

## Chapter 2

# Random Number Generator

Suppose that a local poultry farmer is raising a variety of laying hens and that he is interested in the egg production of a particular breed of hens (Breed X). Suppose that he has asked you to take a random sample of 5 of Breed X's 32 laying hens to identify overall egg production of this breed. Using your Excel skills to determine egg production, you will need to define a "sampling frame." A sampling frame is a list of objects, events, or people from which you want to select a random sample. In this case, it is the group of 32 chickens. The frame starts with the identification code (ID) of the number 1 that is assigned to the first hen in the group of 32 laying hens on the poultry farm. The second hen has a code number of 2, the third a code number of 3, and so forth until the last hen has a code number of 32.

Since the poultry farm has 32 Breed X hens, your sampling frame would go from 1 to 32 with each hen having a unique ID number.

We will first create the frame numbers as follows in a new Excel worksheet:

### 2.1 Creating Frame Numbers for Generating Random Numbers

Objective: To create the frame numbers for generating random numbers

A3: FRAME NO.

A4: 1

Now, create the frame numbers in column A with the Home/Fill commands that were explained in the first chapter of this book (see [Sect. 1.4.1](#)) so that the frame numbers go from 1 to 32, with the number 32 in cell A35. If you need to be reminded about how to do that, here are the steps:

Click on cell A4 to select this cell  
Home  
Fill (then click on the “down arrow” next to this command and select)  
Series (see Fig. 2.1)

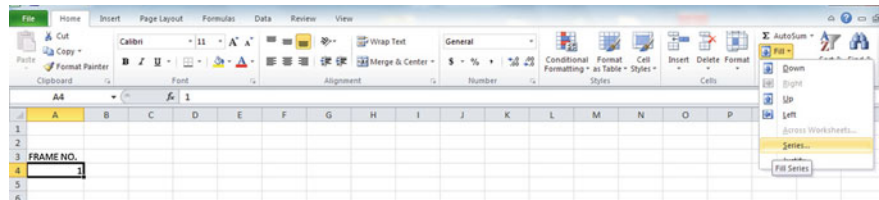


Fig. 2.1 Dialogue Box for Fill/Series Commands

Columns  
Step value: 1  
Stop value: 32 (see Fig. 2.2)

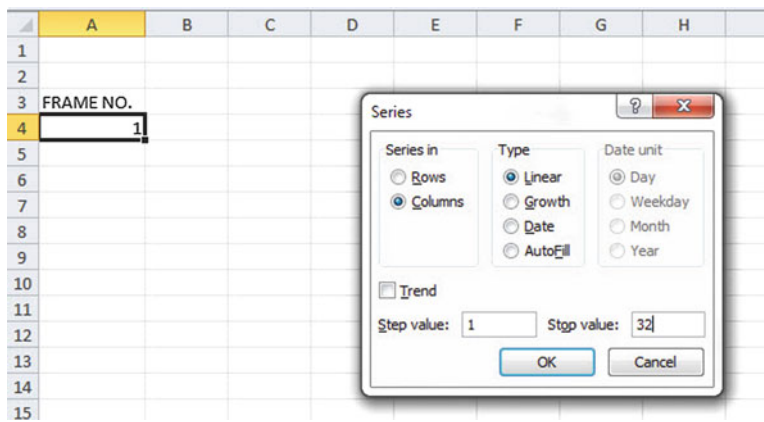


Fig. 2.2 Dialogue Box for Fill/Series/Columns/Step value/Stop value Commands

OK

Then, save this file as: Random29. You should obtain the result in Fig. 2.3.  
Now, create a column next to these frame numbers in this manner:

| FRAME NO. |
|-----------|
| 1         |
| 2         |
| 3         |
| 4         |
| 5         |
| 6         |
| 7         |
| 8         |
| 9         |
| 10        |
| 11        |
| 12        |
| 13        |
| 14        |
| 15        |
| 16        |
| 17        |
| 18        |
| 19        |
| 20        |
| 21        |
| 22        |
| 23        |
| 24        |
| 25        |
| 26        |
| 27        |
| 28        |
| 29        |
| 30        |
| 31        |
| 32        |

**Fig. 2.3** Frame Numbers from 1 to 32

B3: DUPLICATE FRAME NO.  
B4: 1

Next, use the Home/Fill command again, so that the 32 frame numbers begin in cell B4 and end in cell B35. Be sure to widen the columns A and B so that all of the information in these columns fits inside the column width. Then, center the information inside both Column A and Column B on your spreadsheet. You should obtain the information given in Fig. 2.4.

| FRAME NO. | DUPLICATE FRAME NO. |
|-----------|---------------------|
| 1         | 1                   |
| 2         | 2                   |
| 3         | 3                   |
| 4         | 4                   |
| 5         | 5                   |
| 6         | 6                   |
| 7         | 7                   |
| 8         | 8                   |
| 9         | 9                   |
| 10        | 10                  |
| 11        | 11                  |
| 12        | 12                  |
| 13        | 13                  |
| 14        | 14                  |
| 15        | 15                  |
| 16        | 16                  |
| 17        | 17                  |
| 18        | 18                  |
| 19        | 19                  |
| 20        | 20                  |
| 21        | 21                  |
| 22        | 22                  |
| 23        | 23                  |
| 24        | 24                  |
| 25        | 25                  |
| 26        | 26                  |
| 27        | 27                  |
| 28        | 28                  |
| 29        | 29                  |
| 30        | 30                  |
| 31        | 31                  |
| 32        | 32                  |

Fig. 2.4 Duplicate Frame Numbers from 1 to 32

Save this file as: Random30

You are probably wondering why you created the same information in both Column A and Column B of your spreadsheet. This is to make sure that before you sort the frame numbers that you have exactly 32 of them when you finish sorting them into a random sequence of 32 numbers.

Now, let's add a random number to each of the duplicate frame numbers as follows:

## 2.2 Creating Random Numbers in an Excel Worksheet

C3: RANDOM NO. (then widen columns A, B, C so that their labels fit inside the columns; then center the information in A3:C35)

C4: =RAND()

Next, hit the Enter key to add a random number to cell C4.

Note that you need *both* an open parenthesis *and* a closed parenthesis after =RAND(). The RAND command “looks to the left of the cell with the RAND() COMMAND in it” and assigns a random number to that cell.

Now, put the pointer using your mouse in cell C4 and then move the pointer to the bottom right corner of that cell until you see a “plus sign” in that cell. Then, click and drag the pointer down to cell C35 to add a random number to all 32 ID frame numbers (see Fig. 2.5).

Then, click on any empty cell to deselect C4: C35 to remove the dark color highlighting these cells.

Save this file as: Random31

Now, let's sort these duplicate frame numbers into a random sequence:

| FRAME NO. | DUPLICATE FRAME NO. | RANDOM NO.  |
|-----------|---------------------|-------------|
| 1         | 1                   | 0.178997426 |
| 2         | 2                   | 0.269196787 |
| 3         | 3                   | 0.48649709  |
| 4         | 4                   | 0.882904516 |
| 5         | 5                   | 0.015953504 |
| 6         | 6                   | 0.099651545 |
| 7         | 7                   | 0.42850057  |
| 8         | 8                   | 0.381659988 |
| 9         | 9                   | 0.431296832 |
| 10        | 10                  | 0.476642453 |
| 11        | 11                  | 0.268603728 |
| 12        | 12                  | 0.871330234 |
| 13        | 13                  | 0.775421903 |
| 14        | 14                  | 0.908450998 |
| 15        | 15                  | 0.138749452 |
| 16        | 16                  | 0.159535582 |
| 17        | 17                  | 0.672417279 |
| 18        | 18                  | 0.956231064 |
| 19        | 19                  | 0.486746795 |
| 20        | 20                  | 0.83596565  |
| 21        | 21                  | 0.688574546 |
| 22        | 22                  | 0.467838617 |
| 23        | 23                  | 0.695493167 |
| 24        | 24                  | 0.226521237 |
| 25        | 25                  | 0.335451708 |
| 26        | 26                  | 0.209245145 |
| 27        | 27                  | 0.631291464 |
| 28        | 28                  | 0.210229448 |
| 29        | 29                  | 0.553196562 |
| 30        | 30                  | 0.494647331 |
| 31        | 31                  | 0.986702143 |
| 32        | 32                  | 0.178067956 |

**Fig. 2.5** Example of Random Numbers Assigned to the Duplicate Frame Numbers

2.3 Sorting Frame Numbers into a Random Sequence

Objective: To sort the duplicate frame numbers into a random sequence

- Highlight cells B3: C35 (include the labels at the top of columns B and C) Data (top of screen)
- Sort (click on this word at the top center of your screen; see Fig. 2.6)

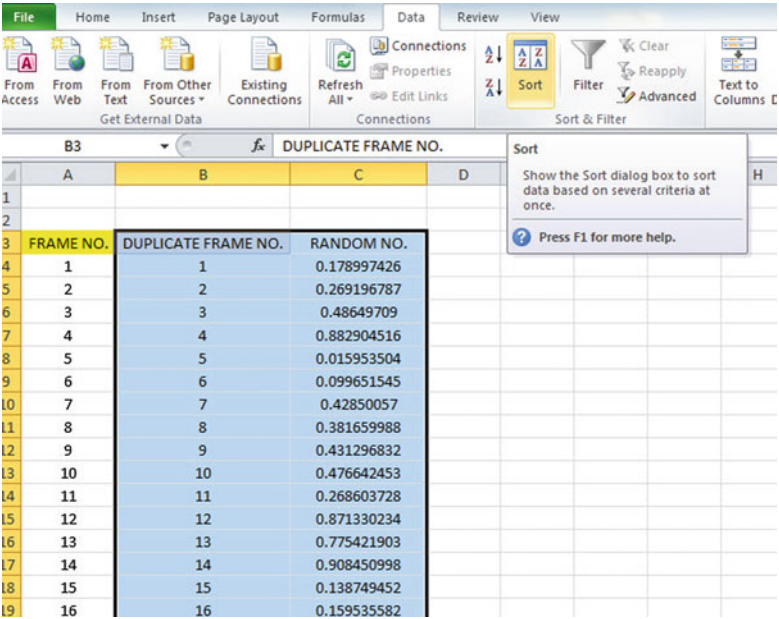


Fig. 2.6 Dialogue Box for Data/Sort Commands

Sort by: RANDOM NO. (Click on the down arrow)  
Smallest to Largest (see Fig. 2.7)

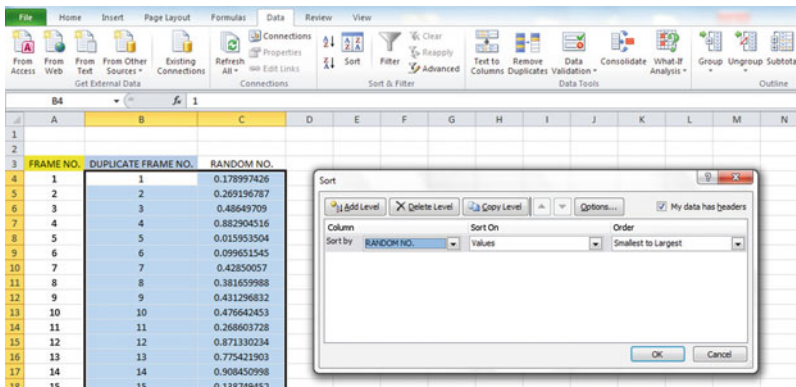


Fig. 2.7 Dialogue Box for Data/Sort/RANDOM NO./Smallest to Largest Commands

OK  
Click on any empty cell to deselect B3:C35.  
Save this file as: Random32  
Print this file now.

These steps will produce Fig. 2.8 with the DUPLICATE FRAME NUMBERS sorted into a random order:



| FRAME NO. | DUPLICATE FRAME NO. | RANDOM NO.  |
|-----------|---------------------|-------------|
| 1         | 5                   | 0.063981403 |
| 2         | 6                   | 0.977468743 |
| 3         | 15                  | 0.225170263 |
| 4         | 16                  | 0.765734052 |
| 5         | 32                  | 0.274680922 |
| 6         | 1                   | 0.594468001 |
| 7         | 26                  | 0.511966171 |
| 8         | 28                  | 0.625577233 |
| 9         | 24                  | 0.906310053 |
| 10        | 11                  | 0.488640116 |
| 11        | 2                   | 0.020129977 |
| 12        | 25                  | 0.723003676 |
| 13        | 8                   | 0.975227547 |
| 14        | 7                   | 0.469582962 |
| 15        | 9                   | 0.14889954  |
| 16        | 22                  | 0.955629903 |
| 17        | 10                  | 0.897398234 |
| 18        | 3                   | 0.314860892 |
| 19        | 19                  | 0.442019486 |
| 20        | 30                  | 0.078566335 |
| 21        | 29                  | 0.172474705 |
| 22        | 27                  | 0.104689528 |
| 23        | 17                  | 0.406630369 |
| 24        | 21                  | 0.961398315 |
| 25        | 23                  | 0.094222677 |
| 26        | 13                  | 0.323429051 |
| 27        | 20                  | 0.470615753 |
| 28        | 12                  | 0.978014724 |
| 29        | 4                   | 0.618082813 |
| 30        | 14                  | 0.727776384 |
| 31        | 18                  | 0.919475329 |
| 32        | 31                  | 0.324497007 |

**Fig. 2.8** Duplicate Frame Numbers sorted by random Number

*Important note:* Because Excel randomly assigns these random numbers, your Excel commands will produce a different sequence of random numbers from everyone else who reads this book!

Because your objective at the beginning of this chapter was to select randomly 5 of Breed X’s 32 laying hens, you now can do that by selecting the *first five ID numbers* in DUPLICATE FRAME NO. column after the sort.

Although your first five random numbers will be different from those we have selected in the random sort that we did in this chapter, we would select these five IDs of hens using Fig. 2.9.

| FRAME NO. | DUPLICATE FRAME NO. | RANDOM NO.  |
|-----------|---------------------|-------------|
| 1         | 5                   | 0.063981403 |
| 2         | 6                   | 0.977468743 |
| 3         | 15                  | 0.225170263 |
| 4         | 16                  | 0.765734052 |
| 5         | 32                  | 0.274680922 |
| 6         | 1                   | 0.594468001 |
| 7         | 26                  | 0.511966171 |
| 8         | 28                  | 0.625577233 |
| 9         | 24                  | 0.906310053 |
| 10        | 11                  | 0.488640116 |
| 11        | 2                   | 0.020129977 |
| 12        | 25                  | 0.723003676 |
| 13        | 8                   | 0.975227547 |
| 14        | 7                   | 0.469582962 |
| 15        | 9                   | 0.14889954  |
| 16        | 22                  | 0.955629903 |
| 17        | 10                  | 0.897398234 |
| 18        | 3                   | 0.314860892 |
| 19        | 19                  | 0.442019486 |
| 20        | 30                  | 0.078566335 |
| 21        | 29                  | 0.172474705 |
| 22        | 27                  | 0.104689528 |
| 23        | 17                  | 0.406630369 |
| 24        | 21                  | 0.961398315 |
| 25        | 23                  | 0.094222677 |
| 26        | 13                  | 0.323429051 |
| 27        | 20                  | 0.470615753 |
| 28        | 12                  | 0.978014724 |
| 29        | 4                   | 0.618082813 |
| 30        | 14                  | 0.727776384 |
| 31        | 18                  | 0.919475329 |
| 32        | 31                  | 0.324497007 |

Fig. 2.9 First Five Hens Selected Randomly

5, 6, 15, 16, 32

Save this file as: Random33

Remember, your five ID numbers selected after your random sort will be different from the five ID numbers in Fig. 2.9 because Excel assigns a different random number *each time the =RAND() command is given*.

Before we leave this chapter, you need to learn how to print a file so that all of the information on that file fits onto a single page without “dribbling over” onto a second or third page.

## 2.4 Printing an Excel File so that All of the Information Fits onto One Page

Objective: To print a file so that all of the information fits onto one page

Note that the three practice problems at the end of this chapter require you to sort random numbers when the files contain 63 test tubes, 114 steel samples, and 75 field mice, respectively. These files will be “too big” to fit onto one page when you print them unless you format these files so that they fit onto a single page when you print them.

Let’s create a situation where the file does not fit onto one printed page unless you format it first to do that.

Go back to the file you just created, Random 33, and enter the name: *Jennifer* into cell: A50.

If you printed this file now, the name, *Jennifer*, would be printed onto a second page because it “dribbles over” outside of the page range for this file in its current format.

So, you would need to change the page format so that all of the information, including the name, Jennifer, fits onto just one page when you print this file by using the following steps:

Page Layout (top left of the computer screen)

(Notice the “Scale to Fit” section in the center of your screen; see Fig. 2.10)

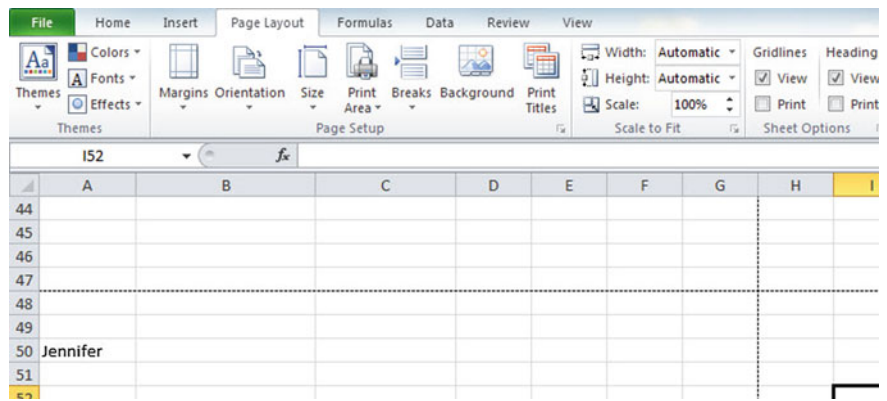


Fig. 2.10 Dialogue Box for Page Layout/Scale to Fit Commands

Hit the down arrow to the right of 100 % *once* to reduce the size of the page to 95 %

Now, note that the name, Jennifer, is still on a second page on your screen because her name is below the horizontal dotted line on your screen in Fig. 2.11 (the dotted lines tell you outline dimensions of the file if you printed it now).

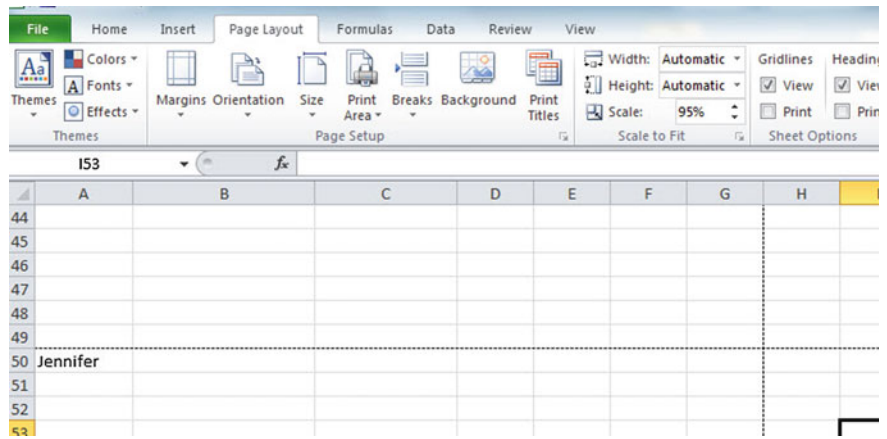
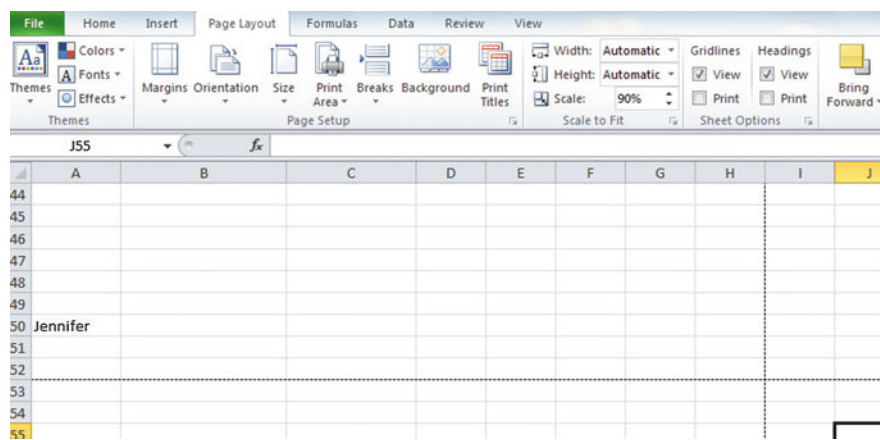


Fig. 2.11 Example of Scale Reduced to 95 % with “Jennifer” to be Printed on a Second Page

*So, you need to repeat the “scale change steps” by hitting the down arrow on the right once more to reduce the size of the worksheet to 90 % of its normal size.*

Notice that the “dotted lines” on your computer screen in Fig. 2.12 are now below Jennifer’s name to indicate that all of the information, including her name, is now formatted to fit onto just one page when you print this file.



**Fig. 2.12** Example of Scale Reduced to 90 % with “Jennifer” to be printed on the first page (note the dotted line below Jennifer on your screen)

Save the file as: Random34  
Print the file. Does it all fit onto one page? It should (see Fig. 2.13).



## 2.5 End-of-Chapter Practice Problems

1. Suppose that you had cultured various strains of bacteria in a college microbiology laboratory. You want to study the growth rate of one strain of bacteria. You have samples of this bacteria strain in 63 test tubes and you would like to test randomly 15 of these 63 samples.
  - (a) Set up a spreadsheet of frame numbers for these test tubes with the heading: FRAME NUMBERS using the Home/Fill commands.
  - (b) Then, create a separate column to the right of these frame numbers which duplicates these frame numbers with the title: Duplicate frame numbers.
  - (c) Then, create a separate column to the right of these duplicate frame numbers and use the =RAND() function to assign random numbers to all of the frame numbers in the duplicate frame numbers column, and change this column format so that 3 decimal places appear for each random number.
  - (d) Sort the duplicate frame numbers and random numbers into a random order.
  - (e) Print the result so that the spreadsheet fits onto one page.
  - (f) Circle on your printout the I.D. number of the first 15 test tubes that you would use in your research study.
  - (g) Save the file as: RAND9.

*Important note:* Note that everyone who does this problem will generate a different random order of test tube ID numbers since Excel assigns a different random number each time the RAND() command is used. For this reason, the answer to this problem given in this Excel Guide will have a completely different sequence of random numbers from the random sequence that you generate. This is normal and what is to be expected.

2. Suppose that you have been hired as a consultant to test building materials for engineers designing suspension bridges. The engineers of this company are interested in using a new type of steel in future bridge construction. You have been given 114 samples of this type of steel and you have been asked to test a random sample of 10 of these samples for tensile strength in terms of their material consistency.
  - (a) Set up a spreadsheet of frame numbers for these steel samples with the heading: FRAME NO.
  - (b) Then, create a separate column to the right of these frame numbers which duplicates these frame numbers with the title: Duplicate frame no.

- (c) Then, create a separate column to the right of these duplicate frame numbers entitled “Random number” and use the =RAND() function to assign random numbers to all of the frame numbers in the duplicate frame numbers column. Then, change this column format so that 3 decimal places appear for each random number.
  - (d) Sort the duplicate frame numbers and random numbers into a random order.
  - (e) Print the result so that the spreadsheet fits onto one page.
  - (f) Circle on your printout the I.D. number of the first 10 steel samples that would be used in this research study.
  - (g) Save the file as: RANDOM6.
3. Suppose that a biology field researcher wants to take a random sample of 20 of 75 wild field mice that have been collected from the prairie grass that grows above the bluffs along the Mississippi River in Elsah, Illinois for a field research study.
- (a) Set up a spreadsheet of frame numbers for these mice with the heading: FRAME NUMBERS.
  - (b) Then, create a separate column to the right of these frame numbers which duplicates these frame numbers with the title: Duplicate frame numbers.
  - (c) Then, create a separate column to the right of these duplicate frame numbers entitled “Random number” and use the =RAND() function to assign random numbers to all of the frame numbers in the duplicate frame numbers column. Then, change this column format so that 3 decimal places appear for each random number.
  - (d) Sort the duplicate frame numbers and random numbers into a random order.
  - (e) Print the result so that the spreadsheet fits onto one page.
  - (f) Circle on your printout the I.D. number of the first 20 mice that the field biologist should select for her study.
  - (g) Save the file as: RAND5.



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