CognalysisTM Reserving System User Manual

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1.0 Starting an Analysis

Starting or Opening an analysis can be done in one of three ways:

- 1. Creating a new analysis file by pulling data from a file
- 2. Opening an existing analysis file
- 3. Creating triangles by entering data manually or by cutting & pasting

The user begins the analysis by selecting Open from the File menu at the top of the screen or by choosing the folder icon on the toolbar below the menus at the top of the screen. Upon selecting open the user can choose from these three options.

Open Options		
	Select Opening Option:	
	O Open Data Files (Start an Analysis)	
	O Open an Analysis File (Return to an Analysis)	
	🔿 Create Triangles (Enter Data Manually)	
	DK Cancel	

1.1 Opening a Data File

The Cognalysis[™] Reserving System allows for a wide variety of layouts for input data.

When you start a new analysis by opening a data file, you will be able to browse for the file containing loss information. Currently supported file types are Comma Separated Variable (.csv), and Microsoft Access Database (.mdb). If the input file is an Access Database file, you will also be prompted to select the table containing the loss data.

After selecting the appropriate file you will be given the option to filter the data.

Filters	
Would you like	e to filter data?
<u>Y</u> es	

This allows you to import a subset of records from your data source. In this way the data source can be built in such a way that it includes data for multiple analyses. If you choose to filter data, select the fields you are interested in filtering by highlighting a field and clicking the right single arrow. Selecting the right double arrow will select all fields. To remove a single field, highlight the field on the right and hit the left single arrow (the left double arrow will move all the fields back to the Available Fields box). In the example shown below, the Line of Business (LOB) and Region fields have been selected for filtering and have been moved from the Available Fields box to the Data Filter Fields box.

>>	
<<	

Once the fields for filtering have been selected and the user has selected the OK button, the user will be given the opportunity to select the values within the selected fields to include in the analysis. In the example shown on the next page, Auto has been selected for inclusion from the list of unique values in the data file in the LOB field. Subsequently, the West Region is shown as being selected for inclusion from the list of unique values in the data file in the list of unique values in the data file in the Region field.

Available Values	Data Sele	ction Values
GL WC Prop	> Auto	
ed Values for Device		
ed Values for Region Available Values	Data Sele	ction Values
ed Values for Region Available Values North East South	Data Sele Vest	ction Values

If you choose not to filter data, or after you filter data, you will be taken through a series of screens to assign the fields of data to various data elements (this may occur automatically if the field structure and names are identical to a previous import). In the screen shown below, we are given the list of fields in the data file that may be chosen to map to Accident Period.

Input Field Mapping	
Incurred/Accident Period	
Data Type:	Select the Field to Map to: Incurred/Accident Period
 Incurred/Accident Period 	Accident_Period
 Incurred/Accident Date 	Age Paid Incurred LOB Region
This data type is for pre-aggregated data. Acceptable formats are: YYYY, YYYYQ, YYYYMM	
[< Back Next > Cancel

The Accident Period can be determined in one of two ways. It can be pre-identified on the source data, or it can be based on an accident date. If the period is on the source data itself, it must be in acceptable format (YYYY, YYYYQ, or YYYYMM). If accident date is to be used to build the accident periods, you will be asked to identify the length of the periods (annual, quarterly, or monthly).

You will next be asked to map Development Period.

Input Field Mapping	2	×
Development Period		
Data Type:	Select the Field to Map to: Age	
 Age 	Accident_Period	
Valuation Date	Paid Incurred LOB Region	
This data type is the age of the incurred loss in periods corresponding to the size of the accident/incurred period, i.e. (1,2,3 etc.)		
	< Back Next > Cancel	

Similar to accident period, development period can either exist already on the data source, or it can be determined using valuation date.

Next you will be prompted to map paid losses. These can be incremental amounts or cumulative amounts.

Input Field Mapping	
Paid Loss	
Data Type:	Select the Field to Map to: Cumulative Paid Loss
 Cumulative Paid Loss 	Accident_Period
Incremental Paid Loss	Age Paid Incurred LOB Region
This data type is for total paid losses from the beginning of the accident period to the valuation date or age	
	< Back Next > Cancel

Finally, you will be prompted to map incurred losses (or build them using case reserves + paid).

Input Field Mapping		
Incurred Loss or Case	Reserves	
Data Type:	Select the Field to Map to: Cumulative Incurred Loss	
 Cumulative Incurred Loss Incremental Incurred Loss Case Reserve Balance 	Accident_Period Age Paid Incurred LOB Region	
This data type is for total incurred losses from the beginning of the accident period to the valuation date or age		
< Back Next > Cancel		

Your options here include mapping a field to cumulative incurred losses, incremental incurred losses, or case reserve balances.

After mapping each of these elements, you will be given a summary as shown below with the option to go back and remap as needed.

😸 Mapping Summary	
Selected Mapping	Summary
Data Element:	Field Selected:
Incurred/Accident Period	Accident_Period
Age	Age
Cumulative Paid Loss	Paid
Cumulative Incurred Loss	Incurred
	Back Finish Cancel

Upon completion of the mapping, the option to save the layout is provided. When a mapping is saved, future data imports will automatically recognize if a data source file is of the same format, and make the appropriate mappings. Since data filtering and length of accident period could vary from analysis to analysis from within the same data, these questions are asked regardless.



The next step is the opportunity to import premium or exposure information. If you choose to import premium or exposure, you will select the file containing the premium or exposure and if necessary assign the Time Period Identifier and Premium or Exposure Identifier. [If mapping is required, you will be given a mapping summary and the opportunity to save the layout for future premium importation.] If you choose not to import premium or exposure, a value of 1 will be used in each period for calculations.

This will be followed by the option to import a previous analysis file. This is the analysis file corresponding to a previous valuation date. Importing this information has a number of benefits:

- Allow you to start your analysis with previously selected factors, loss ratios, and selected ultimate losses.
- Allow you to compare actual loss development against previously projected loss development as well as to compare changes in selected ultimate losses.

If you chose to import a previous analysis file, you will be able to browse for the file.

The user will then be asked to provide a title for your analysis. After entering the title, the setup for the analysis is complete.

Analysis Title	
Title for Analysis:	OK Cancel
Title	

A user may edit the title at any time by simply double-clicking the title shown on the screen.

1.2 Opening an Analysis File

When you start a new analysis by opening an analysis file, you will simply open a previously saved analysis file by selecting the file from the usual file menu box. The analysis file is the file used by Cognalysis that contains imported data (paid loss, incurred loss and/or premium or exposure) and any selections made (loss development factors, seed loss ratios, ultimate values, etc.).

1.3 Create Triangles

If you choose to create triangles by manually entering data, you will start by defining the characteristics of the triangle. This includes defining the starting incurred or accident period, the number of incurred or accident periods and the number of development periods. This allows the user the flexibility to create triangles in a multitude of period and development increments.

Cognalysis Reserving System	
Starting Incurred/Accident Period (acceptable	OK
formats- YYYY, YYYYQ, YYYYMM):	Cancel

Cognalysis Reserving System	
Number of Incurred/Accident Periods:	ОК
	Cancel
1	

Cognalysis Reserving System	
Number of Development Periods:	OK Cancel
<u>[</u>	

After defining the triangle parameters, the user will then be provided a grid for entering cumulative paid loss values. The user can type values or paste the values in from clipboard data copied from other sources. After entering all the paid values, select OK in the lower right corner of the screen.

ata Edit										
imulative Paid Loss										
	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10
▶ 1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	
2001	0	0	0	0	0	0	0	0		
2002	0	0	0	0	0	0	0			
2003	0	0	0	0	0	0				
2004	0	0	0	0	0					
2005	0	0	0	0					_	
2006	0	0	0							
2007	0	0		= 1				_		
2008	0			-						

The user will then be prompted to enter incurred values and exposure or premium values.

Exposure/Premum 1999 0 2000 0 2001 0 2002 0 2004 0 2005 0 2006 0 2007 0 2008 0		
Expirate 1989 0 2000 0 2001 0 2002 0 2003 0 2004 0 2005 0 2006 0 2007 0 2008 0	ata Edit posure/Premium	
1999 0 2000 0 2001 0 2002 0 2003 0 2006 0 2007 0 2008 0		Exposure
2000 0 2002 0 2003 0 2004 0 2005 0 2007 0 2008 0	1999	0
2001 0 2002 0 2004 0 2005 0 2006 0 2008 0	2000	0
2002 0 2003 0 2004 0 2005 0 2007 0 2008 0	2001	0
2004 0 2005 0 2006 0 2007 0 2008 0	2002	0
2004 0 2006 0 2007 0 2008 0	2003	0
2005 0 2007 0 2008 0	2004	0
2006 0 2007 0 2008 0	2005	0
2007 0 2008 0	2006	0
2008 0	2007	0
	2008	0

The user may then enter a title for the analysis and optionally retrieve a prior analysis.

2.0 Editing Data

Users have the ability to edit loss (incurred or paid triangle) or premium/exposure values. The user can choose the element to be edited from the Edit/Data menu option at the top of the screen or by double clicking any number of the paid triangle on the Paid LDF screen, any number of the incurred triangle on the Incurred LDF screen, or any earned premium number on the Paid B-F or Incurred B-F screen.

to to	gnaly	sis™ F	Reserving System	n - [Summar	y of Ultimates Und	ler Different	Methods]								- 7 🛛
File	Edit	Vie	w Graphs Tool	s Help ww	vw.cgconsult.com										
1	Ca .	Сору	Ctrl+C												
In		Сору	Table Ctrl+T										Reserve Percentiles:	10%	42,934,846
		Paste	e Ctrl+V										Mean (Selected):	25%	43,842,592
		Data		Detal	Tripe de	1			Paid LDF F	Paid B-F	Optimize F	Results Residual	44,900,295	50%	44,873,640
	L	Data		Palu	manyle								Optimized Indication:	75%	45,928,935
				Eve					LDF	B-F	Methods Pro	ojections Changes	44,300,235	90%	46,899,984
				- Cope	sure	1								00%	40,010,214
							Summary	of Ultimates Table	e						^
			Earned Premium	Current Paid	Current Incurred	Paid LDF	Incurred LDF	Paid B-F	Incurred B-F	Optimal Weighting	Previous	: Selected	Loss Ratio		
	15	397	11,506,094	9,569,609	10,040,632	9,885,406	10,392,054	9,924,181	10,417,365	10,392,054	10,119,15	7 10,392,054	90.3%		
	19	998	12,384,141	10,708,011	11,376,077	11,393,324	12,024,513	11,370,810	11,972,596	12,024,513	11,722,973	3 12,024,513	97.1%		
	19	399	11,356,614	10,228,039	11,043,409	11,189,475	11,893,751	11,021,094	11,698,141	11,893,751	11,566,520	D 11,893,751	104.7%		
	20	000	11,409,056	9,474,992	10,359,005	10,792,016	11,446,701	10,534,232	11,183,823	11,446,701	11,217,51	B 11,446,701	100.3%		
	20	001	10,867,684	9,511,124	10,973,275	11,527,482	12,575,373	10,872,845	11,961,495	12,575,373	12,012,99	1 12,575,373	115.7%		
	20	002	16,314,960	9,060,008	10,694,769	12,113,231	12,790,944	12,003,749	12,610,537	12,790,944	12,491,39	6 <u>12,790,944</u>	78.4%		
	20	003	20,293,316	7,508,130	9,899,245	11,855,337	12,878,918	12,743,826	13,194,737	12,878,918	12,698,688	6 12,878,918	63.5%		
	20	004	24,079,420	5,387,894	7,962,340	11,244,535	12,023,133	13,918,751	13,496,754	12,023,133	11,828,875	5 12,023,133	49.9%		
	20	005	24,475,213	3,603,477	6,303,684	12,219,391	12,519,116	14,801,988	14,182,353	12,519,116	12,518,53	9 12,519,116	51.2%		
	20	006	27,496,114	1,916,518	4,048,494	12,959,495	13,323,594	16,347,359	15,837,068	13,323,594	(D 13,323,594	48.5%		
	To	otal	170,182,612	76,967,802	92,700,930	115,179,692	121,868,097	123,538,835	126,554,869	121,868,097	106,176,65	5 121,868,097	71.6%		
							Summary o	f Standard Deviati	ons Table						
					► 1007		Paid LDP DE C1/	1 27.992	Falu 64	e incu	EC 049				
					1990		41.223	+ 27,303 7 33,371	40.22	e E	57 701				
					1999		41,237	22,371	40,32	1	176 469				
					2000		43 377	7 3/3/3	120.71	1	91,297				
					2000		92.434	1 135 064	168.90	1	161.961				
					2007		238 348	254.917	454.88	13	506.092				
					2002		005 1 74	101,000	1 100 00		100 500				~
Status		_													
	star		Cognalysis Us	er Man	ognalysis™ Rese	rvi			Search	Desktop			2 🛛 🖞 🔕	h. © 5	👷 ⁰⁾ 1:46 PM

After selecting the data element to edit the user will be given a data edit screen. Users can manually type in new values or paste values from clipboard data copied from other sources. After all values are edited, the user selects the OK button in the lower right corner to save changes and return to Cognalysis. The Data Edit screen is shown below.

	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10		
7	11,892,202	15,172,357	15,836,483	16,204,096	16,421,435	16,526,157	16,237,245	16,272,511	16,291,290	16,305,163		
3	14,523,254	18,634,741	19,457,421	19,893,629	20,123,469	20,246,762	20,305,218	20,332,618	20,352,138			
3	15,114,627	19,253,876	20,087,639	20,516,644	20,723,327	20,816,622	20,863,035	20,895,313				
)	16,825,284	22,973,633	24,021,935	24,455,194	24,685,311	24,768,341	24,842,768					
	19,545,533	26,366,132	27,540,141	28,087,625	28,357,433	28,489,943						
2	17,730,257	23,290,491	24,239,259	24,732,438	25,002,346							
i	19,042,697	24,530,848	25,544,817	26,020,530								
6	20,131,964	26,390,377	27,415,363									
j.	21,753,136	29,443,606										
6	200.240.000											
	20,346,006											
	20,346,000											
	20.346,000											
	20,36,000											
	20.346,000											
	20.346,000											

In the case where premium or exposure is being edited, you will be prompted with a question regarding rescaling of loss ratios.

Cognalysis Reser	ving System
Rescale Selected Se	eed Loss Ratios?
Yes	No

Rescaling would adjust the seed loss ratio to be consistent with the same level of losses before the change in premium or exposure.

3.0 Reviewing and Adjusting Methods

Cognalysis contains four standard techniques commonly used for analyzing ultimates. Those methods are the Paid Loss Development Method, the Incurred Loss Development Method, the Paid Bornhuetter-Ferguson Method and the Incurred Bornhuetter-Ferguson Method. Each of the methods as presented in the model is described below.

3.1 Paid LDF

Users can review and adjust the Paid Loss Development Factor method by selecting the Paid LDF button in the upper right part of the screen. The paid loss triangle will be shown as entered or imported. Double clicking on a cell in the triangle will allow the user to <u>edit</u> the values in the triangle. Below the triangle of loss values, the triangle of age-to-age development factors is shown. The highlighted values in the age-to-age factor triangle are the factors used in the weighted and simple averages.

File Edit View Graphs Tools Help www.cgconsult.com Industry H1 Current View Industry H1 Current View Industry H1 Current View Industry H1 Current View Use Run Tests to Determine N Age1 Age2 Age 1997 1.094.575 2.536.829 4.413; 1998 1.301.045 3.105.752 5.200; 1999 1.460.089 3.242.648 5.561; 2000 1.615.641 3.562.864 5.662; 2001 1.615.641 3.564.037 5.682; 2002 1.894.116 3.524.646 5.662; 2003 1.705.511 3.564.037 5.682; 2004 1.850.733 3.454.746 5.367; 2005 1.965.868 3.603.477 2.2005 1.916.518 Use Triangle 1 to 2 2 to 3 3 to 1 1997 2.318 1.740 1:	ge3 Age4 384 5.996,459 794 7.114,889 0.06 7.219,154 1.00 7.232,129 0.013 7.344,399 0.013 7.344,399	Age5 7,341,758 8,339,339 8,483,535 8,297,800 8,461,272	Age6 8.250,311 9.439,846 9.111,338 8.874,527 8.511,134	Paid L Incur LD1 Age7 8.687.864 9.998.307 9.813.296 9.813.296 9.474.992	DF Paid red Incur 84 9,066,007 10,371,062 10,228,039	B-F Optim red Metho Summ Age9 9.287.547 10.708.011	ize Re ds ary Proje Age10 9,569,609	esults	Residual Triangles Changes	Reserve Percentiles: Mean (Selected): 44.900.295 Optimized Indication: 44.900.295	10% 25% 50% 75% 90% 99%	42,934,846 43,842,592 44,873,640 45,928,935 46,899,984 48,619,274
Paid Loss Triangle Age1 Age2 Age2 Paid Loss Triangle Age1 Age2 Age1 1997 1.034.575 2.536.829 4.413; 1998 1.301.045 3.105.752 5.200; 1999 1.460.089 3.242.648 5.561; 2000 1.515.641 3.562.864 5.562; 2001 1.756.010 3.708.660 5.766; 2002 1.894.116 3.544.704 5.562; 2003 1.705.251 3.564.037 5.664; 2004 1.850.733 3.454.746 5.367; 2005 1.366.866 3.603.477 2.2006 1.316.518 2006 1.316.518 1.22 1.203 1.200 1987 2.318 1.740 1.326 1.203 1.203	ge3 Age4 .384 5.996,458 .794 7.114,889 .016 7.219,154 .190 7.232,129 .013 7.344,399 .013 7.344,393 .241 7.503,179	Age5 7,341,758 8,399,399 8,483,535 8,297,800 8,461,272	Age6 8,250,911 9,439,846 9,111,338 8,874,527	Paid L Incur Age7 8,687,864 9,998,307 9,813,296 9,474,992	DF Paid red Incur 84 9,066,007 10,371,062 10,228,039	B-F Optim red Metho Summ Age9 9,287,547 10,708,011	ize Re ds Proje Age10 9,569,609	ections	Residual Triangles Changes	Reserve Percentiles: Mean (Selected): 44.900.295 Optimized Indication: 44.900.295	10% 25% 50% 90% 99%	42,934,846 43,842,592 44,873,640 45,928,935 46,899,984 48,619,274
Paid Loss Triangle Age1 Age2 Age2 1997 1.094,575 2.536,829 4.413 1998 1.301,045 3.105,752 5.200 1999 1.460,009 3.242,648 5.561, 2000 1.515,641 3.562,864 5.565, 2001 1.756,010 3.708,660 5.766, 2002 1.894,116 3.544,704 5.625, 2003 1.705,261 3.564,037 5.664, 2004 1.850,733 3.454,746 5.387, 2005 1.966,866 3.603,477 2.206 1.916,518 2006 1.916,518 1.02 2.03 1.740	ge3 Age4 .334 5,996,458 .794 7,114,899 .016 7,219,154 .103 7,232,129 .013 7,344,399 .24 7,503,179	Age5 7,341,758 8,399,399 8,483,535 8,297,800 8,461,272	Age6 8,250,911 9,439,846 9,111,338 8,874,527 9,511,124	Paid L Incur LDI 8,687,864 9,998,307 9,813,296 9,474,992	DF Paid red Incur 84 9,066,007 10,371,062 10,228,039	B-F Optim red Metho 	ize Re ds Proje Age10 9,569,609	ections	Residual Triangles Changes	Reserve Percentiles: Mean (Selected): 44,900,295 Optimized Indication: 44,900,295	10% 25% 50% 75% 90% 99%	42,934,846 43,842,592 44,873,640 45,928,935 46,899,984 48,619,274
Use Run Tests to Determine N Paid Loss Triangle Age1 Age2 Age2 1997 1.094,575 2.538,829 4.413, 1998 1993 1.400,089 3.242,446 5.561, 2000 1993 1.460,089 3.242,446 5.565, 2001 2000 1.615,641 3.562,864 5.565, 2002 2003 1.756,010 3.708,860 5.766, 2.002 2003 1.705,211 3.242,449 5.561, 2.003 2004 1.850,733 3.457,746 5.367,4 2005 1.966,886 3.603,477 2.2066 2006 1.916,518 1.02 2.03 3.04 4.997 2.318 1.740 1.3	ge3 Age4 .384 5.996,458 .774 7.114,889 .016 7.219,154 .103 7.232,129 .013 7.344,399 .24 7.503,179	Age5 7,341,758 8,399,399 8,483,535 8,297,800 8,461,272	Age6 8,250,911 9,439,846 9,111,338 8,874,527 9,511,124	Paid L Incur LDP 8,687,864 9,998,307 9,813,296 9,474,992	DF Paid red Incur 8-1 Age8 9,066,007 10,371,062 10,228,039	B-F Optim red Metho Summ Age9 9,287,547 10,708,011	ize Re ds Proje Age10 9,569,609		Residual Triangles Changes	Mean (Selected): 44,900,295 Optimized Indication: 44,900,295	25% 50% 75% 90% 99%	43,842,593 44,873,644 45,928,933 46,899,984 48,619,274
Use Run Tests to Determine N Paid Loss Triangle Age1 Age2 Age 1997 1.094,575 2.538,829 4.413, 1998 1.301,045 3.105,752 5.200, 1999 1.460,089 3.242,648 5.561, 2000 1.615,641 3.562,864 5.565, 2001 1.756,010 3.708,660 5.786, 2002 1.894,116 3.524,744 5.664, 2003 1.705,261 3.564,037 5.664, 2004 1.850,733 3.454,746 5.387, 2005 1.966,886 3.603,477 2.006 1.316,518 U Hoto Age Triangle 1 to 2 2 to 3 3 to 1 to 2 2 to 3 3 to Hoto Age Triangle 1 to 2 2 to 3 3 to	ge3 Age4 .384 5.996,458 .794 7.114,889 .016 7.219,154 .190 7.22,129 .101 7.23,123 .103 7.344,339 .241 7.503,179	Age5 7,341,758 8,399,399 8,483,535 8,297,800 8,461,272	Age6 8,250,911 9,439,846 9,111,338 8,874,527 9,511,124	Age7 8,687,864 9,998,307 9,813,296 9,474,992	DF Paid red Incur B-1 Age8 9,066,007 10,371,062 10,228,039	B-F Optim red Metho Summ Age9 9,287,547 10,708,011	ize Re ds Proje Age10 9,569,609	ections	Residual Triangles Changes	44,900,295 Optimized Indication: 44,900,295	50% 75% 90% 99%	44,873,64(45,928,93) 46,899,98(48,619,27(
Use Run Tests to Determine N Paid Loss Triangle Age1 Age2 Age1 1997 1.094,575 2.536,829 4.413; 1989 1.301,045 3.105,752 5.200, 1999 1.460,089 3.242,648 5.561, 2000 1.615,641 3.552,864 5,565, 2001 1.705,610 3.706,660 5,766, 2002 1.894,116 5,524,704 5,562, 2003 1.705,513 3.564,037 5,684, 2004 1.890,733 3.454,746 5,387,74 2005 1.966,886 3,603,477 2006 1.916,518 Kapeto Age Triangle 1.162 2.103 3.04 1.997 2.318 1.740 1.33	ge3 Age4 ,384 5.996,458 ,794 7.114,889 ,016 7,219,154 ,190 7,232,129 ,013 7,344,339 ,241 7,503,179	Age5 7,341,758 8,399,399 8,483,535 8,297,800 8,461,272	Age6 8,250,911 9,439,846 9,111,338 8,874,527 9,511,124	Age7 8,687,864 9,998,307 9,813,296 9,474,992	Age8 9,066,007 10,371,062 10,228,039	Age9 9,287,547 10,708,011	ds ary Proje Age10 9,569,609	ections	Changes	Optimized Indication: 44,900,295	75% 90% 99%	45,928,93 46,899,98 48,619,27
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2001 1,756,010 3,708,660 5,766,1 2002 1,894,116 3,524,704 5,625, 2003 1,705,261 3,564,037 5,664, 2004 1,850,733 3,454,746 5,367,4 2005 1,966,886 3,603,477 2 2006 1,916,188 2 2 A ge-to-Age Triangle 1 1937 2,318 1,740 1.3	,013 7,344,399 ,241 7,503,179	8,461,272	9 511 124									
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Age-to-Age Triangle 1 to 2 2 to 3 3 to ▶ 1997 2.318 1.740 1.3]				
▶ 1997 2.318 1.740 1.	to 4 in 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10						
	.359 1.224	1.124	1.053	1.044	1.024	1.030						
2.387 1.675 1.3	.368 1.181	1.124	1.059	1.037	1.032							
1999 2.221 1.715 1.:	.298 1.175	1.074	1.077	1.042								
2000 2.205 1.562 1.3	.300 1.147	1.070	1.068									
2001 2.112 1.560 1.:	.269 1.152	1.124										
2002 1.861 1.596 1.3	.334 1.207											
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Eactor Calculations 1102 2103 31	to4 4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to Il≹	1				~
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The factor calculations are shown below the triangle of age-to-age factors. The rows highlighted in yellow contain the values that may be edited. A description of each row is given below.

<mark>lf</mark> Cognalysis™ Reserving System	n - [Loss Dev	elopment F	actor Metho	d: Paid Loss	1									- 6 🛛
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Industry H1 Current Vi	ew											Reserve Percentiles:	10%	42.934.846
	011											Mean (Selected):	25%	43,842,592
							Paid	DF Paid	B-F Ooti	mize Resu	Its Residual	44,900,295	50%	44,873,640
Use Run											Triangles	Optimized Indication:	75%	45,928,935
Tests to Determine N							Incur LD	red Incu F B·	rred Meth F Sum	nods Project	ions Changes	44,900,295	90%	46,899,984
												1	33%	40,013,274
Age-to-Age Triangle	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10					^
1997	2.318	1.740	1.359	1.224	1.124	1.053	1.044	1.024	1.030					
1998	2.387	1.675	1.368	1.181	1.124	1.059	1.037	1.032						
1999	2.221	1.715	1.298	1.175	1.074	1.077	1.042							
2000	2.205	1.562	1.300	1.147	1.070	1.068								
2001	2.112	1.560	1.269	1.152	1.124									
2002	1.861	1.596	1.334	1.207										
2003	2.090	1.589	1.325											
2004	1.867	1.560												
2005	1.832													
Factor Calculations	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to Ult				
 Periods (N) 	6	8	7	6	5	4	3	2	1	0				
Simple Average	1.994	1.625	1.322	1.181	1.103	1.064	1.041	1.028	1.030	1.033				
Weighted Average	1.985	1.618	1.320	1.180	1.103	1.064	1.041	1.029	1.030	1.033				
Regression Factor	1.957	1.593	1.319	1.180	1.103	1.064	1.041	1.029	1.030	1.033				
Prior Selection	2.027	1.616	1.321	1.176	1.098	1.063	1.040	1.024	1.035	0.000				
Selected Age-to-Age Factor	1.994	1.625	1.322	1.181	1.103	1.064	1.041	1.028	1.030	1.033				
Age-to-Ultimate	6.762	3.391	2.087	1.579	1.337	1.212	1.139	1.094	1.064	1.033				
Age-to-Ultimate St. Dev	0.687	0.217	0.089	0.045	0.026	0.010	0.005	0.005	0.004	0.004				
Estimated Ultimates	12,959,495	12,219,391	11,244,535	11,855,337	12,113,231	11,527,482	10,792,016	11,189,475	11,393,324	9,885,406				
Ultimate St. Dev	1,316,298	781,991	477,334	335,171	238,348	92,434	43,377	55,622	41,237	35,614				
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Periods (N) – This value can be typed in by the user or it can be set to a default which employs run tests to determine the length of history to use for factor averages . A run test is performed using all of the available data points where a run is defined as a series of factors either above or below the median value. If an insufficient number of runs are observed given total number of data points and the significance level of the test, then the earliest factor is dropped. This procedure is repeated until the number of runs is sufficient given the remaining number of data points and the significance level. You can modify the significance level in the "tools – options – default squaring options" menu item to be either more stable or more responsive.

In order to set N to the default value, the user presses the "Use Run Tests to Determine N" button shown toward the top of the screen on the left side.

Simple Average - The simple average of development factors for each period for the most recent N values (the highlighted values in the age-to-age triangle).

Weighted Average - The weighted average of development factors for each period for the most recent N values (the highlighted values in the age-to-age triangle).

Regression Factor- The projected future value of the age to age factor based on linear regression. This regression method employs a stabilizing technique intended to avoid distortions caused by random fluctuations of data. More information about this technique can be found at <u>www.cgconsult.com/docs/FactorMethods.pdf</u>. A key parameter in this method is

the significance level, which can be adjusted in the "tools – options – default squaring options" menu item.

Prior Selection – If a previous analysis file was imported, this row will be populated with the development factors from that previous analysis. If a previous analysis file was not retrieved, this row will be blank.

Selected Age-to-Age Factor- In this row the user will select the incremental development factors. The user can type values into the cells or double click the row title for one of the averages shown above to select that set of averages. The user can also double click on any factor within the age-to-age factor triangle to select that factor for the corresponding period.

Age-to-Ultimate- This row shows the accumulated selected development factors.

Age-to-Ultimate St. Dev- This is the estimated factor to provide the standard deviation of ultimate losses when multiplied by the current loss amount.

Estimated Ultimates- The estimated ultimate given the current valuation and selected development factors are presented in this row.

Ultimate St. Dev- This row provides the estimated standard deviation of the ultimate loss.

3.2 Incurred LDF

Users can review and adjust the Incurred Loss Development Factor method by selecting the Incurred LDF button in the upper right part of the screen. The layout and functionality of this section is exactly like that of the Paid LDF section. Please refer to the Paid LDF section above for further explanations.

3.3 Paid B-F

Users can review and adjust the Paid Bornhuetter-Ferguson method by selecting the Paid B-F button in the upper right part of the screen. As in the Paid LDF section, the Paid Loss Triangle is shown at the top of this section. Below the triangle, the B-F calculations are listed. Each row in this calculation area is described below.

Co	gnalysis™Reserving Systen	n - [Bornhue	etter-Fergus	on Method:	Paid Loss]										_ 7 🗙
File	Edit View Graphs Too	ls Help w	ww.cgconsult.c	om											
2	3 3														
In	dustry H1 Current Vi	ew											Reserve Percentiles:	10%	42,934,846
	dustry in ourion in	vn											Mean (Selected):	25%	43,842,592
					Paid LDF Paid B-F Optimize Results Residual						44,900,295	50%	44,873,640		
	Select Seed											I riangles	Optimized Indication:	75%	45,928,935
	Loss Ratios							Incur	red Incu F B-	red Meth	ods Pro	jections Changes	44,900,295	90%	46,899,984
	Dynamically													99%	48,619,274
Г	Paid Loss Triangle	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10				
	1997	1,094,575	2,536,829	4,413,384	5,996,458	7,341,758	8,250,911	8,687,864	9,066,007	9,287,547	9,569,609				
	1998	1,301,045	3,105,752	5,200,794	7,114,889	8,399,399	9,439,846	9,998,307	10,371,062	10,708,011					
	1999	1,460,089	3,242,648	5,561,016	7,219,154	8,483,535	9,111,338	9,813,296	10,228,039						
	2000	1,615,641	3,562,864	5,565,190	7,232,129	8,297,800	8,874,527	9,474,992							
	2001	1,756,010	3,708,660	5,786,013	7,344,399	8,461,272	9,511,124								
	2002	1,894,116	3,524,704	5,625,241	7,503,179	9,060,008									
	2003	1,705,261	3,564,037	5,664,483	7,508,130										
	2004	1,850,733	3,454,746	5,387,894											
	2005	1,966,886	3,603,477												
	2006	1,916,518													
	B-F Calculations	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997]			
	 Earned Premium 	27,496,114	24,475,213	24,079,420	20,293,316	16,314,960	10,867,684	11,409,056	11,356,614	12,384,141	11,506,094				
	Percent of Ultimate	14.8%	29.5%	47.9%	63.3%	74.8%	82.5%	87.8%	91.4%	94.0%	96.8%				
	Prior Seed Loss Ratio	0.0%	67.7%	71.0%	73.2%	74.4%	74.4%	74.4%	79.2%	86.9%	93.6%				
	Selected Seed Loss Ratio	61.6%	64.9%	68.0%	70.3%	71.6%	71.6%	76.1%	81.2%	89.2%	96.3%				
	Estimated Ultimates	16,347,359	14,801,988	13,918,751	12,743,826	12,003,749	10,872,845	10,534,232	11,021,094	11,370,810	9,924,181				
	St. Dev. Factor	0.166	0.137	0.090	0.084	0.039	0.022	0.014	0.008	0.004	0.004				
	Ultimate St. Dev.	2,816,870	2,182,883	1,481,538	1,196,066	454,883	168,908	120,711	77,011	48,325	39,246				
Status															
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Earned Premium-The earned premium or exposure that the user imported into the system will be shown in this row. If the user imported or entered a zero value for premium or exposure, this row will show zeroes but will use a value of 0.001 for calculations. The user may edit premium or exposure by double-clicking any premium cell on this page.

Percent of Ultimate- This row shows estimated percent of ultimate based on the selected age-toultimate factor in the Paid LDF section of the analysis. The Age 1 percent of ultimate will be equal to 1/(Age 1 Age-to-Ultimate value).

Prior Seed Loss Ratio- If a prior analysis file was retrieved, this row will show the seed loss ratio used in the prior analysis. If a prior analysis file was not retrieved, this row will be blank.

Selected Seed Loss Ratio- The user has the option of typing (or copying) in seed loss ratios or using the "Select Seed Loss Ratios Dynamically" option. If the user chooses the "Select Seed Loss Ratios Dynamically" button located in the upper left quadrant of the screen, the user will be prompted to enter a radius as shown in the print screen on the next page.

Radius	×
Enter radius	OK Cancel
8	

This radius is defined as the number of periods before and after the evaluated period to be used in estimation of the seed loss ratio for that period. The Cognalysis[™] Reserving System will use the minimum variance weighting of paid link ratio and incurred link ratio estimated ultimate losses for the entire period specified by the radius. The default value for the radius is determined as that radius which minimizes the variance of the total reserve estimate. The outcome for this process will change each time new loss development factors are selected. The selected seed loss ratios will only update if you press the "Select Seed Loss Ratios Dynamically" button.

Estimated Ultimates- This row provides the estimated ultimate given the seed loss ratio. The estimated ultimate is calculated for each age as (1-Percent of Ultimate)*Premium*Seed Loss Ratio +Cumulative Loss.

St. Dev. Factor- This is the factor that when applied to the seed ultimate (premium * seed loss ratio) gives the estimated standard deviation for the ultimate loss.

Ultimate St. Dev.- This row provides the estimated standard deviation of the ultimate loss.

3.4 Incurred B-F

Users can review and adjust the Incurred Bornhuetter-Ferguson method by selecting the Incurred B-F button in the upper right part of the screen. The layout and functionality of this section is exactly like that of the Paid B-F section. Please refer to the Paid B-F section above for further explanations.

4.0 Selecting Ultimates

Users can review indications and select ultimates in the Methods Summary section shown below by selecting the Methods Summary button in the upper right part of the screen.

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File	Edit	View	Graphs Tool	s Help www	w.cgconsult.com										
6	8	í													
S	ample	An	alvsis										Reserve Percentiles:	10%	172,428
-			,,										Mean (Selected):	25%	172,816
									Paid LDF	Paid B-F	Optimize Results	Residual	173,249	50%	173,248
													Optimized Indication:	75%	173,681
									LDF	B-F	Methods Summary Projection	is Changes	173,249	90%	174,072
													,	00%	
		_					Summary	of Ultimates Tab	le	O - Key al					
			Earned Premium	Current Paid	Current Incurred	Paid LDF	Incurred LDF	Paid B-F	Incurred B-F	Weighting	Previous	Selected	Loss Ratio		
	► 200	08-1	158,492	9,123	20,111	319	51,203	-1,297,442	48,876	45,483	0	45,483	28.7%		
	200	08-2	155,398	4,606	15,636	336	53,788	-583,467	48,469	47,690	0	47,690	30.7%		
	200	8-3	166,566	3,303	11,355	347	55,277	-432,579	52,008	49,078	0	49,078	29.5%		
	200	08-4	159,326	1,762	6,747	361	56,197	-186,687	49,510	49,792	0	<u>49,792</u>	31.3%		
	To	al	639,782	18,794	53,849	1,363	216,465	-2,500,175	198,863	192,043	0	192,043	30.0%		
							Summary of	Standard Devia	tions Table						
							Paid LDF	Incurred LDF	Paid	B-F Incu	rred B-F				
					▶ 2008-1		2,254	255	5 1,873	.607	682				
					2008-2		2,380	26	8 1,800	.896	727				
					2008-3		2,501	30	6 2,209	,487	1,678				
					2008-4		2,577	33.	1 2,745	.279	2,296				
					Perfectly	Independent	4,862	58	3 4,378	.586	3,013				
					Perfectly	Correlated	9,712	1,16	0 8,629	.269	5,383				
					Partially (Correlated	4,862	873	5 6,360	.828	4,329				
Statu	s														
-	start		Cognalysis Us	er Man	(⊤Cognalysis™ Rese	rvi			Sear	ch Desktop			2 3 3 0 2 4	ال <i>ہ ©</i> ق	🛒) 1:24 PM

For each period, the current data is shown (Earned Premium, Paid and Incurred). The indicated ultimate from each of the four methods as well as a blended estimate intended to minimize variance (optimal weighting) is also shown. If a previous analysis file was retrieved the previous ultimates will be shown otherwise the previous column will contain zeroes. The user can type in a selected ultimate value, double click on a single cell for a given period to use that value as the ultimate for that period or double click on a column to use that method as the ultimate for all periods. The implied loss ratio is supplied in the last column. If Premium was not entered into the model, a value of one is used for loss ratio calculations. Individual cells for various indications that highlighted in Deep Sky Blue are more than 5% below the selected ultimate for that period while cells highlighted in Tomato Red are more than 5% higher than the selected ultimate for that period.

Below the Summary of Ultimates Table, the standard deviations of reserves by period are shown for each of the four methods. Standard deviations for all years for each method are also provided assuming three different scenarios of correlations between years (perfectly independent, perfectly correlated and partially correlated).

5.0 Reviewing Diagnostics and Reports

Cognalysis offers a variety of diagnostics and reports to help the user refine the analysis being performed. The diagnostics include graphs and summaries of the optimization routine, results, projections, residuals, changes and reserve percentiles. A description of each of the available options is described below.

5.1 Optimization Metrics

The Cognalysis[™] Reserving System provides valuable insight into the different levels of variability of reserve methods arising from using each of the four basic methods of loss development. It also develops a blended estimate which reflects the potential for diversification across these methods to reduce the overall uncertainty.

Users can review the details of this analysis as shown below by selecting the Optimize button in the upper right part of the screen.

🛵 Cognalysis™ i	Reserving	System - [Optim	ization of Method	Weights]								_ 7 🗙
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Industry H	1 Curro	nt View								Reserve Percentiles:	10%	42,934,846
industry in										Mean (Selected):	25%	43,842,592
							Paid I DE Paid B.E	Ontimize Besults	Residual	44,900,295	50%	44,873,640
									Triangles	Optimized Indication:	75%	45,928,935
							Incurred Incurred	Methods Summary Projections	Changes	44,900,295	90%	46,899,984
									\square	1	99%	48,619,274
Methods Or	otimization											^
			Weights Applied	to Each Method]						
		Paid LDF	Incurred LDF	Paid BF	Incurred BF	St. Deviation	Estimated Reserve					
	▶ 1	-0.333	3 1.5841	0.3635	i -0.6143	1,112,587	44,857,770	Four Methods Combined				
	2	-0.036	7 1.1223	-0.0855	i 0	1,487,082	45,015,098					
	3	-0.132	9 1.331	(-0.1981	1,330,997	44,860,734	Three Methods Combined				
	4	0.954	з с	-0.0657	0.1114	2,276,140	38,929,889					
	5		D 1.2146	0.2655	-0.4806	1,214,766	43,079,895					
	6	-0.036	1 1.0361	(0	1,546,707	45,141,746					
	7	0.976	1 0	0.0235	0	2,286,837	38,411,674	Two Methods Combined				
	8	0.955	5 C	(0.0445	2,280,860	38,718,085					
	9		0 1.0855	-0.0855	i 0	1,488,140	44,757,447					
	10		0 1.1876	(-0.1876	1,347,834	44,021,057					
	11		0 0	-0.1409	1.1409	4,992,326	50,012,026					
	12	-	1 0	(0	2,290,256	38,211,890					
	13	1	0 1	(0	1,547,824	44,900,295	One Method Only				
	14		0 0	1	0	5,604,829	46,571,033					
	15		0 0	(1	5,002,229	49,587,067					
				Correlation Ma	trix and St. Dev of	Reserves						
			Paid LDF	Incurred LDF	Paid BF	Incurred BF	St. Dev of Reserve					
		Paid LDF	1.000	0.703	0.358	0.374	2,290,256					
		Incurred LDF	0.703	1.000	0.520	0.708	1,547,824					_
		Paid BF	0.358	0.520	1.000	0.918	5,604,829					~
Chabura												
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The four common methods discussed above (the Paid Loss Development, Incurred Loss Development, Paid Bornhuetter-Ferguson, and Incurred Bornhuetter-Ferguson methods) are used to determine the optimal weighted estimated ultimate.

Given the standard deviation of the reserve using each method, and the correlations matrix for these methods (both shown at the bottom of the screen), weights can be found that minimize the variance of the combined estimate. The result is the first row of the Weights table. These weights have the potential

to be negative for individual methods. While negative factors are an interesting result that bears some consideration, the Cognalysis[™] Reserving System does not allow them for the minimum variance weighting it ultimately uses. The remaining 14 rows show the systematic determination of the minimum variance *non-negative* weighting. Rows 2-5 eliminate one of the methods each and optimizes. Rows 6-11 eliminate two of the methods each and optimizes. Rows 12-15 eliminate three of the methods each and optimizes. The weighting that is used is the one that minimizes the variance among those with only non-negative values.

For more information about this technique please see: www.cgconsult.com/docs/MinVarianceReserves.pdf

5.2 Summary of Results

Users can review the selected ultimate, selected reserve and reserve range percentiles (10th, 25th, 50th, 75th, 90th and 99th) in the Results section shown below by selecting the Results button in the upper right part of the screen.

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File	Edit View	Graphs Tools	Help www.co	gconsult.com											
1 📂															
In	ductor H1	Current Vie										Reserve	Percentiles:	10%	42 934 846
	luusiiyiii	Current vier	~									Mean (Selected):	25%	43 842 592
											Besic	lual 44,900,	295	50%	44.873.640
								Paid LDF	Paid B-F	Uptimize	Hesults Triang	gles Optimize	ed Indication:	75%	45,928,935
								Incurred	Incurred	Methods D	aiaatiana Chan	44,900	295	90%	46,899,984
	0.0-6							LDF	B-F	Summary	ojections			99%	48,619,274
г		os 🔾 Annualize													
							Reserve Range	e Percentiles:							
		Earned Premium	Current Paid	Current Incurred	Selected Ultimate	Selected Reserve	10th	25th	50th	75th	90th	99th			
	1997	11,506,094	9,569,609	10,040,632	10,392,054	822,445	786,907	803,326	821,969	841,046	858,594	889,652			
	1998	12,384,141	10,708,011	11,376,077	12,024,513	1,316,502	1,275,283	1,294,460	1,316,104	1,338,110	1,358,232	1,393,569			
	1999	11,356,614	10,228,039	11,043,409	11,893,751	1,665,712	1,624,601	1,643,802	1,665,400	1,687,282	1,707,224	1,742,092			
	2000	11,409,056	9,474,992	10,359,005	11,446,701	1,971,709	1,927,893	1,948,386	1,971,410	1,994,706	2,015,909	2,052,924			
	2001	10,867,684	9,511,124	10,973,275	12,575,373	3,064,249	2,893,220	2,971,647	3,061,277	3,153,610	3,239,096	3,391,660			
	2002	16,314,960	9,060,008	10,694,769	12,790,944	3,730,936	3,410,527	3,554,800	3,722,258	3,897,604	4,062,482	4,362,696			
	2003	20,293,316	7,508,130	9,899,245	12,878,918	5,370,788	5,215,827	5,288,025	5,369,411	5,452,050	5,527,518	5,659,837			
	2004	24,079,420	5,387,894	7,962,340	12,023,133	6,635,239	6,377,007	6,496,614	6,632,132	6,770,476	6,897,463	7,121,583			
	2005	24,475,213	3,603,477	6,303,684	12,519,116	8,915,639	8,346,855	8,606,431	8,904,303	9,212,484	9,498,980	10,012,996			
	2006	27,496,114	1,916,518	4,048,494	13,323,594	11,407,076	10,292,590	10,790,758	11,372,557	11,985,725	12,565,841	13,630,599			
	Total	170,182,612	76,967,802	92,700,930	121,868,097	44,900,295	42,934,846	43,842,592	44,873,640	45,928,935	46,899,984	48,619,274			
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Radio buttons are available above the table on the left to choose a ratio view or to annualize the values if a monthly or quarterly analysis was performed.

5.3 Projected Losses

The Cognalysis[™] Reserving System provides projections of both paid and incurred losses. These projections:

- Tie to the selected accident year ultimate losses (both for paid and incurred)
- Are based on weighted projections of intermediate period loss from the four basic methods (Paid LDF, Paid BF, Incurred LDF, Incurred BF).
- Rely on past variability by development period to reconcile between method projections, and selected values.

Users can review the projected paid and incurred losses in the Projections screen by selecting the Projections button in the upper right area of the screen.

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Inc	dustry H1	Curren	t Viev	N											Rese	rve Percentiles:	10%	42,934,846
	····, ···														Me	an (Selected):	25%	43,842,592
										Paid LD	F Paid B	-F Optimiz	e Resu	lts Resid	tual 44.	900,295	50%	44,873,640
													==			timized Indication:	75%	45,928,935
										LDF	d Incurre B-F	d Method Summa	ry Projec	ions Chan	ges 44	,900,295	90%	46,833,384
																	00.0	40,010,214
					Incremental	Paid Loss ir	n Period											^
	Cal Yr	Paid		Inc Yr	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	tail			
	2007	11,578,50		1997	1,094,575	1,442,254	1,876,555	1,583,074	1,345,300	909,153	436,953	378,143	221,540	282,062	822,445			
	2008	9,796,26	3	1998	1,301,045	1,804,707	2,095,042	1,914,095	1,284,510	1,040,447	558,461	372,755	336,949	327,588	988,914			
	2009	7,358,31	4	1999	1,460,089	1,782,559	2,318,368	1,658,138	1,264,381	627,803	701,958	414,743	366,695	320,692	978,325			
	2010	5,192,27	3	2000	1,615,641	1,947,223	2,002,326	1,666,939	1,065,671	576,727	600,465	435,939	343,276	308,506	883,988			
	2011	3,920,47	7	2001	1,756,010	1,952,650	2,077,353	1,558,386	1,116,873	1,049,852	777,432	479,151	385,234	330,088	1,092,343			
	2012	2,526,18		2002	1,894,116	1,630,588	2,100,537	1,877,938	1,556,829	1,136,062	716,474	463,741	350,340	344,546	719,772			
	2013	1,891,85	1	2003	1,705,261	1,858,776	2,100,446	1,843,647	1,572,500	1,153,716	719,392	458,364	351,098	339,885	775,834			
	2014	1,300,25	3	2004	1,850,733	1,604,013	1,933,148	1,866,488	1,422,808	1,016,067	654,930	422,759	317,358	323,034	611,796			
	2015	841,07		2005	1,966,886	1,636,591	2,304,067	1,930,215	1,442,258	987,255	665,751	444,318	321,729	347,728	472,318			
L	2016	495,084	4	2006	1,916,518	1,969,293	2,441,017	2,044,791	1,527,313	1,043,980	704,853	471,254	340,735	368,757	495,084			
					Incremental	Incurred Lo	ss in Period											
	Cal Yr	Incurred		Inc Yr	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	tail			
	2007	8,744,65	2	1997	2,810,811	2,094,776	1,837,182	1,121,791	919,213	445,131	176,680	239,170	189,218	206,660	351,422			
	2008	6,291,88	2	1998	3,331,607	2,504,015	1,942,171	1,421,088	751,913	486,222	462,833	264,887	211,341	238,898	409,538			
	2009	4,280,24	3	1999	3,131,986	2,562,860	2,063,623	1,306,512	694,307	442,633	547,633	293,855	209,825	236,318	404,199			
	2010	2,918,20	5	2000	3,412,438	2,581,511	1,619,651	1,397,435	896,753	125,770	325,447	269,334	201,938	227,436	388,988			
	2011	2,087,94	5	2001	3,669,308	2,766,810	1,895,125	1,309,580	697,379	635,073	406,011	295,861	221,828	249,836	428,561			
	2012	1,624,97	1	2002	3,945,367	2,495,772	2,172,109	1,261,373	820,148	470,570	413,118	301,040	225,710	254,209	431,528			
	2013	1,205,83	3	2003	4,106,387	2,810,301	1,686,758	1,295,799	871,134	473,897	416,038	303,168	227,306	256,007	432,124			
	2014	883,92	2	2004	4,087,515	2,003,564	1,871,261	1,281,937	813,496	442,542	388,512	283,109	212,267	239,068	399,862			
	2015	683,35	4	2005	3,874,509	2,429,175	1,985,660	1,334,584	846,906	460,717	404,467	294,736	220,984	248,887	418,490			
	2016	446,15	71	2006	4,048,494	2,659,861	2,113,132	1,420,259	901,274	490,293	430,433	313,657	235,171	264,864	446,157			×
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On the left side of the screen the projected calendar year payments and incurred loss changes are shown for the number of periods in the future as was provided for history. These values are the sum of the each new diagonal added to complete the squared triangle.

To the right of the calendar period projections, the squared triangle is provided. The projected payments and incurred losses are shown by incurred period and development period (shown with aqua shading).

5.4 Residual Triangle

It can be useful when reviewing reserve analyses to consider the residual errors observed from applying current parameters to past development. Patterns observed in these residual triangles may suggest changes to selected parameters are needed.

The residual triangles can be viewed by selecting the Residual Triangle button in the upper right area of the screen. The residuals are provided for each method and older ages can be viewed by using the scroll bar at the bottom of each method.

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Ir	ductor	H1 Curro	ot Vic	, w														Reserve	e Percentile	\$: 10%	42 934 846
	uusuy	III Culle	IL VIE	***														Mean	(Selected):	25%	43.842.592
														-			Residual	44,900),295	50%	44,873,640
												Paid LDF	Paid B-		mize i	lesults	Triangles	Optimi	zed Indication	75%	45,928,935
												Incurred	Incurre	d Meth	nods Pr	ojections	Changes	44,90	0,295	90%	46,899,984
												LDF	B+	Sum	mary		changee			99%	48,619,274
ſ					Paid I D	F Besidua	18							Incurred	DF Besid	uals					~
		Age	1 /	Age2	Age3	Age4	Age5	Age6	Age7	Age8		Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8		
	1997	354.2	6 29	1.037	161,964	259,941	152.952	-91,105	21,941	-32,306	▶ 1997	248.073	291,922	36,205	227,132	58,645	-164,789	-5,375	5,968		
	1998	511,4	8 15	3,947	239,439	-3,285	175,309	-45,689	-37,176	46,559	1998	315,149	103,950	168,863	-57,589	48,387	76,663	-18,509	-789		
	1999	331,2	1 29	1,713	-132,509	-42,286	-246,001	118,832	12,398		1999	505,145	269,747	57,398	-103,411	13,224	170,162	14,367			
	2000	341,2	6 -22	4,464	-125,052	-243,344	-277,946	32,495			2000	339,539	-268,443	171,645	103,782	-310,173	-45,795				
	2001	207,1	6 -24	0,560	-304,710	-212,463	178,341				2001	356,075	-132,252	-31,750	-151,013	180,192					
	2002	-252,1	3 -10	2,403	66,610	198,754					2002	-96,334	143,150	-125,360	-48,819						
	2003	163,7	7 -12	7,077	19,683						2003	112,405	-491,999	-89,356							
	2004	-235,6	6 -22	6,068							2004	-681,933	-47,429								
	2005	-318,4	14								2005	-116,377									
	2006										2006										
	<				Ш					>	<			Ш					>		
				Paid B	ornhuette	-Ferguson	Residuals						Incurred	d Bornhuet	ter-Fergus	on Residua	als				
		Age	11 /	Age2	Age3	Age4	Age5	Age6	Age7	Age8		Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8		
	1997	-186,5	0 -16	2,233	-123,303	71,058	55,965	-150,307	-20,750	-66,550	1997	-121,298	86,484	-63,808	176,828	35,157	-177,892	-26,759	852		
	1998	180,8	9 6	2,458	212,910	14,145	189,855	-27,012	-24,925	49,738	1998	294,684	196,800	239,096	11,787	77,496	109,340	-233	23,548		
	1999	426,9	8 62	1,599	238,016	203,900	-82,258	213,215	82,766		1999	718,546	606,615	319,804	76,462	101,435	252,543	72,537			
	2000	670,93	6 40	4,784	329,866	67,207	-91,809	140,304			2000	845,053	247,849	468,430	315,039	-195,475	47,614				
	2001	808,8	5 64	5,601	360,072	222,028	450,695				2001	1,210,558	665,686	476,985	176,034	347,166					
	2002	-86,5	14 -4	8,861	78,985	213,455					2002	159,470	326,430	11,451	37,487						
	2003	-238,3	6 -52	4,535	-353,348						2003	-42,939	-567,302	-230,685							
	2004	-802,9	6 -1,07	9,669							2004	-1,271,237	-715,832								
	2005	-698,4	8								2005	-747,708									
	2006				101			1		5	2006			100)		5		~
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5.5 Changes in Ultimate Loss Estimates and Actual vs. Projected

The change in estimated ultimate and the actual paid and incurred loss compared to expected can be viewed by selecting the Changes button in the upper right area of the screen. If a previous analysis is retrieved at the start of the analysis, for all but the most recent year change in selected ultimate is shown by period. Also, based on the projected payments and incurred losses from the previous analysis the variance of actual versus projected is provided. If a previous analysis is not retrieved, the prior estimated ultimate and projected losses will be zero.

inalysis – Rese	rving System -	[Actual vs. P	rojected Incr	emental Loss	, Change to S	Selected Ultima	ites]						
Edit View	Graphs Tools	Help www.c	gconsult.com										
lustry H1 C	urrent View	,									Reserve Percentiles:	10%	42,934,8
,											Mean (Selected):	25%	43,842,5
							Paid I	.DF Paid B-F	Optimize	Results Residual	44,900,295	50%	44,873,0
											Optimized Indication:	75%	45,928,
							Incur LDI	red Incurred F B-F	Methods Summarv	Projections Changes	44,900,295	90%	46,899,
												33%	48,613
	Prior	Current Estimated	Change to	Projected	Actual Paid	Paid Variance	Projected	Actual	Incurred				
	Ultimate	Ultimate	Ultimate	Paid	Actuari ala	1 did validrice	Incurred	Incurred	Variance				
1997	10,119,157	10,392,054	-272,897	831,610	282,062	549,548	285,185	206,660	78,525				
1998	11,722,973	12,024,513	-301,540	255,218	336,949	-81,731	223,295	211,341	11,954				
1999	11,566,520	11,893,751	-327,231	522,486	414,743	107,743	268,739	293,855	-25,116				
2000	11,217,518	11,446,701	-229,183	701,382	600,465	100,917	391,309	325,447	65,862				
2001	12,012,991	12,575,373	-562,382	1,319,420	1,049,852	269,568	403,190	635,073	-231,883				
2002	12,491,396	12,790,944	-299,548	1,600,064	1,556,829	43,235	878,841	820,148	58,693				
2003	12,698,686	12,878,918	-180,232	2,114,772	1,843,647	271,125	1,436,775	1,295,799	140,976				
2004	11,828,875	12,023,133	-194,258	2,265,407	1,933,148	332,259	1,924,781	1,871,261	53,520				
2005	12,518,539	12,519,116	-577	1,839,021	1,636,591	202,430	2,572,674	2,429,175	143,499				
TOTAL	106,176,655	108,544,503	-2,367,848	11,449,380	9,654,286	1,795,094	8,384,789	8,088,759	296,030				

5.6 Reserve Percentiles

As can be seen on all screen views in the user manual, the reserve percentiles for all periods combined is provided in the upper right corner of the analysis at all times. This summary contains the mean (selected) reserve, the optimal indicated reserve and the reserve at 6 different percentiles. This gives the user a status of the analysis that can be viewed at all times regardless of which specific screen the user may be viewing.

5.7 Graphs

Eight main categories of graphs are available for the user to view and print. The graphs can be accessed at any time by selecting the desired graph option from the Graph menu at the top of the screen. A description of each graph type is provided below.



Paid Development – This graph (shown above) shows the paid as a percent of ultimate at each age for the periods reviewed based on the selected ultimate and projected losses. The historical portion of each line is black while the projected portion is red. The user can select a specific period to be highlighted (bold) from the drop down menu on the right. The "up" and "down" arrow keys on the keyboard will also scroll the user through the different accident periods.

Incurred Development – Like the paid development graph, the incurred development graph shows the reported as percent of ultimate at each age for the periods reviewed based on the selected ultimate and projected losses. The historical portion of each line is black while the projected portion is red. The user can select a specific period to be highlighted (bold) from the drop down menu on the right.

Projection and Revision – This graph (shown on the next page) provides a stacked bar chart that splits the ultimate loss for each period into each of its components (paid loss, case reserve and IBNR with the total bar reflecting the ultimate). If a previous analysis has been retrieved, the prior selected ultimate is also shown, as well as projected values for paid, case, and IBNR reserves to the current point in time. If the user has performed a quarterly or monthly analysis, double-clicking on a bar will show the quarterly or monthly view for that period. Once in this view, the user can return to an annual view by clicking the Back button in the lower right area of the screen.



Seed Loss Ratios – This graph (shown below) shows a line with the seed loss ratios as well as the loss ratio implied by each of the four indications for each accident period.



Ultimate Box –Whisker – This graph shows the selected values for each period while also presenting the values at various percentiles. The user can choose to view this graph from a reserve or an ultimate perspective by selecting one of those two options from the drop down menu to the right of the graph. If the user has performed a quarterly or monthly analysis, double-clicking on a box will show the quarterly or monthly view for that period. Once in this view, the user can return to an annual view by clicking on the Back button in the lower right area of the screen.



Range and Methods – This graph shows a probability density function for the ultimates. This probability density function is shown in relation to premium, current paid and current incurred values. Box and whisker graphs for each of the four methods are also added to give the user perspective relative to the method indications. The user has the option of choosing to view this graph for all periods or for an individual period by choosing from the drop down menu on the right (or by scrolling through by using the "up" and "down" arrow keys.



Paid LDF Perspective – This graph shows the observed paid development factors for each period for a given age-to-age relative to averages, prior and selected values. The user can select the desired age to view from the drop down menu to the right.

Graphing can become useless when outlier values change the scale. The user may also exclude or include such outliers by checking the box to the right.

The shaded gray region that highlights the factors that were discarded in order to calculate the simple and weighted averages (see section 4.1). The line representing this cutoff may be moved to the left or right (by clicking and dragging). The lines representing the simple and moving average factors will adjust accordingly (including on the LDF screen), but the selected factor (and associated line) will remain unchanged. The selected factor line may also be moved up or down to a new selected value (NOTE: This will change the selected factor on the LDF pages as well as indications of ultimate loss, projections, etc.).



Incurred LDF Perspective – Similar to Paid LDF Perspective, but for Incurred factors.

5.8 Reports

Reports can be printed for each of the main screens and graphs discussed above. To select reports for printing choose Print Setup from the File menu at the top of the screen. The box shown below will appear for the user to check the boxes of the reports to be printed. The user may also choose to print any notes added to the analysis by checking the appropriate box.

Print Selections	×
Reports □ Results Summary □ Comparison to Prior Analysis □ Reserve Range Exhibit □ Indicated and Selected Estimates of Ultimate Loss □ Development of Chain Ladder Indication - Paid □ Development of Chain Ladder Indication - Incurred □ Development of Bornhuetter-Ferguson Indication - Paid □ Development of Bornhuetter-Ferguson Indication - Incurred □ Paid Loss Triangle □ Incurred Loss Triangle □ Graph: Paid Development □ Graph: Projection and Revision □ Graph: Seed Loss Ratios □ Graph: Range and Methods ☑ Graph: Paid LDF Perspective	
Options Include Notes	
OK Cancel Header/Footer	

The user may also add a Header and/or Footer to the printed reports. After selecting the Header/Footer button from the Print Setup box, the user may type text in any of the header or footer boxes. Alternatively, the user can click in any header or footer box and then select the item they wish to have appear on the report. The options for the header and footer are shown below and include Date, Time, Analysis Name, Report Name and Page Number.

Aodify Header or Footer		
Header Left &[Date]	Center	Right &[Report]
Footer Left	Center &[Page]	Right &[Analysis]
Add Eurrent Date Add Report Name Add Current Time Add Analysis Name Add Page Number		DK Cancel

Users can preview the reports by selecting Print Preview from the File menu. On the Print Preview screen the user can adjust the view by selecting from the screen view buttons or page box at the top of the screen. After previewing the reports, the user can print the reports by selecting the printer button or they can close out of print preview by selecting the Close button.

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		4/17/2009										Paid Loss Trimgle			
		Industry Paid Loss	y H1 Cur Triangle	rent View											
		Period 1997 1,1 1998 1,1 2000 1,2 2000 1,1 2002 1,2 2003 1,1 2003 1,1 2004 1,2 2004 1,7	Age1 094,575 301,045 460,089 615,641 756,010 894,116 894,116 850,733 966,886 916,518	4,972 2,536,829 3,105,752 3,242,448 3,708,640 3,562,864 3,562,864 3,564,037 3,444,746 3,660,3477	<u>Am3</u> 4,413,584 5,200,794 5,565,106 5,565,103 5,765,601 5,765,601 5,765,644 5,565,7894	Am4 5,996,438 7,2114,889 7,219,154 7,232,129 7,232,129 7,232,139 7,232,130 7,508,130	Am5 7,341,788 8,399,399 8,483,335 8,297,800 8,297,800 9,060,008	App6 8,250,911 9,439,248 9,111,338 8,874,527 9,511,124	<u>A#97</u> 8,667,864 9,998,307 9,913,236 9,474,992	Ar08 9,066,007 10,371,662 10,228,039	<u>4809</u> 9,287,547 10,708,011	<u>Apr10</u> 9,569,609			
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🔧 start	🖉 Councilysis User Man	10 Cogni	alysis ⁷⁴⁴ Res	ervi					Search D'asilit	11.			2 2	‡ «, © () _ ше ⁰ ≥исн	n.

5.9 Notes

Users can add notes for documentation purposes on each section of the analysis (except graphs). If the user selects Notes from the View menu at the top of the screen a box will appear at the bottom of the screen for the user to type comments into (this area can also be retrieved by selecting CTRL+N). The notes section is shown on the portion of the screen view circled on the following page.

,							Paid LDF Incurred LDF	Paid B-F C Incurred B-F S)ptimize Resu Iethods ummary Project	Its Residual Triangles ions Changes	Mean (Selected): 44,900,295 Optimized Indicatio 44,900,295	25% 50% n: 75% 90% 99%	43,842,59 44,873,64 45,928,93 46,899,98 48,619,27
					Summarv	of Ultimates Ta	ble				·		~
	Earned Premium	Current Paid	Current Incurred	Paid LDF	Incurred LDF	Paid B-F	Incurred B-F	Optimal Weighting	Previous	Selected	Loss Ratio		
1997	11 506 094	9,569,609	10.040.632	9 885 406	10.392.054	9 924 181	10 417 365	10.392.054	10 119 157	10 392 054	90.3%		
1998	12,384,141	10,708,011	11,376,077	11,393,324	12,024,513	11,370,810	11,972,596	12,024,513	11,722,973	12,024,513	97.1%		
1999	11,356,614	10,228,039	11,043,409	11,189,475	11,893,751	11,021,094	11,698,141	11,893,751	11,566,520	11,893,751	104.7%		
2000	11,409,056	9,474,992	10,359,005	10,792,016	11,446,701	10,534,232	11,183,823	11,446,701	11,217,518	11,446,701	100.3%		
2001	10,867,684	9,511,124	10,973,275	11,527,482	12,575,373	10,872,845	11,961,495	12,575,373	12,012,991	12,575,373	115.7%		
2002	16,314,960	9,060,008	10,694,769	12,113,231	12,790,944	12,003,749	12,610,537	12,790,944	12,491,396	12,790,944	78.4%		
2003	20,293,316	7,508,130	9,899,245	11,855,337	12,878,918	12,743,826	13,194,737	12,878,918	12,698,686	12,878,918	63.5%		
2004	24,079,420	5,387,894	7,962,340	11,244,535	12,023,133	13,918,751	13,496,754	12,023,133	11,828,875	12,023,133	49.9%		
2005	24,475,213	3,603,477	6,303,684	12,219,391	12,519,116	14,801,988	14,182,353	12,519,116	12,518,539	12,519,116	51.2%		
2006	27,496,114	1,916,518	4,048,494	12,959,495	13,323,594	16,347,359	15,837,068	13,323,594	0	13,323,594	48.5%		
Total	170,182,612	76,967,802	92,700,930	115 170,002	121,068,097	123,538,835	126,554,869	121,000,001	100 170 655	121,868,097	71.6%		
This is the no	tes section.												~

6.0 Batch Processing

In the Cognalysis[™] Reserving System, routine triangle processing and report production for a large number of analyses may be done automatically in batch mode. This can provide a useful first draft analysis for large amounts of data, providing you information about where there may be issues for more focused analysis.

In order to build a batch process the user selects the Batch option from the Tools menu at the top of the screen.

🔚 Cognalysis 🛎 Re	eserving System									- 6 🛛
File Edit View	Graphs Tools Help	www.cgconsult.com								
8	Batch									
Industry H1	Curren Options						-	Reserve Percentiles:	10%	42,934,846
			 					Mean (Selected):	25%	43,842,592
			Paid LDF	Paid B-F	Optimize	Results	Residual Triangles	44,900,295	50%	44,873,640
			Incurred	Incured	Methods		- mangao -	Optimized Indication: 44 900 295	75% 90%	45,928,935
			LDF	B-F	Summary	Projections	Changes	11,000,000	99%	48,619,274
				-		-				
Status										
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After selecting Batch, the user will be taken to a screen where an existing batch process can be opened or a new batch process can be created by selecting one of these options from the File menu at the top of the Batch screen. Once a batch process is created or edited the user can save this process by selecting Save from the File menu to be retrieved for future batch imports.

🖷 Batch										
File Edit	View									
New										
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Save										
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				×						
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In building the batch process, the user will enter information in each of the following fields:

- Loss File Path the path of where the loss data file is located
- Loss Table Name the name of the MS Access table that contains the loss information
- Loss Filter full string text that filters the field values (for example, LOB=Auto and Region=West)
- Period the length of the period (monthly, quarterly, or annual)
- Premium File Path the path of where the premium data file is located
- Premium Table the name of the table that contains the premium information
- Premium Filter full string text that filters the field values (for example, LOB=Auto and Region=West)
- Analysis Title the title to be given to this new analysis
- Prior File Path if any, the location of the previous analysis file
- Save File Path the path of where this new analysis file should be save
- Print Reports a list of reports that should be printed upon creating this analysis file

Items in each field (except Period and Analysis Title) can be browsed for by right-clicking in each cell. This will bring up a menu to aid in your selection. Individual rows can be replicated by right-clicking on the row header of the row to be replicated. In this way a large number of similar entries can be made quickly.

After the batch process has been built, the user can run the process by selecting the Run option in the lower right corner of the screen.

When building or modifying a batch process, the user can use the Edit options from the menu at the top of the screen to target certain rows or cells. These Edit options are also available by right-clicking on a row in the Batch Analysis list.

📰 Batch												- 6 🛛
File E	dit View											
	Cells >	Browse	1									
L	Rows 🕨	Сору										
Bat	ch Analysi	Paste										
	Loss File Path	Loss Table Name	Loss Filter	Period	Premium File Path	Premium Table	Premium Filter	Analysis Title	Prior File Path	Save File Path	Print Reports	
•				~								
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7.0 User Preferences

At any time users can define default squaring options or the default file directories. Users can make changes to these preferences by selecting one of these options from the Options menu under the Tools drop down menu at the top of the screen.



7.1 Default Squaring Options

The Cognalysis[™] Reserving System offers a variety of default options when you begin to square triangles. By selecting Default Squaring options from the Tools/Options menu, choices for default calculations are available to the user. Each of the default options is described below.

😸 Default Calculations	
Initial Selections Image: Selection Minimum Variance Weighted Average (MVWA) Previously Selected Ultimates with No Automatic for Most Recent Previously Selected Ultimates with MVWA for Most Recent Previously Selected Ultimates with MVWA for Most Recent Simple Average Factors Weighted Average Factors Regression Factors Previously Selected Factors Previously Selected Factors	Statistical Thresholds Critical Value for Correlation t-Test 1 Run Test Significance 0.2 Age-to-Age Factor Slope Significance 0.5
 Dynamic Determination of Loss Ratios Previously Selected Loss Ratios 	Restore Default OK Cancel

Ultimates

Users may choose the default ultimate from the following four options:

- No Automatic Selection The ultimate for each period will be zero until the user selects an ultimate value.
- **Minimum Variance Weighted Average** The ultimate for each period will be the optimized value that combines methods to produce the minimized variance.
- **Previously Selected Ultimates with No Automatic for the Most Recent** The ultimate for each period will be set equal to the ultimate for the same period from the previous analysis file that has been imported. For the most recent (and therefore new) period, the ultimate will be zero until an ultimate is selected.
- Previously Selected Ultimates with MVWA for Most Recent The ultimate for each period will be set equal to the ultimate for the same period from the previous analysis file that has been imported. For the most recent (and therefore new) period, optimized value that combines methods to minimize variance will be selected.

Development Factors

Users may choose from the following four options for default development factors:

• Simple Average Factors – The starting selected development factors default to simple averages of historical factors.

- Weighted Average Factors The starting selected development factors defaults to lossweighted averages of historical factors.
- **Regression Factors** The starting selected factors are based on a regression analysis of historical development (with stability adjustments- see Statistical Thresholds section below).
- **Previously Selected Factors** The starting selected factors will default to the development factors from the previous analysis that has been imported (if available).

Seed Loss Ratios

Users may choose from the following two options for default development factors:

- **Dynamic Determination of Loss Ratios** The seed loss ratios are calculated using a moving average of the paid and incurred link ratio methods. A radius (number of periods before and after the period) is derived with the goal of determining seed loss ratios that minimize the variance of the reserve estimate.
- **Previously Selected Loss Ratios** The seed loss ratios will default to the seed loss ratios from the previous analysis that has been imported (if available).

Statistical Thresholds

Some additional parameters guide behavior of particular algorithms within the Cognalysis[™] Reserving System:

- Critical Value for Correlation T-test The measured correlations between accident periods are subject to a test for significance of the relationship against a null hypothesis of zero correlation. If the test finds the measured relationship insignificant, zero correlation is used. The default critical value is 1, meaning t-test of values greater than 1 will be seen as significant. You can lower this number to be more sensitive to measured correlation between accident periods or raise it to be more stringent with regard to reacting to these measured correlations.
- **Run Test for Significance** The default number of periods used in the determination of weighted and simple average development factors is based on run tests to determine whether there are changes in development patterns over time. The sensitivity of these run tests is governed by this parameter, which is the significance level of the test. The default is .5 which means that 50% of the time the test will reject the null hypothesis (no change over time in development factors) even when it is true. You can adjust this parameter lower to be less reactive to changes in development patterns (resulting in longer periods used for the factor averages) or you can raise the parameter to be more reactive to changes in development patterns (resulting in shorter periods used for the factor averages).
- Age-to-Age Factor Slope Significance— The regression that can be used to estimate projected loss development factors is governed by this parameter. A significance test is performed on the slope (rate of change in factors over time) determined by the regression. When the slope is found to be statistically insignificant, the result will be a weighted average of factors. When the slope is found to be significant, the result will be a factor that reflects the trend. The greater the slope is relative to its critical value, the more slope will be reflected in the calculated factor. You

can lower the parameter shown in this box to reduce the sensitivity to the observed trend ($0 \Rightarrow$ long term weighted averages are used). You can raise the parameter to increase the sensitivity to the observed trend ($1 \Rightarrow$ the factor completely reflects the observed trend).

7.2 Default Directories

The user can select an existing folder or make a new folder to act as the default directories. A default directory can be chosen for data files, analysis files and system files. Data files are files containing data that will be imported into a new analysis. Analysis files contain a saved analysis (after information has been imported into Cognalysis, parameters and estimates selected, etc.). You can change these default directories to better streamline your data input and output processes.

System files are files that are used by the Cognalysis system such as working files and user preference files. Changes to the system files directory are not recommended.

