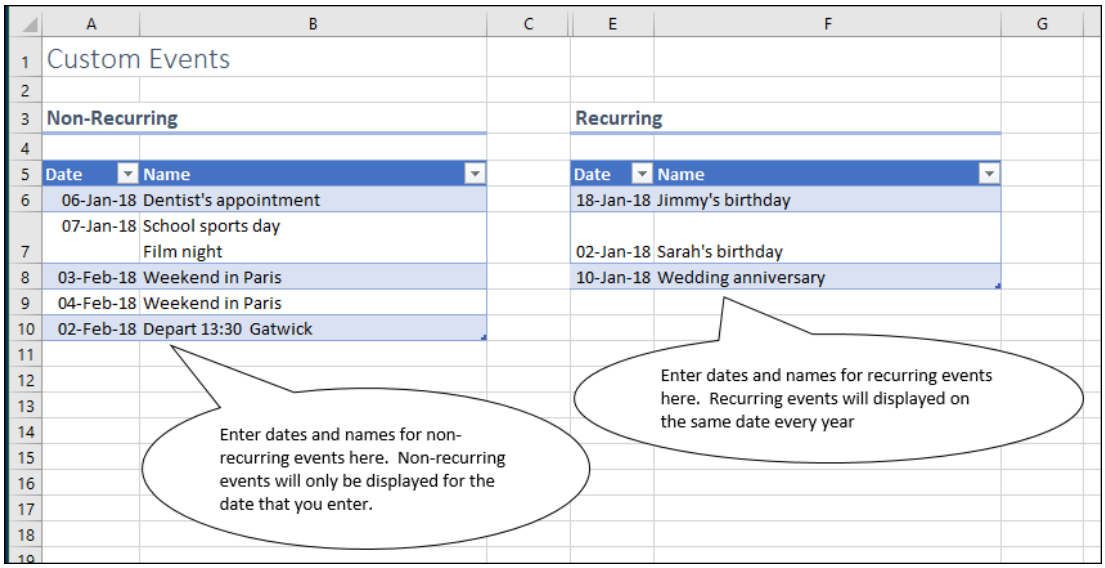
Excel Construction Kit #1
Year Planner Application

In this book you will learn how to use and apply advanced Excel skills to construct this robust Excel business application:



Users can define both recurring and non-recurring events:



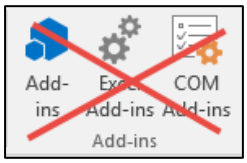
Learning by doing.
An alternative approach to learning and applying Excel skills

For over 900 years craftsmen have traditionally taught their skills to an apprentice. The apprentice would work (often unpaid) for a period of five to nine years to learn the craftsman's trade. In this model the apprentice learned his trade by observing how the master craftsman used his skills. The apprentice would then attempt to imitate the same techniques.

This construction kit will teach you advanced Excel skills in the same way. Even if you only have basic Excel skills, the construction kit is designed in such a way that you'll be able to construct a complex, polished professional Excel application that would be well beyond the powers of most advanced Excel users.

As you progress through the book you will use advanced Excel skills to construct a finished application. Along the way you'll learn Excel techniques that you will be able to apply in the future to a multitude of Excel business problems.

No VBA program code or Macros are used in this construction project.



The use of VBA programming code or recorded macros (recorded macros also contain VBA program code) is always a virus threat. For this reason, most corporate environments have a security policy that does not allow VBA program code within Excel workbooks.

When using Excel for its intended purpose it is actually very rare find a true need for custom VBA program code.

No VBA program code, recorded macros or add-ins are used in the sophisticated project you'll build using this book. You will complete your construction kit using only regular Excel features.

This book will teach you best-practice when applying your Excel skills to large real-world projects.

This book won't only teach you Excel skills. You'll also learn a best-practice design and development methodology that will stand you in good stead when working on future Excel projects.

In constructing this project you'll discover new and interesting ways to use many of Excel 2016's more powerful and complex features.

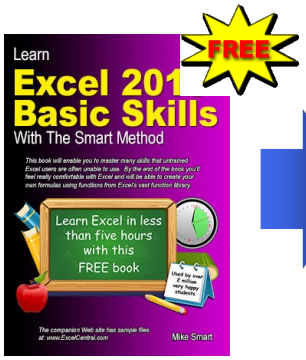
Use of this book as courseware

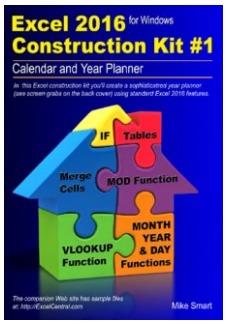
This book is particularly useful for training organizations, teachers, schools, colleges and universities who would like to engage, motivate and interest students by having them use Excel skills to produce an interesting, useful and impressive Excel application.

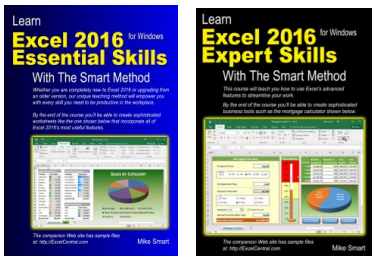
You can use this construction kit in two ways

As an Excel beginner

If you are an absolute beginner who has never used Excel before you'll need to acquire some basic skills before beginning this construction kit. We publish a free *Excel Basic Skills* tutorial on our ExcelCentral.com website as a free e-book and on-line video. This covers the bare minimum skills you'll need to get started.







Useful for reference

If you follow this track, you'll still learn a lot of useful information (and hopefully have fun along the way), but you'll only have a surface-level understanding of some of the Expert-level skills you'll use. You'll also have a more limited knowledge of Excel as you'll only discover the features that you use in the construction kit.

It isn't necessary to have the *Essential Skills* and *Expert Skills* books (or e-books) on hand to complete this construction kit but it is highly recommended that you do.

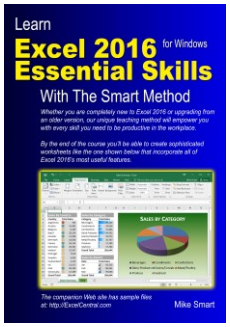
The *Essential Skills* and *Expert Skills* tutorials provide an in-depth understanding of all the advanced features used in this construction kit. If you have the books (or e-books) on hand you'll be able to use them as a reference to expand your understanding of some of the advanced skills you will use in this construction kit.

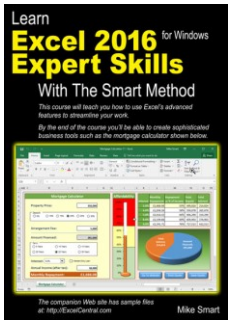
As an Excel Expert

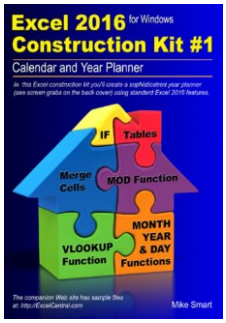
If you've already completed our *Essential Skills* and *Expert Skills* tutorials you already have advanced Excel skills that are rarely mastered by the average user.

This construction kit will show expert users how to plan and implement a high-quality Excel solution. You'll learn a solid design methodology that will enable you to use and apply your skills to satisfy even the most complex business requirements.

You will also discover some innovative techniques that combine Excel's advanced features to elegantly solve complex requirements.







Every step in your construction kit is presented on two facing pages

> Pray this day, on one side of one sheet of paper, explain how the Royal Navy is prepared to meet the coming conflict.
> ***Winston Churchill, Letter to the Admiralty, Sep 1, 1939***

Winston Churchill was well aware of the power of brevity. The discipline of condensing thoughts into one side of a single sheet of A4 paper resulted in the efficient transfer of information.

A tenet of our teaching system is that every step in this construction kit is presented on *two* facing sheets of A4. We've had to double Churchill's rule as they didn't have to contend with screen grabs in 1939! If we can't teach an essential concept in two pages of A4 we know that the subject matter needs to be broken into two smaller lessons.

How this book avoids wasting your time.

Many presentational methods have been used in this book to help you to skip reading about things you already know how to do, or things that are of little interest to you.

There are now two versions of Excel 2016 (the pay-once Excel 2016 version and the subscription Excel 365 version). Where there are differences they are clearly documented.

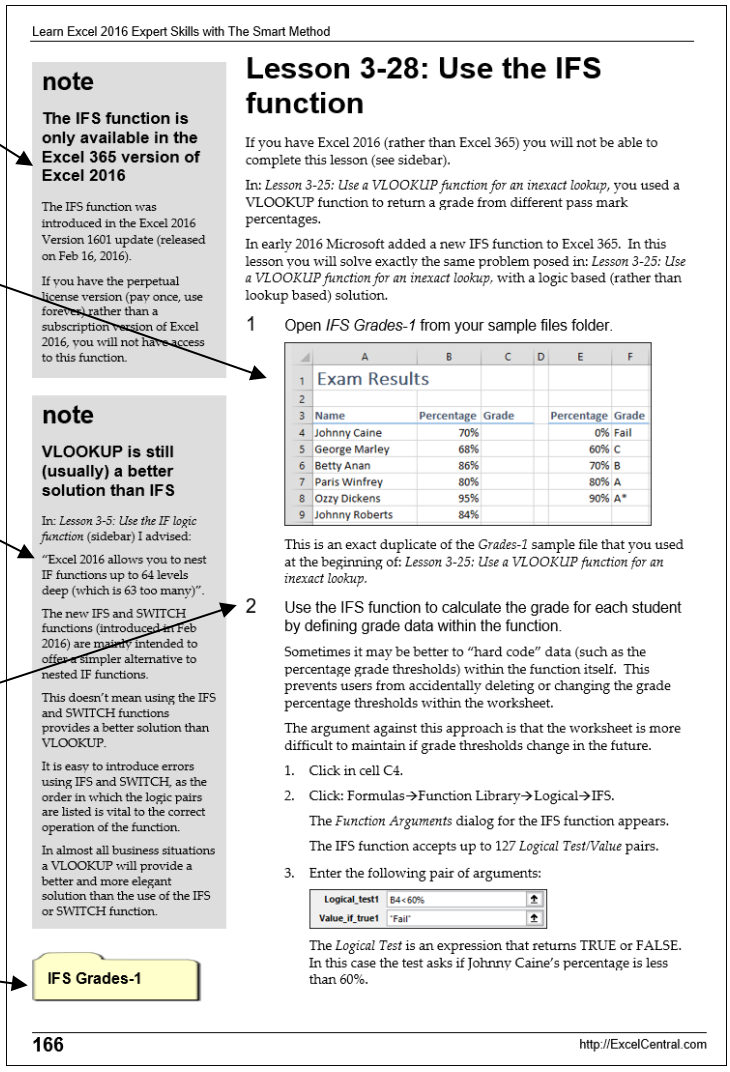
Screen grabs are provided in-line with the text when they can explain what you need to do more clearly than words alone.

If you want to progress through the course as quickly as possible you don't have to read notes.

Notes usually expand a little on the information given in the lesson text.

If you already know how to do something simply read the bold text for each step and just do it. Step notes sometimes provide precise instructions about how to progress if the one-line description is inadequate. Notes also often include interesting information about the current task.

When there is a sample file (or files) to accompany a lesson, the file name will be shown in a folder icon. You can download the sample file set from: http://ExcelCentral.com.



Learn Excel 2016 Expert Skills with The Smart Method

note

The IFS function is only available in the Excel 365 version of Excel 2016

The IFS function was introduced in the Excel 2016 Version 1601 update (released on Feb 16, 2016).

If you have the perpetual license version (pay once, use forever) rather than a subscription version of Excel 2016, you will not have access to this function.

note

VLOOKUP is still (usually) a better solution than IFS

In: *Lesson 3-5: Use the IF logic function* (sidebar) I advised:

"Excel 2016 allows you to nest IF functions up to 64 levels deep (which is 63 too many)".

The new IFS and SWITCH functions (introduced in Feb 2016) are mainly intended to offer a simpler alternative to nested IF functions.

This doesn't mean using the IFS and SWITCH functions provides a better solution than VLOOKUP.

It is easy to introduce errors using IFS and SWITCH, as the order in which the logic pairs are listed is vital to the correct operation of the function.

In almost all business situations a VLOOKUP will provide a better and more elegant solution than the use of the IFS or SWITCH function.

IFS Grades-1

Lesson 3-28: Use the IFS function

If you have Excel 2016 (rather than Excel 365) you will not be able to complete this lesson (see sidebar).

In: *Lesson 3-25: Use a VLOOKUP function for an inexact lookup*, you used a VLOOKUP function to return a grade from different pass mark percentages.

In early 2016 Microsoft added a new IFS function to Excel 365. In this lesson you will solve exactly the same problem posed in: *Lesson 3-25: Use a VLOOKUP function for an inexact lookup*, with a logic based (rather than lookup based) solution.

1 Open *IFS Grades-1* from your sample files folder.

	A	B	C	D	E	F
1	Exam Results					
2						
3	Name	Percentage	Grade		Percentage	Grade
4	Johnny Caine	70%			0%	Fail
5	George Marley	68%			60%	C
6	Betty Anan	86%			70%	B
7	Paris Winfrey	80%			80%	A
8	Ozzy Dickens	95%			90%	A*
9	Johnny Roberts	84%				

This is an exact duplicate of the *Grades-1* sample file that you used at the beginning of: *Lesson 3-25: Use a VLOOKUP function for an inexact lookup*.

2 Use the IFS function to calculate the grade for each student by defining grade data within the function.

Sometimes it may be better to "hard code" data (such as the percentage grade thresholds) within the function itself. This prevents users from accidentally deleting or changing the grade percentage thresholds within the worksheet.

The argument against this approach is that the worksheet is more difficult to maintain if grade thresholds change in the future.

1. Click in cell C4.
2. Click: Formulas→Function Library→Logical→IFS.

   The *Function Arguments* dialog for the IFS function appears.

   The IFS function accepts up to 127 *Logical Test/Value* pairs.
3. Enter the following pair of arguments:

Logical_test1	B4<60%
Value_if_true1	"Fail"

The *Logical Test* is an expression that returns TRUE or FALSE. In this case the test asks if Johnny Caine's percentage is less than 60%.

166 http://ExcelCentral.com

Learning by participation

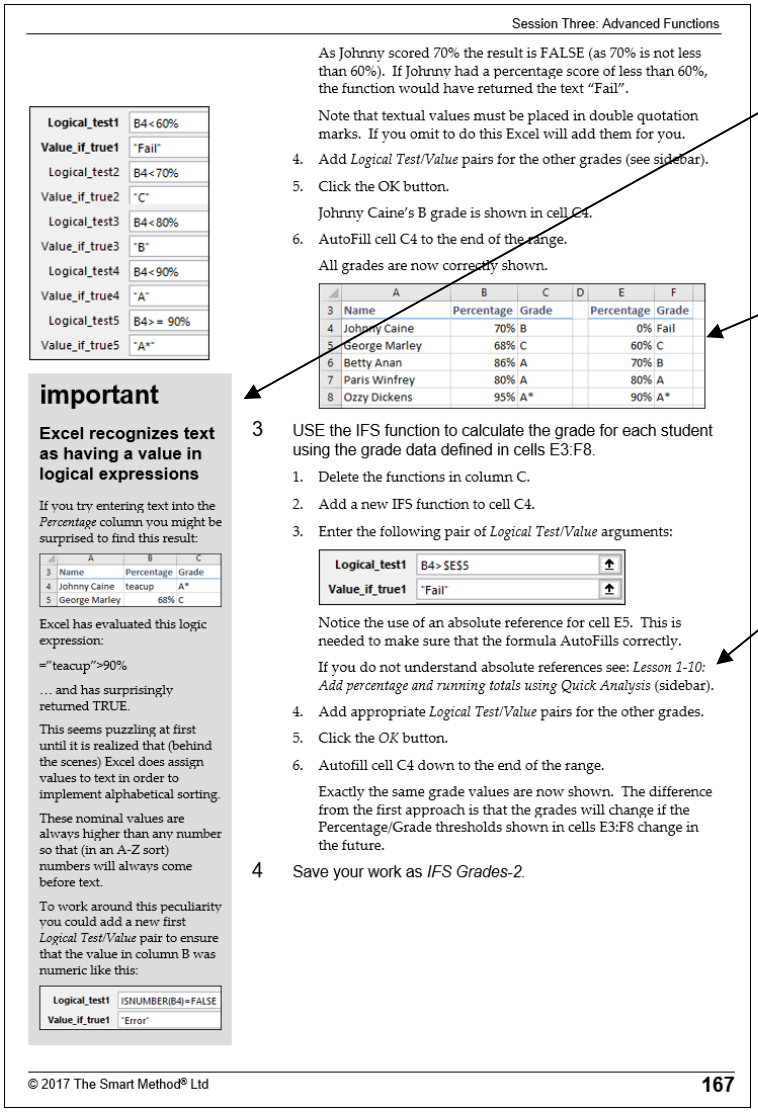
> Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand.
>
> ***Confucius, Chinese teacher, editor, politician and philosopher (551-479 BC)***

Confucius would probably have agreed that the best way to teach IT skills is hands-on (actively) and not hands-off (passively). This is another of the principal tenets of The Smart Method® teaching method.

Research has backed up the assertion that you will learn more material, learn more quickly, and understand more of what you learn if you learn using active, rather than passive methods.

For this reason, pure theory pages are kept to an absolute minimum with most theory woven into the hands-on lessons, either within the text or in sidebars.

This echoes the teaching method used in Smart Method classroom courses where snippets of pertinent theory are woven into the lessons themselves so that interest and attention is maintained by hands-on involvement, but all necessary theory is still covered.



Session Three: Advanced Functions

As Johnny scored 70% the result is FALSE (as 70% is not less than 60%). If Johnny had a percentage score of less than 60%, the function would have returned the text "Fail".

Note that textual values must be placed in double quotation marks. If you omit to do this Excel will add them for you.

4. Add *Logical Test/Value* pairs for the other grades (see sidebar).
5. Click the OK button.

Johnny Caine's B grade is shown in cell C4.

6. AutoFill cell C4 to the end of the range.

All grades are now correctly shown.

	A	B	C	D	E	F
3	Name	Percentage	Grade		Percentage	Grade
4	Johnny Caine	70%	B		0%	Fail
5	George Marley	68%	C		60%	C
6	Betty Anan	86%	A		70%	B
7	Paris Winfrey	80%	A		80%	A
8	Ozzy Dickens	95%	A*		90%	A*

Logical_test1	B4<60%
Value_if_true1	"Fail"
Logical_test2	B4<70%
Value_if_true2	"C"
Logical_test3	B4<80%
Value_if_true3	"B"
Logical_test4	B4<90%
Value_if_true4	"A"
Logical_test5	B4>= 90%
Value_if_true5	"A*"

3 USE the IFS function to calculate the grade for each student using the grade data defined in cells E3:F8.

1. Delete the functions in column C.
2. Add a new IFS function to cell C4.
3. Enter the following pair of *Logical Test/Value* arguments:

Logical_test1	B4>E5
Value_if_true1	"Fail"

Notice the use of an absolute reference for cell E5. This is needed to make sure that the formula AutoFills correctly.

If you do not understand absolute references see: *Lesson 1-10: Add percentage and running totals using Quick Analysis* (sidebar).

4. Add appropriate *Logical Test/Value* pairs for the other grades.
5. Click the *OK* button.
6. Autofill cell C4 down to the end of the range.

Exactly the same grade values are now shown. The difference from the first approach is that the grades will change if the Percentage/Grade thresholds shown in cells E3:F8 change in the future.

4 Save your work as *IFS Grades-2*.

important

Excel recognizes text as having a value in logical expressions

If you try entering text into the *Percentage* column you might be surprised to find this result:

	A	B	C
3	Name	Percentage	Grade
4	Johnny Caine	teacup	A*
5	George Marley	68%	C

Excel has evaluated this logic expression:

="teacup">90%

… and has surprisingly returned TRUE.

This seems puzzling at first until it is realized that (behind the scenes) Excel does assign values to text in order to implement alphabetical sorting.

These nominal values are always higher than any number so that (in an A-Z sort) numbers will always come before text.

To work around this peculiarity you could add a new first *Logical Test/Value* pair to ensure that the value in column B was numeric like this:

Logical_test1	ISNUMBER(B4)=FALSE
Value_if_true1	"Error"

© 2017 The Smart Method® Ltd 167

Whenever something can easily go wrong, or when the subject text is particularly important, you will see the *important* sidebar. You should always read important sidebars.

Each lesson models a real-world business problem. You'll immediately appreciate the value and relevance of each skill you learn.

A goal of this book is not to waste your time by explaining any skill twice. Sometimes you may forget something that has already been covered earlier in the course.

Cross-references are extensively used pointing you back to the lesson in which the relevant skills was learned. The cross-references also help when you use this course as a reference book but have forgotten the more basic skills needed to complete each step.

What you will learn

In the process of completing this construction kit, you'll learn how to apply many Excel skills in the context of a real-world project.

Here are some of the skills you will use (in the order that they first appear in the book).

- Understand the Waterfall Method.
- Understand update channels and enable automatic updates.
- Apply background colors.
- Specify a custom color using RGB values.
- Create a Custom Color Set.
- Enable and disable gridlines.
- Apply Borders and Lines.
- Select non-contiguous cells, rows and columns.
- Resize rows and columns.
- Use AutoFill.
- Set vertical and horizontal cell alignment.
- Set cell indents.
- Set font sizes and colors.
- Wrap text.
- Merge cells.
- Use custom formats.
- Create line breaks within custom formats.
- Insert Symbols into cells.
- Insert pictures into a worksheet.
- Use a Spin Button Form Control.
- Use a Checkbox Form Control.
- Insert and name worksheets.
- Create a Tables.
- Name a Table.
- Apply Cell Styles.
- Work with shapes.
- Define named ranges and named cells.
- Use the Name Manager to view, delete and edit range names.
- Create a drop-down list using a list validation.
- Understand and use control settings.
- Understand and use helper cells.

- AutoSize columns.
- Use the IF logical function.
- Understand Date Serial Numbers.
- Use the DATE function.
- Understand international date formats (MDY and DMY).
- Use the WEEKDAY function.
- Understand precedence rules.
- Format date serial numbers using a custom format.
- Use the TEXT function.
- Use the UPPER function.
- Use a cell link to connect a Spin Button control to a control setting.
- Understand magic numbers.
- Create a formula driven conditional format.
- Use the MONTH function.
- Use the Conditional Format Rules Manager.
- Use the OR logical function.
- Understand the AND, NOT and XOR logical functions.
- Use absolute, relative and mixed cell references.
- Calculate the correct date for New Year's Day (in any year) using the DATE function.
- Link a table of fixed events to the calendar so that fixed events are appropriately displayed.
- Use the VLOOKUP function.
- Use the IFERROR function.
- AutoFill formulas.
- Copy and Paste.
- Understand calculated table columns.
- Calculate the correct dates for New Year's Day, Independence Day, Christmas Day and Veterans' Day (for any year) using the DATE function.
- Calculate the correct date for Martin Luther King Day, President's Day, Labor Day, Columbus Day and Thanksgiving Day (in any year) using simple Excel formulas and helper cells.
- Understand the CHOOSE function.
- Calculate the correct date for Memorial Day (in any year) using simple Excel formulas and helper cells.
- Understand symbolic constants and how they can be used to give meaning to magic numbers.
- Calculate the correct date for Easter Sunday (in any year).
- Add a unique constraint to a table using a formula-driven data validation.
- Understand the COUNTIF and COUNTIFS functions.
- Use structured table references.

- Use the CHAR function.
- Understand the CODE function.
- Concatenate text.
- Create a text length data validation.
- Calculate the age of the moon using Synodic Months and the MOD function.
- Calculate the correct phase of the moon (for any date) based upon the moon's age.
- Use the ROW function.
- Use Excel's zoom feature.
- Use Paste Formulas to copy formulas without disturbing conditional formatting.
- Create user-friendly validation error messages.
- Hide error warning markers.
- Use Smart Tags.
- Unlock cells.
- Hide columns and entire worksheets.
- Protect a worksheet to prevent users from making unwanted changes.

Excel 2016 Construction Kit #1

Calendar and Year Planner

Mike Smart

Excel 2016 Construction Kit #1: Calendar and Year Planner

Published by:

The Smart Method® Ltd
Burleigh Manor
Peel Road
Douglas, IOM
Great Britain
IM1 5EP

Tel: +44 (0)845 458 3282 Fax: +44 (0)845 458 3281

E-mail: info@ExcelCentral.com
Web: http://ExcelCentral.com (this book's dedicated web site)

International Standard Book Number (ISBN13): 978-1-909253-10-0

6 8 10 9 7 5

Contents

Blank page

Introduction

Welcome to *Excel 2016 Construction Kit #1: Calendar and Year Planner*. This book has been designed to enable students to apply their existing advanced Excel skills to the construction of a polished and professional Excel application. The book is equally useful as courseware to deliver classroom courses.

Smart Method® publications are continually evolving as we discover better ways of explaining or teaching the concepts presented.

Feedback

At The Smart Method® we love feedback – both positive and negative. If you have any suggestions for improvements to future versions of this book, or if you find content or typographical errors, the author would always love to hear from you.

You can make suggestions for improvements to this book using the online form at:

http://ExcelCentral.com/support

Future editions of this book will always incorporate your feedback so that there are never any known errors at time of publication.

If you have any difficulty understanding or completing a lesson, or if you feel that anything could have been more clearly explained, we'd also love to hear from you. We've made hundreds of detail improvements to our books based upon reader's feedback and continue to chase the impossible goal of 100% perfection.

Downloading the sample files

In order to use this book, it is necessary to download sample files from the Internet. The sample files are available from:

http://ExcelCentral.com

Type the above URL into your web browser and you'll see the link to the sample files at the top of the home page.

Problem resolution

If you encounter any problem using any aspect of the course you can contact us using the online form at:

http://ExcelCentral.com/support

We'll do everything possible to quickly resolve the problem.

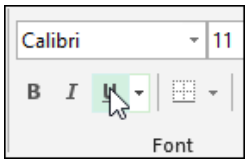
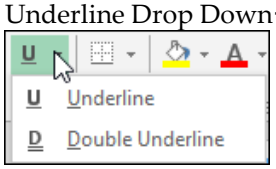
The Excel versions that were used to write this book

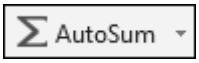
This edition was written using both the *Excel 2016* perpetual license (the one-time payment version) and *Excel 2016 for Office 365 subscribers* (semi-annual version 1708, released on Jan 9, 2018). You'll discover which version your computer is running in: *Lesson 2-1: Check that your Excel version is up to date.*

In this book, the perpetual license version of Excel is referred to as: *Excel 2016* and the subscription version as *Excel 365*. This book is written purely for Excel 2016, though readers may find some of the content is also applicable to earlier Excel versions.

Typographical Conventions Used in This Book

This guide consistently uses typographical conventions to differentiate parts of the text.

When you see this	Here's what it means
Click *Line Color* on the left-hand bar and then click *No line.*	Italics are used to refer to text that appears in a worksheet cell, an Excel dialog, on the Ribbon, or elsewhere within the Excel application. Italics may sometimes also be used for emphasis or distinction.
Click: Home→Font→Underline. 	Click on the Ribbon's *Home* tab and then look for the *Font* group. Click the *Underline* button within this group (that's the left-hand side of the button, not the drop-down arrow next to it). Don't worry if this doesn't make sense yet. We cover the Ribbon in depth in session one.
Click: Home→Font→ Underline Drop Down→Double Underline. 	Click on the Ribbon's *Home* tab and then look for the *Font* group. Click the drop-down arrow next to the Underline button (that's the right-hand side of the button) within this group and then choose *Double Underline* from the drop-down list.
Click: File→Options→ Advanced→General→ Edit Custom Lists→Import	This is a more involved example. 1. Click the *File* tab on the Ribbon, and then click the *Options* button towards the bottom of the left-hand pane. The *Excel Options* dialog appears. 2. Choose the *Advanced* list item in the left-hand pane and scroll down to the *General* group in the right-hand pane. 3. Click the *Edit Custom Lists…* button. Yet another dialog pops up. 4. Click the *Import* button.
Type: **European Sales** into the cell.	Whenever you are supposed to actually type something on the keyboard it is shown in bold faced text.
Press **<Ctrl> + <Z>**.	You should hold down the **Ctrl** key and then press the **Z** key.



When a lesson tells you to click a button, an image of the relevant button will often be shown either in the page margin or within the text itself.

note

In Excel 2007/2010/2013/2016 there are a possible 16,585 columns and 1,048,476 rows. This is a great improvement on earlier versions.

If you want to read through the book as quickly as possible, you don't have to read notes.

Notes usually expand a little on the information given in the lesson text.

important

Do not click the *Delete* button at this point as to do so would erase the entire table.

Whenever something can easily go wrong, or when the subject text is particularly important, you will see the *important* sidebar.

You should always read important sidebars.

tip

Moving between tabs using the keyboard

You can also use the **<Ctrl>+<PgUp>** and **<Ctrl>+<PgDn>** keyboard shortcuts to cycle through all of the tabs in your workbook.

Tips add to the lesson text by showing you shortcuts or time-saving techniques relevant to the lesson.

The bold text at the top of the tip box enables you to establish whether the tip is appropriate to your needs without reading all of the text.

In this example you may not be interested in keyboard shortcuts so do not need to read further.

anecdote

I ran an Excel course for a small company in London a couple of years ago...

Sometimes I add an anecdote gathered over the years from my Excel classes or from other areas of life.

If you simply want to learn Excel as quickly as possible you can ignore my anecdotes.

trivia

The feature that Excel uses to help you out with function calls first made an appearance in Visual Basic 5 back in 1996 …

Sometimes I indulge myself by adding a little piece of trivia in the context of the skill being taught.

Just like my anecdotes you can ignore these if you want to. They won't help you to learn Excel any better!

When there is a sample file (or files) to accompany a lesson, the file name will be shown in a folder icon. You can download the sample file from: http://ExcelCentral.com.

How to use this construction kit

Three important rules

#1 - Complete the construction kit from beginning to end

Just like a real-world construction project you need to start at the beginning and progress, one lesson at a time, until you have completed the application.

When you have finished your project, you can re-do specific lessons by using any of the incremental sample files to regress to any point in the construction process.

#2 If possible, complete a session in one sitting

The book is arranged into *sessions* and *lessons* (each presented upon two facing pages).

You can complete as many, or as few, lessons as you have the time and energy for each day. Many learners have completed their construction kit by setting aside just a few minutes each day to complete a single lesson.

If it is possible, the most effective way to learn is to lock yourself away, switch off your telephone, and complete a full session, without interruption, except for a 15-minute break each hour. The memory process is associative, and we've ensured that the lessons in each session are very closely coupled (contextually) with the others. By completing the whole session in one sitting, you'll store all that information in the same part of your memory and will find it easier to recall later.

The experience of being able to remember all the words of a song as soon as somebody has got you "started" with the first line is an example of the memory's associative system of data storage.

#3 Rest at least every hour

In our classroom courses we have often observed a phenomenon that we call "running into a wall". This happens when a student becomes overloaded with new information to the point that they can no longer follow the simplest instruction. If you find this happening to you, you've studied for too long without a rest.

You should take a 15-minute break every hour (or more often if you begin to feel overwhelmed) and spend it relaxing rather than catching up with your e-mails. Ideally you should relax by lying down and closing your eyes. This allows your brain to use all its processing power to efficiently store and index the skills you've learned. We've found that this hugely improves retention.

How to best use the incremental sample files

All lessons in this construction kit (apart from those that have no hands-on tasks) use a sample file that is incrementally improved during each lesson. At the end of each lesson an interim version is always saved. The first file you will save will be called *Year Planner-1*. You will then begin the following lesson with the *Year Planner-1* file and then save it (after completing all lesson steps) as *Year Planner-2.* By the end of the construction kit you'll be up to *Year Planner-43* (the finished application).

A complete set of sample files (including all incremental versions) are provided in the sample file set. This provides three important benefits:

- If you have difficulty with a lesson it is useful to be able to study the completed workbook (at the end of the lesson) by opening the finished version of the lesson's workbook.

- When you have completed the book, you may want to revise some of the steps that you used to complete it (perhaps to use the same skills in another project). The sample files allow you to work through any single lesson in isolation, as the workbook's state at the beginning of each lesson is always available.
- When teaching a class one student may corrupt their workbook by a series of errors (or by their computer crashing). It is possible to move the class on quickly and easily to the next lesson by instructing the student to open the next sample file in the set (instead of progressing with their own corrupted file or copying a file from another student).

Blank page

1 Session One: Methodology & Functional Specification

> Give me six hours to chop down a tree and I will spend the first four sharpening the axe.
>
> ***Abraham Lincoln, 16th President of the United States (1809-1865)***

Imagine you are building a house. You wouldn't just race into a field and start digging foundations. You'd begin by employing an architect to carefully design every aspect of the finished house.

You wouldn't begin building the house until everything had been carefully designed and documented. In other words, you'd have to know exactly what you were building before you started building it.

You'd be amazed to know that in the world of business, most real-world software projects are not planned quite so well. In fact, some are not designed and documented at all. It is often the case that managers don't understand the need for a design phase and expect developers to begin construction on the first day of a project.

Methodology

This construction kit uses a high-quality application development methodology sometimes called the waterfall model. If you use this approach, you'll develop higher quality solutions faster – no matter how small the project is.

The basis of the waterfall model was first defined in 1970 by a paper authored by Winston W. Royce (a computer scientist at Lockheed working on the space program).

Winston had spent nine years developing software for spacecraft mission planning, commanding and post-flight analysis. His 1970 paper distilled his vast experience into the observation that software development consisted of two steps: Analysis and Coding. More simply put, you have to figure out what you need to do before you actually do it.

Winston observed, however, that in larger systems, any project that included *only* these two steps was "doomed to failure". In this session you'll learn how to use Winston's waterfall model. Even though this is a simple application, you'll still use the waterfall model to design it.

The Functional Specification

The waterfall model requires that every project should begin with a *Functional Specification.*

It may seem like overkill to have a functional specification for such a small project, but as you progress through the construction kit you'll appreciate the usefulness of this approach. You'll also realize how much longer everything would have taken if you hadn't specified what you needed to do before starting.

anecdote

It is often the case that non-technical project managers expect programmers to begin coding on the first day of a new software project. They find it hard to understand why the first months of a large project need to be spent documenting and designing.

I have my own acronym for managers that ask this question: **WIMP**.

It stands for "Why Isn't Mike Programming".

Lesson 1-1: Understand the Waterfall Model

How the waterfall methodology is used in this construction kit

During my own career developing large software systems (for corporate clients in different business areas) I have discovered many different names given to the steps originally identified by Winston Royce. Here are my preferred names for the steps you need to successfully complete a project along, with their many aliases:

Step One: Functional Specification

Other names: Requirements Specification, Requirements Analysis, Requirements Definition, Software Requirements, Specification, Spec, Analysis, Project Analysis Document, Problem Statement, Conceptual Design, Goal Centered Design, Logical Design.

What it really means: What the application needs to do, but not what it will look like or how it will do it.

Your users will need to sign-off on the *Functional Specification* before you proceed to the *User Interface*.

Step Two: User Interface

Other names: Prototype, User Interface Design, User Interface Specification.

What it really means: What the application looks like and how it will deliver the requirements detailed in the *Functional Specification.*

Later, in: *Session Two: Create the User Interface,* you'll design a user interface that will show how all of the features described in the functional specification will be delivered.

You'll deliver the user interface as a non-functioning, annotated Excel workbook. This can then be shared amongst your users to make sure they are happy with the final appearance and how the application will work before you spend time making everything work.

Step Three: Construction

Other names: Coding, Implementation, Coding & Debugging, Programming.

What it really means: Making everything in the user interface work as specified.

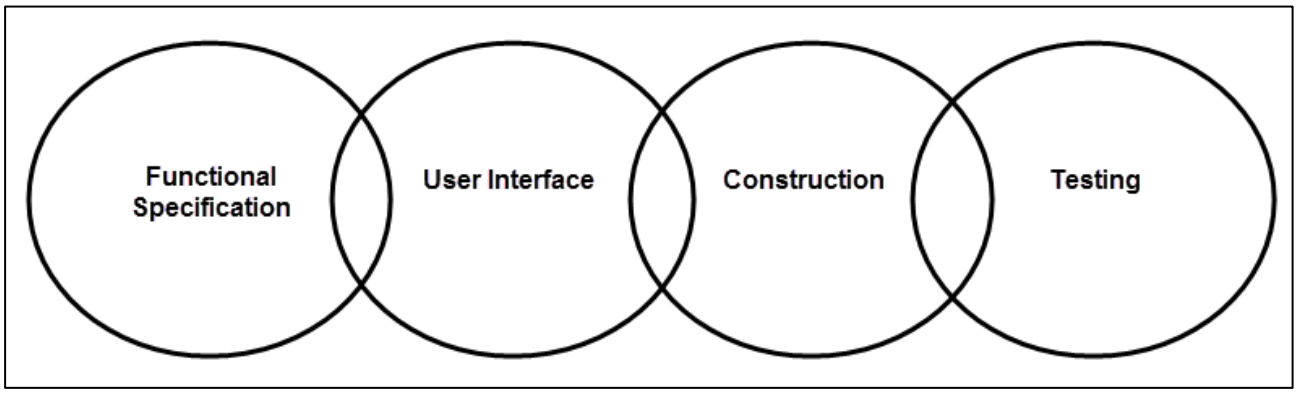
In the construction phase you'll go on to make the features that were specified in the *functional specification* work using the *user interface* you have designed.

Step Four: Testing

Other names: System Testing, Integration Testing, Acceptance Testing.

What it really means: Working through the Functional Specification and making sure that the finished application reliably and correctly provides all of the functionality that was specified there.

How the four phases of the waterfall model work together



The above diagram shows how the *Functional Specification* and *User Interface* fit into the overall development process. You can see that each process overlaps. This is designed to indicate some degree of interaction between each step and the preceding step. In other words, users may see the *User Interface* and then realize that it doesn't cater for a requirement that should properly have been included in the *Functional Specification*. At this stage, the uncaptured requirement can be added to the *Functional Specification* and incorporated into the *User Interface*.

You should only ever re-iterate to the previous step.

The waterfall model insists that there should be no overlap other than with the preceding step.

This means that once the functional specification and user interface have been agreed, development can only proceed efficiently if no further functionality is added to the current version.

Any late requests for enhancements should form the subject of a new functional specification for the second release and you should not try to incorporate them into the current version. This is an **absolutely essential** discipline for efficient software development.

You can see now why Winston's methodology has been called the *waterfall model*. Water only flows one way in a waterfall, just as the project flows from left to right in the diagram above (but never from right to left).

note

In 1985 the United States government published a document titled: *Defense Systems Software Development (DOD-STD-2167A).*

This document broadly describes the Waterfall Method as the preferred standard for software development.

The document defined six phases (an elaboration of the four described in this lesson):

- Preliminary Design
- Detailed Design
- Coding
- Unit Testing
- Integration
- Testing

You'll learn more about unit testing and integration testing in: *Lesson 7-4: Remove test data and finalize the year planner.*

Lesson 1-2: Understand the structure of a functional specification

A good functional specification completely describes an application without considering what the user interface will look like or how the functionality will be implemented.

The functional specification should describe all of the things that the application needs to do.

Make sure that the functional specification describes what the application does and not how it will do it

I've organized many meetings with business experts to draw up a functional specification for a new software solution. Some have been for very large systems with functional specifications stretching to over 200 pages.

At the beginning of the meeting I always emphasize that users are not allowed to talk about the user interface when describing functionality. Of course, they always do, and I have to work hard to steer them back to functionality.

For example, a user will say something like:

"We need a drop-down list showing different countries and when you click on a country a box will pop up showing year-to-date sales for the current year".

The user needs to be brought back onto track to state the actual requirement as:

"It must be possible to quickly view year-to-date sales for any country".

Later, when the user interface is designed, the users can see how it is proposed to deliver the functionality defined in the functional specification. This may be very different from the way in which the user originally visualized it.

Staying focused in this way will allow you to capture the requirements of the business far more precisely.

The three main sections of a functional specification

Mission statement

> "There are no big problems, there are just a lot of little problems."
>
> ***Henry Ford, founder of the Ford Motor Company (1863-1947)***

Important

Always organize a sign-off meeting for the functional specification

I have discovered that if you simply e-mail a functional specification to a client for review it is rare for anybody to invest the time needed to read it.

The functional specification is hugely important as it defines success. Your project will demonstrably be a success if it delivers all the functionality defined in the functional specification.

If you don't make sure that the functional specification is accurate you are setting yourself up for failure when you deliver the finished application.

I have found it best to organize a meeting of stakeholders including business experts and the actual end-users of the application.

Read out each requirement at the meeting and invite questions. You'd be amazed how many new requirements you will capture by doing this.

I've often had to organize a second meeting to review version 2 of the functional specification as it had to be completely re-written after the first sign-off meeting.

The best way to start a functional specification is with a mission statement. You need to turn Henry Ford's words upside down and appreciate that the project will solve lots of little problems but can also be described in a more abstract way as one big problem.

Ideally your mission statement will consist of a single sentence, but it could also be extended to two or three sentences.

You'll see the mission statement for this construction kit later, in: *Lesson 1-3: The Functional Specification.*

Primary business objectives

Having defined the mission statement, the primary business objectives now flesh out the requirement in a little more detail.

There will normally be less than ten primary business objectives even in a large system.

You'll see the primary business objectives for this construction kit later, in: *Lesson 1-3: The Functional Specification.*

Requirements

Having defined the *mission statement* and the *primary business objectives*, the requirements now express in detail the precise functionality that the system needs to deliver.

You'll see the requirements for this construction kit later, in: *Lesson 1-3: The Functional Specification.*

Lesson 1-3: The Functional Specification

Here is the functional specification for the application you are about to create.

When the application is complete it will be possible to test it against this functional specification to confirm that all of the features specified have been delivered.

Mission Statement

To create a year planner that can be easily be populated with different date-related events.

Primary Business Objectives

1. Provide a calendar that will show an entire month of dates and events.
2. Allow the user to quickly select any year or month.
3. Allow the user to select Sunday or Monday as the first day of the week.
4. Show the phase of the moon for each date.
5. Allow one fixed event (such as Christmas Day or New Year's Day) to be displayed for each date.
6. Display custom events defined by the user for each date (such as appointments or birthdays).
7. Allow both fixed and custom events to recur each year if required.
8. Allow users to customize the calendar by enabling or disabling event types that they may have no use for.
9. Ensure that the finished calendar looks professional when printed.

Requirements

1. Supported date range

The calendar needs to support, as a minimum, all dates up to 100 years in the past and up to 100 years in the future. For the purposes of this specification this will mean the date range: 1st January 1917 to 1st January 2117.

2. Information to be shown for each date

2.1. The calendar will always show 37 days, starting with the Monday or Sunday on or before the 1st of the month that is being displayed.

2.2. Moon Phase

For every date in the supported date range, it should be clearly indicated which phase of the moon is active. Eight different phases of the moon should be displayed:

- New Moon
- Waxing Crescent
- First Quarter
- Waxing Gibbous
- Full Moon

- Waning Gibbous
- Last Quarter
- Waning Crescent

3. **Fixed events**.

   The following fixed events will be automatically calculated and included (for every year):

   - New Year's Day
   - Martin Luther King Day
   - Presidents' Day
   - Easter Sunday
   - Memorial Day
   - Independence Day
   - Labor Day
   - Columbus Day
   - Veteran's Day
   - Thanksgiving Day
   - Christmas Day

4. **Custom events**

   4.1. It must be possible for a user to quickly define several custom events for each day (such as a birthday, holiday or appointment).

   4.2. Events must be restricted to the visible space available for display for each calendar day without scrolling.

   4.3. It must be possible to define custom events that are up to 32 characters (in total) long for each day.

5. **Recurring events**

   It must be possible for a user to define each custom event as recurring or non-recurring. A recurring event is defined as an event that will occur on the same date of every year in the supported date range.

6. **Calendar Settings**

   6.1. Customization of calendar display

   It must be possible to show or hide Moon Phases, Fixed Events and Custom Events.

   6.2. First day of the week

   It must be possible to define either Sunday or Monday as the first day of the week.

7. **Usability**

   7.1. The user must not need any Excel skills or training

   7.2. The year planner must be intuitive and easy to use for untrained users.

   7.3. On-screen help must be provided whenever the purpose of any on-screen item is not obvious.

8. **Compact design**

   8.1. The main features of the application should be designed so that users do not have to scroll their screens when using a standard 22-inch monitor (providing a resolution of 1680X1050).

8.2. The calendar should appear professional and legible when printed upon one sheet of Letter-Sized or A4 paper (in landscape orientation).

9. Security

9.1. It must not be possible for a user to break any of the functionality of the application in normal use.

9.2. The implementation must not make use of any VBA or macro code.

2

Session Two: Create the User Interface

> Good looks only take you so far.
>
> ***Angie Everhart, American Actress (1979-).***

When the functional specification has been completed and (most importantly) signed off by users, the next step will be to design the user interface.

In this lesson you'll design the visual appearance of the year planner application. You can then submit the workbook to users for approval before you move on to make each feature work.

Sometimes users will see the user interface and then identify new requirements that were missed when the functional specification was agreed.

In: *Lesson 1-1: Understand the Waterfall Model*, you learned that it is permissible to re-visit the functional specification if new requirements are identified as a result of making a non-functioning user interface available to users.

Session Objectives

By the end of this session you will have:

- Checked that your Excel version is up to date
- Designed the user interface
- Applied background colors
- Applied borders
- Resized rows and columns
- Added test values
- Applied text formatting
- Merged cells
- Added moon phase icons
- Added a company logo
- Added controls
- Created a table for non-recurring custom events
- Created a table for recurring custom events
- Packaged the user interface for review by users

important

Update Channels

Update channels determine *when* users will receive the latest Excel version.

Excel 2016 perpetual users

If you have a perpetual license (the pay-once version of Excel 2016) you will not receive any feature updates, so you do not have an update channel.

Excel 365 home users

If you have a subscription version of Excel 2016 (this is referred to as *Excel 365* in this book) that is targeted at home users, you are required to receive monthly updates.

This is called the *Monthly Channel*.

You will potentially receive new or improved features every month.

Excel 365 business users

New features added in the *Monthly Channel* may have bugs, as they will not yet have been extensively tested by real-world use.

If you have an Excel 365 version that is targeted at business users (usually called *Excel Pro Plus*), you will (by default) use the *Semi-annual Update Channel*.

The Semi-annual Channel allows new features to be thoroughly tested before use. It is possible (though difficult) for Excel Pro-Plus users to change their update channel to the *Monthly Channel.*

The *Semi-annual Channel* only updates Excel twice each year (in January and July).

This book was written using *Excel Semi-Annual Version 1708.* This version was released to *Monthly Channel* users on *Sept 12, 2017* and was released to *Semi-Annual* channel users on *Jan 9, 2018.*

Lesson 2-1: Check that your Excel version is up to date

Automatic Updates

Normally Excel will look after updates without you having to do anything. By default, automatic updates are enabled. This means that updates are downloaded from the Internet and installed automatically.

It is possible that automatic updates have been switched off on your computer. In this case there is a danger that you may have an old, buggy, unsupported and out of date version of Excel installed.

This lesson will show you how to make sure that you are using the latest (most complete, and most reliable) version of Excel.

1 Start Excel and open a new blank workbook (if you have not already done this).

2 Make sure that automatic updates are enabled.

1. Click the *File* button 

at the top-left of the screen.

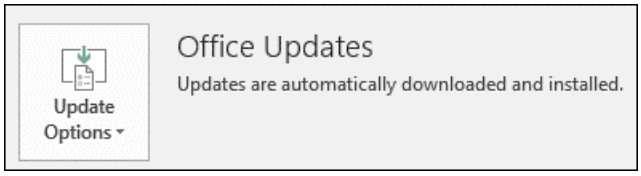
   This takes you to *Backstage View*. Backstage View allows you to complete an enormous range of common tasks from a single window.

2. Click: *Account* 

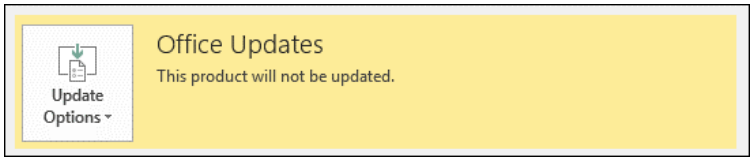
in the left-hand list.

   Your account details are displayed on screen. Notice the *Office Updates* button displayed in the right-hand pane.

   If all is well, and automatic updates are switched on, you will see a button similar to this:



   If *automatic updates* have been switched off, you will see a similar button to this.



   In this case you will need to switch automatic updates on (see next step).

3 Switch on automatic updates if necessary.

Click: Update Options→Enable Updates.

note

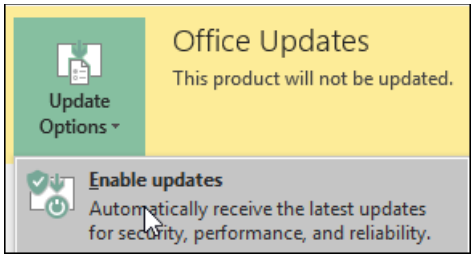
Version number and Build

A new Excel version is usually released to the monthly update channel every month.

Each new version may add new features to Excel 365.

If bugs or security issues are found in a new version, Microsoft will fix them and publish a new *build* of the same version.

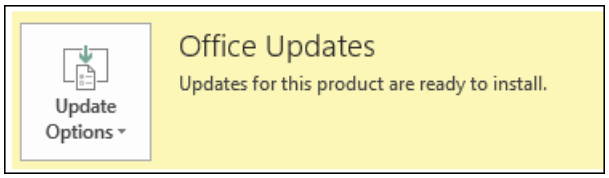
It is quite normal for there to be several new *builds* of each new *version* during the month that it is released.



4 If there are updates waiting to install, apply them.

Sometimes Excel will download updates but will not install them automatically.

In this case you will see an update button similar to the following:

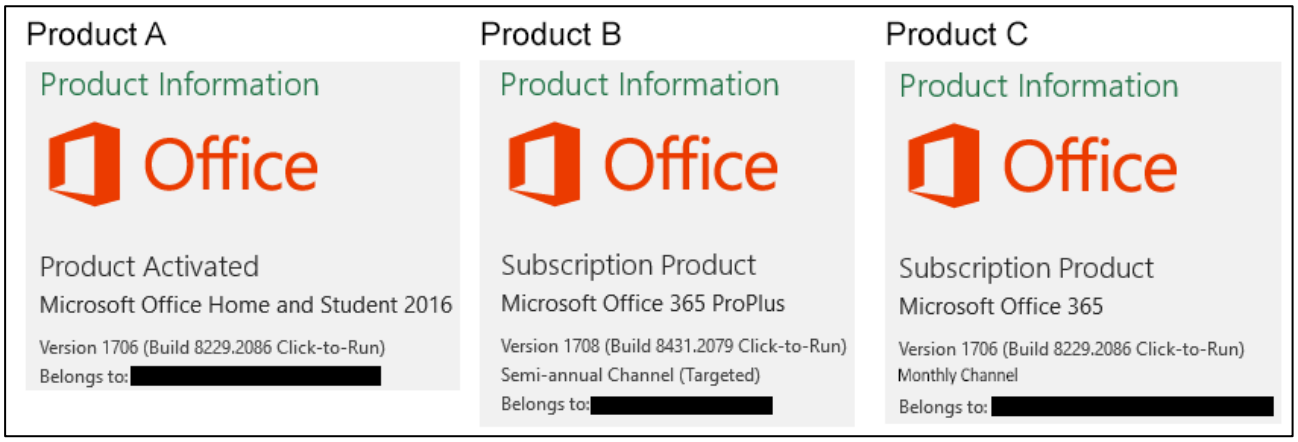


If you see this type of button you should apply the update.

Click: Update Options→Apply Updates.

You may be asked to confirm that you want to apply the update, and to close any open programs to apply the update.

5 Notice your version number and update channel.



note

Perpetual license versions have different features

Perpetual license holders still receive monthly updates, but these only include security updates and bug fixes (not new features).

A perpetual license holder running Version 1708 will thus see different features than a subscription license holder running the same Excel version.

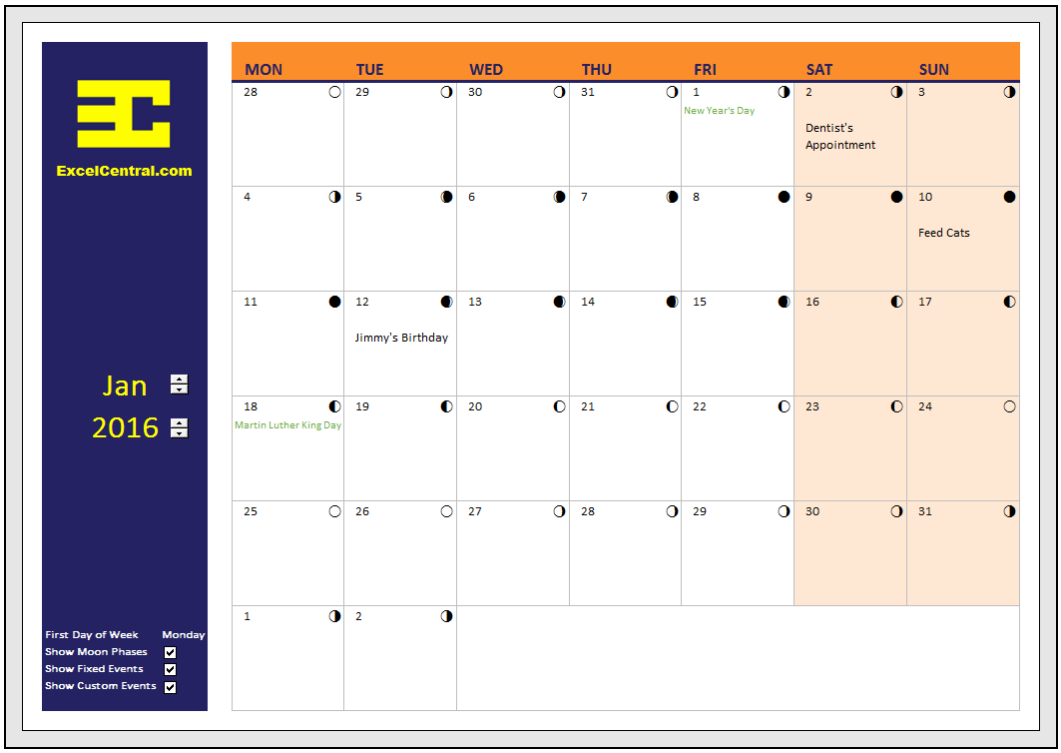
You will see a product information section displayed. If you see the number *365* or the words *Subscription Product*, you will know that you are using the subscription version of Excel 2016 (this is the case for products B and C above). Otherwise you are using the *perpetual license* version (this is the case for product A above). In this book, the perpetual license version will be referred to as *Excel 2016* and the subscription version as *Excel 365*.

Notice also the *update channel* and *version numbers* (see sidebars).

6 Click the *Back* button  to leave *Backstage View* and return to the worksheet.

7 Click the *Close* button  in the top-right corner of the Excel screen to close Excel.

Lesson 2-2: Design the user interface



After reviewing the *Functional Specification* described in: *Lesson 1-3: The Functional Specification*, it is possible to identify several design-related constraints that must be satisfied. They are:

1. Show an entire month of dates and events.
2. Allow the user to quickly select any year or month.
3. Allow the user to select Sunday or Monday as the first day of the week.
4. Show the phase of the moon for each date.
5. Allow one fixed event (such as Christmas Day or New Year's Day) to be displayed for each date.
6. Display custom events defined by the user for each date (such as appointments or birthdays). It must be possible to display custom events that are up to 32 characters (in total) long for each day without scrolling.
7. It must be possible to show or hide Moon Phases, Fixed Events and Custom Events.
8. Ensure that the finished calendar looks professional when printed upon one sheet of Letter-Sized or A4 paper (in landscape orientation).
9. The calendar must show 37 days, starting with the Monday or Sunday on or before the 1st of the month that is being displayed.

It is important to appreciate that graphic design and technical implementation are different skills. For this reason, you might decide to use a graphic artist to create the final design.

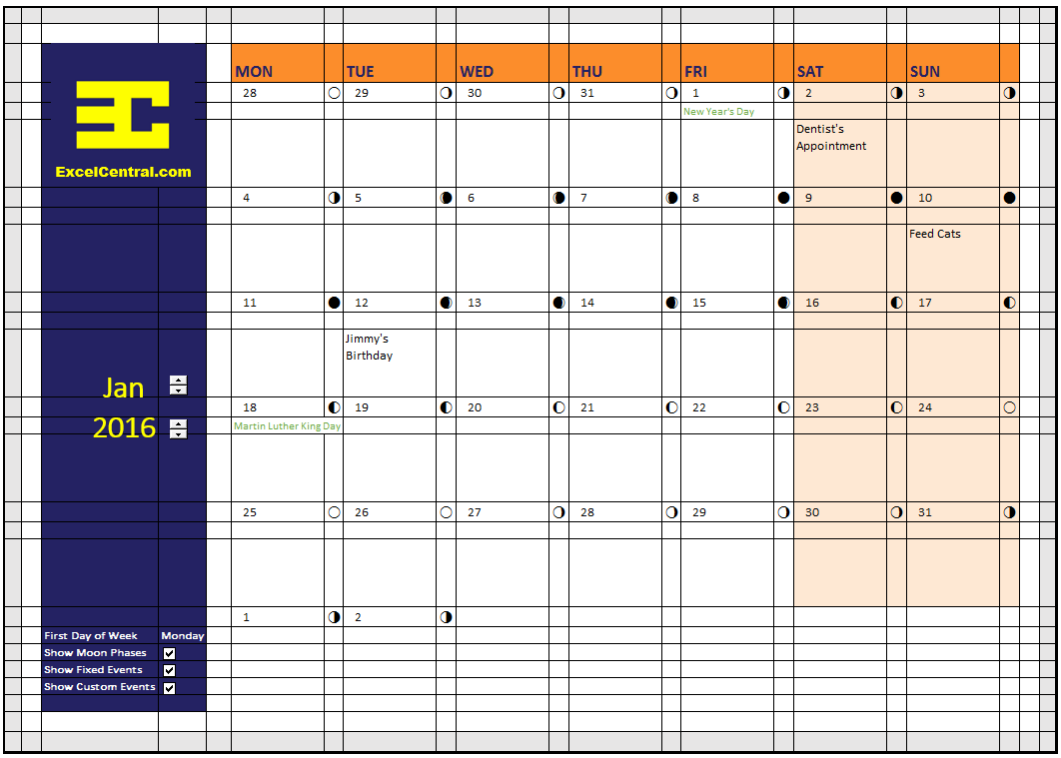
For the purposes of this lesson, imagine that your designer has submitted the design (shown at the start of this lesson) for approval. You have checked it against the design constraints and decided that it is capable of delivering the functionality required.

You now need to re-create the design within Excel.

The calendar presents a complex user interface that will require information to appear in many different places. To make this possible, each area where a different piece of information will appear needs to be a distinct cell.

For example, above each day in the calendar you need to show the day number and an icon indicating the phase of the moon. In order to do this in Excel, you will need one cell for the day number and another cell for the moon phase.

A designer will usually create a layout using guides (that are normally hidden when the design is printed out). In this case, the designer has provided you with a copy of the design with visible guides (used by the designer to align each item). The guides resemble the rows and columns that appear upon an Excel worksheet. Here is the user interface design with guides:



As you can see, the design will require 21 columns and 26 rows.

You'll begin by applying background colors to define each part of the calendar, then you'll resize the rows and columns, add borders, merge cells as necessary and finally populate cells with test values.