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## Update from the Product Manager

**A**s we get closer to finalizing the version 7.0 data model and the Ain/Atb input data editors, I want to share some of the details so you can begin to plan how to take advantage of the changes and to modify processes used to create MG-ALFA files or read MG-ALFA output.

**Overview:** Version 7.0 begins the data model conversion. Our expectation is that most of the MG-ALFA data file types will continue, but with a "2" appended to the extension to indicate the file is associated with our new data model. Table I summarizes the data files that will change in version 7.0.

The system will automatically convert version 6.7 project input data files (Ain, Atb, Ail and Aia) to the version 7.0 file formats without any manual intervention or loss of information. However, due to the expanded functionality and the changes in file formats, you may need to update some of your processes used to build input files or retrieve values from result data files.

File Type	Contents	6.7	7.0
Project file	Asset, liability, and non-cellular input	Ain	Ain2
	Everything else	Ain	Ain
Table file	Asset, liability, and non-cellular tables	Atb	Atb2
Asset in-force	Text file with in-force asset data	Aia	Aia2
	Binary file with in-force asset data	Aia.Bin	Aia2.Bin
Liability in-force	Text file with in-force liability data	Ail	Ail2
	Binary file with in-force liability data	Ail.Bin	Ail2.Bin
Arbitrary 2-Dim tables	Binary file with tables that can be accessed directly in liability formula variables	A2d	A2d2
Results report file	Binary file used to support results reporting	Ars	Ars2
Runtime reports	Binary file used to support runtime reporting	Ard	Ard2*

\*Each runtime report will have a separate Ard2 file name Rreq.xxx.Ard2

Table I: Data file migration from version 6.7 to version 7.0

**Expanded functionality in data model:** The most visible, and oft-requested, enhancement to the data model is the changes to the characteristic structure. In version 7.0, definition of the number of characteristics, the characteristic identifiers, and the names of the characteristic values is virtually unrestricted. Specification of the characteristics is done through the inforce file format definition.

The characteristic identifier is no longer a single character, but rather a word. For example, "X" becomes Gender and "M" becomes Class. In addition, the characteristic values are no longer limited to a single character, but can also be words, increasing the number of choices from 38 to a virtually unlimited number. For example, the choices for the Gender characteristic might be *Male* and *Female* rather than *M* and *F*. To reiterate, existing files will be converted to the new data structure, so you do not have to redesign your characteristic structure for the initial migration from version 6.7 to 7.0. However, over time, you will want to re-evaluate your characteristic structure and processes used to build input data files.

Another new feature in version 7.0 is added layers of security and change history. We will be providing the option to use Windows® Active Directory to set user permissions to change input files, run models and review results. The new data model is designed from the ground up to maintain meta-data which describes the model change history. Initially, this change history will be maintained at the table name level for Atb2 files and at the line of business and variable name level for the Ain2 file. The change history will be a table containing three columns— who, when and how. There will be separate entries

*continued on page 2*

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## Update from the Product Manager *continued from Page 1*

for each time the input item was changed. For installations that use the Windows Active Directory based security model, file changes will be controlled by the MG-ALFA user role. These MG-ALFA user roles will be similar to Windows – Administrator, Power User, etc. Only MG-ALFA Administrators will be allowed clear the input change history.

The new input editors provide a more modern, Windows-standard look and feel.

Some additional enhancements to the version 7.0 data model include the following:

- When the model definition changes, data will not be lost for characteristic combinations that no longer exist. The user will have the option of removing unused characteristic combinations, but this will not happen automatically.
- Varying by issue year will be expanded to allow for explicit definition of values for future issue years.
- The ability to explicitly link the same input values to multiple characteristic combinations, similar to the PlanInput inheritance structure, provides the option to reduce data management even further than provided by the current structure.
- The inforce file format will no longer have the structure of the fixed key at the front, so building and editing these files in Excel or other applications will be easier.

The use of standard Excel keystrokes in the data grid makes data manipulation and entry familiar and easy.

**Expanded utility:** The new input editors provide a more modern, Windows-standard look and feel. We have carried forward the features of the formula editor, such as improved accessibility to information using the multi-pane view and the use of visual cues to facilitate data review and error checking. For example, color coding is used to identify characteristic combinations that have not yet been set due to new keys and characteristic combinations that have been set to the default value. The use of standard Excel keystrokes in the data grid makes data manipulation and entry familiar and easy. Finally, new tools like the option to copy all data for characteristic value A to value B facilitate functions like adding a new plan that is similar to an existing model plan.

**Features no longer supported:** There are a few features in the current version of the system that we will no longer be supporting in Version 7.0. These include:

- The pre-calc and post-calc formula variables in the inforce file format definitions will be eliminated. You will need to create these items within the process being used to generate the Ail or Aia text file or link to a table containing the information. For version 6.7 models, the values for these variables will be converted to input when the version 7.0 Ail2 and Aia2 files are created. Weighted-average and actual-to-expected ratio calculations are still supported and can generally be used to replicate the pre-calc and post-calc functionality.
- The option for future issue cells in an Ail to be treated differently than existing business cells will be eliminated. This is currently specified with the NewBusAil option variable on the Setup page of the Ain.
- The DeriveIMO option on the setup page of the Ain will be eliminated and the issue month in the Ail file will always be used directly for all cells.
- New business model specification for Pricing runs and Sales Volume in Projection runs will be defined in a new way. We are still working through the details, but conceptually, this specification will be adequate for the system to automatically create a proxy, behind-the-scenes, Ail2 file that contains the appropriate information.
- All runtime report data will be placed into Ard2 files that will use the factor files (Afd) binary form. Each runtime report request specification will create an associated Ard2 file. The Afd Com object that is distributed with the system can be used to access the output data directly through program control in another application, such as Excel, Access, SAS, and Visual Basic.
- Asset and Liability Segment runtime reports will no longer be supported.

The additional flexibility in model structure, coupled with the additional control provided by the security and change history enhancements, provides an environment that will be easier to learn, use, and maintain.

We are anxious to get these changes in your hands and receive practical feedback. The additional flexibility in model structure, coupled with the additional control provided by the security and change history enhancements, provides an environment that will be easier to learn, use, and maintain.

*Pat Renzi*

## Focus on Performance

**D**uring the Users' Group Meeting in September, we were asked if there were plans to rewrite the system to take advantage of improvements in technology. As you know, we are in the process of rewriting the user interface to give it a more modern look and feel. However, as for the core calculations, our efforts over the past several years were focused on a gradual restructure of the core calculations to maximize performance and minimize maintenance efforts. Through the use of current tools and modern programming principles, we have delivered a new system without disrupting your daily work effort. As a result of these changes, MG-ALFA models run faster than other flexible actuarial projection systems. Table I clearly demonstrates the benefits of this development effort – you can do 7 times more analysis in the same amount of time as could be done for year-end 2005. We will continue to look for opportunities to re-architect the system to provide additional benefits, but we do not anticipate the need to “start fresh”.

Version	Cells Per Hour (1000s)
5.5	83
5.6	96
6.0	95
6.1	126
6.2	163
6.3	224
6.4	351
6.5	460
6.6	586
6.7	586

Table I: Calculation run time improvements for a 30-year monthly ILP projection.

In addition to the changes in the underlying system code, we have also focused on incorporating options to take advantage of changes in hardware. Beginning in the Spring of 2007, we added the option to take advantage of multi-core processors, effectively reducing the runtimes in Table I by the number of CPU cores available in your desktop machine. Since dual processor quad-core workstation class machines are readily available, this feature effectively reduces run time by a factor of eight. When you need access to more computing power than you can get from a desktop machine, MG-ALFA's grid computing options give you access to 100's of processors with little effort and little overhead. Distribution is supported at the scenario level or

at the cell level when running in Independent Liability Projection (ILP) mode.

The above performance benefits are related to the pure calculation time. We have development underway that will allow for the simultaneous processing of run requests to maximize grid usage. This will be particularly beneficial for models with a large number of run requests, each of which has significant amount of calculation time. The simultaneous processing means that the user interface will proceed to launch the calculation engine for additional run requests during the period it is normally waiting for the calculation engine to complete.

In version 7.0 the calculation engine will directly read input from the Ain and Atb files. This will significantly reduce the amount of time for the user interface to launch the calculation engine. Looking forward, other planned changes are to compile the calculation engine as a 64-bit application and incorporate cell threading in DLP run mode. This means that DLP speed and capacity for a single scenario run will increase by a factor that corresponds to the number of CPU cores on your machine.

If you are looking to invest in new hardware during 2009, we recommend multi-core machines with 2 gigabytes of memory per CPU core and a 64-bit version of Windows. Intel® recently released the Xeon® 7400 Series Processor which has 6 CPU cores. High end machines using these processors will be available with 6, 12, 18 or 24 CPU cores. ●

**The next generation of supercomputing is here:**  Windows® HPC Server 2008

Windows® HPC Server 2008 can effectively scale to thousands of processing cores with out-of-the-box functionality to help improve productivity and reduce complexity of your HPC environment. Microsoft and Milliman have joined forces to provide an affordable, scalable, and easy-to-implement high performance computing solution. Find more information at [www.microsoft.com/hpc](http://www.microsoft.com/hpc). ●

You can do seven times more analysis in the same amount of time as could be done for year-end 2005.

In version 7.0 the calculation engine will directly read input from the Ain and Atb files. This will significantly reduce the amount of time for the user interface to launch the calculation engine.

## Version 6.7 Release Update

The release of MG-ALFA version 6.7 included the following major enhancements:

**Cluster Modeling:** Version 6.7 includes the option to group liability cells, asset cells, and scenarios using cluster modeling techniques. Cluster modeling allows a user to compress seriatim or very granular asset or liability records using financial results as the measure of fit in an efficient and automated process. Compression levels and overall fit of the compressed models promise to be far superior to what one can achieve with classic actuarial compression approaches. We are extremely excited about the opportunities this utility provides and have been encouraged by the results we have seen during our initial testing and internal use. The User Reference has been updated to include detailed instructions to use this new functionality. For additional theoretical information, refer to the research report prepared by Avi Freedman and Craig Reynolds that is located on the Milliman website at the following location: <http://www.milliman.com/expertise/life-financial/publications/rr/cluster-analysis-a-spatial-rr08-01-08.php> In addition, please see David Wang's article in the Technician's Corner on Page 5.

**F97Valuation Enhancements:** Several enhancements to the F97Valuation SOP03-1 calculations have been included in version 6.7. This includes the option to determine separate SOP03-1 reserves for DB and IB benefits and an option for a roll-forward based reserve following the unlock date.

**Equity Indexed Product Enhancements:** In version 6.6, we included a number of enhancements for EIA products. We have enhanced support for these products further in version 6.7, including support for Equity Indexed Universal Life products and for EIA products with multiple buckets to support products with multiple funds.

**Integration with Microsoft HPC:** Microsoft released a new version of their grid computing solution, HPC, at the end of September. We have integrated with HPC in version 6.7, providing access to the updated features provided by Microsoft.

**Enhanced options for modeling dynamic behavior:** A new utility has been included to support dynamic lapse behavior based on

the "in-the-moniness" of a model point. The function, ITMLookup(), has been incorporated into the US and Japan variable annuity databases.

### Upcoming Webcast:

**HPC in Life Insurance Modeling - Leveraging Milliman's MG-ALFA on the Cray CX1 Supercomputer with Windows HPC Server 2008 to Meet Emerging Insurance Requirements and Deliver Advanced Analytics**

**Date:** Monday, December 1, 2008

**Live Event start time:** 9:00 a.m. PST

**Duration:** 60 minutes

**URL:** <http://msevents.microsoft.com/CUI/WebCastEventDetails.aspx?EventID=1032389075&EventCategory=2&Culture=en-US&CountryCode=US>

**Conference Call:**

US/Canada: (866) 615-8438

International: (503) 295-8000

### 2009 Upcoming Events

*March 29*

**Asset Training**

New York City

Marriott Marquis

In conjunction with the SOA Investment Symposium 3/30 - 3/31

*April 29 - May 1*

**Exhibit at the ERM Symposium**

Chicago, IL

*May 18 - 19*

**Hospitality Suite**

SOA Spring Life Meeting

Denver, CO

*June 29 - 30*

**Hospitality Suite**

Product Development Symposium

Los Angeles, CA

*July 30 - 31*

**New User Training**

Chicago, IL

O'Hare Marriott

*September 24 - 25*

**Users' Group Meeting & Hospitality Suite**

Valuation Actuary Symposium

Anaheim, CA

*October 25 - 28*

**SOA Annual Meeting & Exhibit**

Boston, MA

Compression levels and overall fit of the compressed models promise to be far superior to what one can achieve with classic actuarial compression approaches.

6.7 includes support for Equity Indexed Universal Life products and for EIA products with multiple buckets to support products with multiple funds.



## Technician's Corner: Cluster Modeling *by David Wang*

*Converting a skeptic in to a true believer -  
An empirical study using scenario clustering in VA pricing*

**W**hen the cell clustering technique was first presented, I was probably not the most enthusiastic in the office. My work has primarily been in pricing so I typically deal with at most hundreds of cells but thousands, or even tens of thousands, of economic scenarios. So, for me cell clustering is much less important than scenario reduction techniques. However, when I was told that the same clustering technique used for cell compression could be applied to scenarios, I "enthusiastically volunteered" to confirm (or refute) that assumption.

Sitting in my office, I questioned how the clustering technique could possibly produce reasonable hedge costs of complicated GMB riders without utilizing Antithetic, Importance Sampling, Control Variate, or one of the other scenario reduction techniques that my professors at Berkeley had taught. However, since using the scenario clustering is very easy, I figured the small investment in time to refute the hypothesis was worthwhile. In a matter of seconds I had my 1000 risk neutral stochastic interest-equity scenarios clustered to 50. I was not expecting reasonable results from the 50 clustered scenarios, but my plan was to increase the number of clustered scenarios gradually until the results matched reasonably well to those from the 1000 scenarios.

Run time was naturally much shorter. A projection that had required an hour before now took 3 minutes. There goes my long lunch break. What was unexpected was the result, which is shown in Figure 1.

Full 1000 Scenarios		Clustered to 50 Scenarios	
Plan	GMWB	GMWB	Match
000001	66.46	<b>65.67</b>	99%
000002	55.49	<b>53.55</b>	96%
000003	59.30	<b>58.67</b>	99%

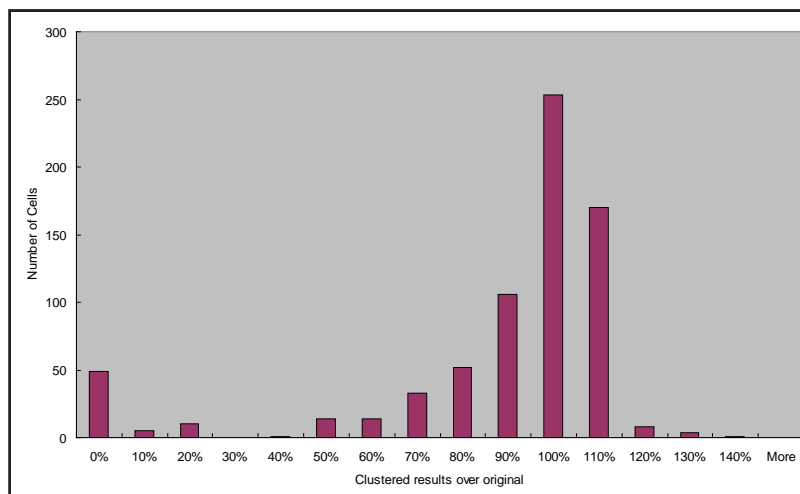
*Figure 1 - Results of Scenario Clustering in pricing a GMWB rider.*

This was a fairly complicated lifetime GMWB product with resets, bonuses, dynamic lapse behavior and dynamic withdrawal behavior all modeled together. I calculated the hedge costs of the GMWB with three different base variable annuity products. Still, the clustered 50 scenarios tracked remarkably well to the original hedge costs (quoted in basis points). For

each plan, the results were weighted across 720 cells with different ages, genders, lapse assumptions, and investment mixes. My next test was to review the cell level results.

Figure 2 illustrates that 529 of the 720 cells had clustered results ranging between 90% and 110% of the original results. However, I was concerned and perplexed by the 64 cells with clustered results of less than 20% of the original results.

With a closer look at the 64 cells, I concluded that the concern was unwarranted. These 64 cells had hedge costs from the original 1000



*Figure 2 - Fit by model point*

In a matter of seconds I had my 1000 risk neutral stochastic interest-equity scenarios clustered to 50.

The clustered 50 scenarios tracked remarkably well to the original hedge costs.

## Cluster Modeling *continued from page 5*

scenario run in the 1 - 2 basis point range, so a deviation of 1 basis point is a large percentage difference. While it is true that the degree to which clustered scenario results match from the results from all scenarios varies from cell to cell, overall the scenario clustering technique seemed to have worked very well.

I was still a bit skeptical and wanted to make sure this was not just a coincidence. So, I decided to test if the scenario clustering would work equally well for other products. I applied the same technique to GMAB, GMIB, and GMDB products. These were again fairly complicated GMB riders. As can be seen in Figure 3, the scenario clustering held up across these additional tests.

Full 1000 Scenarios		Clustered to 50 Scenarios	
Plan	Total Claims	Total Claims	Match
GMAB	39.03	40.35	103%
GMIB	64.72	60.89	94%
GMDB	29.64	29.16	98%

Figure 3 - Results of Scenario Clustering in pricing other GMB riders.

While the results of this analysis were encouraging, I decided to further explore the use of different location variables. In the initial tests, I simply used the wealth factors to compress the scenarios. I decided to try adding the present value of claims as a location variable, which means I was calibrating the scenario cluster to the PV of claims across the full set of scenarios. Using the wealth factors is much easier and does a good job of capturing the risk associated with VA guarantees going in-the-money due to drops in the equity market and with interest guarantees going in-the-money due to falling interest rates. However, capturing risks such as disintermediation associated with sharp increases in interest rates may be missed. Calibrating the scenario cluster to something like the PV of claims reflects the entire range of results and provides a tighter fit across all policies, as shown in Figure 4. My conclusion is that a 10% scenario cluster using wealth factors as the location variables produces a reasonable fit to the mean, standard deviation and tail of the distribution. A 5% scenario cluster with the PV of claims as the location variable produces an even better fit.

Model Fit with Alternate Cluster Scenario Specification							
Statistic	2000 Seriatim Scenarios	Ratio to Seriatim Present Value of Claims					
		Location Variables Scenario Wealth Factors			Location Variables PV of Claims		
		100	200	400	100	200	400
0.50%	63	101.3%	101.3%	101.3%	107.3%	97.7%	97.7%
1	67	101.5%	101.5%	100.5%	101.9%	100.0%	100.6%
5	72	102.8%	100.0%	101.0%	102.6%	101.1%	99.8%
10	76	100.4%	98.6%	100.4%	97.1%	98.9%	99.7%
25	86	97.4%	97.7%	98.1%	97.5%	100.1%	100.5%
50	131	90.9%	86.2%	95.2%	96.4%	100.8%	101.4%
65	301	97.8%	91.3%	96.9%	99.8%	100.7%	100.0%
75	560	103.0%	103.0%	100.3%	100.3%	100.2%	99.9%
90	1,739	72.9%	83.3%	90.5%	100.2%	99.8%	100.0%
95	3,128	74.6%	91.6%	91.6%	102.2%	100.0%	100.0%
99	7,413	88.7%	89.1%	88.7%	98.7%	99.9%	100.0%
99.50%	8,310	79.5%	139.0%	91.6%	98.4%	100.0%	100.0%
Mean	663	85.1%	95.8%	91.5%	100.0%	100.0%	100.0%
Std Dev	1,370	83.2%	101.9%	91.0%	100.0%	100.0%	100.0%
65% CTE	1,680	84.3%	96.4%	90.9%	100.0%	100.0%	100.0%
70% CTE	1,901	83.9%	96.3%	90.6%	100.0%	100.0%	100.0%
75% CTE	2,185	83.2%	95.8%	90.0%	100.0%	100.0%	100.0%
80% CTE	2,567	82.5%	95.5%	89.6%	100.0%	100.0%	100.0%
85% CTE	3,105	82.8%	95.5%	89.5%	100.0%	100.0%	100.0%
90% CTE	3,954	82.5%	96.9%	89.4%	100.0%	100.0%	100.0%
95% CTE	5,608	84.8%	101.2%	89.0%	100.0%	100.0%	100.0%

Figure 4 - Comparison of compression based on wealth factors and PV of claims.

Calibrating the scenario cluster to the PV of claims reflects the entire range of results and provides a tighter fit across all policies, as shown in Figure 4.

Run time is no longer an obstacle to performing more sensitivity tests or pricing more cells. The scenario clustering is revolutionizing my pricing work.

The end result is that I am now a true believer and while I may have to give up my long lunches, the runtime reductions will enable me to analyze pricing results in a much more efficient way. Run time is no longer an obstacle to performing more sensitivity tests or pricing more cells. The scenario clustering is revolutionizing my pricing work.

David Wang is a consultant in the Milliman Seattle office who specializes in pricing complex guarantees. David is an FSA and has a Masters of Financial Engineering from Berkeley. ●

## From the Support Line

**Q** We would like to perform a cost analysis on offering a 3% minimum interest rate guarantee. What is the best way to isolate and price this guarantee in MG-ALFA?

**A** To isolate and price the guarantee as a separate part of the contract, I would recommend creating a variable that represents the instances where the guarantee comes into effect and then use the TotalTemp analyzer on that variable. For example, in the formula below, the variable *GuarMinCost* will be zero in all durations where the minimum guarantee is not in effect and will be positive in the durations where the guarantee is in effect.

$$GuarMinCost = BegAv(t,h) * [max(0, iGuar - iCurrPortfolio)] / 12$$

After adding this variable, the next step in the pricing exercise is to set up a Total Template (*TotalTemp*) containing the variable *GuarMinCost* and run a set of stochastic scenarios. Once this is complete, you can analyze the cost using the TotalTemp Analyzer.

Summary Values	1 yr	5 yrs	10 yrs	20 yrs	30 yrs
0.5%					
1.0					
5.0	0.71	2.09	2.09	2.09	2.09
10.0	0.84	2.87	3.46	3.46	3.46
25.0	1.14	4.40	4.40	5.81	5.81
50.0	1.31	5.78	7.05	24.98	24.98
65.0	1.33	10.94	19.73	46.83	46.83
75.0	1.35	15.74	32.22	108.26	108.26
90.0	1.37	22.06	74.87	199.93	199.93
95.0	1.39	22.88	88.59	323.41	323.41
99.0	1.58	23.51	91.17	332.92	332.92
99.5%	1.58	23.51	91.17	332.92	332.92
Mean	1.20	9.51	21.92	65.16	65.16
Std Dev	0.30	6.82	26.23	92.34	92.34
5% CTE	0.35	1.04	1.04	1.04	1.04
10% CTE	0.52	1.65	1.65	1.65	1.65
65% CTE	1.38	17.75	50.17	161.36	161.36
70% CTE	1.39	18.82	56.85	186.26	186.26
90% CTE	1.49	23.19	89.88	328.17	328.17
95% CTE	1.58	23.51	91.17	332.92	332.92

The analysis view of a total report template provides statistical information on the selected data items across the scenario set. It is possible to select a “Cost/Profit Variable” and if desired a “Revenue Variable” as well as a “Discount Variable.” In our example, we will be selecting *GuarMinCost* as the Cost/Profit Variable, and not utilizing the other two variables.

The analyzer provides a view of the distribution of results. In the top section, results are displayed for specified percentiles of the distribution at specified points in time. The percentile distribution is followed by the mean and standard deviation and then by a set of CTE measures. The ability to control the row and column values in the analyzer is an enhancement in version 6.7.

The 88.59 value highlighted in the screenshot above indicates that only 5% of the scenarios had costs in excess of this over the first 10 years.

**Q** I am running my traditional life model in ILP mode. When I run the NY7, it re-runs the liabilities for each scenario. Why is this necessary if my liabilities aren’t scenario dependent?

**A** For projections where the liability cash flows are not interest sensitive, it is possible to project the liability cash flows once and re-use them in subsequent projections. This is done by using the Ars tab of the Proj setup to design your projection to run the Trad LOB once and then use the results from that run in subsequent projections of the assets or to combine with other LOBs that are interest sensitive.

Create a variable that represents the instances where the guarantee comes into effect and then use the TotalTemp analyzer.

The analysis view of a total report template provides statistical information on the selected data items across the scenario set.

For projections where the liability cash flows are not interest sensitive, it is possible to project the liability cash flows once and re-use them in subsequent projections.

## From the Support Line continued from page 7

Setup:

1. Create Proj.001 and select the Lseg representing the Traditional business on the Liab tab of the Projection definition.
2. Run Proj.001 for Scenario 1.
3. Setup Proj.002 with your interest sensitive liabilities selected on the Liab tab of the Projection and Proj.001 selected with the AllLiab parameter on the Ars tab of the Proj definition.



My investment department supplies an individual prepayment curve for each CUSIP in our mortgage portfolio. This means that I have over 400 prepayment curves to input and maintain. Is it possible to use perm tables to set the curves rather than the special asset tables?



With such a large number of prepayment tables, making a small database change to use perm files would make your process more efficient. The following steps would allow for using a perm file reference for prepayment rates.

Steps for accessing prepayment data in perm file form:

1. Create a (y,m) input variable (*CustomPrePayCurve(y,m)*) to which you will assign the table of prepayment curves. In this customization, the (y) index will represent the curve number and the (m) index will represent the interest rate differential. This will allow the custom curve to be defined with up to 12 different interest rate points.
2. Create a scalar input variable (*CustomCurveNumber*) to represent the custom prepayment curve number.
3. Change the database code for the variable *MarketPSA(y,m)* to be along the lines of the following:

```
CustomPrePayCurve(CustomCurveNumber, IntRateDiff)
```

where

```
IntRateDiff = ParRate(y,m) - MarketYieldRate(y,m)
```



I am trying to run a monthly income statement for a final expense product. I have chosen to run the model as monthly, and my premium mode is monthly, but the income statement is showing annual premium. What is going on?



In US statutory accounting for traditional products, Premium Income is defined as follows:

Premium Income = Cash Premium + Change in Gross Deferred Premium

There is also an expense item called Increase in Loading which is defined as follows:

Increase in Loading = Increase in Gross Deferred Premium - Increase in Net Deferred Premium

The net effect is that cash premium plus increase in net deferred premium flows through income. The latter term is there to make up for the fact that mean reserves assume a full annual net premium has been collected. A net deferred premium asset is established to offset that mean reserve assumption.

Therefore, at the beginning of a policy year the premium income reflects a full year's premium even if the premium mode is not annual. I hope this helps explain what you are seeing. ●

With such a large number of prepayment tables, making a small database change to use perm files would make your process more efficient.



## November Puzzler



A client received the following translation error.

However, looking at the formula for GP everything seemed fine. What is producing this error?

Translate error: mLiab

E3001 temp.lia L233,C1: Syntax error.

00233 GP & t & r & FLEXPREM ULJOINTLIFE VUL VULJOINTLIFE FIXEDPREMUL  
DEFANN INDEXDEFANN TRADITIONAL PAR PARJOINTLIFE & &



Formula for GP

0	if (t > 1)
GrossPremInput	if (CalcGp <> GPrem)
AnnIncomeInit * iaNSPgp * LoadFactor / frequency(AnnuityMode)	otherwise
where	
LoadFactor = 1 / (1 - GrossPremExpLoad)	if (GrossPremExpLoad <> 1)
0	otherwise

A database called Nov Puzzler.Adb has been posted to the MGALFA website ([www.mgalfa.com](http://www.mgalfa.com)) for you to try out your theories.

Email your answer to Valea Coyne at [valea.coyne@milliman.com](mailto:valea.coyne@milliman.com)



## Answer to the May Puzzler

In May, the puzzler asked you to think of clever ways to write a formula that calculated a variable on a calendar year basis. We asked you to use your creativity and we received a lot of excellent, ingenious responses. However, the following technique was the clear user favorite and the technique that we employ in the standard database variable *RateIncr(t,h)*.

month = (12 + RateIncrMonthNum - valmonth) mod' 12,

RateIncrMonthNum =

1	if (RateIncrMonth = January)
2	if (RateIncrMonth = February)
3	if (RateIncrMonth = March)
4	if (RateIncrMonth = April)
5	if (RateIncrMonth = May)
6	if (RateIncrMonth = June)
7	if (RateIncrMonth = July)
8	if (RateIncrMonth = August)
9	if (RateIncrMonth = September)
10	if (RateIncrMonth = October)
11	if (RateIncrMonth = November)
12	otherwise



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