

ISSUE 41 | OCTOBER 2011

SOCIETY OF ACTUARIES  
Technology  
Section

# CompAct

ELECTRONIC NEWSLETTER



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### LETTER FROM THE CHAIR

by Jeffrey Pomerantz

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## **KEYS TO SUCCESSFUL REPORTS**

by Jeremy Benson

In my 15 years as an actuary, I have had many opportunities to produce reports for many different people. The actuarial reports could be anything from simple loss ratio reports to a full pricing analysis. ...

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## **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! ...

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## **SPEAKING "DATA" PROPERLY PART 2**

by Dan Rachlis

This article is the second in a four-part series about eliminating the confusion with using data terminology. ...

[\[ full article \]](#)



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## LETTER FROM THE CHAIR

by Jeff Pomerantz

Greetings!!! It's hard for me to believe that the year is coming to a close and that this will be my last "Letter from the chair." It has been a pleasure serving the Technology Section as chairperson. I am very pleased with what we have accomplished this year, and I'm even more excited about what the future may hold for some of the initiatives that are underway.

I have enjoyed working with all of the council members the last three years. I want to thank our other two retiring council members, Tim Deitz (2010 chairperson) and Frank Reynolds, for their contributions. I wish Tim and Frank the best as they move on to other opportunities. Even though I will no longer be on the council next year, I am excited about what's next. Eddie Smith will take over as chairperson in 2012. Eddie brings a lot of enthusiasm and knowledge to his role; he has already had a big impact on the council, and I know that he will continue to do the same in 2012.

I want to mention a few highlights from the past year that will continue to be major initiatives for 2012. The number one topic for our council this year has undoubtedly been "Apps for Actuaries." The topic is an almost constant brainstorm on what apps might be useful for actuaries. There have been sessions and discussions at meetings, ongoing columns in our newsletter, member survey questions, as well as the actual implementation of a mobile app for actuarial meetings, beginning with the Health Spring Meeting this year. If you have suggestions on apps you would find useful, please send them to any Council member. Also, be sure to check out the

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"Apps for Actuaries" session at the Annual Meeting (Wed., 8:30 - 9:45 a.m.). There is also a Technology-sponsored session on "Model Management" that you may find interesting (Tues., 3:45 - 5 p.m.).

Another hot topic this year has been LinkedIn ([www.linkedin.com](http://www.linkedin.com)). The LinkedIn group for section members, "Society of Actuaries Technology Section," is continuing to grow. I am happy to say that we now have 192 members, up from 120 members just a few months ago. I would love to see this number go to 500 or more in the near future. This online forum for networking and information sharing is only what you, the members, make of it. So, please join, read and participate in discussions that interest you. If you have any reservations about joining the LinkedIn site, please let us know what those are so we can address them. Addressing how this forum, as well as others, such as Twitter, can best serve the members will continue to be a priority for the 2012 council.

I won't go into any detail on the rest of our activities in 2011, but here is a non-exhaustive list:

- actuarial club presentations
- actuarial meeting sessions
- co-sponsoring of speculative fiction contest
- table manager updates
- newsletter articles writing and editing

On the topic of the newsletter, I would like to thank Howard Callif and Eddie Smith for serving as co-editors of **CompAct** for several years. Howard has served as editor of the newsletter for the past four years and Eddie has served as co-editor the past two. Howard and Eddie have done a terrific job in obtaining and editing articles for CompAct in what is often a thankless and not at all well-recognized role. It is efforts like theirs that make the Technology Section what it is today, and those efforts are definitely appreciated. Howard and Eddie are both stepping down from their co-editorship role in 2012. New co-editors will be Andrew Chan and Rich Junker. Rich has already been working on the newsletter in a co-editor capacity. Thanks to Andrew and Rich for taking on this critical role.

As I close, I want to thank all of our volunteers for their willingness to get involved, and say thanks again to all of our council members and friends of the council who work hard to keep our section going. Please reach out to any of the council members listed inside the front cover of this newsletter with your ideas or to volunteer.

### **Additional Food for Thought**

I thought it would be interesting to mention some interesting quotes relating to technology, so I looked online. Probably the most interesting quote was the "640K ought to be enough for anybody" quote supposedly uttered to Bill Gates at a trade show in 1981. However, despite Bill Gates' denial and a lack of any solid proof, the quote lives on. Some other interesting quotes I found are as follows:

*Any sufficiently advanced technology is indistinguishable from magic.*  
~Arthur C. Clarke

*Lo! Men have become the tools of their tools.* ~Henry David Thoreau

*The production of too many useful things results in too many useless people.* ~Karl Marx

*The Internet is so big, so powerful and pointless that for some people it is a complete substitute for life.* -Andrew Brown

However, of all the ones I saw, probably my favorite is this one:

*For a list of all the ways technology has failed to improve the quality of life, please press three.* ~Alice Kahn

I don't know about you, but sometimes, I really prefer talking to a person over pushing a button.

Thanks, and happy reading!!!

Jeff Pomerantz

2011 Section Council Chair

*Jeff Pomerantz, FSA, CFA, MAAA, is an actuarial consultant at Quantitative Risk Management in Chicago and can be contacted at [jeff.pomerantz@qrm.com](mailto:jeff.pomerantz@qrm.com).*



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## EDITORS' NOTES

by J. Eddie Smith, Rich Junker, and Andrew Chan

The triumvirate you see above is temporary. Eddie will be advancing to the role of Chairperson of the Technology Section. For the coming year, Rich and Andrew will share the editing role. Eddie has made exceptional contributions over the past few years in the editor role, and been active in all facets of the Technology Section's operations. It was inevitable that he would soon accede to the Chairperson role. So Andrew and Rich soldier on, inheriting a newsletter process greatly improved during Eddie's stint as primary editor.

**Speaking of Andrew Chan**, he will be coming on board as CompAct co-editor. Andrew has contributed outstanding material in the past, such as the sharing link you see at the top of each article. He will be a prolific source of ideas for advancing our newsletter. Andrew is a seasoned actuarial systems consultant who has been helping actuaries to develop/implement systems that can increase their productivity. He has a wide range of working experience, e.g., C++, Excel add-ins, MATLAB, and more.

### Number Puzzle

With regret, we say adieu to the Number Puzzle. The last puzzle solution ran with the July 2011 issue. Intricate and elegant in our mother tongue numbers, each puzzle was a small work of art. We salute Marc Whinston, Teachers Insurance and Annuity, for providing us a welcome diversion in many past issues of CompAct.

### Apps, apps, apps

Dave Kester writes in "One Actuary's Journey Through Technology"

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of the explosion of the past few years in Social Media, Smart Phone Apps, and iPad/Tablet hardware. It's wonderful how affordable, easy to install, mobile and synchronizable the tools are all becoming. Yet the number of tools and the variety of the features in each makes it extremely difficult to exploit all these recent wonders, atop the demands of our omni-imposing jobs. Dave has the right idea, learning from his kids and colleagues.

Group teaching sessions over a lunch hour, or an after-work session one-on-one can be a great help in sorting out which new app to take up next. We all love our technology toys, and we love talking about them. Sharing these apps can be an effective strategy for each of us to keep up, and to extend the reach of our skills to fellow actuaries.

If you would like to share apps that you've found useful, a short article in CompAct is the ideal way. Even if you'd rather not write an article, feel free to submit your app experiences to the editors.

### **Honing Technological Competency**

The **Competency Framework tool** introduced by the Society of Actuaries office in 2008 was recently highlighted anew this past May with a terrific article by Rod Bubke of the Professional Development Committee, [How to Become a Better Actuary](#). First you complete the 100-question survey in terms of how important each of the skills is to your work and how well you are able to perform them. Then you are directed to a spreadsheet, the personal planning workbook tool. It provides methods to improve your self-assessed personal deficiencies on each of the eight families of competencies.

The competencies with the largest gaps are areas where you will want to focus your professional development efforts. If, heavens forfend, you conclude that the Technical Skills & Analytical Problem Solving competency is one of your greater weaknesses, the personal planning workbook provides remedies. It provides the following array of improvement methods:

- Listen to relevant meeting sessions from recent SOA meetings—audio recordings sessions,
- Listen to relevant meeting sessions from recent SOA meeting—slides, and
- Take a relevant e-Course.

*Now how could accessing section newsletters ever have been omitted as a method? Most prominently, your CompAct newsletters have featured a multitude of articles that target the *Technical Skills & Analytical Problem Solving* competency head on. For example, if lack*



of adroitness with Excel is among your perceived deficiencies, several articles written from the unique perspective of actuaries are available from recent editions. For us actuaries, this is significantly more palatable reading than the online tutorials of Microsoft. Not to impugn the MS tutorials! They are wonderful in their own way.

To buttress Rod Bubke's words ...

"The Committee on Professional Development has done us all a salutary service in devising the Competency Framework and the Self-Assessment Tool. We are all self-teachers, and this tool is an outstanding aid to focusing our professional development and furthering our careers."

### **Looking Back And Forward**

Many thanks to all of the authors contributing to the newsletter in 2011, both articles and suggestions.

As we move farther into the 21<sup>st</sup> century, we're seeing the pace of technological innovation increase more rapidly every year. From cloud computing to mobile apps, there are many fronts that present opportunities for actuaries, but they require education as well. Without technology education, the chasm between tech-savvy actuaries and those less eager to try new things will grow even larger than it is today.

CompAct is a potent conduit for transferring technology knowledge among SOA members. You can play a key educator role in this technology-dependent era by sharing your knowledge in the form of articles, or even article ideas.

We look forward to hearing from you!



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## ACTUARIAL SOFTWARE WINS MICROSOFT INNOVATION AWARD

by Kevin Pledge

I recently attended the Microsoft World Partner Conference in Los Angeles. With 15,000 attendees, this is the largest conference in North America. To accommodate the large numbers keynote sessions were held in the Staples Center, and breakout sessions took up the LA Convention Center and several hotels.

Over the past few years I have been quite vocal about how little technology companies understand the needs of insurance companies and even that life insurance is different from P&C. The converse has also been true; many insurance software vendors care little about technology standards and practices and focus only meeting the immediate business needs. This can result in underperformance, incompatibility and leave gaps in security, governance and disaster recovery. The large technology companies all offer certification programs for developers and software; there is little excuse for software vendors who are serious about developing solutions.

Back to the Microsoft World Partner Conference: I didn't expect to run into any other actuaries at this conference as it is technology focused, so imagine my surprise on the first day when Van Beach of Milliman is called onto center stage at the Staples Center with Steve Ballmer to receive the Innovation Partner of the Year Award for Technical and High Performance Computing (HPC) for MG-ALFA.

The Technical and High Performance Computing Innovation Partner

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of the Year Award recognizes an Independent Software Vendor or System Integrator for achievements that enable scientists, engineers and analysts (and actuaries!) to solve the world's most complex problems through simulation and modeling. In particular Microsoft wanted to recognize a partner that innovated by enabling simulation and modeling in the cloud, using Windows HPC Server burst capability. MG-ALFA was the first actuarial software to integrate with Microsoft HPC (WCCS, at the time). They are currently developing a burst to Azure capability (Azure is Microsoft's cloud platform) through Windows HPC Server 2008 R2. Milliman is also building a Solvency II solution that will manage and run MG-ALFA natively on Azure.

For actuaries, solutions to problems that were previously impossible to analyze, were made possible through the scalability and capacity of distributed computing through HPC with in-house clusters. By harnessing the power of the cloud to augment in-house clusters, this scalability and capacity now becomes nearly infinite, on-demand, and marginal cost—with zero internal footprint. HPC and the integration with Azure has benefited MG-ALFA by increasing power and efficiency while reducing costs for customers.

Most importantly from my perspective, it is exciting to see an actuarial vendor win against other industries and pure technology companies. Not only does this mean that an actuarial vendor can follow standards and innovate with cutting edge technology, but also that the world's largest software company is recognizing the real business value that actuaries can drive when equipped with world-class software tools.

Congratulations to Milliman and MG-ALFA on this achievement.

Kevin Pledge, FSA, FIA, is CEO and co-founder of Insight Decision Solutions, Inc. He can be contacted at [kpledge@insightdecision.com](mailto:kpledge@insightdecision.com)



Steve Balmer greets  
Van Beach on stage



Van Beach center stage  
at the Staples Center



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## TOUCH THE SCAI

by Van Beach

*While SCAI (Scalable Cloud Actuarial Infrastructure) is a somewhat lighthearted reference to "the Cloud," the implications of cloud-based infrastructures such as Microsoft Azure are serious business. Cloud computing is a major disruptor to nearly all software products, and actuarial software is no different. Insurers need to start thinking about how they are going to work with their vendors to move to the next level of actuarial infrastructure—"touch the SCAI."*

Last year, I wrote an article for CompAct where I playfully dubbed the term "SCAI" (pronounced sky) and discussed how shared computing resources from multi-core servers to public clouds like Azure contribute to a continuum of solutions to support actuarial processing. While SCAI is a somewhat lighthearted play on words, the concept and implications are all serious business.

The Cloud is here to stay. Microsoft has publicly doubled-down on their "all-in" position with regard to Azure (Microsoft's cloud infrastructure). Specific to actuarial computing environments, Microsoft has enabled a bridge between on-premise HPC (High Performance Computing) clusters to Azure through their recent release of Server 2008. Amazon, Google, IBM and others are all investing in cloud infrastructures. With each new software vendor that moves to the cloud and each company that utilizes a cloud-based offering, the fear and uncertainty break down and the very real business benefits come into focus.

### Actuarial Computing Capacity Delivered Through the Cloud

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The following scenario still holds today:

Results are needed immediately, but the in-house compute cluster (i.e., the grid of servers used to parallelize computations) is already fully utilized and there is a queue of jobs that will keep the resources occupied for days. A job could get bumped, or priorities reordered, but even with all 200 computing resources (cores) in the cluster available, running another 1000 scenarios will require over 10 hours to complete.

The 10-hour run-time is certainly a dramatic improvement over running on a single computer (which was the situation before the compute cluster was installed), but it is still far from ideal.

Instead of 200 cores available 365 days a year, a more effective distribution might be 2,000 cores 36.5 days a year. At certain times, 20,000 cores for 3.65 days would be the optimal configuration. If computing capacity were marginal cost, these would all be equivalent. In addition to marginal cost, the ideal solution would also provide infinite, on-demand, zero-footprint resources.

This "nirvana" solution—effectively infinite resources that are on-demand, marginal cost, and zero-footprint—exists. Further, this cloud-computing infrastructure is being used to provide the computing capacity to back mission-critical Solvency II actuarial models and will regularly utilize multiple thousands of cloud-based CPUs. And when the calculations are done, the resources are de-provisioned, and the meter stops running. Touch the SCAI.

#### **Bridging On-Premise and Cloud Computing through Microsoft HPC Server**

In-house computer clusters to support actuarial calculations have provided a computational "backbone" for actuarial projection work. The key innovation that triggered this expansion was the introduction of Microsoft HPC—a cost-effective, centralized operating system that turns a bank of servers into a scalable resource that can be made broadly available. In recent years companies have continued to expand their on-premise computing capacity and are thoroughly invested in this environment. As such, a cloud-only option is not practical.

However, it seems inevitable. To help illustrate this coming reality, let's contrast the process for bringing a new bank of servers online within a traditional grid farm to a Cloud approach using MS Azure.

With a traditional grid farm, servers are delivered and a rack is

constructed where each server needs to be network connected, plugged in, configured, tested, etc. This happens in a room with special cooling, power, and surge protection. Expert technicians are often involved for the setup, configuration, and maintenance of the grid farm. This process, expertise, and footprint is redundant across thousands of companies.

Now consider bringing several thousand new Azure servers online instead. A huge container the size of a semi-trailer is dropped off at what looks like a giant parking lot. A single large cable is hooked up. Immediately, the thousands of servers boot up, automatically configure themselves, and bring themselves online within minutes. Further, the maintenance cost ratios for Azure servers are a fraction of in-house servers. The efficiencies are too significant to ignore.

The R2 release of Microsoft Windows HPC Server 2008 aims to bridge the gap between on-premise HPC Clusters and Azure. R2 enables a "Burst to Azure" capability where on-premise resources can be augmented with Azure resources—so the cluster can be expanded virtually. Jobs are still submitted to the local cluster, but can then be "re-routed" to execute on Azure. This feature provides companies with an option to blend in-house and cloud-based computation resources. Touch the SCAI.

### **The Role of the Application**

In most cases, the software vendor must cloud-enable their product, so the benefits of cloud-computing will not necessarily be available (or effective) for a given actuarial projection software application. Further, there are at least two levels to consider—integration and optimization.

At a minimum, an application needs to provide an integration layer to make the computing option available. For example, there needs to be an integration layer between the application and Microsoft HPC for the Microsoft compute cluster to be available as a compute option.

It is a different question to ask whether the application has been optimized for the given computing option. With a cloud-based infrastructure such as Azure, where all resources are essentially identical, the vendor can begin tailoring their application to run effectively in that environment. Further, the vendor can build additional controls, redundancies, and safeguards to ensure the environment is robust, secure, and controlled.

In short, working with a cloud platform like Azure requires a tremendous amount of effort and expertise on the part of the

application vendor to utilize the cloud resources optimally. If done well, however, a SCAI can reduce maintenance costs, improve turnaround time for calculations, and reduce risk.

### Summary

The need for actuarial computing capacity is not going to recede. To meet regulatory and risk management requirements, companies will need to find solutions to this capacity challenge. Public clouds such as Microsoft Azure are emerging as a transformative technology across many applications including actuarial software—assuming your actuarial projection software can support the cloud. The question is no longer "if" additional capacity is needed. The question is "how" the capacity can most effectively be provided. Insurers need to move to the next level of actuarial infrastructure.

It's time to touch the SCAI.



*Van Beach, FSA, MAAA is the MG-ALFA Product Manager at Milliman. He can be reached at [van.beach@milliman.com](mailto:van.beach@milliman.com).*



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## ONE ACTUARY'S JOURNEY THROUGH TECHNOLOGY

by Dave Kester

I am an actuary with more than 25 years of experience. The first few years of my actuarial career were in a "technology heaven." PCs were just showing up, and the power of spreadsheets, databases and programming languages were available for those who wanted to pursue them. I didn't have much formal training in technology (BS in math education), but I had a willingness to learn. I was constantly learning new tricks, tools and trade.

However, at the turn of the century, my focus shifted from a technology actuary to a business actuary. I started my own consulting company in the mid-1990s, and solving clients' problems took center stage. In fact, I found technology often got in the way of those solutions. Thus, for the first decade of the 21st century, I put my technology on the shelf and probably functioned more like a "normal" FSA: Let other, younger actuaries "do the dirty work."

Usher in the second decade of the 21st century. It started simple enough with the purchase of a smartphone. For me, it is probably stretching to call it a smartphone because all I used it for was to make phone calls and occasionally check email. Of course, I had to have my kids or staff members set up the phone so it could check my email.

Next, came the iPad. I'm not sure what motivated me to buy an iPad. I suppose I thought it was going to be kind of a fun toy to play with. That is a bit odd since my life was already overflowing and adding a toy to play with was not consistent with my goals or responsibilities

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at that time. Regardless, I bought it for some reason. After I had my staff and kids set it up so I could get email and some other basic functionality, the iPad was a convenient tool to check email and surf the Web at night. Nothing too fancy.

Finally, early in 2011, I bought an Apple MacBook Air. I really appreciated my iPad in how quick it would start, wouldn't need to be reboot, and how applications rarely crashed. Given the MacBook Air book had a hard drive that was always "on," it would be almost as quick as the iPad in getting started and staying active. After using it awhile, I became increasingly less patient with my "work" computer as it continued to drag and spin its way through the applications.

In the spring of 2011, I got my first smartphone app, which gave me instant weather. As a runner, I loved to be able to instantly get not only the temperature but the humidity—an important fact when running in Iowa in the summer. Slowly initially, I started reviewing other apps, primarily for my iPad. It didn't take long until I realized I had been hooked again by the "technology bug."

The technology advances of the late 1980s and 1990s were impressive. However, what has changed with the latest advancement are the following components, which were primarily missing from the 20th century:

1. *Ability to use mobile technology.* I know that isn't news to anyone. However, until you really experience it, you miss the power and capacity that we have now. And by mobile, I'm not referring to carrying around an eight-pound notebook computer.
2. *New opportunities.* Mobility not only has a convenience factor, but it greatly increases the opportunities for tools. If you can run an app from anywhere, and there is technology such as GPS and cloud storage, the opportunity for software development goes to all new levels.
3. *Ease of software installation.* It is amazing how quickly we can search, install and use a new app. Most apps have very short learning curves to them.
4. *Affordability.* I see great apps that get poor ratings by users because they are so expensive. And they cost less than \$20! Software in the 1980s and 1990s usually cost more than \$100.
5. *Synchronization.* This was briefly mentioned in item number 2, but it's now easier than ever to synchronize your data and applications so that it doesn't matter whether you are using

your PC desktop at work, your iPad, or your SmartPhone. They all can work together. This is still a work in progress, but it has come a long way, and it is getting there. The iCloud concept from Apple that is due out in the Fall of 2011 will be a game changer.

Actuaries, as expected, are not at the cutting edge of developing these apps. That's OK. However, we are getting started. We will be discussing where we should go and how we can get there at the 2011 Annual SOA meeting in Chicago. I look forward to going on this new technology adventure with other actuaries to see how we can use these apps to better manage risk in a digital world.

*David Kester, FSA, MAAA is the co-founder and President of SALT Solutions, an actuarial consulting company from Des Moines, Iowa. David's focus is converting actuarial beasts into beauties by using technology as a friend. His latest venture is [CoachingActuaries.com](http://CoachingActuaries.com), a site that provides online practice tools for students preparing for actuarial exams.*



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## KEYS TO SUCCESSFUL REPORTS

by Jeremy Benson

In my 15 years as an actuary, I have had many opportunities to produce reports for many different people. The actuarial reports could be anything from simple loss ratio reports to a full pricing analysis. I have also produced reports for marketing, underwriting, claims, external clients and others.

Today, I am responsible for approximately 20 different reports. Some of these were built by my team and me, while some were built by others and transferred to us. Because of this, we are going through an extensive process improvement project.

Based on these experiences, I have found that customers, quality and efficiency are the three key components to successful reports.

And that implies that:

- Reports that are not used by your customer are useless
- Reports that have bad information are useless
- Reports that are late are useless

In addition to the above, technology enables you to create the reports, and product knowledge enables you to understand the information in the reports.

### Customers

First, let's define what a customer is. A customer is anyone who uses

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your product. In this case your product is the report. Part of a successful reporting process is to find out who your customers are for each report. Once you have done that, the next step is to determine how your customers are using the report. A tool used in Six Sigma is called Voice of Customer (VoC). VoC is used to understand what is critical to the quality of the process according to your customer. It can be used to gather the needs and issues of the customers and requires a dialogue between both parties.

For those who are using the reports, discuss with them ways that you can improve the product. Is there additional data they would like to be included? Would they like it in a different format? Would they like it more or less frequently? Would they like an alternative way to access the report? Would they like canned reports or dynamic?

If there are people that you thought were your customers, but they aren't using the reports—find out why. Is the report too complicated? Does it have the wrong information? Is it too complex to use (i.e., is it in the format of a pivot table and the customer doesn't know how to use pivot tables)? Does the report not reconcile with other information?

If no one is using the reports, you should also consider whether the report is worth producing. It does not make sense to create a report that no one is using.

After talking to your customers, you will start turning their needs into requirements. These requirements will then need to be prioritized with all other requirements for all reports. The needs of the business along with the complexity and time required to complete the requirements should determine the priority.

### **Quality**

Ideally, every report that you produce will have information that is 100 percent accurate. In the real world, this is not always possible. However, you should strive to produce reports with as high a quality of information as possible.

The first issue is the quality of the data that is used for the report. This is the classic "garbage-in garbage-out" situation. If your data that you use for the report is bad, then the information in the report will also be bad.

Before you start testing for quality of the data, you need to understand what is in the database. It is ideal to have metadata, or data about the data. Metadata can be pretty extensive, so it might be

too time consuming to capture every piece of information about each field. At a minimum you should have an operational definition, possible values and any business rules associated with each field in the report.

There are two main approaches that I have used on testing data quality on input data. First, a thorough data profiling exercise on the data is important. Data profiling is an exercise in exploring and learning about data. The main types of information that you should capture during this stage are:

1. Fill Rates - This is the percentage of the field that does not contain missing or null records for a particular field. It will help you identify whether data even exists or not. Care should be taken, however. There could be some fields that may have missing values by design. It is important to compare these results to the expected domain (desired or valid values) in the metadata.
2. Frequency Distributions - This is a count of how often each value occurs in the dataset for a given attribute (field). When comparing to expectations, you should be able to identify instances where information is not valid.
3. Two-way profiling - This is basically extending the two methods above to a second dimension. For example, you may want to see how an attribute's fill rate has changed over time, so you calculate it by year. Two-way frequency distributions are useful in looking at relationships between two attributes. If you know that two values shouldn't be related, but they occur for the same record, this signals a quality issue.
4. Basic statistics - Statistics like mean, minimum, maximum, standard deviation should be compared to the expected values. They could identify outliers or data that is unexpected.

A second way to identify data quality errors is more direct. It is through the testing of business rules. Since they are tests of the data already in the database, some call them data validation rules, but they are usually synonymous with business rules used in application development.

These rules are tested against the data and any violations are flagged and investigated. If the data is determined to be in error, then there are two ways to fix the error.

1. First, the actual data should be cleaned. Either it can be

cleaned at the source or in the database used for reporting (e.g., data warehouse).

2. Second, the process that caused the error should be fixed so the error doesn't occur again.

It is very important to analyze the data to understand the root cause of any data quality issues. Only through an understanding of the root cause can the underlying issue be fixed. Otherwise, even if you clean the data, more errors will occur in the future.

There are several ways to examine the root cause. A qualitative way used in Six Sigma is a Cause and Effect Diagram which is sometimes called a Fishbone because of the way it looks. It organizes possible causes for a specific problem by displaying them in increasing detail. A quantitative way to examine root causes with data is data lineage. Data lineage is the history of a data item, including its acquisition, transformation and integration. Knowing where the data came from can help you find the root cause of the error.

Even if the underlying data is correct, the report could have information that is not. Therefore, the person producing the reports should perform additional quality tests on the reports themselves before they are released to the customer.

There are two main tests that we do. They are called delta reports and control totals. The delta reports show what has changed from one report to the next. If what has changed is different from expected, then the reason should be investigated. Delta reports are part art, part science. It requires someone knowledgeable enough about the business to know what is expected; therefore, a subject matter expert can be referred to in such cases.

Control totals are basically a reconciliation of the report results with a source that either should be equal to the report totals (or subtotals), or the differences can be explained. If the report cannot be reconciled, then further investigation is required. The results of the investigation might show an issue with the process that creates the report, or it may be a data quality issue.

One important lesson on data quality when doing reporting is to get to know the people who use the data and the people who own the data. The people who use the data will be able to help you answer questions about unusual things you see in the data. They also will help you identify whether rule violations are errors or not. The people who own the data will many times be the ones you will have to work

with to fix the process that is causing the data quality error.

One other way to find out about data and information quality errors is to listen to your customer. This can be conducted formally through surveys, focus groups or interviews or done informally. In talking with your customers, many times you will discover information that is very difficult to glean from the data itself.

Successful reporting provides information that is used by customers, is of a high quality, and arrives in a timely manner. Potential misuse is still possible (if not probable) when users misunderstand or misinterpret the information. Three ways to minimize this are to:

1. provide clear definitions for the fields in the reports
2. identify key takeaways from each report for the user
3. train report users on how to interpret the information in the report

### **Efficiency**

There are many ways that the process used to produce the report can be inefficient. The main ones that I have witnessed are lack of automation, useless information, redundant information, wasteful process steps and a lack of documentation.

#### *Lack of Automation*

When a report is first created, manual steps are important in order to understand the process. However, once the report is in production, manual steps can add significant time to the process. In addition, manual steps increase the probability of human error.

One of the dangers of automation is that a change in the underlying data might go unrecognized. That is why you must still be diligent in testing the quality of the data and reports as discussed above.

It is also important to make sure the process continues to run smoothly. Capturing the time it takes to run each step and building Statistical Control Charts are one way to do this. Whenever a step takes significantly more time, it will be outside of the upper control level (UCL). When this happens, the cause of the variation should be investigated.

#### *Useless Information*

Extra information not used by the customer is useless. Having this information slows down processing time. It also slows down the time to test the quality of the data. If your customers are not using that information, then you should consider removing it from the report.



One thing to keep in mind is that you might be a customer of your own report, so if you need the information, keep it.

Removing information from your report does not mean removing the data from your database. You should probably keep more data in your database than in the reports, in case you need to fulfill requests for reports using that data.

#### *Redundant Information*

When you have different customers asking for similar information, but in different formats, there is a tendency to create different reports and thus have a different process for each of them. When this happens, you could meet with each of your customers and determine if there is a way to combine the reports.

The decision to do this also depends on how long it takes to create a single report. For example, if the report can be created easily from a data mart with a dynamic interface, then the time saved may not be significant. So make sure that the benefits of the time saved by combining the reports outweigh the benefits that your customers may have had with separate reports.

#### *Wasteful Process Steps*

Some steps don't add any value to the process. Either in the development stage or when the reports are in production, it is important to determine if each step leads to the ultimate goal. If it doesn't, then the process should be redesigned.

Lean Six Sigma has a process improvement method called MUDA, which is a Japanese term for eliminating waste. It identifies activities that add no value to the overall process, but add time and/or cost. These concepts come from manufacturing, but can be used in data management and reporting also. There are seven categories of waste in lean:

1. Overproduction - this usually happens when we give the customer more information than they actually need (such as too many fields).
2. Unnecessary transportation - this happens when data moves from one system to another unnecessarily. The process should minimize the number of movements of data from source to final report.
3. Waiting/queuing - this is waste caused by inactivity in the process. It is usually caused by manual processes in which you rely on someone else for information.

4. Extra processing - this is additional work needed after the product is completed that adds no value to the customer. One example in reporting is continually cleaning data instead of fixing the process.
5. Motion - this is movement of people that doesn't add value. One example is having different people generating similar reports.
6. Inventory - this is having more reports on hand than are actually needed.
7. Defects - this is reports that are produced with errors.

#### *Lack of Documentation*

When a reporting process is put into production, the process should be documented. Lack of documentation becomes an issue when:

- Frequency of reports is low - A person tends to forget the steps if there is significant time between creation of the reports.
- Turnover - When a process has to be transferred from one person to another, lack of documentation makes it difficult to train the new person on the process.
- Manual Steps - If there are any steps that are manual, a process with documentation takes less time and is more efficient.

Each process should have standard operating procedures. In addition, every attribute (column) in the report should be defined so that the user of the report does not misinterpret it.

#### **Technology**

Technology is an enabler to the process. However, the choice of which technology we use does not change the customer requirement or the quality of the input data. Certain technologies can help you be more efficient, but process efficiencies go far beyond the type of technology that is being used.

Too many times we have seen companies implement new systems and talk about all of the great things they can do. But in my experience, too much of the focus is on the front-end of the system, and as a result the back-end data and the reporting suffer. When building new systems, customer reporting requirements, data quality and how efficiently you can create reports should be part of the main considerations.

#### **Product Knowledge**

The reporting team needs to have knowledge of the products that reports are based on. However, it should not be assumed that they know everything. There will always be people inside of the business that know a lot more (called subject matter experts, SMEs). You should work with these people to help tackle issues that are outside your area of expertise.

#### **Conclusion**

In order to have a successful reporting process, it is essential to understand customer needs, produce high quality reports and produce them in an efficient manner. Technology and product knowledge will also enable you to have successful reports.

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## 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.

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(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](mailto:marypat.campbell@gmail.com).

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## SPEAKING "DATA" PROPERLY

by Dan Rachlis

*Data Mining, Data Analysis, Data Warehouse, Data Mart, Data Modeling, Data Requirements, Data Integration, Data Visualization, Data Cleansing, Data Transformation, Relational Database, Business Intelligence, Data Management, Data Architecture, Data Privacy, Data Security, Data Access, Data Integrity, Metadata, Data Backup, Disaster Recovery, Business Continuity Planning, Data Governance, Data Asset Customer Relationship Management (CRM) Software, Records Management, Data Structure, Data Movement*

Have you ever used any of the above terms? Chances are that you have and that you may be using them incorrectly. In an era where technology is continually advancing, electronic data can be found everywhere. In the health care actuarial industry especially, data and understanding how to manage the constant flow of information is vital to an organization's operational and financial viability. Actuaries need to be sure the analysis and opinions they provide are accurate, asking for the wrong data or not understanding what data to ask for can have a significant impact.

This article is the second in a four-part series about eliminating the confusion with using data terminology. In part one, we discussed data governance, the formal management of data assets with respect to availability, usability, integrity, and security throughout the enterprise. Data governance ensures that data can be trusted and that people can be made accountable for any adverse event that happens because of low data quality. It assigns responsibilities to fix

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and prevent issues with data so that an enterprise can become more efficient. Part two will discuss data analysis and database management.

### **Data Architecture, Analysis and Design**

**Data Analysis** is a process in which raw data is organized and reviewed so that useful information can be extracted. The main goal of data analysis is to highlight information to draw conclusions and support decision making. Data analysis has multiple facets and approaches that encompass many techniques in different business and consulting environments. A **data structure** is a specialized format for storing and organizing data in a computer so that it can be used efficiently in data analysis. **Data architecture** describes the data structures used by a business and/or its applications. These are descriptions of data in storage and data in motion including descriptions of data stores, data groups and data items and mappings of those data artifacts to data qualities, applications and locations. Data is commonly in tables, which are a collection of meaningful data elements. A **data dictionary** is a centralized repository of information about data such as the source table, meaning or description, relationships to other data, origin, usage, and format. A **database** is an organized collection of data in the form of tables for one or more uses. **Data modeling** is the formalization and documentation of a business process. A data model defines, analyzes and diagrams data requirements and relationships needed to support the business processes of an organization. **Data visualization** is the graphical representation of data or information which has been abstracted in some schematic form, with the goal of providing the viewer with a qualitative understanding of the information contents. **Data integration** involves combining data residing in different sources and providing users with a unified view of this data. **Data cleansing** or **data scrubbing** is the term used to identify and correct (or remove) corrupt or inaccurate information from a table. Data cleansing differs from **data validation**. The term data validation refers to a process during which data is subject to a comparison with a set of acceptance criteria. Data validation guarantees to your application that every data value is correct and accurate. **Data integrity** is data that has a complete or whole structure. All characteristics of the data including business rules, the accuracy and consistency of the data, and the exact duplication of data must be correct for data to be complete. Data that has integrity is identically maintained during any operation (such as transfer, storage or retrieval). Put simply in business terms, data integrity is the assurance that data is consistent, certified and can be reconciled.

Future articles in this series will focus on data warehousing, business intelligence, and records management.

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Your help and participation are needed: Articles, book reviews and other information on technology useful to actuaries are needed! All articles will include a byline to give you full credit for your effort. An annual prize is awarded for the best article of the year. If you would like to submit or discuss an idea for an article, please contact [Richard Junker](#) or [Andrew Chan](#).

Submissions for future editions are also welcome!

Submission deadline is November 7 for the January issue.

Thank you for your ideas!

Andrew Chan can be reached at [chan\\_a@algconsultings.com](mailto:chan_a@algconsultings.com).

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