

ISSUE 41 | OCTOBER 2011

SOCIETY OF ACTUARIES

Technology
Section

CompAct

ELECTRONIC NEWSLETTER



CONTENTS

[Table of Contents](#)
[Letter from the Chair](#)
[Editors' Notes](#)
[Actuarial Software Wins](#)
[Microsoft Innovation](#)
[Award](#)
[Touch the SCAI](#)
[One Actuary's Journey](#)
[Through Technology](#)
[Keys to Successful](#)
[Reports](#)
[Excel Formula Rogue's](#)
[Gallery 2: Electric](#)
[Bugaloo](#)
[Speaking "Data" Properly](#)
[Part 2](#)
[Articles Needed](#)

QUICK LINKS

[Technology Section](#)
[Web site](#)
[Council](#)


LinkedIn

Forward
to Colleague

Print

Search
Back Issues

EXCEL FORMULA ROGUE'S GALLERY 2: ELECTRIC BUGALOO

by Mary Pat Campbell

Welcome to the second installment of the horror that is the Excel Formula Rogue's Gallery!

But before we get started in this funhouse, let me pass on a request from the European Spreadsheet Risks Interest Group:

EuSPRIG has been seeking to build up a repository of "model" spreadsheets—models of both what is good practice and what is bad practice. Below is a list of the sorts of things they are looking for:

Please point us to links to publicly available spreadsheets that have something of interest in their construction:

** very large number of formulas*

** complex formulas or VBA*

** user has sustained a material loss because of an error*

** exemplifies good practice in construction*

** or anything else that is outside the run-of-the-mill spreadsheet with three sheets and a few dozen SUM formulas.*

Download an example of the sort of thing they're looking for.

[Links of Interest](#)

[Fiction Contest](#)

[Richard Junker, Co-editor](#)

[Andrew Chan, Co-editor](#)

SOA Staff

[Meg Weber, Staff Partner](#)

[Sue Martz,](#)

[Section Specialist](#)

[Sam Phillips, Staff Editor](#)

(The linked workbook was associated with work on Basel II. More info on the [QIS 5 exercise](#).)

If the spreadsheets aren't publicly available, a suitably anonymized version that could be shared with the group (original raw data scrubbed, for instance) is also welcome. Please email examples or links to [Patrick O'Beirne](#). If you send them to me, I will also make sure EuSPRIG gets them.

And now back to the horror show

First up, Gadi Bizinyan from the Excel Gurus LinkedIn group shared his experience:

"Last week, I was hired to modify a financial projection plan, and add 24 more months to the existing 36 months. This workbook was the closest thing to a 10,000 pieces jigsaw puzzle. The workbook itself was initially created by a certified accountant and had a very slick look. I would call it a masterpiece. It also contained 19 sheets and 46 named ranges. It covered 3 products, with corresponding checkboxes, enabling the user to select which product(s) out of the 3 to include in the projection. No VBA whatsoever. When I was happily modifying each of the items in the projected Income Statement, I came across a set of 24 line items with light variations of this formula:

```
=IF(Revenue_Rule=2, IF(F$4>=Start_Date, IF(Profit_Ctr_1='
```

Luckily these formulas were only for the first 12 months projection, so I had no need to duplicate them. I don't remember when was the last time I got such a headache when reviewing formulas in Excel. Everyone must agree this is a killer!..."

In addition to the nested IFs and multiple pieces added together, we have the issue of redundancy: if you are checking cells with Boolean (i.e., TRUE or FALSE) entries, the following are equivalent:

- IF(Profit_Ctr_1=TRUE, Wages!\$J15, 0)
- IF(Profit_Ctr_1, Wages!\$J15, 0)
- Profit_Ctr_1 * Wages!\$J15

The beauty of how Excel handles Boolean values is that TRUE = 1

and FALSE = 0.

The following Boolean arithmetic holds: (I am assuming A and B are Boolean values)

- $AND(A, B) = A * B$
- $OR(A, B) = A + B - A * B$

The second item ($A + B - A * B$) is more complicated than the original, so generally it's best not to use it.

So even without fixing the generic hideousness, the above formula could have been simplified to this:

```
=IF(Revenue_Rule=2,
    IF(F$4>=Start_Date,
        Profit_Ctr_1*Wages!$J15
        + Profit_Ctr_2*Wages!$K15
        + Profit_Ctr_3*Wages!$L15
        +
    OR(Profit_Ctr_1,Profit_Ctr_2,Profit_Ctr_3)*Wages!$M15)
,
    Profit_Ctr_1*(F$4>=Profit_Ctr_1_Date)*Wages!$J15
    +
    Profit_Ctr_2*(F$4>=Profit_Ctr_2_Date)*Wages!$K15
    +
    Profit_Ctr_3*(F$4>=Profit_Ctr_3_Date)*Wages!$L15
    +OR(Profit_Ctr_1,Profit_Ctr_2,Profit_Ctr_3)*Wages!$M15)
```

It's still somewhat bad, but now it becomes clearer what the logic is (and further simplification could occur). For example, I can see there's no calculation given for the situation should Revenue_Rule =2 and $F\$4 < Start_Date$. The formula would return FALSE (and if you formatted it as a number, that would give you 0).

Next, CompAct reader Georges Rouhart points out the following:

```
=IF(ROW()-ROW($H$2)+COLUMN()-
COLUMN($H$2)>3,"",SUM(OFFSET($B$2,ROW()-
ROW($H$2),ROW()-ROW($H$2),COLUMN()-
COLUMN($H$2)+1,1)))
```

Rouhart's comment:

"What does this formula do? I have no idea because I have not taken the time or effort to parse it. The significance of the formula is its source! It is extracted from the CompAct electronic newsletter issue 40; the article by Damian."

Yes, well, these things do happen. More specifically, it can be difficult to avoid complexity when you're doing something complex with your formulas.

I must say, this one took me a while to think through. (And while I was thinking it through, I got height and width in the OFFSET mixed up in my mind. I had to do some examples to check if the logic was right.) Considering what it is doing (taking cumulative sums along a diagonal ... sort of), there's no real elegant way to do the above, unless one wants to use more unique formulas with interim steps.

For this particular example, the non-empty result is contained in a 4x4 area of the spreadsheet (intended to fill the upper triangle of H2 to K5), so it would be simple to have a bunch of unique formulas doing those sums ... but what if you wanted to do it over 200 rows and columns?

As has been shown with the Obfuscated C contest (and many examples of code in Perl or APL), one can make some relatively terse formulas do some complicated things ... but it becomes difficult to debug such things should there be errors in the logic.

Rouhart has some helpful advice on the score of teasing apart these complicated formulas—because many times we are given these formulas as part of legacy spreadsheets, and we are forced to parse them in order to update them or audit them.

For situations such as your rogue formulas, a solution is to use the "Evaluate Formula" that is buried in the Excel menus and tool bars of Office. It allows you to step through each element of an Excel formula and see it operate. The number one solution when faced with a mega or cryptic formula.

In Excel 2007 and 2010, the "Evaluate Formula" tool can be found in the Formulas tab on the ribbon. In Excel 2003, this tool is in the Formula Auditing toolbar and also under the "Tools" menu, under Formula Auditing.

Finally, Rickard Warnelid at Corality (a firm specializing in financial modeling, model audits, and training) shares the following [two other](#)

horrors):

```
=-IF(Debt.Bond1.Flag=1,
J$434*IF(AND(J$434=1,K$434=0),I924+SUM(J920:J922),
IF(AND(Debt.Bond1.Term*P-(J$11-
1)<VLOOKUP($B919,Table.Depreciation,4)*P,
Debt.Bond1.Term*P-(J$11-
1)>=0),(I924+SUM(J920:J922))/(Debt.Bond1.Term*P-
(J$11-1)+1),(I924+SUM(J920:J922))/(
VLOOKUP($B919,Table.Depreciation,4)*P
))),J$368*IF(AND(J$368=1,K$368=0),I924+SUM(J920:J922),
AND((Debt.Bank1.Term+Debt.Bank3.Term)*P-(J$11-1)
<VLOOKUP($B919,Table.Depreciation,4)*P,
(Debt.Bank1.Term+Debt.Bank3.Term)*P-(J$11-
1)>=0),(I924+SUM(J920:J922))/
((Debt.Bank1.Term+Debt.Bank3.Term)*P-(J$11-
1)+1),(I924
+SUM(J920:J922))/(VLOOKUP($B919,Table.Depreciation,4)*P)
```

Warnelid commented he found the above monstrosity in a spreadsheet to support a bid for a \$2 billion project.

If that sort of money is on the line, would it kill you to expand the calculation over several columns?

Sometimes we try to do the calculation all in one leap to make the visual presentation of the final numbers prettier. What I usually do, if I need to use the spreadsheet to make presentation tables, is hide the calculation steps in other sheets. I think it's better to have presentation sheets that merely reference the results from other pages. That way I can play separately with calculation and the display.

If I have the two concerns combined in the same place, I can end up with spaghetti logic formulas as my model develops while I try to maintain a particular look. Computer memory is cheap—use the extra file space.

If you have your own examples of formula horror, or have some elegant fixes to recommend to any of these or prior Rogue's Gallery entries, please email them to me at marypat.campbell@gmail.com.

Mary Pat Campbell, FSA, MAAA, is life analyst for Conning Research & Consulting, Inc. She can be reached at

marypat.campbell@gmail.com



475 North Martingale Road, Suite 600 Schaumburg, Illinois 60173

Phone: 847.706.3500 Fax: 847.706.3599 www.soa.org