



STIMRA Actuarial Management Syllabus Report

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Summary

Using the Indonesian Society of Actuaries (PAI, Persatuan Aktuaris Indonesia) recommended readings as our starting point, we recommend minor changes to the references for three topics that will be taught at STIMRA. These suggested changes reflect the fact that references have been updated since the time the recommended readings were developed.

I. Introduction and Outline of the Report

Our team, from the University of Wisconsin-Madison, will provide lesson plans, teaching guides, and other supporting materials for topics that will be taught at STIMRA (Sekolah Tinggi Manajemen Risiko dan Asuransi, or the Institute of Risk Management and Insurance). In this report, we provide “recommendations on changes, if any, to text books on Risk Theory, Actuarial Mathematics and General Insurance Actuarial I & II”.

For some readers, it may be helpful to have some additional background that will provide a context underlying the recommended changes (which are minor). This background is in Section II, where we briefly review the role of actuarial education, describe the educational roles of professional organizations including the International Actuarial Association (IAA) and the Indonesian Society of Actuaries (PAI, Persatuan Aktuaris Indonesia), as well as the part that universities such as STIMRA play in the actuarial education process.

Other readers may wish to skip directly to Section III, where we provide recommendations on changes to the three topics: General Insurance Actuarial I & II, Risk Theory and Actuarial Mathematics. Section IV closes with a few concluding remarks.

II. Background

Section II.1 Role of Actuarial Education

We begin by describing the field of actuarial science. Actuarial science has enjoyed a long history, dating back to Edmund Halley's Breslau Life Tables in 1693. These tables of births and deaths by age, based on a small community in Belgium, offered the first systematic way of computing annuity values, a cornerstone of the modern life insurance industry. Despite this long history, actuarial science is certainly not a part of everyday, colloquial conversation. In part, this is due to the broad, interdisciplinary nature of the field. Actuarial science is founded on tools based in probability modeling, statistics, economics, financial economics and demography; these foundation areas are used in actuarial science to study financial security systems.

Actuarial science is also not always well appreciated by the public due to its technical nature. Actuaries use tools from mathematics and the social sciences to quantify the riskiness of contractual promises that comprise financial security systems. The definition of a "financial security system" is broad and may encompass many financial arrangements that serve to protect individuals, organizations or segments of society in the event of unforeseen events. Some of the lead examples include private arrangements such as annuities, life insurance, health insurance, property and casualty insurance (such as automobile and homeowners insurance) and pension plans as well as public arrangements such as, in the United States, Social Security and Medicare.

Actuaries work in many different areas of practice, focusing mainly on life insurance (including annuities), retirement systems, health care, finance, and general insurance (known as property and casualty insurance in North America). Thus, it is difficult to pinpoint the "job" of an actuary. However, the following are three important functions that many actuaries take on regularly: (1) pricing of insurance, also known as ratemaking, (2) assessing liabilities (or obligations that arise from insurance contracts), and (3) determining the amount of capital needed to maintain a risk-taking enterprise such as an insurance organization on an ongoing basis, also known as loss reserving. For educational purposes, the foundational tools from areas of probability modeling, statistics, economics, financial economics and demography are needed for these three functions.

Section II.2 Role of the International Actuarial Association (IAA)

Most developed countries have at least one professional association of actuaries, such as the Indonesian Society of Actuaries (PAI). In contrast, the International Actuarial Association (IAA) is an umbrella organization; professional associations are members of the IAA. There are currently 64 full member organizations (of which PAI is one) and an additional 26 Associate member organizations.

The objectives of the IAA are directly aligned with member professional associations. These objectives include developing actuarial education and research, promulgating standards of professional conduct and fostering of actuarial networks. Actuarial education includes requirements for both basic learning associated with qualification standards as well as continuing education standards for life-long learning. Promoting actuarial research is important so that actuaries are equipped with the appropriate tools to compete in an ever-changing financial environment. Standards of professional conduct are necessary because of the significant fiduciary responsibilities actuaries are entrusted with – actuaries deal with complex financial matters that are the bedrock of financial security for many consumers; actuaries must not only act responsibly but also convince the public that they can be entrusted with this responsibility. And lastly, an actuarial organization provides a vehicle that allows organization members to interact with one another and develop creative ideas.

One of the strategic objectives of the IAA is to “Establish, maintain and promote common standards of actuarial education and common principles of professional conduct.” To fulfill this objective, the IAA has developed a set of educational guidelines and a general syllabus that member organizations use for guidance. All member organizations are asked to ensure that their fully qualified actuaries are admitted through education processes that are consistent with this education syllabus and guidelines.

Section II.3 Role of the Indonesian Society of Actuaries (PAI)

As described in Brown (2000, “The globalisation of actuarial education,” *British Actuarial Journal* 8 (1), pages 1-3), there are three different approaches that IAA member organizations take to meet the general education syllabus and guidelines. These are:

- The university only-model, including most of Europe and Latin America, where individuals commence qualification by attending a university. After completing a degree (generally at the Master’s level) and a period of work experience, candidates become qualified actuaries.
- The United Kingdom model, where there exist examinations established by the professional association but candidates may be exempted from one or more examinations by successfully completing a course(s) at an approved university. Other countries, for example Australia, follow this model.
- The United States of America (USA)/Canada model, where there are sets of examinations set by a professional association. Here, universities offer courses that support candidates study for this material but no exemptions to the examinations are permitted.

Moreover, there are many mutual recognition agreements in place, whereby actuaries who have qualified under rules from one country can be fully recognized in another country through an automatic exchange. Some IAA member organizations have not adopted their own examination system but rather rely on systems from other countries. For example, one can become a qualified actuary in Malaysia by passing the examination sequence from one of the following: (a) USA/Canada Society of Actuaries, (b) USA/Canada Casualty Actuarial Society, (c) UK Institute and Faculty of Actuaries, or (d) the Australian Institute of Actuaries.

The Indonesian Society of Actuaries (PAI) follows the USA/Canada model (as do many other countries world-wide). Under this model, an examination that is common to all candidates in the country allows the

profession to control the content of the material and promotes equality and uniformity among candidates who are going through the qualification process.

The PAI evaluates candidates on eight (8) topics at the associate level and three (3) topics at the fellowship level. For the third fellowship topic, candidates may choose from among four practice areas, life insurance, pension funds, general insurance or health insurance (see Table 1). This specific report focuses on two of the associate level topics and one of the fellowship topics.

| Table 1. List of PAI Examination Topics | |
|--|---|
| Associate Topics | Fellowship Topics |
| A10 Financial Mathematics | F10 Investment And Asset Management |
| A20 Probability And Mathematical Statistics | F20 Actuarial Management |
| A30 Economics | F31 Actuarial Aspect In Life Insurance |
| A40 Accounting | F32 Actuarial Aspect In Pension Fund |
| A50 Statistical Methods | F33 Actuarial Aspect In General Insurance |
| A60 Actuarial Mathematics | F34 Actuarial Aspect In Health Insurance |
| A70 Risk Theory | |
| A80 Professionalism | |

Section II.4 Role of STIMRA

STIMRA has developed a 146 credit hour program designed to educate budding actuaries and support the PAI actuarial curriculum. It is a four-year program that begins with a foundational calculus sequence, and ends with a comprehensive examination and either an internship or paper. For completeness, an outline of this program is attached in the appendix. From this detailed program, one can see that students have an opportunity to complete the actuarial coursework in a coherent and efficient manner. Courses build upon one in a logical fashion. From the outline, one can also see that students completing the STIMRA program will have studied all of the Associate level topics (although they will need additional background experience for the Professionalism topic A80). Additionally, they will have good background to study many of the Fellowship topics, particularly F10, the Investment and Asset Management course. Part of this proposal will be to provide courses that support F33, Actuarial Aspect In General Insurance.

III. Specific Recommendations

Section III.1 General Insurance Actuarial I & II

Table 2 lists the recommended readings for topic F33, Actuarial Aspect In General Insurance, from the PAI website (http://www.aktuaris.org/?module=Text&file_id=73). In this table, website locations (URLs) are listed so that readers may gather more information about this text.

Overall, we recommend this source of readings as a sound foundation for university courses. The exception is that the first reading is no longer in print. It is now available in the 3rd edition, available at: <http://www.actexamdriver.com/productdetails.cfm?PC=1575>.

This recommendation may seem somewhat strange in that the readings are dated. It is natural to look to the Casualty Actuarial Society (CAS) for more current readings and, indeed, we have done so. However, although the CAS has many good resources to draw upon that have a more modern approach, these resource/readings are designed for the specialist, not for a broad introduction to property and casualty actuarial issues. Specifically, the CAS resource/readings are designed for the actuary that focuses his or her entire educational training on property and casualty insurance rather than one of many topics as in the PAI syllabus. Thus, the CAS has not developed a good modern alternative to these recommended readings.

We note that the US/Canada Society of Actuaries (SoA) does use the first text as part of their advanced curriculum (specifically, as part of their Fellowship Admission Practice, or FAP, module). This provides some independent corroboration that it is good source material.

We think that these are the best books for students to buy and study from. However, when we develop our lesson plans and teaching guides, we will also refer to selected materials from the advanced CAS material.

Table 2. PAI Recommended Readings for F33, Actuarial Aspects In General Insurance

1. *Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance* (Second Edition), 2001, ACTEX Publications by Brown, R.L. and Gottlieb, L.R.
 - a. Chapter 1, (as background)
 - b. Chapter 2, Coverage
 - c. Chapter 3, Ratemaking
 - d. Chapter 4, Loss Reserving
 - e. Chapter 5, Intermediate Topics
 2. *Introductory statistics with applications in general insurance (second edition)*, Cambridge 1999, I.B.Hossack, J.H.Pollard, B.Zehnwirth. Available at:
http://www.cambridge.org/gb/knowledge/isbn/item1160990/?site_locale=en_GB
 - a. Chapters 1-4 (as background)
 - b. Chapter 5, Statistical Distributions Useful in General Insurance Work
 - c. Chapter 6, Inferences From General Data
 - d. Chapter 7, The Risk Premium
 - e. Chapter 8, Experience Rating
 3. *Foundations of Casualty Actuarial Science (Fourth Edition)*, 2001. Available at:
<http://www.casact.org/pubs/index.cfm?fa=castext>
 4. Government Regulations
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Section III.2 Risk Theory

Table 3 lists the recommended readings for A70, Risk Theory, from the PAI website (http://www.aktuaris.org/?module=Text&file_id=73). In this table, website locations (URLs) are listed so that readers may gather more information about this text.

The recommended text is no longer in print however, having been replaced by a third edition. Thus, when designing a new course, it makes sense to base the design on a newer or latest edition, as this will more likely be widely available in the future. Thus, we recommend the third edition of the text with the sections listed below.

Loss Models: From Data to Decisions, (Third Edition), 2008, by Klugman, S.A., Panjer, H.H. and Willmot, G.E., Chapters 3, 4, 5 (Sections 5.1– 5.4 only), 6 (Sections 6.1– 6.5 and 6.7), 8, 9 (Sections 9.1–9.7, excluding 9.6.1 and examples 9.9 and 9.11, Sections 9.11.1–9.11.2), 12, 13, 14, 15 (Sections 15.1– 15.6.4, 15.6.6 only), 16, 20, (Sections 20.2, 20.3, excluding 20.3.8, 20.4, excluding 20.4.3), 21 (Sections 21.1–21.2, excluding 21.2.4).

As with the PAI syllabus, the choice of these sections corresponds to the current North American society readings (from the US/Canada Society of Actuaries and the Casualty Actuarial Society). Details of this syllabus may be found on the web at:

<http://www.beanactuary.org/exams/preliminary/exams/syllabi/2012-05-exam-c.pdf>

These are also the recommended readings for the actuarial science courses taught at the University of Wisconsin-Madison. We have experience teaching from this source and we know that it is an effective resource for students.

Table 3. PAI Recommended Readings for A70, Risk Theory

Topics:

1. Actuarial Models
2. Continuous Models
3. Discrete Distribution and Process
4. Aggregate Loss and Ruin Models
5. Empirical Models
6. Estimated Parametric Models
7. Adjusted Estimated and Credibility
8. Simulation Methods

Reference

Loss Models: From Data to Decisions, (Second Edition) 2004, by Klugman, S.A., Panjer, H.H., and Willmot, G.E.
<http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470187816.html>

- Chapter 1 through 3 (background only)
 - Chapter 4, Sections 4.1-4.4 (excluding data-dependent distributions), 4.6.1-4.6.5, 4.6.7 through Theorem 4.51 (excluding zero-modified distributions, in particular Example 4.46, Theorem 4.49 and subsequent examples that depend on these distributions), 4.6.9-4.6.11, Chapter 5
 - Chapter 6, Aggregate Loss
 - Chapter 7 and 8, Ruin Models
 - Chapter 9 through 11, Empirical Models
 - Chapter 12 through 14, Parametric Statistical Method
 - Chapter 15 and 16, Adjusted Estimates
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Section III.3 Actuarial Mathematics

Table 4 lists the recommended readings for A60, Actuarial Mathematics, from the PAI website (http://www.aktuaris.org/?module=Text&file_id=73). In this table, website locations (URLs) are listed so that readers may gather more information about this text.

The Table 4 recommended readings (both 2010 and 2011) are no longer in print. As with Section III.2, when designing a new course, it makes sense to base the design on a new book, as this will more likely be widely available in the future. Thus, we recommend using the following book with the sections listed below.

Dickson, C.M.D., Hardy, M.R., and Waters, H.R. (2009), *Actuarial Mathematics for Life Contingent Risks*, Cambridge: Cambridge University Press. Chapters 1-11 (excluding Sections 9.5-9.7 and 10.5). plus *Supplementary Notes for Actuarial Mathematics for Life Contingent Risks Version 2.0*.

As with the PAI syllabus, the choice of these sections corresponds to the current North American society readings (from the US/Canada Society of Actuaries). Details of this syllabus may be found on the web at:

<http://www.soa.org/education/exam-req/edu-exam-m-detail.aspx>

These are also the recommended readings for the actuarial science courses taught at the University of Wisconsin-Madison. We have experience teaching from this source and we know that it is an effective resource for students.

Table 4. PAI Recommended Readings for A60, Actuarial Mathematics

Topics

1. Life Insurance Models
2. Contingent Life Annuities Models
3. Premi dan Cadangan Premi
4. Multiple Life Models
5. Multiple Decrement Models
6. Model Klaim dan Model Collective Risk

Basic Reference (2010):

Actuarial Mathematics (Second Edition), 1997, by Bowers, N.L., Gerber, H.U., Hickman, J.C., Jones, D.A. and Nesbitt, C.J

- Chapter 3, Chapter 4, Sections 4.1--4.4, Chapter 5, Sections 5.1-5.4,
 - Chapter 6, Sections 6.1(excluding utility-theory approach), 6.2-6.4, and Chapter 7, Sections 7.1(excluding utility theory approach), 7.2-7.6,
 - Chapter 8, Sections 8.1-8.4 and Chapter 9, Sections 9.1-9.5, 9.6.1, 9.7, 9.9,
 - Chapter 10, Sections 10.1-10.4, 10.5-10.5.1, 10.5.4, 10.6,
 - Chapter 11, Chapter 12, Sections 12.1-12.4, and Chapter 13
- Chapter 14 and Chapter 15, Sections 15.1-15.2.1, 15.4, 15.6-15.6.1.

Basic Reference (2011):

Models for Quantifying Risk (Second Edition), 2006, R. Cunningham, T. Herzog, R. L, London

Chapter 3, Chapter 4, Chapter 5 - Sections 5.1-5.4, Chapter 6 - Sections 6.1-6.4, Chapter 7 - Sections 7.1-7.3, Chapter 8 - Sections 8.1-8.4, Chapter 9 - Sections 9.1-9.5, Chapter 10 - Sections 10.1-10.6, Chapter 11, Chapter 12, chapter 13 Sections 13.1-13.3.

IV. Concluding Remarks

Because of the dynamics of an active marketplace, we have found that textbooks, and hence the recommended references for topics corresponding to actuarial exams, change over the years. In Section III, we recommended using updated editions of books as well as a new book for A60, Actuarial Mathematics. Why is this important?

From an examination standpoint, it is important to keep abreast of the selected readings. Actuarial students are trained to look at details closely; they want to know exactly what they are being examined upon. Nonetheless, from an educational viewpoint, the content of the actuarial syllabus changes much less rapidly and the learning objectives are relatively constant over time.

An advantage of newer texts is that they reflect more modern approaches that are more likely to be used in practice. To illustrate, newer texts are more likely to incorporate computational techniques that reflect the widespread availability of modern computing power. As another illustration, modern approaches emphasize quantifying the entire distribution of a risk, not just its expectation, as has traditionally been the case. Our knowledge base is moving forward and there are practical advantages to using more modern treatments.

There is a natural tension between wanting to use a modern edition of a book and a tested, more traditional, approach. Because we are developing syllabi for new courses, we recommend using the newer versions of the texts. We believe that by teaching students from these more modern versions that they will be more effective in practicing actuarial work. Further, because the learning objectives are relatively constant over time, students that use a newer version of a book will not be at a serious disadvantage even if the industry association (i.e., PAI) continues to produce exams based on older versions of texts.

Appendices

Table A.1. Web Resources for Selected Sites

| <i>Site</i> | <i>Web Location</i> |
|---|---|
| STIMRA | http://www.stimra.ac.id/home.php |
| Society of Actuaries of Indonesia (PAI) | http://www.aktuaris.org/ |
| Indonesian PAI List of Exam Requirements | http://www.aktuaris.org/?module=Text&file_id=73 |
| International Actuarial Association (IAA) | http://www.actuaries.org/index.cfm |
| IAA Education Syllabus | http://www.actuaries.org/ABOUT/Documents/Education_Syllabus_EN.pdf |
| US/Canada Society of Actuaries | http://www.soa.org |
| US/Canada Casualty Actuarial Society | http://www.casact.org |
| Actuarial Society of Malaysia | http://www.actuaries.org.my/ |
| UK - The Institute and Faculty of Actuaries | http://www.actuaries.org.uk/ |
| The Institute of Actuaries of Australia | http://www.actuaries.asn.au/ |
| The Institute of Actuaries India | http://www.actuariesindia.org/ |

Appendix STIMRA Actuarial Management Curriculum

Kurikulum STIMRA. Program S1 Manajemen Aktuaria – Reguler.

| Semester | Mata Kuliah / Subject | SKS |
|--|---|------------|
| Semester I | 1. Pengantar Manajemen /Intro to Management | 3 |
| | 2. Kalkulus I/Calculus I | 4 |
| | 3. Pengantar Ekonomi/Intro to Economics. | 3 |
| | 4. Akuntansi I/Accounting I | 3 |
| | 5. Pengantar Asuransi / Intro to Insurance | 2 |
| | 6. Bahasa Inggris / English language I | 2 |
| | 7. Kewarganegaraan / Civics. | 2 |
| | Jumlah | 19 |
| Semester II | 1. Agama / Religion | 2 |
| | 2. Kalkulus II / Calculus II | 4 |
| | 3. Matematika Keuangan I / Financial Mathematics I | 2 |
| | 4. Akuntansi II / Accounting II | 3 |
| | 5. Praktek Asuransi / Insurance Practice | 3 |
| | 6. Dasar-dasar Asuransi Jiwa / Life Insurance basics | 3 |
| | 7. Bahasa Inggris II / English language II | 2 |
| | Jumlah | 19 |
| Semester III | 1. Matematika Keuangan II / Financial Mathemaics II | 2 |
| | 2. Probabilita & Statistika I / Probability & Statistics I | 4 |
| | 3. Akuntansi (Asuransi) III / Accounting III | 3 |
| | 4. Dinamika Kelompok / Group Dinamics. | 2 |
| | 5. Operasional Asuransi Jiwa/ Life Insurance operation | 3 |
| | 6. Manajemen Pemasaran / Marketing Management | 3 |
| | 7. Bahasa Indonesia / Indonesian Language | 2 |
| | Jumlah | 19 |
| Semester IV | 1. Perilaku Keorganisasian / Organizational Behaviour | 3 |
| | 2. Probabilitas & Statistika II /Probability & Statistics II | 4 |
| | 3. Metoda Statistika I / Statistical Methods I | 3 |
| | 4. Pengantar Asuransi Kerugian /Intro to Non-life Insur. | 3 |
| | 5. Hukum & Peraturan Perasuransian/Insur Law&Regul | 3 |
| | 6. Manajemen Sumber Daya Manusia/HR management | 3 |
| | Jumlah /Total | 19 |
| Semester V | 1. Permodelan &Teori Risiko I / Risk Theory & Modelling I. | 4 |
| | 2. Metoda Statistika II / Statistical Method II | 3 |
| | 3. Prinsip Asuransi Pribadi / Personal lines Insur. | 3 |
| | 4. Manajemen Keuangan / Financial Management | 3 |
| | 5. Asuransi Sosial dan Dana Pensiun / Social Insur.& Pension Fund. | 3 |
| | 6. Kepemimpinan / Leadership. | 3 |
| | Jumlah | 19 |
| Semester VI | 1. Permodelan &Teori Risiko II / Risk Theory & Modelling II. | 4 |
| | 2. Metoda Statistika III /Statistical Method II. | 3 |
| | 3. Matematika Pensiun / Pension Mathematics. | 4 |
| | 4. Analisis Laporan Keuangan/ Financial report analysis | 3 |
| | 5. Sistem Informasi Manajemen/ Mgt. Info. Syst. | 3 |
| | 6. Pengantar Asuransi Syariah/ Intro to Syariah Insur. | 2 |
| | Jumlah | 19 |
| Semester VII | 1. Aktuaria Asuransi Umum I/NonLife Actuary I | 4 |
| | 2. Matematika Aktuaria I/ Mathematic Actuary I | 3 |
| | 3. Invest & Manajemen Aset /Invest & Aset Management | 3 |
| | 4. Reasuransi /Reinsurance. | 3 |
| | 5. Metoda Penelitian dan Komunikasi / Research & Communication methodology. | 3 |
| | 6. Pengantar Auditing / Intro to Auditing | 3 |
| | Jumah | 19 |
| Semester VIII | 1. Aktuaria Asuransi Umum II/ NonLife Actuary II | 3 |
| | 2. Matematika Aktuaria II/ Mathematic Actuary II | 4 |
| | 3. Tugas Akhir /Internship or Paper writing | 4 |
| | 4. Ujian Komprehensif./ Comprehensive exam. | 2 |
| Jumlah | 13 | |
| Total SKS / Total Credit Points | | 146 |