

## Guide to recreate RNTV-PercentRankInc.xlsm

The [PERCENTRANK.INC](#) method is used to search for the location of a verse, selected at random from the collection of all verses in the NT, to identify its BCV (book, chapter and verse) coordinates within the NT.

### Steps

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### **1A Load data from csv file with Power Query Editor**

With cell C4 selected in a fresh worksheet, import RNTV-TransformedData.csv (Data tab >> From Text/CSV >> Import). Choose Transform Data which will open the Power Query Editor (PQE).

In the PQE, remove the first three and other empty rows in the file (Home tab >> Reduce Rows >> Remove Rows >> Remove Blank Rows), and use the first row as header (Home tab >> Use First Row as Headers >> Use First Row as Headers). Note how the type of the Chapters and Verses columns changed from text (left-aligned) to number (right-aligned) with this action.

Close PQE and load the transformed data to cell C4 of an existing worksheet (Home tab >> Close & Load >> Close & Load To).

In the Namebox, choose RNTV\_TransformedData to select the table. Change the table style to Light (Table Design tab >> Table Styles >> Light) to remove formatting, and convert the table to range (Table Design >> Convert to Range).

Format the column-width of the selected range (C5:AG31) to autofit (Home tab >> Cells group >> Format >> AutoFit Column Width). Remove the "Column" headings, and adjust for readability.

The chapters and verses columns respectively give the number of chapters and total number of verses in each book. The numbers to the right of column E state the number of verses for each chapter in a book.

Verify that E5 is the sum of F5:AG5, down to row 31. For example, in A15 type =SUM(F5:AG5)=E5, and copy this formula down to A131.

Remove the query connection (Data tab >> Queries & Connections, right-click on the connection). A query connection is useful for refreshing data that is dynamic (changes quite frequently) and keeping replicated data consistent. Since this data is static, the connection is no longer necessary.

(Sheet 1A Loaded Data)

## 1B Prepare data for percentrank search

Insert a new column before column F; in cell F3 type 'Cum BV' for Cumulative Book Verse. This helper column is used by percentrank to identify the book of a randomly chosen verse.

In F5 type =SUM(\$E\$5:E5), and use [autofill](#) to copy this formula down to F31. This creates a running total of the number of verses over the NT books. The value in F31 is the total number of verses in the NT; verify that this value is equal to the sum of E5:E31.

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Enter 0 in F4 to mark the beginning of the series; although the very first verse is 1, 0 is used so that percentrank does not return 0 for verse 1. With 0, the first verse for each book is an increment (+1) of the verse number of its previous book. For example, verses [1, 1071] (1 to 1071 inclusive) belong to Matthew, verses [1072, 1748] are in Mark and so on.

Similar helper data are also needed to identify the chapter and verse of a randomly chosen verse, once its book is identified. These are prepared in AK5:BL31. To make working on this area easier, copy G4:AH4, and in cell AK, paste column width only (Home tab >> Paste >> Paste Special >> Column Widths). Clear the clipboard.

In cell AK5 type =IF(G5 > 0, SUM(\$G5:G5), 0), and copy this formula across to the right to cell BL5. Adjust column widths to autofit content. The value in BL5 should equal the value in E5 since the AK5:BL5 values are a running total of the number of verses across the chapters in the book of Matthew. In AJ4 type 'Cum CV' for Cumulative Chapter Verse.

Repeat for the other books. Select AK5:BL5, and copy down to row 31. Adjust column widths to autofit content. Verify that the max of each row equals the value in column E. In AI5, type =MAX(AK5:BL5)=E5, and copy down this formula to AI31.

Fill AJ5:AJ31 with 0s to mark the beginning of each series. Use autofill to number the books from 1...27, in cells B5 to B31. Hide columns G to AI. Adjust column widths and other formatting to design taste.

(Sheet 1B Prepared Data)

## 2A Book search with percentrank

The [PERCENTRANK.INC](#) function is used to identify the book of a verse chosen at random by RANDBETWEEN.

Copy '1B Prepared Data'!B3:F31, and paste (with Values & Source Formatting option) to a new worksheet. This paste option is used to reduce formulas in the new worksheet, thereby reduce needless [recalculations](#).

In D35 type = PERCENTRANK.INC(\$F\$4:\$F\$31, D34, 6), to find where the value in cell D34 fits, within the series identified by the (sorted) range F4:F31.

The result returned by the percentrank function needs to be converted to an integer in [1, 27] to identify the book. In D36 type =D35 \* 27, and in D37 type = CEILING.MATH(D36) to identify the book index. In D38 type =INDEX(\$C\$5:\$C\$31, D37), to retrieve the name of the book.

To aid comprehension, formula text of relevant cells are displayed in the '2A Book Search' worksheet. This sheet is protected to prevent accidental modification of data or formulas; cells D34 and L3 are [unlocked](#) to be editable in protected mode.

Enter different values in D34 to understand how percentrank identifies a book for a given random verse. Test with values: 0, 0.5, 1, 10, 1000, 1071, 1072, 6790, 6791, 7957 and 7958. Check that the correct book is identified for each test.

Use [data validation](#) to prevent nonsensical values like 0.5 and 7958 from entering D34 (Data tab >> Data tools group >> Data validation >> Allow whole numbers between 1 and 7957).

To test with random verses, type =RANDBETWEEN(1, 7957) in D34, and hit Shift-F9 to recalculate the sheet.

The formulas in D35:D38 can be combined ([nested](#)) into a single formula, by working in reverse order (from the last to the first or outer to inner), and substituting cell references with their formula text, as follows: Start with =INDEX(\$C\$5:\$C\$31, D37), and substitute D37 with CEILING.MATH(D36). Next with =INDEX(\$C\$5:\$C\$31, CEILING.MATH(D36)), substitute D36 with D35 \* 27. Lastly with =INDEX(\$C\$5:\$C\$31, CEILING.MATH(D35 \* 27)), substitute D35 with PERCENTRANK.INC(\$F\$4:\$F\$31, D34, 6).

The final single formula =INDEX(\$C\$5:\$C\$31, CEILING.MATH(PERCENTRANK.INC(\$F\$4:\$F\$31, D34, 6) \* 27)) now only references a single 'variable' cell, D34. Enter this formula in D40 to check that it produces the same results as D38.

To be convinced that the above percentrank method will identify the correct book for any NT verse, perform a systematic test; of concern are edge cases and tuning of the significance parameter of percentrank.

In H5 type =F4+1, and autofill down; these numbers are the first verse of each book.

In I5 type =F5, and autofill down; these numbers are the last verse of each book.

In J5, type =CEILING.MATH(AVERAGE(H5:I5)), to obtain verse numbers around the middle of each book.

Copy the single formula in D40 to K5, but make it apply to H5 for random verse and L3 for significance, that is =INDEX(\$C\$5:\$C\$31, CEILING.MATH(PERCENTRANK.INC(\$F\$4:\$F\$31, H5, \$L\$3) \* 27))

Autofill the formula in K5 right to M5 and down to M31. Note that several results are *incorrect*. The book identified in each row in columns K to M, should equal the book stated on the same row in column C; for instance, K8, L8 and M8 should all contain the value in C8.

Use conditional formatting to highlight the incorrect results (Home tab >> Conditional Formatting >> New Rule >> Format only cells that contain >> Cell Value not equal to \$C5; apply rule to K5:M31).

Increase the significance value (L3) until there are no errors.

After the book for a random verse is identified, the number of verses in the book can be calculated to hone in on the chapter and verse of the random verse.

In D43, type =INDEX(\$F\$4:\$F\$30, D37), to retrieve the total number of verses before the identified book. Subtracting this amount from the random verse gives the remaining verses in the identified book.

In D44, type = D34-D43.

Enter different values in D34, including 1, 2, 1071, 1072, 7553 and 7957, to check that the number of verses in a book is calculated correctly. For instance, with 7550 in D34, the book is Jude and the number of verses in book is 25. This is correct since 7553 is the last verse in the book of Jude, which has 25 verses in its only chapter. The BCV (book-chapter-verse) coordinate for the random verse 7553 is therefore Jude 1:25. The next section handles books with more than one chapter.

(Sheet 2A Book Search)

## 2B Chapter and verse search with percentrank and offset

The procedure to identify the chapter of a random verse within a book, also uses the percentrank method, and follows the same strategy described in section 2A for book search. However, instead of a random verse, the 'input' is the number of verses remaining in book, calculated in cell D44. And the [OFFSET](#) function is used to create a dynamic reference range corresponding to the 'Cum CV' row of an identified book.

Copy columns '2A Book Search'B:F to a new worksheet, and [name](#) ranges C5:C31, D5:D31 and F4:F31 'books', 'chapters' and 'cumBVs', respectively. Name also cells D34 and D37 'random\_verse' and 'book\_index', respectively. Names increase understanding of formulas, and help reduce typing errors. By default, names identify cells in the worksheet where they are defined, but they can be used throughout a workbook.

Use the Find and Replace function which works on formulas as well, to edit the formulas copied from section 2A with the new range and cell names (Ctrl-F >> Find \$F\$4:\$F\$31 Replace with cumBVs). Refer to '2B Chapter and Verse Search'E35:E44 for the updated formulas. Check that the edited formulas still identify the correct book and verses remaining in book, for a given random verse.

In D46 type =INDEX(chapters, book\_index), to obtain the number of chapters in an identified book.

In D47 type =OFFSET(\$H\$4,book\_index,0,1,D46+1), to obtain the corresponding 'Cum CV' range for the identified book.

To see the values returned by this formula, select D47 and hit F2 and F9. But do not enter these values into D47 (hit ESC or click X next to the formula bar) since these values should change with book\_index.

One is added (+1) to D46 to account for the added '0' in column H (analogous to the 0 in F4). For example, with book\_index = 15, the formula in D47 returns values in the range H19:N19. Verify that this is so: enter 6661 in D34.

It is crucial that the correct range be identified so that percentrank returns a sensible result and the correct chapter is identified. Do a quick test: in G5 type =MAX(OFFSET(\$H\$4,\$B5, 0,1,\$D5+1)) = \$E5 and copy this formula down to G31. Another test is =COUNT(OFFSET(\$H\$4,\$B5, 0,1,\$D5+1)) = \$D5+1.

In D48 type =PERCENTRANK.INC(OFFSET(\$H\$4, book\_index, 0, 1, D46+1), D44, 6), to find where the value in cell D44 fits, within the series identified by the offset range.

In D49 type =CEILING.MATH(D48 \* D46), to identify the index to chapter or chapter, for the remaining in-book verses (D44).

At this point, the search has fixed the book and chapter coordinates of the random verse.

In D51, type =INDEX(OFFSET(\$H\$4, book\_index, 0, 1, D46+1), 1, D49), to retrieve the total number of in-book verses before the identified chapter. Subtracting this amount from the remaining in-book verses gives the final coordinate, the in-chapter verse number. In D52, type = D44-D51.

For example, with random\_verse=6661, book\_index is 15, and there are 110 remaining in-book verses which lands the search in chapter 6 of book 1 Timothy. Since there are 92 verses in total before chapter 6 starts in 1 Timothy, the verse number is 18.

The search method for the BVC (Book-Chapter-Verse) coordinates of a random verse is now complete. Name cells D38, D49 and D52, 'Book', 'Chapter' and 'Verse' respectively. In D54 type =CONCAT(Book, " ", Chapter, ":", Verse), to view the final result, and name cell D54 'BCV'.

If not already done so, in D34 type = RANDBETWEEN(1, 7957), and lock D34 (Right-click on the cell >> Format Cells >> Protection >> check Locked). Finally, protect the current sheet (Review tab >> Protect Sheet).

(Sheet 2B Chapter and Verse Search)

## 2C Test chapter and verse search

To be convinced that the percentrank method in section 2B identifies the correct chapter and verse within a book, for any NT verse, conduct edge case testing for Chapter and Verse search, similar to what was done previously for Book search in section 2A. Of interest are the first and last verses of each chapter in each book.

From '1B Prepared Data', copy B3: BL31, and paste (Source & Values Formatting) in B3 of a new worksheet. Format column width to autofit, apply Clear All to columns F and AI, and adjust other formatting to design taste.

The non-zero cells in AK5:BL31 are the last verses of each chapter in each book.

To obtain the first verses of each chapter in each book, in AK34 type =IF(AK5 > 0, AJ5+1, 0), copy this formula (drag the autofill handle to the right) to BL34, and with AK34:BL34 selected, autofill down to row 60 (double-click the autofill handle).

Use autofill to number AK3:BL3 from 1 ... 28. With AK3:BL3 selected, copy it (Ctrl-C) and paste (Keep Source Column Widths) to BO3:CP3, and to CR3:DS3, to demarcate the area for the tasks below.

In BO5, type =CEILING.MATH(PERCENTRANK.INC(OFFSET(\$AJ\$4, \$B5, 0, 1, \$D5+ 1), AK5, 6) \* \$D5) to test chapter search for last verses. Copy this formula right to CP5 and down to CP31. The numbers that appear are the identified chapters for the last verses.

In BO34, type =CEILING.MATH(PERCENTRANK.INC(OFFSET(\$AJ\$4, \$B5, 0, 1, \$D5+1), AK34, 6) \* \$D5) to test chapter search for the first verses. Copy this formula right to CP34 and down to CP60. The numbers that appear are the identified chapters for the first verses.

The identified chapter numbers should match column-wise, with the numbers in BO3:CP3. With BO5 selected, use conditional formatting to detect mismatches (Home tab >> Conditional Formatting >> New Rule >> Format only cells that contain >> Format only cells with Cell Value not equal to BO\$3), and apply the new rule (Conditional Formatting >> Manage Rules) to both areas: \$BO\$5:\$CP\$31 and \$BO\$34:\$CP\$60. Only the zeros should be highlighted as mismatches.

Another check that can be done on the identified chapter numbers is to compare them with the number of chapters in each book, as is done in column BN of the '2C Test Chapter and Verse Search' worksheet.

The expected verse number for the first verses is 1, which is the result produced in CQ34:DS60.

The expected verse number for the last verses, should match the number of verses in the last chapter of each book. This is what is shown by the zero values in DU5:EV31 which are the difference result between G5:AH31 and CR5:DS31.

(Sheet 2C Test Chapter and Verse Search)

## 2D Add hyperlink to verse text

On a new worksheet, in C3 type =BCV; this name was defined in step 2B.

To obtain the text for the random verse, in C5, type  
=HYPERLINK(CONCAT("https://www.biblegateway.com/passage/?search=", \$C\$3, "&version=RSVCE"), "Read Verse here")

Hit F9 to test that a new random verse is produced, and that the link retrieves the correct verse.  
Hide worksheets, columns or rows, and adjust formatting to design taste.

Optional: Read the verse and lookup its surrounding text for context.

(Sheet 2D Add link to verse text)