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the Actuary INDIA

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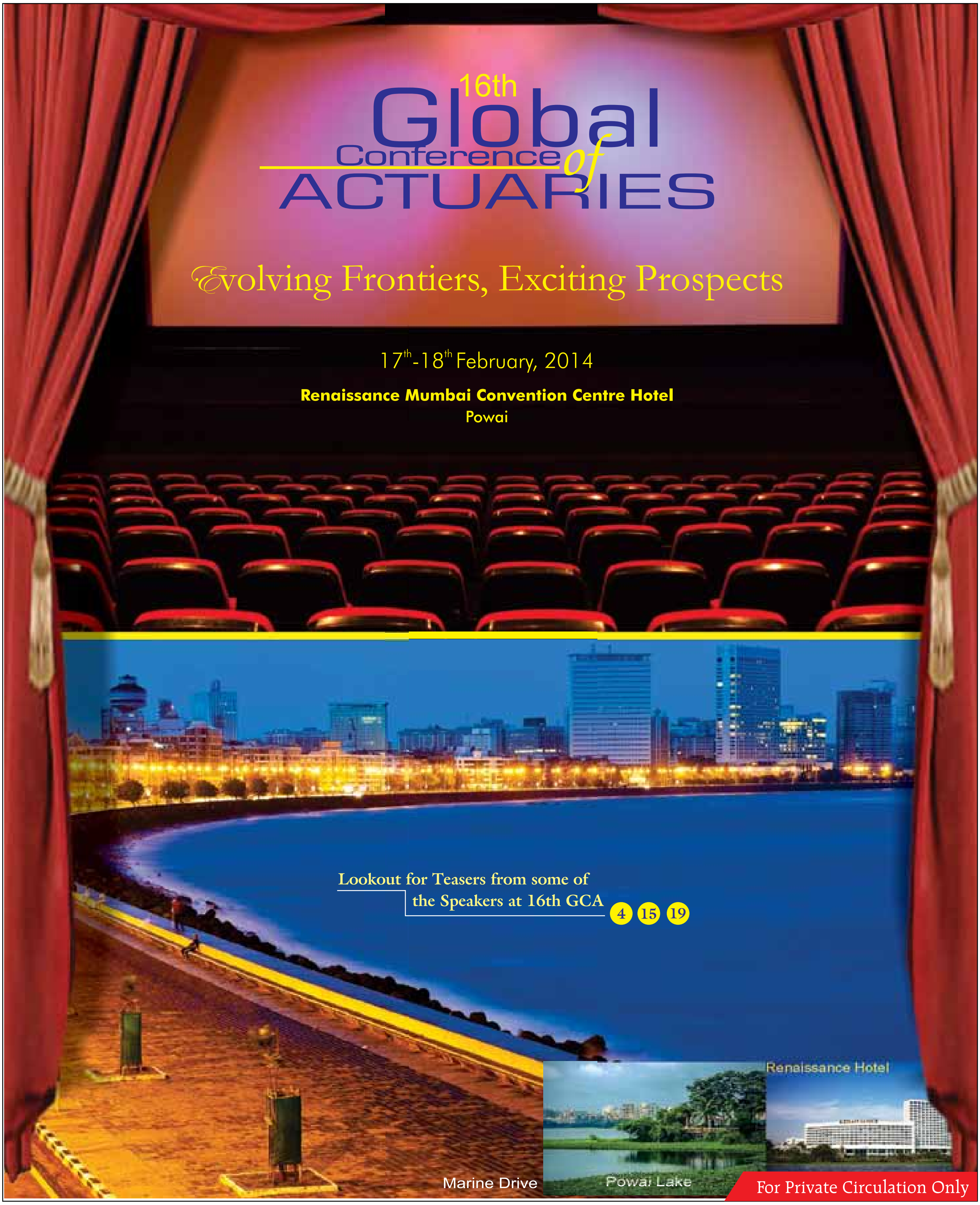

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16th Global Conference of Actuaries (16th GCA) is being organized by the Institute of Actuaries of India (IAI). It is an event where actuaries and non-actuaries will assemble in a global ambience to share thoughts and debate on matters that affect the financial services industry in general and insurance industry in particular. This year the GCA will be held in Renaissance Mumbai Convention Centre Hotel in Powai, Mumbai, from **17th to 18th February 2014** and the theme is **"Evolving Frontiers, Exciting Prospects"**

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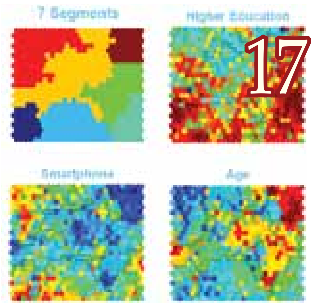

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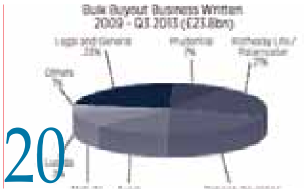

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FROM THE EDITOR'S DESK

RAUNAK JHA

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WISH YOU ALL A VERY HAPPY NEW YEAR !

Hope you all have booked your seats for our upcoming Global Conference of Actuaries (GCA) and are excited to be part of this annual event where actuaries from all around come under a common roof! GCA prompts us to say that "we all are actuaries" and does not let us categorise ourselves as life, non-life, pensions or reinsurance actuaries (in fact the list doesn't end here for current actuarial roles).

We feel proud that our Profession (and its professionals) can boast about contributing to the corporate world in numerous ways and Actuarial Science has managed to establish its own position as a specialist profession which is looked up to by all and is becoming the most sought after profession in the world! This profession gained its first recognition in Great Britain in the eighteenth century with contributions from people like William Morgan. He was the one who helped Equitable Life Assurance to weather all financial storms and stay in good shape which had led the foundations of the modern actuarial profession.

The Actuarial Profession has now spread its wings across the world and is well-acclaimed for its technical know-how. Whether its calculation of reserves in life insurance companies, rating of sub-standard insurance risks in life and health, computing loss statistics in fire insurance, development of derivatives for a reinsurer, or use of predictive analytics to project future risk experience, we all have given a unified recognition of being a risk-management solutions provider, giving a competitive edge to our profession!!

The current theme of 16th GCA, **"Evolving Frontiers, and Exciting Prospects"** rightly captures the essence of the emerging role of actuaries in different areas of work! We need to continue to challenge ourselves and keep proving our competency to the world. So let's gather as professionals of this esteemed profession under one roof and say loudly with proud 'We are Actuaries'!!

Looking forward to see you all !

We invite opinion and comments on the articles published in the magazine.
E-mail: library@actuariesindia.org

Summary, Interpretation and Issues for Principles based reserving of Life Insurance in the US
(S7.Concurrent Session - 3.5)

After a legacy of rules-based reserves, US Life insurance will be transitioning to principles based reserves. Actuaries representing companies will have to pay a larger role in right-sizing reserves depending on product and company specifics. The presentation hopes to provide a summary, timeline, comparisons and issues to the uninitiated profess ional.

- Venugopalan, Aravind

Certified Actuarial Analyst
(IAI Student event)

While the financial services sector continues to change at pace, there has been no new actuarial credential for generations. Now is the time for change.

- Cribb, Derek

Catastrophe Risk: Modelling & Opportunity
(S7.Concurrent Session - 4.5)

Economic losses from catastrophes in 2013 totaled $130 billion worldwide, of which only one third were insured! In a world with increasing uncertainty, are we ready to acknowledge and manage such disasters? With the advances in catastrophe modeling techniques and its applications, we now not only have a valuable tool for effective risk management but also an opportunity for greater profitability.

- Shree, Tanu , Tibrewala, Aditya

The Value in "Value for Money" - a practitioner's view (S3 -Concurrent Session - 3.2)

A critical question emerging from regulatory and industry trends is whether customers genuinely get Value for Money for the product and service provided by insurers. We explore what "value" in insurance may mean and to whom... not all customers may view "value" in the same way! It is well worth the effort to understand what customers compare and evaluate in the context of purchase, and why the "sum of parts" does not equal the whole when it comes to financial products and advice. Companies that master the art of applying and communicating the essence of Value for Money perhaps stand a better chance of being customer centric and out-competing in an increasingly noisy marketplace.

- Rathod, Chirag

Mark your Dates 16th GCA 2014 17-18 FEB

20^{TH} INDIA FELLOWSHIP SEMINAR

• Organized By: Advisory Group on Professionalism, Ethics & Conduct, IAI
• Venue: Hotel Sea Princess, Mumbai • Date: 4th -5th December 2013

The aim of the Indian Fellowship Seminar is to create awareness into Professionalism and Ethical issues concerning its members in the course of discharge of their duties as an actuary. The main focus of discussions is to highlight potential conflicts or difficulties that may arise in a practical context and deliberate on possible courses of actions. Topics discussed in this IFS was a good blend of boiling issue existing in the industry especially in back drop of recent regulatory changes and professional standards to be adhered by all professionals while discharging their duties in various capacities.

The presenters are both newly qualified and also actuaries who are close to qualification. They present to a jury that assess their understanding from a Professionalism viewpoint in order to gain admission as a Fellow member of the Institute. Apart from the presenters, other qualified actuaries attend the IFS and get CPD credit for the same. The first day of Seminar kicked off with opening remarks by. Chandan Khasnobis who explained the importance of IFS and members for whom it is important to attend, requirement to be demonstrated by members seeking fellowship like understanding of Professional Conduct Standards (PCS) and Actuarial Practice Standards (APS) issued by the council and level of maturity to be demonstrated.

Session 1 : Data Quality: This was presented by Joydeep Shah, Dharmender Kumar Shrivastva and Khushboo Hamirbasia under the guidance of Jagbir Singh Sodhi. The main issue here was

Jagbir Singh Sodhi, Dharmender Kumar Shrivastva, Joydeep Shah, and Khushboo Hamirbasia

whether the actuary in question should provide the actuarial certificate of reserve adequacy if he is doubtful about the data. Group discussed the issue with reference to guidance available in PCS and APS 1. They expressed the fact that the data responsibility lies with the management and the CEO requires to certify the completeness of the data. The Group suggested data checks like referring to historical ratios, reserves etc to verify the data accuracy.

Session 2 : Increasing retention limit of life Insurance companies and consequent impact on the risk and capital management: This was presented by Ajai Kumar Tripathi, Sachin Garg, Ankur Goel and Shamit Gupta under guidance of Vivek Jalan Group brought some of the glaring issues relating to new reinsurance regulation

Vivek Jalan, Sachin Garg, Ankur Goel, Ajai Kumar Tripathi and Shamit Gupta

and discussed the possible implications on the industry. J. Meenakumari, HOD, Actuarial Dept in IRDA clarified that the reinsurance regulation is not the prescribed benchmark but it is to be followed for reporting purpose; lower retention limits supported by justification may hold the ground when product is filled with regulator for approval. Participants acknowledged this clarification as new view and new possibility to be considered.

Session 3 : Capital Injection: This was presented under the guidance of

Vishwanath Mahindra, Raunak Jha, Shobhana Sharma, Anuj Bhel and DNKLNK Chakravarthi.

Vishwanath Mahindra by DNKLNK Chakravarthi, Raunak Jha, Shobhana Sharma and Anuj Bhel. The group discussed the absence of governance on Capital Injection, the reasons for capital injection, how free assets can be created etc. The Group also referred to IRDA (Appointed Actuary) Regulation 2002 and APS to state the importance of Appointed Actuary's position in management of any company.

Session 4 : Future of Death Benefit schemes in India: This was discussed by group of Pankaj Tewari, Saurabh Kochrekar, Hemanshu Jain and Kruti Kamlesh Patel under the guidance of S. Chidambaram. Group discussed the DB schemes in India, its importance, factors affecting defined benefit scheme, type of pension schemes, risk factors to

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Khushboo Hamirbasia – FIAI, CFA – Working with Edelweiss Tokio Life Insurance as an Actuarial Consultant

S. Chidambaram, Pankaj Tewari, Kruti Patel, Saurabh Kochrekar and Hemanshu Jain

be considered by scheme sponsor like interest rate, demographic factors, salary escalation, inflation, expenses, asset side risk, etc. Group also specified the possible remedial actions for exiting DB scheme like better asset liability management, tweaking the existing benefit structure, shifting towards hybrid scheme rules, risk sharing between employees and employers, etc.

Session 5 : Internal Relationship and Pressure: This was presented by the group comprising of Ramakant Malpani, Pradeep Anand and Saddam Hossain under the guidance of Bharat

Bharat Venkatramani, Pradeep Anand, Saddam Hossain, Ramakant Malpani

Venkatramani. Group discussed the various professional aspects an actuary should consider while discharging his/her responsibility of protecting policyholder's interest while achieving the shareholders' profitability targets. Group discussed how an actuary should react to a situation where other actuary's work is being criticized in a meeting so that actuary's and profession's reputation is not impacted. Group referred to PCS and various APS relevant in this context.

Session 6 : Group business and Pricing discretion available to an actuary: This was presented by the group of Dinesk K Pant, Vikas Kumar Sharma and Deepak B V under the guidance of Sanket Kawatkar. Group stated that unique nature of each group makes group pricing very important and hence

Sanket Kawatkar, Deepak B V, Vikas Kumar Sharma and Dinesk K Pant.

discretion in pricing is needed for an actuary. All points made in various circulars, regulations are explained in the context of the discussion topic. Guide . Sanket Kawatkar gave concluding remarks based on industry approach and facts. Dinesh K Pant mentioned the need to review the existing guidelines and regulations to bring in the consistency across the group regulations.

Session 7 : New Products: This was discussed by Ajai Kumar Tripathi, Sachin Garg, Ankur Goel and Shamit Gupta under . Viviek Jalan's guidance. Group discussed the case study from new regulations aspects, mentioned the factors like market research, operations, IT and underwriting that plays important role in product design. Abhay Tewari commented that case study should have been explained from PCS and APS point of view rather than just concentrating on product opportunity. In response to one of the comment, 'pilot' project concept was discussed and appreciated by the forum.

Session 8 : Investment: This case study was related to advising a new client and was presented by the group of Abhinav

Jenil Shah, Parasuram Varkavi, Abhinav Singh and Mehtab Kahn

Singh, Jenil Shah, Parasuram Varkavi and Mehtab Kahn under guidance of Rajesh Dalmia. Group spoke about the areas to be covered by the investment actuary while advising the pension fund trustee on decision of transfer of fund to new fund manager. Group dealt with the professional guidelines that investment actuary must comply with while taking up new assignment, communicating with prior fund advisor, criticizing the work of another actuary and giving advice, etc.

Session 9 : Home Insurance: Group comprising of Michale Frylinck, Neel Chheda, Ashwini Arora and Surichi Bhargava under the guidance of Saket Singhal presented pricing issues and limited sale of home insurance products in India. Group talked on importance of

Saket Singhal, Neel Chheda, Surichi Bhargava, Ashwini Arora and Michael Frylinck

data, implications of over and under pricing, need of time to protect companies from giving unviable quotes, distribution and commercial profits considerations, margins loaded in the premium and treating customers fairly.

Group emphasized on need of regulation for home insurance especially for commission and rating factors. Group expressed the need of active selling of home insurance as this is not mandatory as motor insurance supported by profession's active involvement in home insurance education and awareness. . Pankaj Tewari from IRDA gave a brief idea on possible development in general insurance space that is currently under consideration.

Session 10 : Health Insurance: The group comprising of Joydeep Saha, Dharmendra Kumar Shrivastava and Khushboo Hamirbasia talked on challenges faced by life and non life insurers in health insurance segment. Group spoke on current participants in health insurance segment. Based on the past data, group demonstrated that non life players dominate this sector, predominantly PSU players. Group discussed challenges faced by life insurer like product complexity, long term fixed benefit products, higher premiums for ULIP plans, non participation in mass and government schemes, challenge of life time renewability of health cover, etc. Group pointed out that health insurance portability posses more risks for the insurers now a day. Group also talked on complexity of underwriting, multiple claims v/s single claim, hospital network management and TPA servicing rated issues and discussed future potential considering macro and micro economic factors.

Rohan Sachdev

First day of 20th IFS concluded with a presentation on the 'Growing Importance of Professional and Ethical issues in India' by guest speaker . Rohan Sachdev from consulting firm E&Y. Rohan expressed the need for better corporate governance. He gave real life examples and case studies while explaining the concept. He stated five most important factors responsible for corruption i.e. weak law enforcement; numerous government touch-points; complicated tax and licensing system; lack of will in making an effort in getting permission in the right way and lastly grid to get unfair advantage in business.

Session 11 : Defined Benefit Pension Valuation: Second day of IFS started with a presentation by Pankaj Tewari, Saurabh Kochrekar, Hemanshu Jain and Kruti Patel under the guidance of S. Chidambaram. Group discussed how the assumptions need to be set for DB valuations and how the need of various stakeholders should be considered. Group discussed the professionalism aspect of case study by referring to relevant PCS and APS issued by the council.

Session 12 : 'PAR or Non- PAR -what is the way forward?': This much debated topic was presented by Ramakant Malpani, Saddam Hossain and Pradeep Kumar Anand under the guidance of Bharat Venkataramani. Group discussed the key changes brought in by new Linked and Non Linked product regulation, possible impact of these changes on product designs, capital requirement and benefit disclosure requirements. Group discussed the impact of change in guaranteed surrender values on par and non par products. Group stated that mix of par and non par products will prevail and each company's strategy will depend on numerous internal and external factors.

Session 13 : Projected Policy values: was presented by Dinesh K Pant, Vikas Sharma, Deepak B V under guidance of . Sanket Kawatkar. Group discussed the position of an actuary from 'integrity point' in case where illustrated values do not cover all the charges. Group referred to professional guidance given under PCS and APS.

Session 14 : Interest Rate Guarantees: The group comprising of Abhinav Singh, Jenil Shah, Parsuram Varkave and Mehtab Khan under the guidance of Rajesh Dalmia presented how to manage the interest rate guarantee in regular premium traditional products. Group discussed on the type of guarantees, need of guarantees and need of managing the guarantees. . Abhay Tewari and Nick Taket brought to the notice of the group that presentation should have concentrated on regular payment product and not on single premium products.

Session 15 : Another Actuary's Work: A case study on how an actuary should deal with an assignment which was handled by another actuary was discussed by the group comprising of Michael Frylinck, Neel Chheda, Ashwini Arora and Surich Bhargava under the guidance of Saket Singhal. Group discussed how to react to any criticism of another actuary's work, elaborated the approach that need to be followed while work of another actuary is to be criticized and how the professional and technical breach is to be dealt with in light of PCS and APS issued by the council.

Session 16 : Quality Data for pricing Health Insurance: In last technical session of the 20th IFS, group of DNKLNK Chakravarti, Raunak Jha, Anuj Bhel and Shobhana Sharma discussed the topic

K S Gopalakrishnan

"Good quality data for appropriate pricing – Need and Challenges for Health Insurance under General Insurance space '. This was guided by Vishwanath Mahindra. Group covered current scenario in industry, pricing challenges, real world data issues, retail and group business, government schemes in detail. Group expressed the importance of maintaining good data from fair pricing perspective i.e. to derive premium- neither too high nor too low. Group suggested practical and possible solutions for various data issues.

Before closing, K S Gopalakrishnan presented the disciplinary process followed by Institute of Actuaries of India in case of professional breach and misconduct by members of the Institute. He replied to various queries raised by the participants on the disciplinary process. He stated that it is important for every member to be aware of this process and all 4 schedules of the Actuary Act that defines misconduct.

Abhay Tewari

Abhay Tewari Secretary of Advisory Group on Professionalism, Ethics and Conduct, emphasized the importance of ethical professional conduct. He thanked all the participants for making all the sessions interesting and informative. He thanked all the guides for their contributions in making all the presentations valuable.

Sanjeev Pujari - Chairperson of Advisory Group on Professionalism, Ethics and Conduct, concluded the 20th IFS by

Sanjeev Pujari

thanking all the participants. He appreciated the seminar design which had a perfect blend of burning issues in the industry and professionalism issues. He expressed his opinion on capping the commission for participating products to have a parity between other types of products.

All said and done, 20th IFS was a grand success . One can claim that two days seminar had contributed to knowledge quotient of all the participants in a great way. We believe that as this legacy will definitely continue in future, actuarial profession in India is going to touch new heights.

PHOTO FEATURES OF 20TH INDIA FELLOWSHIP SEMINAR

16TH GCA – BOOK YOUR ACCOMMODATION NOW...

This announcement is for Accommodation Reservation for 16th Global conference of Actuaries to be held over 17-18 February, 2014. Please make your hotel reservations without delay to secure your room before our room block is either sold out or any unsold rooms are released on 11th February, 2014.

Hotel	Star Rating	Rack Rates		Rates for 16th GCA		Reservation Visit
-	-	Single	Double	Single	Double	
Renaissance Pawai	5 Star	13500	13500	9000	9000	http://gca.actuariesindia.org accommodation/

- Above mentioned charges are valid from 15th Feb - 21st Feb, 2014 (Subject to availability).
- The hotel is located at a distance of just 8 kms from International Airport and 13 kms from Domestic Airport.
- In case of any issues in booking the rooms, please get in touch with Rohit Shetty at (91) 7798984698
- You must book by 11/02/14 to receive the group rate.

2ND SEMINAR ON ENTERPRISE RISK MANAGEMENT

- **Organized by: Advisory Group on Enterprise Risk Management, IAI**
- **Venue: Hotel Double Tree by Hilton**
- **Date: 11th December 2013**

The seminar was organized in the back drop of tremendous changes in the financial services industry, and in particular in the insurance industry. The economic and regulatory environment has seen significant changes recently, new product regulations are being implemented in India, there is a strong possibility of new banking licenses and the distribution architecture is witnessing significant change as well. Changes to solvency and financial reporting regimes globally will also be felt in India, and regulators the world over have stepped up their focus on risk management and governance issues.

The main focus of the seminar was on:

- Risks and Opportunities in the insurance sector in India;
- How Enterprise Risk Management can add value to business from various stakeholder perspectives; and ,
- A deep dive on the key risks and operational risk measurement and management.

The seminar commenced with an introductory address by Sanchit Maini, Appointed Actuary of Max Life Insurance Co Ltd and chairperson of Advisory Group on ERM wherein he welcomed the participants on behalf of IAI. In addition to sharing his perspectives on ERM, he stressed upon the need of organizing such seminars on a regular basis.

Session 1 : Risk Management in the 'new normal'

Speakers: Kshitij Sharma & Kunj Maheshwari, Consultant, Towers Watson

Kshitij Sharma

Kshitij Sharma started the session with a discussion on the "New Normal" which implies the only thing constant in current global and economic conditions is change. Things will change from their current state of being. As PIMCO puts it:

- "When the US and global economy reset after the crisis, [the global economy] will look different."
- "The financial system will be de-leveraged, de-globalised and re-regulated."

Thereafter, he took the audience's view on what characterizes the new normal for the Insurance sector wherein he touched upon Economic, Physical, Technological, Regulatory and Other factors. Most of the people in the audience were of the opinion that Regulatory changes are most critical in defining the new normal.

Kunj Maheshwari

Kunj Maheshwari presented the results of two Global ERM surveys done by Towers Watson in 2008 and 2012. It clearly came out from the surveys that in 2008 ERM was considered a "tough nut to crack" whereas in 2012 insurance companies had a better understanding of ERM and saw the value in embedding risk culture in order to reap the long term benefits.

He also discussed the role of appropriate "(Economic Capital)" modeling in sound decision making.

- No model can be a complete or perfect representation of the real world.
- Stress testing and factor-based approach are predominant in assessing individual risks.
- Survey pointed out that among Indian respondents, stochastic approach is used only for market risks by a few companies in comparison to the global market
- Further as per the 2012 ERM survey, 46% of the European respondents think Solvency II is a good framework for measuring and managing risk in their company.

Session 2 : Innovations in Integrating Operational Risk Measurement and Management

Speaker: Joshua Corrigan, Principal, Milliman

Joshua Corrigan started the session by giving an introduction on Operational risk assessment and the nature of Operational Risk Losses in the banking sector. He emphasized on the choice of

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Joshua Corrigan,

modeling framework for measuring operational risks appropriately. The following aspects of Operational risk were covered:

- Models should be used as a tool to understand extremes instead of "modal" behavior;
- "Scenario Analysis" and "Loss Distribution approach" can be used as a methodology for loss measurement; and
- The gap between modeling and managing risks should be bridged so as to enable sound business decisions.

After this he covered Cognitive Analysis in detail wherein information is structured as a cognitive map and analyzed using a combination of mathematical and psychological techniques. This approach is particularly helpful in mapping complicated risks which involve multiple factors and exhibit complex behavior. Cognitive Analysis is highly helpful in identifying key interactions between different risk profiles.

He also shared with the audience different modeling approaches which included:

1. **Bayesian Network Model-** The model can be calibrated using available data and expert judgment.
2. **Overall Lapse rate distribution-** The model can be calibrated differently for different products and can be recalibrated to reflect environment changes.
3. **Scenario 'Relative Price more expensive'**
4. **Reverse Stress testing**

On policyholder behavior risk, he shared that factors such as product features, tax regulations, competition etc can influence policyholder behavior risk and can therefore have direct impact on company's profits, expenses, operational risk, ALM etc.

Session 3 : Insurance Industry in Asia Pacific

Speaker : Rajeev Varma, Managing Director, Research- Bank of America Merrill Lynch

Rajeev Varma

Mr. Varma in his session gave an overview on Indian economy and then moved on to discuss Indian Insurance sector and how it is seen from an investor's perspective and the key issues perceived by the investors. Mr. Varma shared his prognostic view on Indian economy which included:

- Increasing urbanization to drive consumption;
- Growth in India bottoming out slowly;
- RBI might cut interest rates possibly by mid of 2014. However, it won't be too aggressive due to integration with global economy; and ,
- Inflation to continue to be a big concern for India.

On Indian Insurance Industry he covered the following points:

- With favorable demographics, there is sufficient headroom to sell insurance as penetration remains lower than advanced economies.
- Expansion of distribution network to tier 2 and tier 3 cities by new players.
- With banks getting aggressive in semi-urban market, Bancassurance is expected to emerge as the biggest distribution channel.
- Agency is an efficient channel to manage but is also the most expensive one.
- Product guidelines should improve persistency.
- There could be a double digit decline in growth of premium due to regulatory changes.
- Premium growth is important in determining the growth of the company but in the long run quality matters over quantity.

In the last phase of his session he shared what analysts look for in insurers P&L and Balance sheet. Parameters such as premium growth, persistency, claims + reserves as % of net premium are a few things that analysts consider in Profit and loss account. In terms of Balance sheet, Investment portfolio growth, return on equity, total reserves as % of net premium are a few factors that are looked at while checking financial health of a company.

Session 4 : Natural Catastrophe Risk Management

Speakers: Vineet Kumar, Head Cat Perils Asia Hub, Senior Vice President, Swiss Re Shared Services (India) Private Ltd.

Vineet Kumar

Vineet started his session with a broad description of the perils across Asia which included earthquakes/tsunamis, man-made disasters and weather-related natural catastrophes. With the help of Swiss Re CatNet tool, 616 metropolitan areas have been identified at risk from natural catastrophes. Further they have been analyzed in terms of people potentially affected and value of working days lost. 4 major Indian cities identified at risk from Nat Cats are Kolkata, Mumbai, Chennai and Delhi.

He iterated the need for Nat Cat models and the reasons included:

- Massive gap between economic and insured losses
- Increasing natural catastrophe losses because of growth of value
- Assessment of Nat Cat risk i.e. premium income vs losses

There are 3 Nat Cat modelling landscapes namely Vendor models, Broker models and Company proprietary models. There are 4 elements to model natural catastrophe losses viz-a-viz Risk, Loss resistance, Value distribution, Coverage conditions.

- Vineet Kumar concluded the session with the given remarks:
- Recent events have indicated that vendor models had missed some key loss drivers (secondary perils) in the loss estimation,
- Nat cat modeling can be integrated in the risk management framework for capacity and capital management

Session 5 : Adding Value to Business

Speaker : Shally Gambhir, CRO, Canara HSBC Oriental Bank of Commerce Life Insurance

Shally Gambhir

In this session, Mr. Gambhir presented a CRO view on the value add that ERM framework brings into an organization. He mentioned that the case for ERM has only become stronger than ever post the 2008 financial crisis. CROs being included in Board meetings is a clear indication of increase in focus on ERM. He also shared that ERM provides value addition to multiple stakeholders in an organization from Board, Rating agencies and Regulator to Shareholders, Employees and Customers. He stressed upon the need of having a strong ERM culture where people challenge and question unusual events. The key take aways from Mr.Gambhir's session were:

- Risk culture plays a vital role in strong ERM embedding.
- Good and effective governance is crucial – Frontline of defense has a key role to play.
- Risks should not to be looked in silos and it's important to understand their inter-linkages.
- Important to align risk management strategies with business objective through ERM.
- Simplifying risk assessment to facilitate management decision making.

Session 6 : Board View

Speaker : Marielle Theron, Non Executive Director, Max Life Insurance

Marielle Theron

Ms. Theron started her session with a recap of the significant risk events in the financial market in the recent past. She also emphasized on the reasons for such events which featured the following common themes:

- Failure in private risk management, governance or regulatory oversight
- Top management was too complacent, naive or careless

  She covered the aspect of increased Board accountability and touched upon:

- Increased role of independent directors;
- Increased focus on managing and pre-empting, not only assessing, risks;
- Increased focus on balancing interests of all stakeholders, not only those of shareholders; and ,
- More transparency to the Board.

Ms. Theron briefly covered the international trends for insurers in terms of various disclosures and regulatory requirements. She also provided an update on the lessons learned by Boards from past experience. She concluded the session on the note that the Board requires a sharp, concise and coherent articulation of a risk management strategy, risk map and an effective mitigation plan. It was stressed that risk management is a culture that should be disseminated throughout the organization. 3 strong lines of defense for effective risk management and control include:

- Operational management functions is to own and manage the risks;
- GRC (Governance, Risk and Compliance) and AA functions are to oversee the risks; and ,
- Internal audit function is to provide independent assurance of the ERM effectiveness.

Ms. Theron also pointed out the need to have Appointed Actuary and CROas distinct roles performed by different individuals.

Session 7 : Risks and Opportunities in the Indian Insurance Sector

Speaker : Peeyush Dalmia, Junior Partner, McKinsey

Peeyush Dalmia

The last session of the day was conducted by Peeyush Dalmia on the risks and opportunities in the Indian insurance industry covering both life and general insurance. He opened the session with the remark that the Indian insurance sector has made significant progress in the last 12 years; however the industry is far from realizing its full potential. He also stressed on the fact that there is a stark difference in performance and outcomes between top performers and the rest. Life insurance sector has lagged behind on value creation with (Operating expense + Commission)/New Business APE in the range of 80% and demonstrating lowest margins globally. The main driver of this is low customer retention. In general insurance sector also India has the highest combined ratio of claims and expense.

Mr. Dalmia stated that current Agency economies are highly skewed resulting in significant drain. So there is a need for life insurers to rethink the Agency model. Also, there is an opportunity to create a more tightly integrated Bancassurance model with targeted product development, focus on persistency and aligned organization and governance model across bank and insurer.

Mr. Dalmia presented an example of an innovative product launched by Allianz, Germany wherein traditional accident insurance was coupled with a selection of related services like laundry, cleaning, personal care etc. He emphasized on the fact that realizing the full potential will require all stakeholders to come together. The session was concluded with the actions to be taken under the policy and regulatory framework:

- FOSTER innovation and penetration - Product reforms and distribution reforms;
- STRENGTHEN industry structure - Risk based capital and disclosure norms;
- ENABLE common industry infrastructure - Information sharing and catastrophe funds; and ,
- ATTRACT foreign capital

PHOTO FEATURES OF 2ND ENTERPRISE RISK MANAGEMENT

2ND CAPACITY BUILDING SEMINAR ON HEALTH CARE INSURANCE

• Organized By: Advisory Group on Health Care Insurance, IAI
• Venue: Hotel Double Tree by Hilton, Gurgaon • Date: 12th December 2013

Capacity Building Seminar on Health Care Insurance was conducted by Institute of Actuaries of India (IAI) to bridge the gap between theory and practice with respect to understanding of Health Insurance data. While most of us are aware of health insurance concepts as presented in our course work few of us have the hands on experience to present insights on such vast data pertaining to this industry. Various topics such as concepts of data analytics, case studies to analyze actual data, application of stochastic modeling techniques and the value addition that actuaries bring for advancement of HealthCare Industry was discussed in great breath. The depth of the seminar reached its peak with insights from the senior members of the IAI who time and again contributed to the seminar from past experiences and enriched both the audience and the presenters. The collaboration built between various industry experts, pioneers and new members of IAI during the seminar was highly appreciable.

Biresh Giri

Biresh Giri the Chairperson, Advisory Group on Health Care Insurance welcomed everyone to the 2nd Capacity Building Health Care Insurance seminar on behalf of Institute of Actuaries of India. He highlighted the scope of the seminar aligning it with future goals of IAI. He also highlighted the importance of bridging the gap between Health Care Insurance concepts and their practical application. He later introduced the esteemed speakers and topics to be covered during the next 6 hours.

Biresh concluded by appreciating the increasing number of participants in both 1st and 2nd Capacity Building Seminar and reached out to the audience to have an open discussion. He thanked IAI and the speakers for their indefinite support.

Session 1 : Data Analytics... A way to look forward

Speaker: Raunak Jha Member of Health Care Insurance, Advisory Group and Senior Consultant at Towers Watson

Raunak Jha started the presentation by discussing about the following topics in greater detail:

Raunak Jha

- Actuarial challenges faced by health insurance industry in today's world
- Role of analytics in dealing with these challenges and
- How health insurers can choose to succeed?

Raunak drew the attention of members of IAI to challenges faced by industry today such as shift in disease patters and increased customer awareness which poses difficulty in product innovation. And some other challenges - lack of certainty w.r.t. course of treatment by providers; and changing medical and healthcare needs of customers. She also highlighted the increased penetration of fraud and abuse; and market competition. The role of analytics to analyze data and propose solutions was suggested to be imperative in finding solutions to the above discussed problems. Also, the use of Advanced Analytics that focuses on forecasting, prediction and optimization paved as the future path as a solution to all the said challenges. Later success strategies to help insures succeed in their business by leveraging data and analytics; and committing to customer centric approach concluded the Industry Outlook and called upon the need for the next session on "Getting behind the Numbers" and two case studies that would illustrate the use of Data Analytics to solve real time questions as posed by Health Care Insurance Actuarial Analysts on a daily basis. To facilitate a healthy in-group discussion, every participant was strategically placed with a senior member of the IAI.

About the Author

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Shuchi has close to seven years of analytics and insurance experience. During her professional journey, she has gained experience in various diversified financial industries and applied research and predictive analytics to a broad array of data. She is currently working with Towers Watson and is part of their Risk and Consulting Services, India. She plays an instrumental role in the release of their quarterly newsletter "India Market General Insurance Update – Towers Watson."

Session 2 : Data Analytics... Getting behind the Numbers

Case Study 1: Retail Health..A Case Study

Speakers: Raunak Jha & Ankit Goyal, Towers Watson – Interactive Sessions on Data Analytics & Case Study 1

Case Study 2: Group Health Case Study

Speakers: Raunak Jha & Priyanka Mahajan, Towers Watson – Group Health Insurance & Case Study 2

Ankit Goyal emphasized on use of Data Analytics as the initial step to solve Risk and Financial challenges. For the study to be successful he also emphasized on defining clear goals/objectives, keeping in mind the level of prudence and detail needed to meet the end user, frequency of analysis and there after adopting a three step approach

Ankit Goyal

of acquire, examine, and analyze and infer. The need of acquiring the data from various sources internal and external and understanding differences between policy and claim characteristics of the data was dealt in greater depth. Data Examination techniques such as reconciliation, validation, errors and distortion, cleaning/transforming and segmentation were not only theoretically explained but also approached by means of example using the case study which helped the younger members of IAI understand the practical implications associated with health insurance data. Use of Exploratory Data Analysis (EDA) to analyze and summarize the main characteristics of data and trends analysis was dealt upon next. The members were compelled to infer results and make decisions post their analysis with assistance from expert volunteers and senior actuarial members across the room.

Data analysis has multiple facets and approaches, encompassing diverse techniques some of which were discussed during the presentation and later examined and implemented by the audience with help of a case study.

Case Study 1:

The objective of the case study was to illustrate the discussed techniques by means of examples and various approaches to solve the same problem. It followed a step by step process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision making. A few exercises were designed to segment data, to show root cause analysis to understand written business, to monitor actuarial control cycle and to implement expense analysis. Volunteers were spread across the room and facilitated discussions and dropped hints to assist the audience with the analysis.

The first case study was concluded with a line of caution while dealing with data and with a reminder that the knowledge of Industry experience over years could not be undermined.

Case Study 2:

Priyanka Mahajan and Raunak Jha briefly discussed concepts related to group health insurance and began with a case study highlighting the

Priyanka Mahajan

emphasis of Inference of the data with respect to various perspectives as perceived by different stakeholders such as Insurer, Employer, Broker and Employee. The handouts showcased a progressive approach to analyze data at hand and decide if they were willing to buy the hypothetical portfolio. The methodology taken by the audience was to question the anomalies based on their understanding of various summaries which depicted business overview, portfolio mix, experience analysis in terms of frequency/severity, claims distribution. Inferences and Insights were derived from each table.

Raunak Jha

Methodology of Case Study 2 was designed in a unique manner that forced audience think if the portfolio in question could be profitable and hypothetically be included in their business. Importance of individual parameters was discussed and singled out from each stakeholder perspective. The audience concluded by discussing the relevant questions, terms and conditions, restructuring plans for their next correspondence that should be put forth before making a decision.

Session 3 : Application of Stochastic Modeling Techniques in Health Insurance – Practical Examples

Speaker: Keerti Singh, Apollo Munich Health Insurance

Keerti Singh explained the application of Stochastic Modeling Techniques in HealthCare Industry by means of examples. She highlighted the differences between the Deterministic Models and Stochastic Models. A deterministic model assumes that its outcome is certain if the input to the model is fixed. Irrespective of the number of iterations, one obtains the same result. It is arguable that the stochastic model is more informative than a deterministic model since the former accounts for the uncertainty due to varying behavioral characteristics.

Keerti Singh

The Stochastic Models was explained:

Stochastic Models:

- Model spatial-temporal behavior of phenomena with random components
- unique input leads to different output for each model run, due to the random component of the modeled process, single simulation gives only one possible result
- Multiple runs are used to estimate

probability distributions

- Behavior of dynamic stochastic systems can be described by different types of stochastic processes, such as Poisson and renewal, discrete-time and continuous-time Markov process, matrices of transition probabilities, Brownian processes and diffusion.

The implications of Stochastic Models in Pricing and Business Planning in scope of Health Insurance were discussed:

Pricing

- Claim Distribution
- Risk Premium calculation
- Risk Premium matrix
- Medical Inflation
- Family Floater Discount

Business Planning

- Loss Ratio Projection
- Correlation between products

Session 4 : Value Actuaries Add in Healthcare

Speaker: Joanne Buckle, Milliman UK

Joanne Buckle

Joanne Buckle was the last speaker in the series and gave a global perspective of HealthCare Insurance Industry. She discussed various types of HealthCare Systems, Industry stakeholders and their respective needs. She further explained the audience some key characteristics of healthcare markets and the similarities they share. She provided answers to age old questions such as sources of funding, its distribution, payment procedures of doctors, hospitals, drugs, evaluating if risk equalization operating system exists. She concluded the topic of discussion by telling the audience that, all systems create different incentives => different behavior = > different outcomes.

The need for Enterprise Risk Management (ERM) to tackle Healthcare system inefficiencies that arise due to economic and market factors and the incorporation of statistics with health economics together with tools used in both life and general insurance was highlighted. Some of the Business Problems modeled by health actuaries and their current and future role were other discussion points enjoyed by the audience. Areas where healthcare actuaries can add value turned interactive and below were points were discussed at length:

- Understanding impact of demographic changes, healthcare reforms (RES etc), and quantifying operational risks
- Benchmarking health systems performance on risk-adjusted basis, Quantifying impact of new contracting methods
- Building models to show allocation of risk to stakeholders to ensure a better understanding of the assumed risk
- Isolating impact of risk factors on healthcare trends and modeling future utilization
- Modeling the financial impact of wellness, disease management and preventive care over the medium/long term

  She ended the session by discussing some of the current issues namely:

- Investment in preventive care
- Use of private providers to drive competition
- Encouraging quality and better outcomes through contracting re-design in hospitals and pharmaceutical companies
- Reducing variation in healthcare utilization

The conference was concluded by vote of thanks from Vishwanath Mahendra, where he presented the speakers with memento's, and thanked both the speaker's and the audience for making the 2nd Capacity Building Workshop on Health Care Insurance a huge success.

Session Highlights

Data Analysis and its practical interpretation from various angles was the main emphasis of the session.

The approach followed was Market driven, Data driven and Customer driven.

Case studies were open ended and open to discussion.

Various interesting point of view were put forth with Industry Insights from senior members of IAI.

Importance of Data and Risk Management Tools was highlighted.

Better understanding of similarities and differences of HealthCare Systems in India vs the World.

Value Addition and Role of Actuaries within HealthCare Industry was discussed and greatly appreciated.

The session was a huge success and the broad areas of discussion helped audience get a complete picture of HealthCare Insurance Industry not only at national level but also with respect to global market.

Actuaries and C. As.: Coordination for better Financial Statements

(Plenary Session - 4)

Actuaries view the future and C As review the past –What mechanisms are needed to synergise them for better disclosure and transparency through the prism of Financial Statements

- Chitale, Mukund

PHOTO FEATURES OF 2ND CAPACITY BUILDING SEMINAR ON HEALTH CARE INSURANCE

MANY HAPPY RETURNS OF THE DAY

the Actuary India wishes many more years of healthy life to the following fellow members whose Birthday fall in **JANUARY 2014**

BHUDEV CHATTERJEE
S. R. KELEKAR
N. K. PARIKH
SRINIVASAN NAGASUBRAMANIAN
RAJENDRA PRASAD SHARMA

(Birthday greetings to fellow members who have attained 60 years of age)

INTRODUCTION TO DATA ANALYTICS FOR INSURERS

Data analytics is the latest buzzword in the marketplace. It is clear that analytics is adding value to many industries. Whilst some insurers are embarking on their analytics journey, most are yet to take advantage of the potential it offers. The purpose of this article is to provide a brief introduction to data analytics and outline some applications in the insurance industry.

About the Author

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Aditi is a UK qualified actuary and an affiliate actuary of the Dutch actuarial association. She is a manager at the Financial Risk Management practice of Deloitte in The Netherlands.

What is data analytics?

Simply put, "Data analytics is the use of data to solve complex business problems". It involves analyses of internal and external data to help shape the strategy of an organisation, enhance its performance and drive decision making. It includes a wide range of approaches and solutions, from looking backward to answer questions such as "What is happening and why is it happening?" to forward looking predictive or scenario modelling which answers questions such as "What are the trends and what should be done about it?".

Figure 1: Common types of data analytics

Common types of data analytics

As can be seen in the figure above, there are four common types of analytics used each with increasing level of analytical capability. A brief description for each of them is provided below.

- Descriptive data analytics is performed on historical data to establish statistical benchmarks in order to gain business insights or answer the question "What is happening?". These analyses are mostly descriptive in nature and form part of traditional business analyses.
- Diagnostic data analytics is used to answer the question "Why is it happening?". It strives to identify root causes, key factors, and unseen patterns.
- Predictive data analytics uses statistical and quantitative analysis to identify potentially meaningful relationships in large sets of data. This typically requires the use of multiple sources of data to model correlations which are used for forecasting and predicting future outcomes. Predictive modelling analyses patterns to establish trends, quantify probabilities, and helps reduce uncertainties. Simply put, predictive modelling involves creating or using a model to better predict an unknown future outcome. A classic example of predictive modelling is credit scoring, where, based on an individual's credit history, a numerical score is calculated; this represents the creditworthiness of that individual.

  Predictive data analytics is not new to the actuarial world, predicting policyholder mortality based on age, for example, has been done for a long time. So in some sense insurers were the pioneers for data analytics. However, in terms of the potential that current technologies and data gives us, insurance is just getting started.
- The next step is prescriptive data analytics. Prescriptive data analytics makes use of the results obtained from predictive models to specify an optimal process to ensure limited resources are being focused on relevant KPIs and measurable results to achieve maximum impact. In other words, prescriptive data analytics makes use of the prediction to guide the decision-making process.

Reality, however, rarely fits into one bucket. Most analytical applications span over more than one type of data analytics. For example targetted online marketing using an individual's browsing history spans across all four types of data analytics.

Applications of data analytics

Data analytics applications can provide value throughout the insurance business cycle. Analytics is everywhere in insurance from product development and pricing, to sales and marketing, to underwriting, to claims management, to finance and reporting. Below are some examples in more detail.

A common example of descriptive analytics is basic KPI reporting, where an overview of relevant KPIs for senior management is provided. Using

Figure 2: Illustrative dashboard using software Qlikview
Source: Deloitte

diagnostics analytics, one could go a step further by including the ability to slice and dice data using interactive dashboards, which would assist in providing insights into profitable and non-profitable areas of the business. For example, underwriting profit/loss could be further investigated by distribution channel, using interactive dashboards with specialised data visualisation software.

Segmentation is a method of clustering data into certain categories with similar characteristics, for example, economic or demographic categories such as age, income, and region, and, lifestyle characteristics such as use of social media, level of education and interest

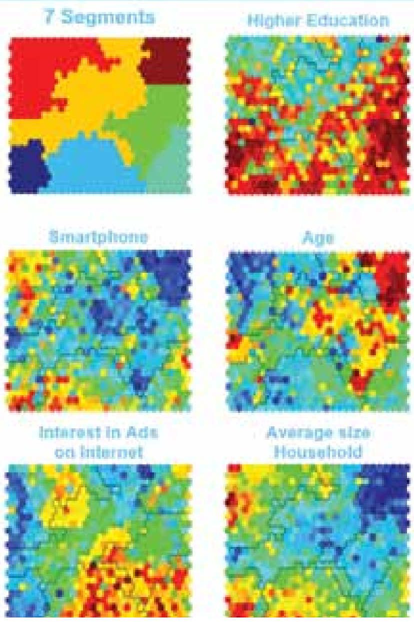
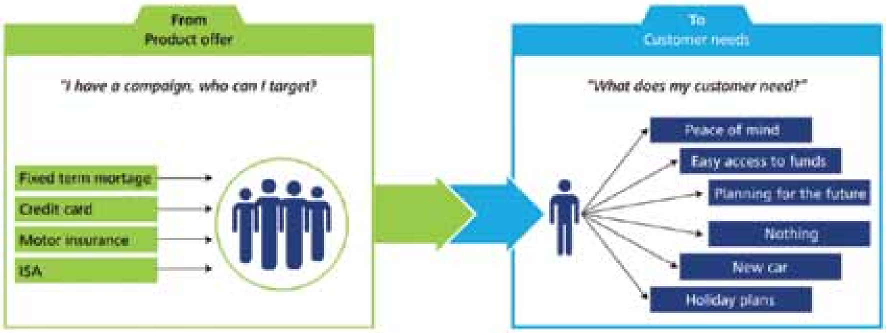


Figure 3: Illustrative segmentation
Source: Deloitte

in internet advertisement. Segmenting in-force policyholder data could be used to develop profiles of customers, such as economical pensioners, independent professionals, or low budget families. Using this segmentation, a specific product and marketing strategy for individual customer profiles could be developed.

Changing focus from products to customers



Source: Deloitte LLP

An interesting new development is calculation of Customer Lifetime Value (CLV). CLV uses all internally and externally available information, to make as individualised calculations as possible. As the name suggests it calculates the value that could be realised from an individual policyholder, taking into account his individual demographic profile, profits from existing contracts, future potential (cross sell or up sell) and value that could be derived from his other relationships (family or friends). CLV could be used to segment customer groups on which marketing or retention efforts may be focussed. It could also replace traditional sales related KPIs, such as, number of policies or premium amounts, as this is more closely connected with potential profit.

Within financial services a common example is 'Next Best Action', which selects the most suitable action from a range of possible actions targeted to the needs and risk profile of an individual customer. Focused retention, cross-selling and up-selling activities could be designed using a 'Next Best Action' program. At each point in time in a customer life cycle, specific products or services to be offered, and the channel through with they should be offered, is designed. It shifts focus from a product centric approach to a customer centric approach, by focussing on the needs of an individual customer and thereby enhancing customer experience. This also enables the most efficient use of marketing resources, by focussing efforts on individually catered products, rather than large scale expensive campaigns.

Using data analytics to predict mortality

Insurers have large internal data sets and access to relevant external data, which may very well have a greater potential than is currently used. Actuaries are optimally positioned to explore and apply these additional possibilities. Typically actuaries have been involved in pricing and reserving, and therefore, have a deep understanding of the data and actuarial models. Actuaries also have in place the advanced modelling skills required for a successful analytics implementation.

One application that has been successfully implemented by several US insurers is applying advanced analytics models to improve mortality predictions by using externally obtained lifestyle data (Scism, 2011). These models improve the accuracy of the underwriting process, without having to rely as much on medical tests.

Underwriting is a time consuming, costly exercise. By using predictive modelling, the process can be made faster, less invasive, cheaper and consistent. A high level example, demonstrating the pathway to developing such a model, for the application process for life-insurance policies is shown below.

- The data sources are the insurance company's internal data, enriched with external data sources (demographic and socio-economic policyholder data as well as behavioural indicators) and publicly available information.
- Different predictive models are constructed and tested to select the optimal set of predictive variables. The most suitable model is used to score the mortality risk of each applicant.
- Decision rules can be written that, based on the mortality-risk score, prescribe a recommended action. Applicants that are scored as good risks could receive an immediate policy offer, while bad risks could be referred to human underwriters for further examination before a decision is made to accept or decline.

Why now?

The volume, complexity and variety of data available to insurers are growing and will continue to grow each day. The rise of social media, mobile technology, and cloud computing, is altering the way organisations interact with their customers and the demands of customers from organisations. A changing regulatory landscape, with the advent of Solvency 2 and IFRS 4 Phase 2, requires deeper insights into risks undertaken by a company. The need to have more informed and responsive decisions, in increasingly complex global businesses, support the cause of deeper analysis. All these factors mean that now is the time, for actuaries to get involved and start thinking about advanced data analytics applications.

Reference (Scism, 2011)

I would like to thank Meindert van Dijk, Ferdi Teunissen, Fabian Kratz, Nagin Parekh, Michiel Lodewijk, Ron Hersmis and Hoang Nguyen for their invaluable input.

Pension Fund Industry in India- Scope for the future

(S3 Concorrent Session- 2.3)

The Session will cover the state of the Pension Fund Industry in India, the evolving scenario including the regulatory and policy changes, the changing demographic patterns and its impact for the development of a well functioning pension fund industry in India, which is conspicuous by its absence till now.

- Srivastava, Anshul

Catastrophe Bonds

(S7 Concurrent Session- 4.5)

Ready to bet on natural disasters - invest in cat bonds!!!

But before that, join us to understand this new breed of asset class, its emerging popularity, how it works and how it compares to other bonds.

- Jain, Saanya & Goyal, Ankit

Updateon life insurance in AP region and Solvency II

(Plenary Session- 3)

The session will provide a brief overview of latest market trends in life insurance within the APAC region, followed by an update on the risk management and measurement advances around the world. The latter part will be an update on the latest position of Solvency II in Europe as well as related developments in various countries in Asia.

- Jalan, Vivek

Coronary Disease

(S3 Concurrent Session- 3.3)

The 6 steps to avoid heart disease

1. Not smoking
2. Controlling cholesterol
3. Lifestyle (diet and exercise)
4. Avoiding diabetes
5. Alcohol in moderation
6. Controlling blood pressure

- Dr Prasad, Sanjay

Critical Illness in Asia – A Success Story

(S3 Concorrent Session- 1.1)

The Asian Markets are responsible for the highest volume of critical illness business sold worldwide.

- The evolution of the Asian markets and why critical illness is so successful here.
- The key differences between the various Asian markets, with a focus on
- Multiple CI products • Cancer-only products

- Braaf, Karsten De and Kattumuri, Raghav

Revival of Indian life insurance sector - how and when?

(S7 Concurrent Session- 3.5)

This presentation discusses the key changes required in the business practices, regulations and the macro-economic environment for a revival and sustainable growth of the Indian life insurance sector.

- Kawatkar, Sanket

The Changing Role of the Actuary - Ramping up our Relevance

(Plenary Session- 2)

The world in which we work is changing at an unstoppable pace. Technology continues to provide new methods to solve problems and, as we rely on it more, makes us work in different ways. As actuarial professionals, we must continue to ask ourselves questions about how the service we provide is evolving, what the future holds for us and what we need to do in order to remain relevant on the global stage.

- Hare, David

STUDENT COLUMN

DEFINED BENEFIT PENSION BUY-OUT IN THE UK A SYNOPSIS

A Defined Benefit (DB) pension scheme is an arrangement where the benefits are defined by the scheme rules (based on the members' salary, accrual rate and length of service in the company). Under such a plan, the employer and employee contribute certain proportion of the employee's salary intwo a fund which is generally managed by the Trustees of that pension fund.

In the 1950s, a shift was seen in benefit design from defined contribution to final salary defined benefit. The popularity of defined contribution and of average salary defined benefit provision in the 1930s declined from the 1950s to the 1970s. In 1979, final salary defined benefit pension funds composed ninety two percent of all pension funds, versus only twenty three percent in 1963.*

Under a DB contract, the employer is responsible for investing the funds in the market in order to meet its obligations to the employees. Hence, the investment risk is borne by the employer whilst the employee is guaranteed a certain minimum level of benefits upon retirement.

What is a buy-out?

As the global trend has been in the past 20 years, the UK market has also experienced a gradual decline in the interest rates, volatile inflation rates along with significant improvements in the mortality rates, which resulted in lower returns on investments and greater liability risk than anticipated. Hence, the Trustees of pension schemes, in order to divest them of all responsibility in respect of pension payments and transfer the risk of uncertain future payments, approached insurance companies and buy-out firms for a potential buy-out.

A buyout of pension benefits means an insurance company/provider takes over all elements of responsibility for the payments to be made to the employees of the scheme. This can take place in the following ways:

- The Insurer issuing a *Trustee policy*, wherein the insurer pays the pension to the trustees' account and further the trustees are liable to pay to the members of the scheme. In such a case, there is no direct contract between the insurer and the members.
- The Insurer issuing Individual policies resulting in a direct payment of pensions to the members of the scheme. This generally turns out to be more expensive to the Trustees due to various other expenses such as administrative expenses.

What a pension scheme pricing actuary does?

In general, a pricing actuary calculates the premium to be charged from the employers. This can be a single premium or paid in installments over a period. It is a complex process and involves various factors and risks, as described below.

Procedure

1. Assumptions

In a buy-out, an insurance firm takes over future liabilities which involve risk and uncertainty. Hence, different assumptions need to be made in this respect, typically for unknown variables. Following is a brief of the assumptions, most commonly taken into consideration by insurers.

Financial Assumptions

Interest Rate - Expected future payments from pension schemes are discounted in order to calculate the Net Present Value (NPV) of the pension liabilities. Lower interest rates reflect a lower-growth environment. Consequently, insurance companies that have charged lower premiums for schemes with high-return guarantees, assuming that the interest rates would rise in future, may have difficulty fulfilling these promises. As a result, the solvency status of insurers would be badly damaged during the crisis.

About the Authors

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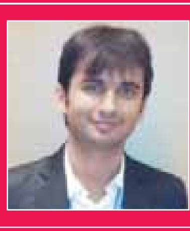
Kajal Sawhney is a student member of IAI. She has been working in the pricing of bulk pension annuities for over two years.



dhawalrajani@gmail.com

Dhawal Rajani is a student member of IAI. He is currently working for the valuations of dividends of participating life insurance products.

Inflation - This is one of the biggest concerns of an insurer in today's highly volatile market. Benefits payable from pension schemes are generally linked to inflation. A lower inflation assumption means a lower value is placed on the pension liabilities. Hence, a shift in the index would affect the amount by which the pensions being paid to retired workers go up each year. On the assets side, if an insurer invests majorly in index-linked (RPI/CPI) bonds, any movement to the inflation index could have major impact on those investments and hence, the earnings of the company.

Life Expectancy

The life expectancy assumptions show the length of time that an insurance company is assuming that pensions will be paid to the members of a pension scheme.

There is regulatory pressure to provide CPI linked benefits to the members. However, in practice, there is no liquid market for CPI instruments. In future, we can expect, the government to come up with measures such as issuing CPI linked bonds.

Mortality Assumptions

Insurers, while setting the base mortality rates, have to consider certain legal and statutory regulations. The starting point for various companies in setting the current life expectancy may be the latest study by the Continuous Mortality Investigation Bureau into the life expectancy of Self-Administered Pension Scheme (SAPS) members. These figures are generally based on the members' age and gender.

Demographic Assumptions

A scheme-specific adjustment may then be applied to calculate the Underwriting Factors using various methods such as Postcode Analysis which aim to reflect the key lifestyle, health & wealth characteristics of the scheme's membership, generally defined as the demographic assumptions.

An insurer can allow for the future improvements in life expectancy for the deferred scheme members, i.e. those retiring in the future.

The insurer may choose to incorporate few other assumptions such as factors for members with very high pensions & empirical studies for larger schemes

Second Life Assumptions

Unknown Spouse Date of Birth & Proportion

Married: Most of the schemes in the UK have attaching second life (spouse or any other financial dependant) benefits payable upon member's death. If an insurer does not have enough information about the members' spouses, it is vital to have certain standard assumptions to assess the proportion of contingent spouse risk.

Statutory requirements Insurers need to take into account certain statutory & legal requirements, as set out by the Government and the Pensions Regulator. These generally include the following:

- Solvency margins which comprise of the Minimum Capital Requirements and the Individual Capital Adequacy Standard (ICAS), developed by the FSA in response to a rash of insolvencies.
- The realistic liabilities and risk capital margin are used in conjunction with statutory mathematical reserves to obtain an Enhanced Capital Requirement (ECR).
- In addition, greater incentives and requirements have been imposed for firms to improve corporate governance and risk management.

The Actuarial Profession has revised down its life expectancy projections for older people after recording slower than expected improvements in mortality rates over the last decade.

These requirements have almost always been a major source of concern for insurers; hence they need to make prudent assumptions in this respect. It affects the overall premium and is generally covered in the expenses charged from the clients.

2. **Expenses**

As pension scheme buy-outs are associated with long term liabilities, an insurer considers a number of costs involved in such arrangements.

Fixed Expenses – In a broader sense, Implementation and Acquisition costs, including certain implicit costs are the basic fixed initial expenses involved in a buy-out.

Running costs – These costs majorly include Administration costs, Legal fees (legal opinion provided to the insurers relating to specific pension issues), Audit fees (specific regulatory requirements, e.g. where scheme membership is in excess of 100 members), Statutory reporting requirements (such as trustee presentations, one to one advisory meetings, etc.), maintenance expenses like Third Party Administration (TPA) and Custodian fees, Interest and Inflation risk expenses, etc.

Solvency II's impact on capital is expected to be significant for most insurance entities; depending on their ability to raise capital, they may have limited options on how to meet the heightened capital requirements.

Policy Expenses – These are usually per member costs which vary according to the number of members in a pension scheme. (E.g. cost of issuing individual policies).

Investment expenses – Investment managers typically disclose annual investment management charges for the management of a pension scheme. This might also include certain additional costs such as Trading Costs (e.g. Brokerage commissions paid when an asset is bought or sold), Stamp Duty, Ramp-up costs and other Taxes (e.g. taxes related to share dealing in certain jurisdictions), etc.

3. **Modeling**

- The data consisting of the scheme members with various other relevant details such as gender, pension amounts, spouses' details, etc. is cleaned and sorted to make it viable to be used in a financial model.
- An appropriate choice of scheme-specific assumptions is made, consistent with the insurer's pricing bases.
- Reserves are calculated by summing up the expected present value of all the future cash flows.
- Expenses incurred or to be borne by the insurer are then added to the reserves to calculate the ultimate scheme liability.

4. **Pricing Strategy**

- An insurer would invest in a variety of funds, typically a mixture of equities, fixed interest gilts & corporate bonds. The price an insurer would charge for its future liabilities will greatly depend on the expected **future return on its current investments**.
- The aim of an insurer would be to provide an optimum level of returns to the

stakeholders' for the amount of risk borne by them, depending upon the company's pricing strategy; an **internal rate of return** on a product's projected capital flows, is the primary financial measure for pricing business opportunities.

The optimum amount of premium (best price of an insurer) is thus calculated, using the results generated through modeling and taking into account the pricing strategy.

In July 2013, Pension Insurance Corporation (PIC) concluded the largest buy-out in UK history with the EMI Group Pension Fund, London. The transaction has passed liabilities worth £1.5bn to PIC, as well as responsibility for 20,000 members.

Stakeholder's confidence is expected to improve due to:

- **Forthcoming regulations that will establish further capital requirements**
- **Improved enterprise risk governance may lead to more effective risk management**
- **Regulators promoting fair outcomes for customers should help bolster confidence in the industry**

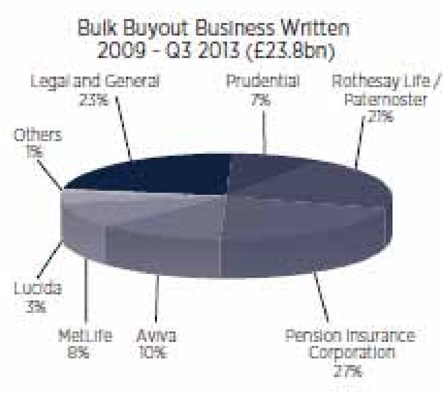
<u>Major problems related to DB schemes</u>

Over one million members of defined benefit (DB) pension schemes will receive their pension from insurance firms by 2017 as more companies and trustees de-risk their pension liabilities using insurance, according to the fifth annual LCP Pension Buy-ins, Buy-outs and Longevity Swaps report.

However, the very idea of conducting a buy-out of annuities to insurers has become an alarming issue for the insurers and other annuity providers as well. These are longer duration liabilities; hence the risk involved is too high. Over the past few years, a combination of tightened financial regulation, more transparent accounting disclosures, falling interest rates on medium and long-term government bonds, deteriorating stock markets, improvements in life expectancy and inflationary pressures has seen DB pension liabilities rocket to unprecedented levels.

Taking into account the costs associated with insurance reserves and a low profit loading, the industry has already started to witness quite a few major players out of the market – highlighted by the recent sale of Lucida to Legal & General – though the remaining providers still produce a competitive market for pension schemes to access.

UK pension schemes are at different points on their routes to settlement, but it is clear that there will be a strong and sustained demand, at least in the near future, from employers, trustees and



members for gradual risk reduction and the settlement of pension liabilities.

The UK BD schemes are closing to new entrants at an alarming rate. People who are already enrolled under BD Plans are reluctant to move out due to the security and assurance of benefits under such plans.

<u>Rise of DC schemes</u>

The future of private (and, possibly public) sector pension provision in the UK is, for the foreseeable future, Defined Contribution (DC). The same can also be said for most other countries with a funded pension system.

Under a Defined Contribution Pension Plan (DCPP), an employee determines which investments their contributions are invested in from a selection of investment options available within the plan. This allows them to create an individual portfolio suited to their own investment goals and tolerance for risk.

DC, sometimes called money purchase, has its own advantages like personal control over the funds, ease of vesting into different avenues of investment and generally higher level of benefits (along with the associated risks) as compared to the traditional final salary pensions.

The statistics certainly speak for themselves:

- only around a quarter of DB schemes are open to new members;
- Within the private sector, about 60 per cent of active members are in, mostly contract-based, DC pension arrangements.
- Moreover, DC has become all the more prevalent in the UK from October 2012 when employers started to auto-enroll their employees into a pension scheme and contributed for them.

Whilst DC plans seem like a good solution for reducing the corporate sponsor's pension risk, DC contributions have remained significantly and consistently lower than DB contributions. A negative for DC is the uncertainty of investment returns. The contribution is usually fixed by agreement with the employer, but the benefits are not fixed in advance. However, the Department for Work and Pensions (DWP) believes that there are alternatives to the two basic structures, i.e. DB and DC, and has been talking to the pensions industry to see what types of scheme structure could offer members a little more security without putting too great a burden on employers, and thereby shore up pensions savings in the UK.

<u>Citation</u>

Information about the market scenarios & facts/ figures - Assistance taken from pension websites and newspaper articles

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16TH GCA SPEAKERS

16th Global Conference of ACTUARIES

INAUGURAL

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Kuruvila, Vivek India Head of Life & Health Client Markets Swiss Re Services India Private Ltd	**Burr, Robert** Hong Kong Head of Life and Health, Asia Swiss Re Services India Private Ltd

PLANERY SESSION

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Nair, Asha India Director & General Manager United India Insurance Co. Ltd.	**Thomsen, Torben** London Chief Pricing Officer, Life and Health Swiss Re Services India Private Ltd	**Pandit, D K** India Partner K.A.Pandit
Jalan, Vivek India Director, Risk Consulting, Towers Watson India Pvt. Ltd.	**Chatterjee, Arup** Philippines Senior Financial Sector Specialist Asian Development Bank	**Comerford, Gary** Canada Chief Marketing Officer RGA Services India Pvt. Ltd.
Chitale, Mukund India Chartered Accountant Mukund M. Chitale & Co.	**Holloway, Richard** Singapore Managing Director, South East Asia and India, Life Milliman India Private Limited	

CONCURRENT SESSION

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Govardhan, N M India Actuary and Former Chairman LIC of India	**Basu, Heerak** India Senior Vice President & Appointed Actuary Tata AIA Life Insurance Company Ltd.	**Peethambaran, A P** India Consulting Actuary in Retirement Benefits	**Shah, Mehul** India Appointed Actuary & Head of ERM L & T General Insurance Co. Ltd.	**Admas, Gayle** India Appointed Actuary Raheja QBE
Madhusudhanan, Sridharan Singapore Chief Pricing Actuary Munich Re	**Guscza, Jim** National Predictiv Analytics Lead Deloitte Consulting	**Pant, Dinesh** India Secretary Product Development Actuarial Core Group Product Actuary LIC of India	**Majumdar, Jyoti** India Head of Client Markets, Property and Casualty Swiss Re Services India Private Ltd	**De Braff, Karsten** Singapore Head of Product Development SCOR Global Life
Raghavrao, Kattumuri Singapore Manager Product Development & Pricing SCOR Global Life	**Rathod, Chirag** India Appointed Actuary and Director - Products & Strategy Canara HSBC Oriental Bank of Commerce Life Insurance Company	**Chakrabarti, Tania** India Head - Actuarial Services & Appointed Actuary Royal Sundaram Alliance Insurance Company Limited	**Rajagopalan, V** India Member of the Advisory Group on Professionalism, Ethics and Conduct Institute of Actuaries of India	**Rastogi, Anurag** India Vice President & Head (Actuarial) Bajaj Allianz General Insurance Company Ltd.
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Sahay, Kamalji India CEO SUD Life & Advisor, GIC Re	**Krishnamoorthy, K G** India CEO Future Generali India Life Insurance Company	**Kulkarni, Girish** India CEO SUD Life	**Sriperumbuduri, Srinivas** India India Retd. Service Center Leader Mercer	**Agrawal, Ankur** India Chair -Offshored Advisory Group, IAI AXA Business Services
Jain, Saanya India Actuarial Analyst Towers Watson India Pvt. Ltd.	**Shree, Tanu** India Actuarial Advisor RSA Actuarial Services (India) Pvt. Ltd.	**Gupta, Varun** India Fellow Member of IAI Max Life Insurance Co. Ltd	**Dr. Bhatnagar, Kavim V** Bangladesh Pension Specialist (International) World Bank's Strengthening Public Expenditure Management Program Ministry of Finance, Government of Bangladesh	

IAI STUDENT EVENT SESSION

Cribb, Derek India Chief Executive, Institute and Faculty of Actuaries	**McInerney, Frank** Singapore General Manager, Life/Health, Gen Re	**Sarma, GLN** India Managing Director, Hannover Re Consulting Services

Nischay Gupta

nischay999@gmail.com

What were the basic mantras of your success?

I would say that persistent practice and going to the depth of each concept would be my key mantras.

Tell us about yourself, your educational background and your hobbies

I am a 4th year B.tech student of Indian Institute of Technology, Roorkee. I did my schooling from Delhi Public School, Vasant Kunj. In my free time, I like listening to music, solving maths puzzles and playing football.

When did you decided to take up Actuarial professional course?

I decided to take this course in the beginning of my final year in college. At that time I was giving a lot of thought to the career choices that I had. I wanted to take up a profession, in which I would love my work.

How did you come to know about the ACET?

From my elder brother- Ashish Gupta, who also gave the ACET exam this year. He is currently pursuing his MBA from MDI Gurgaon.

How much time do you think one requires for serious preparation for this exam?

Since I am an engineering student, i already had a background of most of the basic concepts in the syllabus of acet from my regular courses in the college. It took me around a month, of 2 hrs each day practicing problems, for the complete preparation.

How did you start preparation for the ACET?

I started from the Foundation ActEd Course (FAC) and STATS study material pack provided by the institute. It has very detailed explanation of each topic and that too in an interctive way, so I didn't really feel the need to refer any other source for preparation.

Which is the most difficult part of this examination and why? What was your strategy to tackle this difficult part?

I found the Advanced Probability section of the exam to be relatively tricky, owing to the variety of questions that can be framed from this section.

I practiced a lot of questions from this section and paid attention to the minute details of each problem. I compared similar questions and tried to understand how the change of a single word in a question, changes the entire approach of solving it.

Did you prepare notes? How helpful are the notes? What is your advice on notes-making?

The study material provided by the institute already has course notes, summarizing all the important concepts, at the end of each chapter. I found them very useful, and didn't feel the need to prepare my own notes.

How do you visualize your success?

I would feel successful when I would be leading a decision-making career. When I would be enjoying my work at that position.

What were your strong points which enabled you to achieve success in ACET?

The fact that I enjoy solving maths problems. Regular studies. Time management during the examination.

How do you think you can add value to the Actuarial Profession?

I like to think that I have a knack for mathematics. The Actuarial profession involves application of mathematical techniques to study the past and shape the future. With great interest and understanding in Mathematics, I believe that I can provide a wide range of ideas to solve critical problems, analyse complex relationships and effectively manage the risks involved in all situations.

Are you working somewhere? Describe a typical work week?

I am currently a student. Not working.

What are you passionate about?

I am passionate about solving puzzles and riddles involving maths and complex logic.

Behind one topper are many people who stood by him/her during those uncertain times when he/she was merely an 'aspirant'. Who were those people in your case? Any specific incidence that you would like to share with us?

My elder brother (Ashish) helped me a lot with my preparation.

I remember there was a time when I got confused by a solution of a probability problem. He solved the problem in 3 different ways, and explained to me each solution in detail. I guess that's how I got my base strong.

What are some of the mistakes that an average aspirant can avoid for better time management? What is your message for them?

There were some sections in the syllabus that were relatively easy. An average aspirant might study the theory part, but he might not do sufficient practice by solving problems of those sections. My message would be to not ignore any part, and devote sufficient time to cover the syllabus thoroughly.

Any comments on your experience with ACET process.

I enjoyed studying from the course material, and the overall process went smoothly. I appreciate the quick release of results, which were displayed within 10 days of the exam.

SUCCESS STORY

Vimal Mishra

vimal.jee@gmail.com

What were the basic mantras of your success?

Staying focused and consistent practice were my mantras of success.

Tell us about yourself, your educational background and your hobbies

I have done my B Tech in Mechanical Engineering (2001-2005 Batch) from IIT Kharagpur. Currently I am working as a Senior Business Analyst in Societe Generale Global Solutions Center, Bangalore. I am a certified Risk Professional (FRM Certificate Holder) from GAARP- USA. I am passionate about learning new things, especially in the field of Finance. Of late, this has become my hobby too. I am pretty much interested in learning the application of different fields; eg- Mathematics, Behavioral Science etc in Finance.

When did you decided to take up Actuarial professional course?

I decided to take up this exam in July 2013 and applied for the same as soon as the registration was open.

How did you come to know about the ACET?

I came to know about it through one of my friends.

How much time do you think one requires for serious preparation for this exam?

It depends on the background one comes from. Since, I am from Engineering background and have already gone through the rigorous mathematics as part of my FRM exam, it took me hardly 10 days to prepare for it.

How did you start preparation for the ACET?

I relied solely on the material provided by Actuaries Society as part of this exam.

Which is the most difficult part of this examination and why? What was your strategy to tackle this difficult part?

I found Difference Equation little difficult. It was one topic that I was not much aware about and that's why I found it little difficult initially. I downloaded some material from internet and studied that deeply.

Did you prepare notes? How helpful are the notes? What is your advice on notes-making?

No, I did not prepare any notes as such. I practiced all the questions given in the material. Whether to prepare notes or not depends on once style of learning. For me, it was not required.

How do you visualize your success?

I feel pretty happy and satisfied with what I achieved; however, still have miles to go.

What were your strong points which enabled you to achieve success in ACET?

My keen interest in Mathematics and its application in the field of Finance coupled with my ability to stay focused and take things seriously were the pointers for this success.

How do you think you can add value to the Actuarial Profession?

I think I bring with me all the required qualities that a successful actuary should have, for example – capability to extract information from raw data, capability to analyze logically etc. Besides, my educational background as well as professional experience will add an element of diversity to Actuary profession.

Are you working somewhere? Describe a typical work week?

Yes, currently, I am working with Societe Generale Global Solutions Center, Bangalore as a Senior Business Analyst. It's a Software Development Center for the French Bank. As part of my work, I need to interact closely with my counterparts and Middle Office users in Paris to understand their requirements and design solutions for the same. The finalized solution is what I discuss to IT Dev team in Bangalore.

What are you passionate about?

I am passionate about learning new things.

Behind one topper are many people who stood by him/her during those uncertain times when he/she was merely an 'aspirant'. Who were those people in your case? Any specific incidence that you would like to share with us?

My boss Mr Raminder Ahuja and my wife Anu were the people who motivated me to excel in this exam. Two days before the exam, I was feeling bit low and it was Raminder who called me during the night and advised me to stay cool and confident. It helped me in boosting my morale. I am really thankful to him for his consistent guidance.

It would be unjust if I don't mention the name of my uncle Late Mr Devmani Mishra to whom I owe all the success that I achieve in my life.

What are some of the mistakes that an average aspirant can avoid for better time management? What is your message for them?

I think time given for finishing the exam is sufficient enough to solve all the problems. The only thing that one should do is to read the question and options carefully so that silly mistakes can be avoided.

Any comments on your experience with ACET process.

It was wonderful experience. I didn't find any problem whatsoever with any aspects of ACET process. I must mention one thing about the study material – it was excellent!

■■■

COUNTRY REPORT

GREETINGS FROM CANADA...

In this article i will provide an update on recent developments on the standards of practice for the valuation of insurance contract liabilities and the review by the regulator to update required capita

In Canada, actuarial practice is governed by the Canadian Institute of Actuaries. The Standards of Practice, developed by the Actuarial Standards Board (ASB), provide detailed descriptions of how actuaries are to conduct their work for all practice areas such as, actuarial evidence, pensions and life/property and casualty insurance.

Insurance contract liabilities are valued on the Canadian Asset Liability Method (CALM). Under CALM, the insurance contract liability is the amount of supporting assets which will reduce to zero at the last liability cash flow in a forecast of future asset and liability cash flows. The Standards require testing of cash flows on a number of prescribed interest rate scenarios and adopting a scenario which make sufficient provision for the insurer's obligation. The interest rate scenarios are defined by risk free yields and corresponding premium for each asset class. The models will define the insurer's investment strategy for reinvestment and disinvestment of each asset class. CALM is a "roll forward" method as opposed to traditional actuarial present value methods which are "pull backward" approaches.

Some products, such as the valuation of embedded options in variable annuity guarantees, require stochastic modeling with economic assumptions projected based on an economic scenario generator with the investment returns calibrated to a defined set of criteria.

Current projects by the ASB include a review of the Standards for the economic reinvestment assumptions and investment strategies for long-tailed liability cash flows. Interest rates in Canada are at historical lows, and concerns have been raised about the application of CALM in today's low interest rate environment beyond the term of readily available fixed income assets. The range of investment strategies employed can have a significant impact on insurance contract liabilities. Specific issues with current practices include:

- Differences between the guidance for stochastic and deterministic testing
- Reinvestment strategies using non-fixed income assets
- Risk premiums assumed for reinvestments
- Required capital is governed by the Office of the Superintendent of Financial Institutions (OSFI), which is the regulator of insurance companies and other financial institutions in Canada. The Minimum Continuing Capital Surplus Requirement (MCCSR) provides the framework for which OSFI assess if a life insurance company has adequate capital.

OSFI has been reviewing the MCCSR framework to incorporate advances in actuarial and economic capital theory that are difficult to incorporate into the existing system. The new approach will use a target asset requirement which requires the company to hold assets equal to the sum of the best estimate of its insurance obligations and a solvency buffer. The solvency buffer is the amount of assets a life insurance company must hold in addition to those needed to cover best-estimate life insurance obligations so that the company has a very high degree of confidence that it can withstand adverse conditions over a one year time horizon and sell or run off the business after the year. To support the new approach a working group was established and been conducting Quantitative Impact Studies (QIS) where companies are requested to provide results under the scenarios being tested. The main purpose of the QIS is to test the practicality of the methods being proposed for the new components as well as to estimate the potential impact of adopting these components.

Currently QIS #5 is being tested which includes credit, market, insurance and operational risk. For example, the solvency buffer for interest rate risk uses deterministic shock calculations. Asset and liability cash flows are projected and the sensitivity of the present value of the cash flows to interest rate changes is tested at different interest rate assumptions.

About the Author

Kedar.Mulgund@sunlife.com

Kedar Mulgund is an Actuary at Sun Life Financial in Toronto, Canada. He has 18 years of experience in pricing, product development and financial reporting spanning Canada and India.

PUZZLE

Puzzle No 205:
Can it be said that six words below are in alphabetical order?
accept bell dirty know jot most

Puzzle No 206:
X and XSUM are two variables related to each other as follows.
XSUM equals the total of the digits comprising X
X equals $(XSUM)^3$
One solution is XSUM = 17 and X = 4913, as 4 + 9 +1 + 3 = 17 and 17^3 = 4913. How many other solutions are there? Find these solutions.

Solutions to Puzzles:

Puzzle No 199:
Tom should receive seven coins from Harry and Dick just one.

Puzzle No 200:
Wink should not accept Tiddle's offer. By not accepting Tiddle's offer Wink risks losing by 5-0 or 5-1 but also leaves more room for luck to work in his favor.

Puzzle No 201:
12 signs of the zodiac
7 wonders of the ancient world
54 cards in a pack (with the jokers)
32 degrees Fahrenheit at which water freezes
18 holes on a golf course
4 quarts in a gallon
11 players in a cricket team
5 vowels in the alphabet
1001 Arabian Nights
7 colours of the rainbow
12 months in a year
9 lives of a cat
3 men in a boat

Puzzle No 202:
The fifth man received 2,302 coconuts. From the starting pile of 15,621 coconuts, the first man received 4,147 coconuts, the second man 3,522 coconuts, the third man 3,022 coconuts, and the fourth man 2,622 coconuts. The remaining six coconuts went to the monkey.

Correct solutions were received from:

Puzzle No 199:
1. Shilpi Jain
2. Sarthak Goel
3. Vikas Rathi
4. Kajal Mittal
5. Himanshu Verma
6. Manoj Kumar
7. Saurabh Birla
8. Aishwarya Ramaraju
9. Mayank Tondak
10. Vishal Bhutani
11. Jagrati Chhalani

Puzzle No 200:
1. Shilpi Jain
2. Sarthak Goel
3. Vikas Rathi
4. Himanshu Verma
5. Punit Parekh
6. Manoj Kumar
7. Saurabh Birla
8. Aishwarya Ramaraju
9. Graham Lyons
10. Jagrati Chhalani
11. Harshul Taneja

Puzzle No 201:
1. Vishal Goel
2. Sarthak Goel
3. Shilpi Jain
4. Jagrati Chhalani
5. Akash Chandra Jha
6. Shreya Chheda
7. Richie Lahoti
8. Ajit Kumar Jha
9. Rajarajeswari C.
10. Mercy Amalraj
11. A. Balasubramanian
12. Graham Lyons
13. R. Mythili

Puzzle No 202:
1. Shilpi Jain
2. Sarthak Goel
3. Palash Shah
4. Graham Lyons
5. Prasanna Venkatesh

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SUDOKU

SUDOKU No. 18 for the month of JANUARY 2014

SUDOKU HARD

3		4	2		5		6	9
1			4			7	8	
9				2				6
5								3
8				7				1
	9	2			4			8
4	1		6		3	5		7

HOW TO PLAY
Fill in the grid so that every horizontal row, every vertical column and every 3x3 box contains the digits 1-9, without repeating the numbers in the same row, column or box.
You can't change the digits already given in the grid.

- Sudoku Puzzle by Vinod Kumar

Solution of Sudoku Puzzle No.17 published in the Month of December 2013

SOLUTION

8	6	5	7	3	1	9	4	2
2	1	4	5	6	9	7	3	8
3	7	9	4	2	8	1	6	5
5	2	8	3	7	6	4	1	9
9	3	1	8	4	5	6	2	7
6	4	7	9	1	2	8	5	3
4	8	6	2	9	3	5	7	1
7	5	3	1	8	4	2	9	6
1	9	2	6	5	7	3	8	4

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