Goal: Generate distribution of lossess given log-normal dist of frequency & severity

1. Frequency Distribution (# Events/ unit time)

Goal: Model Normal mean and std. deviation using a Log-Normal (mean and median)

There is no analytic solution for the median given the mean and standard deviation of log-normal

There is an analytic solution for std. deviation given the mean and median of a log-normal distribution.

1 Enter median and mean values (C11 and C12). Examine resulting standard deviation (C14)

2 Adjust Median (C11) until resulting standard deviation (C14) is OK.

	Real-world values		Underlying math statistics		
1Median	**99.5**	Manual	mu	4.600	=LN(C11)
1Mean	**100.0**	Manual	mu+S^2/2	4.605	=LN(C12)
			Sigma^2	0.010	=2*(H12-H11)
1StdDev	10.0	=EXP(H12)*SQRT(EXP(H13)-1)	Sigma	0.100	=SQRT(H13)
1CoefVar	0.10	=C14/C12			

2. Loss Severity Distribution ($): Model as a log normal given mean & median

	Real-world values		Underlying math statistics		
2Median	**10,000**	Manual	mu	9.210	=LN(C19)
2Mean	**20,000**	Manual	mu+S^2/2	9.903	=LN(C20)
			Sigma^2	1.386	=2*(H20-H19)
2Mode	2,500	=EXP(H19-H21)	Sigma	1.177	=SQRT(H21)
2StdDev	34,641	=EXP(H20)*SQRT(EXP(H21)-1)			
2CoefVar	1.73	=C24/C20			

3. Distribution of Total Losses ($/year): Product of Frequency and Severity Distributions

Product of two log-normals is a log-normal

Assume that the frequency and severity distributions are not correlated.

	Real-world values		Underlying math statistics		
3Median	995,000	=EXP(H31)	mu*	*13.810*	=H19+H11
3Mean	2,000,000	=EXP(H31+H32/2)	Sigma^2 *	*1.396*	=H13+H21
3Std Dev	3,487,292	=C32*SQRT(EXP(H32)-1)	Sigma	1.182	=SQRT(H32)
3CoefVar	1.74	=C33/C32			

* Source: Wikipedia: Product Distributions/Related Distributions: #3 Product

4. Standard Error (using the CLT) of distribution of average Loss per unit time

n	4Std Error		4Coef Variation (CV)	
1	3,487,292	=C$33/SQRT(C39)	1.74	=D39/C$32
25	697,458	Pull down	0.35	Pull down
100	348,729		0.17	
400	174,365		0.09	
1,600	87,182		0.04	
2,500	69,746		0.03	
4,900	49,818		0.02	
10,000	34,873		0.02	

June 26, 2017 MAS Finally found an analytic solution to this problem after 35+ years of trying.

References

http://broadleaf.com.au/resource-material/lognormal-distribution-summary/
https://www.johndcook.com/blog/2009/09/29/achievement-is-log-normal/

The product of the frequency and severity -- if both are log-normal -- is also log-normal.
Mu = Mu1 * Mu2. S^2 = S1^2 + S2^2 assuming frequency and severity are uncorrelated

Central Limit Theorem

The distribution of the average loss about the mean is given by s/sqrt(n) per the CLT
In this case, S = sqrt(S1^2 + S2^2)
So the standard error = Sqrt[(S1^2 + S2^2)/n]