

The Actuarial Profession  
making financial sense of the future

# A Maths Toolkit for Actuaries

James Orr & Trevor Maynard

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## Agenda

- A quick recap [5 mins]
-  an example [10 mins]
- Next steps [45 mins]



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## A Quick Recap



The essence of knowledge is,  
having it, to use it.



Sharpening the saw



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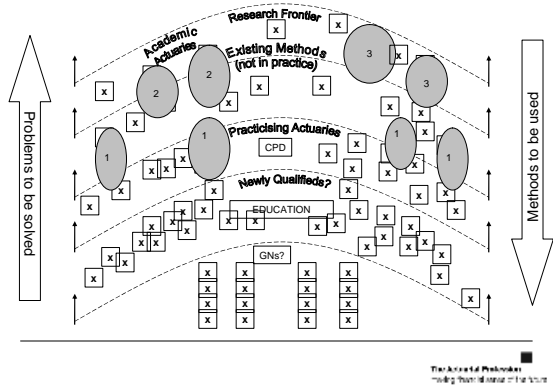
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## A Quick Recap




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## A Quick Recap



Access to experts



Software solutions

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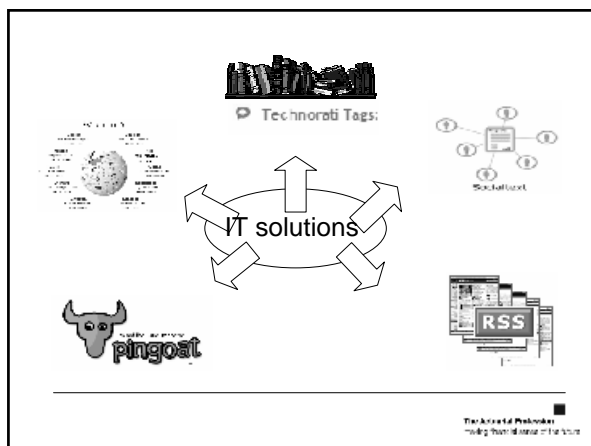
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## An example

	$b_j$										
$a_i$	145.15	380.51	93.79	58.89	20.86	12.13	8.07	4.38	2.68	1.72	
	132.81	327.79	71.87	47.69	15.81	10.21	5.46	3.26	2.14		
	159.29	366.20	109.12	59.82	23.20	13.93	7.70	4.52			
	198.08	530.19	122.89	79.00	24.97	16.25					
	128.71	382.81	89.74	47.83	15.90	11.50					
	193.64	578.43	115.50	72.00	25.69						
	215.62	584.25	135.77	79.57							
	179.18	495.46	110.41								
	156.27	405.32									
	147.49										

$$C_{ij} = e^{c+a_i+b_j}$$

$$a_i = 0$$

$$b_j = 0$$

The Annotated R Notebook  
Modeling Your Data in R



## An example

Create data:



*"small pieces that are loosely coupled"*

Change directory:

```
setwd("C:/0_WORK/Work/R_training")
```

Note the file separators are forward!

Import data:

```
xyData<-read.table("Triangle_10by10.csv",  
header=TRUE,sep=",")
```

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## An example

Perform modelling:

```
modVals<-glm(Y~a2+a3+...a10+b2+b3+...b10,data=xyData  
,family=quasi(link = "log", variance = "mu"))
```

Look at results:

```
summary(modVals)
```

Create some plots:

```
plot(residuals(modVals))
```

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Modeling Your Data in R

## Next Steps – maths topics

Copulas  
Recursions  
Stats( GAMS, GLMs, Kernal Smoothing, Cubic Splines)  
Extreme values  
Time series (seasonality, trends)  
Risk Measures  
Linear analysis – spectral theory  
catastrophe theory, chaos theory, complex analysis  
Linear algebra  
Dynamical sytems  
Numerical methods (integration, ODEs (Runge Kutta etc), PDEs)  
Fluid dynamics  
Fuzzy logic  
Bayesian methods  
Networks

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## Next Steps

Re-form working party?  
How does Quantitative finance network fit in?  
Software comparison group?  
R fan club?  
IT methods group? IT philosophy group?  
Should we use a wiki?  
Should we blog?  
Newly qualified idea (create a wiki, pick a topic (with replacement), put in newly qualified packs, academic to help with reading list, link to universities (i.e. open wiki) collaboration, creating a network - put output on wiki)

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## Next Steps – surveys

Look at syllabi of:

- Physics
- Chemistry
- Maths
- Economics
- Biologists
- Psychologists
- Marketing
- Engineers
- Geographers

We need links to some key papers

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## Next Steps – structure

Umbrella  
Provide IT solution  
Many pieces, loosely coupled  
Free format  
Do what interests you  
Multi chair-people!  
Agree delivery points throughout year  
Present to GIRO as "maths toolkit"? – or "this is a maths toolkit  
production"  
Rename?  
Too grand? Make smaller?

The National Endowment for the Arts  
Funding the National Endowment for the Arts

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