

APRIL 2016

THE MAGAZINE OF THE ACTUARIES INSTITUTE

DIGITAL

Actuaries



COLUMN

The Critical Line - Volume 1: Hello, World!

EVENT REPORT

Deciding the objectives of the super system

In this issue

| | |
|---|----|
| The Critical Line – Volume 2 | 3 |
| Actuaries join Inspirational Insurance Campaign | 5 |
| 2015 Member Survey Results | 6 |
| Time is ripe for Life Insurance Code | 9 |
| Deciding the objectives of the super system | 12 |
| The Critical Line - Volume 1: Hello, World! | 14 |
| Interview with 'Future Leaders' star | 16 |
| Welcome to New Members - March 2016 | 18 |
| Netflix announces new series “The Game of Probabilities”. | 20 |

IMPORTANT INFORMATION FOR CONTRIBUTORS

Actuaries Digital welcomes both solicited and unsolicited submissions. The Editorial Committee reserves the right to accept, reject or request changes to all submissions as well as edit articles for length, basic syntax, grammar, spelling and punctuation via actuariesmag@actuaries.asn.au

Published by the Actuaries Institute
© The Institute of Actuaries of Australia
ISSN 2203-2215

Disclaimer Opinions expressed in this publication do not necessarily represent those of either the Actuaries Institute (the 'Institute'), its officers, employees or agents. The Institute accepts no responsibility for, nor liability for any action taken in respect of, such opinions. Visit <http://www.actuariesmag.com.au/> for full details of our disclaimer notice.



The Critical Line – Volume 2

By Dan Mayoh

In this second instalment of The Critical Line, puzzle champion Dan Mayoh challenges readers to consider the Collatz Conjecture and solve a Blackjack conundrum.

Welcome to the second instalment of the Critical Line! The observant among you will notice that I am not Oliver, author of the first instalment. Writing duties of this column will be shared between a few different authors. Oliver’s previous column mentioned both a famous unsolved problem, and a sequencing problem. In that spirit, I’d like to mention one of my favourite problems, the Collatz Conjecture. Like many good maths problems it is very simple to understand what is being asked, but a fair bit harder to prove.

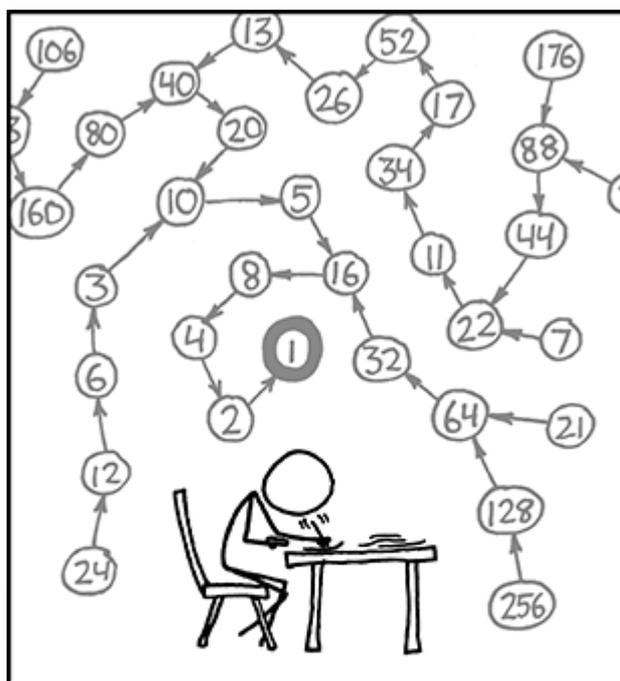
Collatz Conjecture

Start with any positive integer n . If n is even, divide it by 2. If n is odd, multiply it by 3 and add 1. Repeat the process indefinitely. The conjecture says that no matter what value of n you start with, you will always eventually reach 1.

For example, start with $n = 13$. The path will then be 13, 40, 20, 10, 5, 16, 8, 4, 2, 1 at which point the 4-2-1 will keep repeating.

If anyone sends me either (i) a valid original proof of the conjecture, or (ii) a counter-example that disproves the conjecture, I’ll double the Institute’s regular prize out of my own pocket and send you \$100!

An alternative phrasing of the conjecture is provided by Randall Munro [here](#):



THE COLLATZ CONJECTURE STATES THAT IF YOU PICK A NUMBER, AND IF IT'S EVEN DIVIDE IT BY TWO AND IF IT'S ODD MULTIPLY IT BY THREE AND ADD ONE, AND YOU REPEAT THIS PROCEDURE LONG ENOUGH, EVENTUALLY YOUR FRIENDS WILL STOP CALLING TO SEE IF YOU WANT TO HANG OUT.

An infinite deck of cards...

Now for a more reasonable problem. In studying the mathematics of games, analytical shortcuts that give good approximations can often be had by using what is known as an *infinite deck of cards*. By that we mean that when we draw a card, probabilities of outcomes don't depend on what cards have already come. For a standard infinite deck, each value (Ace through King) always has a $1/13$ chance of being drawn.

Blackjack is a great game for using this technique. Today's problem concerns only the dealer's hand. The dealer will draw

cards until their hand totals 17 or more. Aces count as 11 if that makes the hand total 21 or less, and count as 1 otherwise. (E.g. A-6 is 17, and 6-6-A is 13.) Jacks, Queens and Kings count as 10, and all other cards (2 through 10) count as their face value. Any hand value over 21 counts as a "bust".

The six possible outcomes for the dealer are therefore 17, 18, 19, 20, 21 and Bust.

Analysing the likelihood of these six outcomes using an infinite deck is a problem well suited to actuarial techniques, and can be solved precisely rather elegantly (hint: Markov Chains). These six probabilities can also be found on the internet fairly easily, so I'm going to add a small twist to the puzzle.

Part 1. Remove all of the 5's from the infinite deck (so that each remaining card value has a $1/12$ chance of being drawn). What are the probabilities of each of the six dealer outcomes? Answer exactly to six decimal places.

Part 2. Reinstate the 5's, and now remove all of the Kings. Now what are the probabilities to six decimal places?

For your chance to win \$50, send your solution to the Infinite Deck puzzle to ActuariesMag@actuaries.asn.au



Actuaries join Inspirational Insurance Campaign

By Dimity Mannering and Stephanie Quine

Pushing the boundaries on the perception of what it means to have a career in insurance, ANZIIF's Dimity Mannering discusses a new initiative championing actuarial opportunities.

It's one of the enduring laments of the industry — why does everyone seem to 'fall into' insurance? Is it due to a negative perception of the industry? Is it that people aren't aware of it? Whatever the reason, it has always seemed that the vast majority of insurance professionals find their way into the industry without ever having intended to end up there.

The recently launched Careers in Insurance initiative is designed to change all this, inspiring young people to consider choosing insurance as a career through the theme 'Go Anywhere. Do Anything.'

To ensure that aspiring actuaries are aware of opportunities in the industry, Taylor Fry and Finity Consulting are both part of Careers in Insurance. They join businesses from across the industry in engaging with young talent to highlight the breadth of opportunities that insurance offers.

Careers in Insurance starts by raising awareness and changing perceptions of what it's like to work in the industry. To achieve this, the initiative has a website, social media channels and an integrated communications program, and grassroots engagement is being undertaken at university and high school careers fairs.

Thought students and graduates weren't interested in the industry? Think again. So popular were the Careers in Insurance stands at recent careers fairs in Melbourne and Sydney that visitors were queuing up to speak to our volunteers from across the industry, who all stayed long past their shifts to answer questions from students of everything from actuarial studies and finance to law, nursing and even counterterrorism.

For the online component, Careers in Insurance has also launched a website designed to appeal to a young audience through its use of video, personality archetypes and careers content. The site aims to support young people, who often have little or no knowledge of the industry, by allowing them to explore the diverse career paths that insurance has to offer. Actuarial roles are highlighted on the website to emphasise the many opportunities for data-savvy job seekers and to reflect the

way in which actuaries provide critical support for insurance businesses across the world.

The Careers in Insurance website also has a CV repository and an upcoming job board to connect young job seekers with entry-level opportunities in the industry. Acting as a channel between young talent and the industry is a crucial part of the program, which serves to support insurance businesses now and into the future.

'In 2014, our research showed that 94 per cent of insurance businesses struggled to find talent', said Meg Brideson, ANZIIF's General Manager of Marketing and Insights. 'Attracting and retaining quality talent is the key to our industry's success, and it is crucial to ensuring that we have the workforce we need in the years to come. Bringing young people into the industry also enables us to establish the diverse workforce required to address the challenges and harness the opportunities of the future.'

Connect with Careers in Insurance on [Twitter](#), [Facebook](#), [Instagram](#) and [YouTube](#).

Visit the Careers in Insurance website at www.careersininsurance.com.au or www.careersininsurance.co.nz.



2015 Member Survey Results

By Katrina McFadyen

Two separate groups of Members were surveyed in 2015 regarding their assessment of the Institute’s performance across a broad range of member service practices and outcomes. The HQ Team were very pleased with the results. The Institute is currently performing well in the top five areas and there are a number of initiatives planned through the Strategic Plan that should see improvements in the five lowest scoring areas of the Survey.

The Member survey, administered by [Voice Project](#), was distributed to 4,362 Members compared to 4,250 Members in 2014. However, not all of these are included in the response rates/analyses because some Members were either on leave for the entire duration of the survey period or their invitation emails were blocked by their employer.

In total, 741 responses were received (giving a response rate of 19.5%) and the margin of error for the overall sample was 2.8%. In 2014, the survey response rate was 19% with a margin of error of 2.9%.

The 2015 results were benchmarked against the overall results from 2014.

Summary of findings

HQ team members were very pleased that the “overall member satisfaction” moved from ‘medium’ satisfaction in 2014 (77%) to ‘high’ satisfaction in 2015 (80.5%) – an increase of 3.5% (outside the margin of error). The specific questions asked in terms of “overall member satisfaction” were:

- “Overall I am satisfied with the services I have received from the Actuaries Institute.”
- “The Actuaries Institute is achieving its goal of generating pride in the profession.”

Top and bottom five scoring areas

The following table sets out the ratings in the five highest scoring areas:

| Table 1: Five highest scoring areas | % favourable responses | % difference between 2014 and 2015 |
|--|------------------------|------------------------------------|
| Quality The Institute offers services that are of a high quality | 82.5% | -0.5% |
| External Communications The Institute communicates with Members often enough / is open and honest in its communications to Members / keeps Members well informed about what’s going on within the Institute. | 82.5% | +1.5% |
| The Institute HQ Team The Institute HQ Team is knowledgeable about their services / does their job well. | 81.5% | -0.5% |
| Networking I believe that one of the roles of the Actuaries Institute is to provide me with opportunities to interact with my colleagues. | 80% | +2.0% |
| Responsiveness The Institute responds quickly to my requests and questions / responds to my questions and ideas the HQ Team were available when I wanted to contact them. | 79% | -2.0% |

The percentage differences between 2014 and 2015 are well within the margin of error.

The following table shows the five lowest scoring areas - it should be noted that all five scores were at the top end of the 'medium' band (50% to 80%).

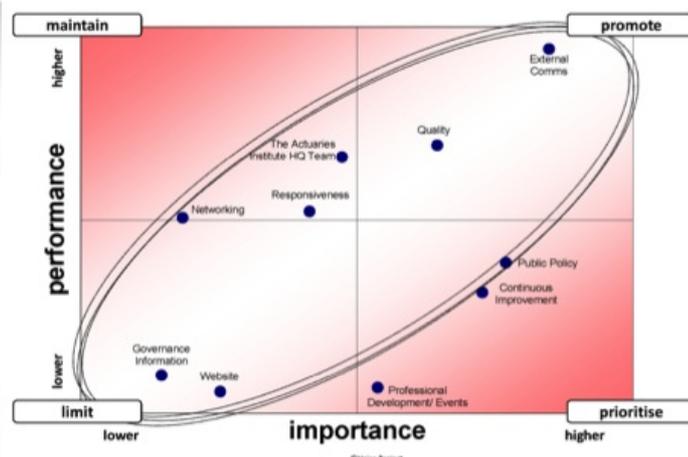
| Table 2: Five lowest scoring areas | % favourable responses | % difference between 2014 and 2015 |
|---|------------------------|------------------------------------|
| Continuous Improvement The Institute implements effective programs of continuous improvement / is progressive. | 76.5% | -0.5% |
| Public Policy The Institute represents the profession's needs well in its public policy initiatives. | 75.5% | +2.5% |
| Website The Institute's website provides useful information / Members can easily find what they need. | 75% | -2.0% |
| Governance The Institute provides sufficient guidance on areas relevant to Members' practice areas / Members are confident that they understand their CPD obligations. | 73% | +2.0% |
| Professional Development / Events The Institute effectively provides continuing professional development / the professional development program helps Members progress their careers. | 71.5% | +9.5% |

Of the five lowest areas of satisfaction in the Survey, three (Public Policy, Governance, Professional Development/Events) demonstrated an increase in satisfaction compared to 2014. However, whilst Professional Development/Events showed an improvement well outside the margin of error, this is because an adjustment was made to the 2014 survey's logic to only allow those respondents who said they participated in the Institute's CPD program to rate their satisfaction level with that program.

The slight decrease in satisfaction for the two remaining areas – Continuous Improvement and Website (-0.5% and -2.-% respectively) – was within the margin of error for the Survey (2.8%).

Gap analysis

Voice Project's gap analysis (below) for the Survey results compares performance on Institute member service practices with the estimated importance of those practices. Further explanation about the way in which the gap analysis is created, as well as the implications of the analysis, can be accessed via the link at the end of the article.



The areas in the bottom right quadrant are relatively more important to Member satisfaction (based on the correlations) and were lower performing (refer Table 2 above). According to Voice Project, improving performance in these three areas – Public Policy, Continuous Improvement and Professional Development/Events – is therefore likely to bring the highest return on investment for improving overall Member Satisfaction.

Key insights

Overall, the service provided by the Institute in the areas of Quality, Responsiveness and the HQ Team continues to score well, as does the service provided in the areas of external communications and networking. This strongly suggests that these areas should continue as usual (in other words, the return on investment of any additional activity in these areas would likely be minimal) and that the focus should be on improving those areas with less favourable scores.

Looking at each of the areas with less favourable scores (see Table 2):

Continuous Improvement: Due to its intangible quality, and presumably its direct relationship with observed improved scores in tangible areas, this is not an aspect of the survey that lends itself to identifying a specific course of action in response to improving member satisfaction. Improvements in other areas will likely lead to improvements in this score.

Public Policy: Although Public Policy rated second in the five least favourable result areas, when compared with 2014, there was a 2.5% increase in the number of respondents who indicated that the Institute continues to represent the profession's needs well in its public policy initiatives. As part of Goal 3 of the Institute's [2015-17 Strategic Plan](#), a significant number of activities in this area have attracted stakeholder and media attention. As this work continues, it is expected that more and more Members will continue to recognise these efforts as positively improving the profile of the profession. As the gap analysis indicates, improvements in the area of public policy have the greatest potential to increase member satisfaction, positively endorsing our strategic approach.

Website: The usefulness of the information on the Institute's website rated highly, however responses indicated that the information architecture and navigation could be improved. Implementation of the CPD Business Plan includes reorganisation of website content according to topic rather than business unit, this will affect and improve other parts of the website (not just CPD).

Governance: The questions in this area relate to awareness of CPD obligations and practice-specific information. Although relevant information does exist and is made available, there is an ongoing challenge in engaging Members. The upcoming implementation of "My Dashboard" on the Institute's website (part of the CPD Business Plan) will provide scope to implement previous suggestions that practice-area specific information be delivered through that tool. Other initiatives through Goal 1 of the Strategic Plan should assist in delivering messages about CPD obligations.

Professional Development/Events: The effective provision of CPD offerings demonstrated an increased score relative to 2014 due to an adjustment in the survey logic (as discussed above). Again, further improvements are expected in the 2016 survey results once the CPD Program Business Plan is rolled out and its impact is felt by Members.

Conclusion

The main conclusion is that the Institute is currently performing consistently well in the top five areas and that there are already a number of initiatives planned through the Strategic Plan that should see improvements in the current five lowest scoring areas.

With so many scores at either the 'high' or top end of 'medium', the Institute is well on track.

Survey invitations to all Members will be distributed again in Q3 2016.

Detailed information regarding the Survey - including the approach taken and ratings logic - can be found [here](#).

Feedback from Members is always welcome - please contact Katrina McFadyen, Head of Communications and Marketing.



Time is ripe for Life Insurance Code

By Trang Duncanson and Apollo Kim

With major consultation activity underway across senior life insurance executives and consumer groups in the lead up to 1 July 2016, we interviewed Sarah Phillips, Financial Services Council Policy Consultant (Life Insurance) on the FSC's critical work to help restore confidence in the life insurance industry.

With the onset of major overhauls to the industry off the back of the Trowbridge recommendations (designed to remove conflicts and improve remuneration structures) in late 2014, "the time is indeed right for the Life Insurance Code of Practice" to come into place, says Sarah Phillips.

The first of its kind Code of Practice for the life insurance industry will require mandatory compliance from the Financial Service Council's (FSC) life insurance members.

It aims to ensure life insurers adhere to high levels of standards in customer service, and to enhance protections where consumers are predominantly vulnerable.



Sarah Phillips, FSC Policy Consultant (Life Insurance)

Why is a Code of Practice needed?

The concept of 'utmost good faith' is well known in the insurance industry. However, there can be a large grey area in the practical implementation of the doctrine, from the consumer perspective.

This came to light in the panel discussion - *Lifting consumer outcomes with a Code of Practice* - at the FSC Life Insurance Conference in March 2016.

Sarah chaired the discussion in which Alexandra Kelly, a solicitor at the Financial Legal Rights Centre, presented a number of case studies (see below) from national insurance hotline service 'Insurance Law Service'.

This service can get up to 100 calls a day from consumers, with the more common ones for Life Insurance relating to issues around surveillance, claims handling, delays and premium increases.

"Currently, there is no effective system of regulation of a number of areas between consumers and life insurers. This can lead to poor consumer outcomes, poor customer service and unnecessarily and prolonged claims practices which are neither beneficial for the consumer or the insurer" says Alexandra, adding that she strongly supports the construction of the Code of Practice.

"Consumers are looking for answers, and these answers often do not exist except within the nebulous concept of utmost good faith."

CASE STUDIES

John has been on claim for a physical injury for 18 months; he is self-employed in a family business. He's under the care of a specialist and advised that it's a matter of time before he will regain function and be able to resume his normal activities. He's had five claims managers; been re-sent to the doctor for new certificates; and told to attend an Occupational Therapist hours from his home or have a Workplace assessor come around. The insurer now wants to send a forensic accountant to go through his books. He also has to see his GP every month, his GP does not bulk bill and he's paying \$130 per month for a report that says nothing has changed. He feels obstacles are being thrown his way and he says to me "I feel it's fraud, I've been paying these premiums for years. I've paid over a \$50,000 in premiums and I feel they've never intended to pay me." His payment was due a few days ago but he hasn't received it. He hasn't received a call. He wants to know from me whether he has to have a forensic accountant come over and look through the books, or can they just suspend his payments without telling him? His renewal has arrived and the premium has increased by 10%. It says all these things about helping him recuperate and he feels he has gotten nothing.

Jane has Stage Four melanoma. Her insurer paid out the TPD component on her existing policy in her Super. After the payout the same insurer contacted her, a cold call to sell life insurance. She told them about her cancer and said she thought she was uninsurable, and she was assured she would be covered. She instructs us that the sales person told her it would be irresponsible of her not to get cover as she has young children. She received the terminal diagnosis two years later. Now, she is being knocked back, because it is a pre-existing condition.

Challenges and Opportunities

Process to date

The FSC commenced development of the Code of Practice in August 2015 as a response to the 2014 Trowbridge review recommendations. Development has been collaborative in nature, with regulators, consumer advocacy groups, industry peak bodies, advisors, plaintiff lawyers, Indigenous advocates and the Financial Ombudsman Service all being consulted as stakeholders in its development.

With the initial drafting phase (August 2015 through to late December 2015) complete, development of the Code is now focused on incorporating stakeholder feedback into the standards. This involves workshops with senior executives and subject matter experts of life insurers.

Sarah emphasised that whilst the date of commencement is imminent, a key feature of the Code is that it is "quite flexible in

nature". An example of the flexibility of the development process was demonstrated when the FSC immediately announced the creation of a Steering Group involving consumer groups to finalise the Code, in response to recent negative media attention on claims management practices, and whether the industry should be trusted to self-regulate. To support the direction of the Code, this Steering Group includes the Consumer Action Law Centre and the Financial Rights Legal Centre.

Challenges and Opportunities

They key challenge in constructing a code that can apply to all life insurers has been the complexity of the life insurance industry, in particular capturing the different distribution models and the relationships with intermediaries such as super trustees and advisers, while providing clarity for consumers. Sarah was very clear in saying the Code of Practice is there to protect the end customer/claimant.

The Life Insurance Code of Practice is set to be implemented on 1 July 2016 and will allow life insurers a 12 month transition period to adopt and adapt.

The Code will cover the typical areas of sales practice, underwriting, claims management, support to claimants, and internal complaints process. Sarah expects that the extent of the change impact will vary between insurers, but will be focussed on systems (communications to customers and the timing) and processes (underwriting and claims management procedures).

"This is what directly impacts the customer experience, in particular at claim time when customers are at their most vulnerable," says Sarah.

There will also be a focus on education of staff, especially front line staff, she says.

From the customer perspective, Alexandra (who is also a member of the FSC Steering Group) says her interest is on a "final Code [that] will ... take significant proactive steps to ensure medical examinations are genuinely independent, limit junk insurance products, ban dodgy sales techniques, take real action on definitions and terms, and sort out poor claims handling and investigation practices.

We will also be looking to make sure that any Code of Practice is more than just mere talk ... otherwise, it would miss the point".

The introduction of the Life Insurance Code of Practice will increase the focus required by insurers on delivering a well understood seamless 'promised' experience to the end consumer.

Major adaptations may need to occur in the form of increasing transparency, building customer trust, simplifying SOA/PDS to customers and improving current processes to meet the aims of the Code.

Both authors would like to particularly acknowledge Sarah Phillips and Alexandra Kelly who were interviewed for this article, but more importantly for their significant contributions the Life Insurance Code of Practice for our industry.



Alexandra Kelly, solicitor, Financial Legal Rights Centre



Deciding the objectives of the super system

By Andrew Boal

On 29 February, around 40 members gathered at the Actuaries Institute for a Research Colloquia hosted by Andrew Boal and Anthony Asher to discuss the objectives of the superannuation system. This is particularly timely given the release by the Government on 9 March of a discussion paper and consultation process on the "Objective of Superannuation". This is a summary of those discussions and some principles that emerged.

One of the goals of retirement policy must be fiscal sustainability, to keep taxpayer expenditures to a reasonable level. While the Superannuation Guarantee (SG) was introduced in 1992, the level of compulsory employer contributions did not reach 9% of earnings until 2002. Nonetheless, superannuation savings have helped to keep a lid on the cost to the taxpayer of the Age Pension.

The increase in the level of superannuation savings combined with the operation of the Age Pension means tests, as well as the gradual increase in the Age Pension eligibility age to 67, is projected to limit the cost of providing age-related pensions to under 4% of GDP until 2049-50 (Source: 2010 Intergenerational Report). This amount is expected to fall further when the new Age Pension assets test commences on 1 January 2017. This cost compares favourably to other countries so it can be said that the superannuation system has already been successful in achieving at least one important goal for Australia's retirement income system.



Read the Institute's April 6, 2016 [Submission to Treasury](#) on the Objective of Superannuation.

It is now widely acknowledged that superannuation will not replace the Age Pension for most Australians, but will act as a supplement to improve their standard of living in retirement. Willis Towers Watson research shows that, using the new Age Pension assets test that will apply from 1 January 2017, a single home owner wishing to spend the ASFA Comfortable level of \$43,000 per annum for 25 years in retirement, and not qualify for any Age Pension payments in that time, will need to have saved close to \$1.5 million (assuming a 6.0%pa investment return in retirement, or \$2.6 million if you assume a 3.5%pa investment return).

There is little disagreement with the view that the objective for superannuation should be to provide a level of retirement income that, together with the Age Pension, allows Australians to live a dignified retirement and meets their reasonable expectations.

That raises the question though of what level of retirement income should be targeted, and what is the role of non-superannuation assets including a person's home?

One suggestion has been to target, say, 65% of a person's after-tax pre-retirement income. However, this would provide very significant levels of retirement income for high income earners and it is questionable whether the cost to the taxpayer of supporting that level of income is warranted.



Andrew Boal (L) and Anthony Asher (R) chaired the session.

An alternative target would be a level standard of living throughout life, including retirement, after allowing for important costs such as children and housing. This approach highlights two difficulties with the current system. The first is the liquidity constraints of the young, in particular families until their children leave home when they become more able to save for retirement very quickly.

"And what of the housing wealth of retirees? According to the Productivity Commission, it is estimated to be worth \$926 billion."

The other difficulty is that, as assets decline during retirement, the workings of the assets test mean that the Age Pension payments will rise over time. It is therefore complicated to design a retirement income product that produces a level income through retirement.

Another alternative would be to target a dollar level of retirement income, such as the ASFA Comfortable level, with limited taxpayer support provided above that amount. This could be achieved using well targeted annual and lifetime contribution caps, as well as a limit on the amount of superannuation savings that can be "crystallised" and then invested in a superannuation income stream product that has a 0% tax on the investment earnings.

ASFA has suggested that one target could be for at least 50% of Australians to reach the ASFA Comfortable level. Willis Towers Watson and the University of Melbourne published research in March 2014 that showed that 11% of singles and 32% of couples are on track for the ASFA Comfortable level when you include both superannuation savings and the Age Pension. However, when you also include other non-superannuation savings (excluding their "own home") these percentages increase to 22% for singles and 53% for couples. Certainly, if we can get at least 50% of Australians up to the ASFA Comfortable level using just their superannuation savings and the Age Pension, then we will be a long way towards achieving a successful retirement for most Australians.



And what of the housing wealth of retirees? According to the Productivity Commission, it is estimated to be worth \$926 billion. Again, there seems to be little disagreement that exempting the home entirely from the assets test is generous and could be limited in some way. The Actuaries Institute also suggests that partial protection (up to a dollar cap) from the Age Pension means test should be provided for amounts released under home equity release schemes or downsizing.

Finally, it is important that retirees have products available to them to help them sustain their living standard in retirement no matter how long they live, and to provide them with the confidence to drawdown their capital safely during retirement. The Institute eagerly awaits the outcomes of Treasury's review into retirement income stream regulations. In particular, we are keen to add deferred lifetime annuities (DLAs) as well as various forms of investment linked lifetime annuities to the product mix available to Australian retirees, with due consideration of the incentives provided to retirees to take their superannuation as an income stream.

Of course, given the heterogeneous nature of retirement outcomes, the Institute does acknowledge the flexibility required in the system to reflect each individual's different retirement income needs and varying capacity to exercise choice. But a system that is equitable and sustainable, including a cap on the combined cost to the taxpayer of superannuation tax concessions and the Age Pension, and allows at least 50% of Australians to reach the ASFA Comfortable level in a reliable and secure way during retirement no matter how long they live, could reasonably be judged to be a successful retirement income system.



The Critical Line - Volume 1: Hello, World!

By Oliver Chambers

Welcome to the first instalment of The Critical Line; the new monthly column dedicated to mathematical musings, transcendental ramblings, statistically independent thought, and most importantly... a plethora of new puzzles.

What's in a name?

Maintaining the tradition, a new puzzle column deserves a new name and today we get two for the price of one. *The Critical Line* is an allusion to the line of thought required to solve each monthly puzzle. In a more literal sense it also refers to the actual line

$$\Re(z) = \frac{1}{2}$$

ADVERTISEMENT

Introducing the Riemann Surface Pro

- ✓ Close up it looks just like an iPad...
- ✓ ...but it's everywhere differentiable from an iPad
- ✓ Make the Riemann Surface Stylus normal to the Riemann Surface pro anywhere! Even when you're on the run.
- ✓ Available in compact and non-compact varieties*



* compact variety has limited holomorphic functionality

You may recognise this as being relevant to the formulation of the Riemann Hypothesis – that all non-trivial zeros of the Riemann zeta function lie on the critical line. It's arguably one of the most important open problems in mathematics, but don't worry, the problems considered in this column will be marginally more tractable.

Warming Up

Here's a problem that I heard from a friend recently:

There exist two cities, A and B, separated by a very long road. N cars have set off from A travelling towards B. Initially, they all drive at a constant speed that has been chosen at random from a continuous (and non-negative) probability distribution X. This road, however, only has one lane so overtaking is impossible. If a fast car comes up behind a slower car then the faster car will

slow down and these cars will form a group. What is the expected number of groups of cars that arrive at B?

(Note: a "very long road" means long enough that a faster car will always have time to catch up to a slower car before arriving at B)

Click to reveal solution

SOLUTION: Let $P(n)$ be the expected number of groups of cars arriving at B given n cars embark from A. When there is only one car we get one group, $P(1) = 1$. Now let's assume we have $k-1$ cars embarking from A and we are going to add a k^{th} car. We can assume without loss of generality that we are adding the fastest car.

- If this car is the first to leave A then no other car will catch it and we will have an additional group arriving at B. This occurs with probability $\frac{1}{k}$.
- If the car is in any other position then it will eventually run into a car in front and the number of group arriving at B will be unchanged. This occurs with probability $\frac{k-1}{k}$.

This means that $P(k) = P(k-1) + 1 \cdot \frac{1}{k} + 0 \cdot \frac{k-1}{k}$ and therefore $P(n) = \sum_{m=1}^n \frac{1}{m}$. So the expected number of groups of cars arriving at B is H_n (the n^{th} Harmonic number). Neat!

And now for the main event...

The Magic Teller Machine

You have several coins. Each of these coins has a front and a back, and on each side of the coin is a non-negative integer. We can represent a coin as the ordered pair $\langle x, y \rangle$ and the value of each coin is the sum of the integers on the front and back, $x + y$. In front of you is a magic teller machine, it knows the contents of your coin purse. If you have a coin $\langle x, y \rangle$, but you have

neither the coin $\langle x+1, y \rangle$ or $\langle x, y+1 \rangle$, then the MTM will allow you to exchange your coin $\langle x, y \rangle$ for two new coins $\langle x+1, y \rangle$ and $\langle x, y+1 \rangle$. You are allowed to make any (finite) number of transactions with the MTM. The aim of the game is to make a sequence of transactions with the MTM so that all of your coins have a value greater than 2. Is this possible in either of the following scenarios:

1. You start with the 6 unique coins with a value at most 2: $\langle 0, 0 \rangle, \langle 1, 0 \rangle, \langle 0, 1 \rangle, \langle 2, 0 \rangle, \langle 1, 1 \rangle, \langle 0, 2 \rangle$
2. You start with a single coin of value zero: $\langle 0, 0 \rangle$

Demonstrate that you can exchange your coins until they all have a value greater than 2, or prove that it's impossible.

For your chance to win \$1,000,000! Send your proof of the Riemann Hypothesis to:

Clay Mathematics Institute
70 Main St
Suite 300
Peterborough, NH 03458
USA

Alternatively, for your chance to win \$50! Send your solution to the Magic Teller Machine puzzle to

ActuariesMag@actuaries.asn.au



Interview with 'Future Leaders' star

By Candice Ming

Actuaries Digital Editor Candice Ming interviews Roosters supporter, Stand-up Paddle Yogi enthusiast and the 2012 winner of the coveted Financial Services Council (FSC) Future Leaders Program Award, Kim Cohen.

Kim beat out other under 30-year-old non-actuarial industry hopefuls for the award, for her submission *"Underwriting and Claims Management Practices. How could developments in medical and information technology transform underwriting and claims management practices over the next decade?"*

Why did you choose this area for research and have you done any follow-up work on this?



I chose to participate in these awards and picked the topic set out for the life insurance practice area. I was particularly interested in exploring this topic because it was a bit left field from traditional Actuarial topics I'd been exposed to. It allowed me to think more broadly and discuss key industry drivers with experts in broader fields. Since then I have targeted a specific development, data analytics and predictive underwriting, and

written a further paper and worked at my company to progress the concepts further.

To be nominated as a representative of your company onto the FSC Future Leaders Program is a prestigious feat. How did you get enrolled onto the program and get support from senior management?

It was fantastic to get the support of BT's CEO Brad Cooper to put me forward for this. As with most exciting development opportunities, by proving you are passionate and committed to what you do and have an inquisitive nature and desire to continually improve, you stand out to be selected. I always made my manager aware I was keen to get involved in these sorts of opportunities and he made sure this was made known to the broader senior management.

Who was your mentor and what role did they play?

My mentor was BT's Appointed Actuary David Su. He guided me through the process, from discussing my ideas and approach, connecting me with senior leaders across the industry to reviewing my paper for maximum impact. He accompanied me to the networking events through the program and made sure I got the right support – e.g. having someone from Marketing review my paper for style and structure rather than an Actuary. Originally Phil Hay, Head of BT Life, was my mentor, but this was not possible as he was also a judge for the awards.

The program is more than doing research on a topic and entails pitching your idea to a panel through various rounds. What was the most challenging aspect of the program for you?

Making the complex simple. The topic was massive and I could have turned each idea explored into a paper on its own. I did a massive amount of reading and spoke to industry experts with many years of collective experience and it was very difficult to distil all this information into clearly structured argument that balanced the technical insurer perspective with the reality of customer impacts and changing needs.

What did you learn about yourself?

I learnt that to make a real impact in the life industry, I needed more than just technical expertise. How you present your view

and influence stakeholders by understanding what drives their focus is just as important to drive forward your ideas.

What did you gain from participating on the program?

My views and thinking were challenged by the many industry experts that helped shape the concepts in my paper. I broadened my thinking and network and gained a passion for the developments explored in my paper. I also won a fantastic trip to New York which gave me access to global expertise as well as a great holiday.

Would you encourage others to participate?

I would definitely encourage others to participate. Use this as a platform to get to meet leaders in your company and the broader industry. As for international contacts, the sky is the limit. It will broaden your knowledge as well as your network and hopefully broaden your view of possible career paths.

What do you think is the next topical issue in financial services and what role do you think actuaries should play in furthering the development of these areas?

There are so many complex issues in financial services, all of which Actuaries can add significant value to the debate. I think longevity products are a key area of development expected to take off as the \$2 trillion in superannuation starts to mature and be utilised in retirement. In life insurance, the life Insurance framework reforms and impacts will be interesting to watch, responses to rising mental illness and worsening disability income experience and also the recent media on denied claims and outdated definitions requires a strong response to ensure trust is restored in an industry which supports so many Australians in difficult times.

What is the most valuable skill an actuary can obtain?

Commerciality. I've seen too many smart actuaries' opinions dismissed and not sought after as an integral input into strategy and decision-making. Actuaries can shape the industry, but only if they understand not only financial viability, but also practical feasibility and customer desirability.

My best advice for younger actuaries is to... think and act broadly. Don't just take a linear path of continual studying and dogged focus on exam success. Live life outside of study and work. Be well-rounded, with exposure to many different areas and people - don't box yourself in.

What's next for Kim Cohen?

I've just started a new role in the last two months at Pacific Life Re (Director, Product Development). It is great to have the depth of experience from working at an insurer that I can now leverage in a reinsurance role where I have the opportunity to work with insurers across the industry. I never know what's next, but since moving out of the traditional actuarial sphere I'm keen to continue towards moving to broader management roles and always learning more. I am passionate about making a difference to both customers and companies, I love learning from other high-calibre professionals and particularly enjoy leading teams to reach their potential.

You can access [Kim Cohen's](#) paper, as well as previous winner and finalist papers, [here](#).

industry. At the same time, these participants will enhance their reputation within their organisation and the other FSC full member organisations, ASIC, APRA, and Treasury.

- Competitors take part in an open auditorium Pitch Fest to at least three judges, drawn from the sector and academia, to both trigger innovative research and a heightened capacity to communicate.
- Participants must meet the age requirements and gain the support of their Chief Executive Officer (or equivalent head of organisation) and submit an application form in order to be considered for the program.
- For further information, to download an application form, or to access information on past programs and future leader participants, please visit the [FSC website](#).
- The entries for the 2016 award closed on 11 March 2016. For young actuaries keen to put their hat in the ring next year, please look for entry details mid-Feb 2017.

FSC Future Leaders Program:

- The program is a purpose-built to encourage future leaders of the wealth management industry to develop innovative research that challenges conventions and produces creative ideas that might shed new light on the hot topics of the



Welcome to New Members - March 2016

By Actuaries Institute

Welcome to the Institute's newest members!

Australia

| | | | |
|---------------------------|-----|--------------------------|-----|
| Saurav ACHARYA | VIC | Zhihui JIANG | NSW |
| Hamid AKBARY | NSW | Jian JIAO | NSW |
| Cameron James ATKINSON | NSW | Meng Fei JIAO | WA |
| Gabrielle Margaret AUSTIN | NSW | Yihao JU | NSW |
| Neil BEZUIDENHOUT | VIC | Darren KHOU | NSW |
| Dorothy Man Shan CHEUNG | NSW | Doyeon KIM | WA |
| William Hon Biu CHOI | NSW | Janeth Justinean LAMBERT | WA |
| Elliot James DAWSON | VIC | Ivan Ka Ho LEUNG | NSW |
| Hirun DE SILVA | NSW | Amy LI | VIC |
| Benjamin DENG | NSW | Han LI | VIC |
| Wushi FENG | NSW | Kent Jianrong LIANG | VIC |
| Chanakya GOLI | ACT | Haokuan LIU | VIC |
| Ying GU | NSW | Jierui LIU | NSW |
| Chengyu GUO | NSW | Wilson LIU | QLD |
| Xucong HE | NSW | Yu LIU | VIC |
| Zirong HE | NSW | Margaret Ming Yen LOO | VIC |
| Yushi HOU | ACT | Yang LU | NSW |
| Lee Seng HOW | NSW | Dmitro LYULIK | NSW |
| Shannon Kaiwai ING | NSW | Frances MAI | NSW |
| Bhavek JAMNADAS | NSW | Davis Renchi MATHEWS | WA |
| Bailin JIANG | NSW | Varun Hari MITTAL | NSW |
| | | Lorjan NAGANTHIRAN | NSW |
| | | Rosalie NOEL | NSW |

| | |
|---------------------------------|-----|
| Vincent NOUTSO | VIC |
| Danielle Louise PAGE | NSW |
| Sabina So-Yeun PARK | NSW |
| Chuyi QIU | VIC |
| Anton Robert RESCH | NSW |
| Jessica SASTRO | VIC |
| Daniel SELF | QLD |
| Hyung- Kwon SEO | NSW |
| Navjot SINGH | NSW |
| Andrew SONG | NSW |
| Kaiwen SONG | VIC |
| Stephanie Jane THOMSON | NSW |
| Dylan Farrel TOOCH | NSW |
| David Vinh TRAN | NSW |
| Kimberley TRINH | WA |
| Daniel Amos VAN DE VORSTENBOSCH | NSW |
| Yige WANG | VIC |
| Ziyuan WANG | NSW |
| Hon Ting WONG | NSW |
| Kit Yui WONG | ACT |
| Lam WONG | VIC |
| Yi Cheuk WONG | NSW |
| Renee Wing Heng WOO | NSW |
| Zhengmao YANG | SA |
| Eric YEUNG | QLD |
| David ZANON | NSW |
| Allan ZHANG | NSW |
| Xiang ZHANG | VIC |
| Zhenyu ZHANG | NSW |
| Ziying ZHANG | NSW |

Overseas

| | |
|-------------------------------------|-------------|
| Evan James Clarke COOPER | New Zealand |
| Man Him FONG | Hong Kong |
| Nicholas Charles HARRINGTON-JOHNSON | Canada |
| Sharon Emily LOTHIAN | New Zealand |
| Jiayi WANG | China |
| Caisha XU | China |



Netflix announces new series “The Game of Probabilities”.

By Kirsten Flynn

Netflix today announced a new original series, 'The Game of Probabilities', following the real lives of six actuaries.

With the tagline “ruin is certain for all but one in the game of probabilities”, the series follows the real lives of six actuaries as they compete to solve challenging problems of probability, like who will win this year’s Eurovision or NRL Premiership.

The show promises technical jargon, sexual tension and laughter, with each episode providing unique insight into the personal and professional lives of the members of the world’s most mysterious profession.

“The actuaries are coming”. Are you ready?”



“We are extremely pleased Netflix are putting the spotlight on the great work actuaries can do. For many years there have been shows about lawyers, police officers, politicians and doctors.

Now it’s our time to shine!” said a member of the Actuaries Institute, Australia.

Test audiences have praised the show, describing it as “the funniest new show since the Big Bang Theory”, exclaiming they “never knew actuaries could be this funny” and asking “why has it taken this long to make a show about actuaries?” The series has been picked up for 10 episodes and will be available for streaming from 1 April 2017.

Disclaimer: Happy April Fools – we hope you enjoyed this hoax article! While we hope Netflix (and other services) would consider a show about actuaries, we are not aware of any plans to do so.



ACTUARIES INSTITUTE
ABN 69 000 423 656
LEVEL 2, 50 CARRINGTON STREET
SYDNEY NSW 2000 AUSTRALIA

t +61 (0) 2 9239 6100
f +61 (0) 2 9239 6170
e actuariesmag@actuaries.asn.au
w www.actuaries.asn.au