ACTEX Learning

Study Manual for General Insurance - Introduction to Ratemaking & Reserving

1st Edition

Ke Min, FCIA, FSA, CERA

An SOA Exam

Actuarial & Financial Risk Resource Materials
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Text 1 - Fundamentals of General Insurance Actuarial Analysis (FGIAA)

NOTES

This study manual ("the manual") is written with the purpose of assisting the candidates for the SOA General Insurance Ratemaking and Reserving Exam.

According to the syllabus, one textbook, *Fundamentals of General Insurance Actuarial Analysis* (J. Friedland), is required for this exam. While the manual is intended to follow the structure of the textbook as closely as possible, some chapters and/or sections are customized for a better presentation of the underlying study material.

Even though most case studies and examples used in the manual were taken from the textbooks, they were modified, sometimes even highly modified. Therefore, the numbers from the manual might not reconcile to the numbers found in the textbook. In addition, the numbers might not reconcile to totals due to rounding.

Past exam questions and answers have been taken from SOA's General Insurance Ratemaking and Reserving Exams, which are identified with "(SOA Exam Year-Spring/Fall Qi)" in the manual. The past exam questions and answers are copyrighted by the Society of Actuaries and are reproduced in this study manual with the permission of the SOA solely for the purpose of assisting students studying for the actuarial exams. I am very grateful to the SOA for its permission to use this material. The SOA, however, is in no way responsible for the structure or accuracy of the manual.

The past exam questions have been attached to the assignment on which the questions are most likely based. Note that some exam questions may make use of materials from multiple assignments of the textbooks.

Questions without identification of "(SOA Exam Year-Spring/Fall Qi)" are original questions based on the required study materials. Although I have made a conscientious effort to eliminate mistakes in questions and answers, errors may exist. I encourage students who find errors to bring them to my attention. You can send your comments to my email address - kemin.business@gmail.com. Any other feedback is also very welcome.

I would also like to thank Stephen Camilli, FSA and President of ACTEX Learning, for his insightful comments. I also would like to thank my wife, Casey Tong Li, for her support.

Best of luck with your studies!!!

FGIAA Chapter 1
About This Textbook

Syllabus

- 1-a), 1-b) and 1-c)

1.0 INTRODUCTION

Since this exam, Introduction to Ratemaking and Reserving, is a FSA level exam, it is likely that you are familiar with the concept of the Actuarial Control Cycle (ACC). ACC was introduced in the Fundamentals of Actuarial Practice (FAP) course. ACC contains three components:

1. Define the problem
2. Design a solution
3. Monitor the result

The ratemaking and reserving procedure can be displayed as:

1. Determining trend and projecting ultimate claims
2. Determining reserves and ratemaking
3. Projecting ultimate claims with ratemaking information incorporated

This procedure would be repeated year after year. It is consistent with the ACC.

1.1 FRAMEWORK FOR THE TEXTBOOK

1.1.2 Emphasis on the Practical

- This book is developed with the practical goal in mind.

1.1.3 Basic vs Advanced Methodologies

- Only principal techniques are presented in this book

1.2 LIMITATIONS ASSOCIATED WITH ALL EXAMPLES INCLUDED IN THE TEXTBOOK

1.3 LANGUAGE AND TERMINOLOGY

1.3.1 Definition of GI Lines of Business

- **Long-tail lines**: Lengthy delay between the period of insurance cover and reporting and/or settlement of the claims. i.e. medical practice and workers compensation insurance.
- **Short-tail lines**: Quick reporting and settlement of the claims. i.e, property insurance.
- Use this section as reference

1.3.2 Types of Insurance Organizations

Typical insurance organizations are:

- Insurance companies
- Reinsurance companies
- Self-insured entities

Self-insured entities include:

- Large deductibles and self-insured retentions (SIRs)
- Self-insured fund
- Pooling program
- Captive insurance company

1.3.3 Key terms: Reserving and Ratemaking

- Reserves: unpaid claims estimate and unearned premium reserves
- Reserving and valuation: the actuarial process to developing estimates of claim liabilities and premium liabilities
- Ratemaking: the actuarial process to develop prices for GI products

1.4 GOOD PRACTICE

- Develop a standard way of doing things

Practice Questions

1. What are the three components of the Actuarial Control Cycle (ACC)? Describe how the ratemaking and reserving process fits into the ACC.
2. What are three types of insurance organizations?

Answers to Practice Questions

1. Three components of the ACC are:
   - Define the problem
   - Design a solution
   - Monitor the result

   The ratemaking and reserving process is:

   - Determining trend and projecting ultimate claims (Design a solution)
   - Determining reserves and ratemaking (Design a solution)
   - Projecting ultimate claims with ratemaking information incorporated (Design a solution)
   - Reviewing trend with the ultimate claims (Monitoring the result)

   This entire process repeats year after year.

2. Three types of insurance organizations are:
   - Insurance companies
   - Reinsurance companies
   - Self-insured entities

FGIAA Chapter 2 Key Considerations for GI Actuaries
Conducting Actuarial Work

Syllabus

- 1-a), 1-b), and 1-c)

2.1 Professional Requirements

- Actuaries must consider code of professional conduct (Code) and actuarial standards of practice (Standards) while conducting work.
- In 2012, the International Actuarial Association (IAA) approved its first international standard of actuarial practice. It is referred to ISAP 1.
- i.e. ISAP defines the intended use and intended users of actuarial services, the typical activities provided by actuaries.
- Actuaries are subject to the Code and the Standards for the area in which services are provided.

2.2 CAS Statement of Principles on Reserving and Ratemaking

- In May 1988, the CAS adopted the "Statement of Principles Regarding Property and Casualty Insurance Ratemaking" and "Statement of Principles Regarding Property and Casualty Insurance Loss and Loss Adjustment Expense Reserves".
- They are collectively referred to as the Statement of Principles.
- The Statement of Principles represents good practice for actuaries working in the areas of reserving and ratemaking for GI products.

FGIAA Chapter 3 Ultimate Claims and Expenses

Syllabus

- 1-g)

3.1 What are Ultimate Claims?

Ultimate claims is

- An estimate of ultimate claims beyond which no other claim payments are expected

3.1.1 Types of Ultimate Values

The following types of ultimate claims can be projected:

- Claims
- Claim-related expense (i.e. Allocated loss adjustment expense (ALAE) and Unallocated loss adjustment expense (ULAE))
- Counts
- Average value of claims
- Recoveries
- Ratios

3.1.2 Components of Ultimate Claims

Ultimate claims consist of:

- Cumulative paid payments
- Case estimates
- Development on case estimates (Incurred but not enough reported (IBNER))
- Claims that have been incurred but not yet reported (IBNYR)

Cumulative paid payments represent:

- All claim payments with a specific accident year (AY) that were paid between a specified time period
- Example:
    - Assume an actuary is reviewing claims for AY1 at December 31, CY2
    - In this case, the cumulative paid payments represent all claim payments, with accident dates during AY1, that were paid between January 1, CY1 and December 31, CY2.

Case estimates:

- Estimate of the amounts yet to be paid that will be required to settle the claim
- Tend to increase over time for long-tail coverages such as
    - Automobile liability
    - Medical practice
    - Workers compensation
- Tend to decrease over time for short-tail coverages such as
    - Property

  - Automobile physical damage coverages

Reported Claims represents:

- The sum of Cumulative claim payments and Case estimates

IBNER represents:

- The claims that are incurred but not enough reported

IBNYR represents:

- The claims that are incurred but not yet reported
- Also known as Pure IBNR

3.1.3 Mathematical Relationships between the Components of Ultimate Claims

- Ultimate claims = Reported claims + IBNR
- Reported claims = Cumulative claim payments + Case estimates
- IBNR = IBNER + IBNYR
- Ultimate claims = Cumulative claim payments + Case estimates + IBNER + IBNYR
- Ultimate claims = Cumulative claim payments + Claim liabilities
- Claim liabilities = Case estimates + IBNER + IBNYR
- Claim liabilities = Case estimates + IBNR
- Ultimate counts = Closed counts + Open counts + IBNR counts

3.2 Why are Estimates of Ultimate Values Required?

Estimate of Ultimate values are mainly used in following five areas:

- Financial Reporting
  - **Accounting date** (**Valuation date**, **As of date**): the date at which the claims are being valued
  - The term **Insurance Contract Liabilities** is the collection of **Claim liabilities** and **Premium liabilities**
  - **Claim liabilities** represent the estimate of liabilities for the claims incurred on or before the accounting date
  - **Premium liabilities** represent the estimates of claim and expense payments to be made after the accounting date
  - The income of a GI company arises from underwriting and investment income
  - Underwriting income = earned premiums – incurred claims – underwriting expense
  - Earned premiums are the revenue the insurer receives in selling its products
  - Incurred claims are essentially the insurer's cost of goods sold
  - $\text{Incurred Claims}_{CYx} = \text{Claim Liabilities}_{CYx} - \text{Claim Liabilities}_{CYx-1} + \text{Claim Paid}_{CYx}$
- Pricing
  - Projection of ultimate values is
    - Fundamental blocks for the development of GI rates
    - Used for the trending analysis (it will be covered in later chapters)
- Financial condition analysis

    - The intent of **Financial Condition Analysis** is to test the insurer's ability to withstand severe circumstances without failing in its obligations
    - In Canada, financial condition analysis is referred to as **Dynamic Capital Adequacy Testing (DCAT)**
- Planning
    - Projection of ultimate values is
        - Used for planning and budgeting purpose
        - A required input to compensation programs
- Merger and Acquisition Analysis

3.2.6 Estimates of Ultimate Values for Self-insurers

Self-insurers rely on the projection of ultimate values for:

- Determining claim liabilities
- Evaluating funding requirements
- Allocating costs of program to each participant

3.3 When are Projections of Ultimate Claims Prepared?

The timing depends on the purpose for which the projections are required:

- For financial reporting purpose, actuaries most frequently reply on data at the accounting date
- For GI pricing purpose, the time requirement varies tremendously by jurisdictions
- For planning, compensation, or cost allocation purpose, there is typically a standard time of year during which the estimate of Ultimate claims is required

3.4 Who Projects Ultimate Claims?

Projection of ultimate claims requires significant professional judgement. One should have the necessary knowledge and experience to:

- Identify and collet the appropriate data
- Verify the data
- Gather qualitative information about the internal and external environment
- Conduct diagnostic analyses
- Choose methodologies and assumptions
- Evaluate results in light of information gathered and diagnostic analyses

Standards address the following process involved in the projection of ultimate claims:

- Identification, collection, and verification of data
- Understanding of the internal and external environments
- Determination of appropriate methodology and assumptions
- Evaluation of results
- Documentation
- Communications and reporting of findings

Practice Questions

1. Which of the following items is not a component of ultimate claims:

a. Cumulative paid claims
b. DCAT
c. Case estimates
d. IBNER
e. IBNYR

2. What do the ultimate claims consist of?

3. What are the five areas that the projection of ultimate claims is used in?

4. What is the main difference between claim liabilities and premium liabilities?

5. (2017-Spring Exam Q7) Your company, EB General Insurance, has just hired a new CFO who has no previous experience with the general insurance industry. The new CFO has made the following four statements:

(i) The reinsurers should rely on the case estimates provided by EB General Insurance.

(ii) The case estimates for automobile liability tend to increase over time and case estimates for automobile physical damage tend to decrease over time. Therefore, the modeling of estimates can be simplified by aggregating these coverages and assuming the increases and decreases will offset.

(iii) Large corporate clients are more effective at managing risk, and therefore more likely to self-insure and less likely to purchase insurance from EB General Insurance.

(iv) EB General Insurance should rely on software programs to project ultimate claims based on the appropriate actuarial methodology.

Provide *either* one argument for, *or* one argument against each statement the CFO has made.

Answers to Practice Questions

1. b. DCAT stands for Dynamic Capital Adequacy Test. It is referred to as financial condition analysis in Canada

2. Ultimate claims = Cumulative paid claims + Case estimate + IBNER + IBNYR

3. The five areas are financial reporting, pricing, financial condition analysis, planning and merger and acquisition analysis

4. Claim liabilities represent the estimate of liabilities for the claims incurred **on or before** the accounting date whereas Premium liabilities represent the estimates of claim and expense payments to be made **after** the accounting date.

For instance,

- Assume that Fake insurance company sells occurrence policies between April 1, 2015 and March 31, 2016 and the accounting date is December 31, 2015.
- In this case, claim liabilities represent the claims with accident date between April 1, 2015 and December 31, 2015 no matter when the payment occurs. Premium liabilities represent the claims with accident date between Jan 1, 2016 to March 31, 2016.

5. (2017-Spring Exam Q7)

(i) Argument against: Reinsurers will typically add additional case reserves to reflect the difference in view of the case estimates provided by the insurers.

(ii) Argument against: Development on case estimates may be very different, and combining the coverages may mask the difference.

(iii) Argument for: Large corporate clients would tend to know their own business better and have established programs in place to manage risk.

(iv) Argument against: Software can assist with the computations, but professional judgement should be used in selecting the ultimate claims estimates.

FGIAA Chapter 4 Data

Syllabus

- 1-g), 1-h), 1-i), 1-j), and 1-k)

4.1 Standards and Data

Standards address issues such as:

- Selection of Data (Section 4.2 to Section 4.9)
    - Whether sufficient data and reliable are available
    - Should all of the relevant data required for actuarial work be obtained
    - Data can be categorized as:
        - Claim data (Section 4.4)
        - Exposure data (Section 4.5)
        - Expense data (Section 4.6)
        - Other data (Section 4.7)
- Reliance of data supplied by others (section 4.10)
    - Data that are supplied by others should be reviewed for
        - Sufficiency
        - Reliability
        - Appropriateness
- Review of Data (Section 4.11)
    - No expectation of auditing the data
    - Should review the data and determine the quality of the data
- Use of Data (Section 4.12)
    - Need to consider the possible effect of a data deficiencies on the results of the actuarial work
- Disclosures with respect to data quality and Documentation (Section 4.13)
    - Document and report the actuary's processes with respect to data

4.2 Selection of Data

4.3 Homogeneity and Statistical Reliability of Data

- Seek a balance between homogeneity and statistical reliability
- Splitting data into finer division
    - Increases homogeneity
    - But reduces stability
- Homogenous data display similar patterns with respect to
    - Reporting
    - Settlement behaviors
    - Severity and frequency of claims.
- The categorization of business is often different between the primary insurer and the reinsurer

4.4 Claim Data

Common types of claim data are:

- Paid / Case estimate for / Reported **Indemnity**
  - Indemnity: Claim payments for loss or damage
- Paid / Case estimate for / Reported **Allocated Loss Adjustment Expenses (ALAE)**
  - ALAE: Claim-related expense that cannot be allocated to a specific claim
  - I.e. Salaries of claim personnel, management and administrative costs
- Paid / Case estimate for / Reported **Claims**
  - Claims: Sum of indemnity and ALAE
- Paid unallocated loss adjustment expenses (**ULAE**)
  - ULAE are usually estimated on a company level
- **Salvage** and **Subrogation**
  - Salvage: Amount recovered by an insurer for the sale of a damaged property
  - Subrogation: The right of the insurer to pursue action against the third party
- Closed/Open/Reported **Counts**

4.4.2 Aggregation of Claim Data

Claim data can usually be aggregated into four categories:

- Calendar year (CY)
  - CY claim data summarize all claim transactions taking place in a given calendar year
  - Advantage: Readily available
  - Disadvantage: No clear indication of an insurer's current situation in terms of pricing or reserve adequacy
- Accident year (AY)
  - All claims occurring in the same year are combined
  - AY claim data are typically used with CY earned premiums to estimate unpaid claims
  - Advantage: Data are available more quickly
  - Disadvantage: Not an exact match between AY claims and CY earned premiums
- Policy year (PY)
  - All claims associated with policies that are effective during the CY are combined
  - Advantage: Precise match of the claims and premiums
  - Disadvantage: Time lag associated with this type of aggregation
- Report year (RY)
  - The key characteristics of the claims the RY
  - RY claim data are typically used for claim-made coverages and for testing the adequacy of prior estimates of unpaid claims for known claims
  - Disadvantage: Does not capture the claims that have been incurred but not yet reported (PURE IBNR or IBNYR)

4.4.3 Claim Data by Line of Business

- Data are typically analyzed by line of business (LOB).

- The line of business might not be the same as regulator-defined LOB.

4.4.4 Claim Data Gross and Net of Reinsurance Bases

- Data Gross of Reinsurance
    - Includes assumed reinsurance
    - Is prior to any ceded requirements
- Data Net of Reinsurance
    - Data after the reflection of cessions to reinsurers

4.4.5 Claim Data at Alternative Limits

- Total limits data
    - All claims are included within the data
    - No capping or limitation on the source data
- Large claims might need to be removed due to its significant distorting influence
    - In this case, the actuary may choose to project ultimate claims at a specific limit (Basic limit).
- Actuaries should:
    - Specify and document the treatment of ALAE in developing a loading for large claims
    - Understand whether the limitation applies to indemnity only or combined indemnity and ALAE
    - Determine if the limit applies on a per-occurrence, per-claim, or per-claimant basis

4.4.6 Claim Data for Ratemaking Analyses

Claim data are:

- Aggregated by LOB and year when
    - Determining changes in the overall rate level
    - Setting prices for large commercial accounts
- Aggregated in a much more granular level for
    - Classification analysis

4.5 Exposure Data

4.5.1 Exposure Defined

- **Exposure**: The state of being subject to loss because of some hazard or contingency.
- **Exposure Base**: The basis to which rates are applied to determine premium.

4.5.2 Selecting an Exposure Base

Multiple criteria of desirable characteristics of an exposure base exist:

- (Dorweiler) Two criteria:
    - The expected claims should be directly proportional to the exposure base
    - The exposure base should be easy to measure and already being recorded
- (Amy Bouska) Two themes:

  - The exposure base should accurately reflect the overall exposure to loss
    - Should be simply to compile
    - Should not be subject to manipulation
  - The exposure base should accurately reflect differences in exposure to loss

4.5.3 Aggregation of Exposure Data

- Exposure data are usually aggregated by CY and PY
- Under CY, all transactions occurring in a CY are combined
- Under PY, exposure for policies written within a common policy year are combined

4.5.4 Exposure Used by Actuaries Working with Insurance Companies for Projecting Ultimate Claims

Actuaries might consider the following types of exposure data:

- Earned premiums
  - The amounts of premium that the insurer has earned
  - Refer to the expired portion of the policy
- Written premiums
  - Total premiums generated on all policies
- In-force premiums
  - The amounts of premium associated with the exposure that have been written and have not expired

Note: Don't spend too much time on these concepts now. More attention will be given to these concepts in later chapters.

4.5.5 Exposure Used by Actuaries Working with Insurance Companies for Ratemaking Analyses

- For Ratemaking purpose, actuaries used premium bases.
- The textbook refers to premium bases as **Ratemaking Exposure**.

4.5.6 Exposure Used by Actuaries Working with Self-Insurers for Estimating Unpaid Claims and Funding

- Actuaries seek exposures that are relevant to the LOB under review.

4.6 Expense Data

Expense data usually include:

- General expenses
  - Include rent, utilities, and senior management salaries
- Underwriting expenses
  - Include commission and brokerage fees, salaries for marking and underwriting staff, advertising costs, premium taxes, licenses and fees

4.8 Granularity of Data Required

For most actuarial work, claim and exposure data aggregated by LOD and by AY, CY, PY and RY is sufficient. But for some circumstances, greater granularity of data is required.

4.9 Internal vs External Data

- When the data are not reliable or sufficient to perform the actuarial work, actuaries might turn to external data
- (Section 4.9.2) When using industry data, the applicability and reliability of the industry benchmark should be evaluated. Difference might arise due to:
    - Definition of counts
    - Claim management
    - Lines of Business
    - Underwriting
    - Geographic mix
    - Claims coding
    - Policyholder deductible and limits
    - Legal precedents

4.10 – 4.13

The contents from section 4.10 to 4.13 are already summarized in section 4.1. Please refer to section 4.1 for details.

Practice Questions

1. According to Dorweiler, what are the desirable characteristics of an exposure base?
2. What are the three important premium data used by Actuaries for projecting ultimate claims?
3. (2013-Fall Exam Q20) (c) Describe two desirable characteristics of exposures for actuarial work.

Answers to Practice Questions

1. Two criteria are:
    - The expected claims should be directly proportional to the exposure base
    - The exposure base should be easy to measure and already being recorded
2. Three important premium data are:
    - Earned premiums
    - Written premiums
    - In-force premiums
3. (2013-Fall Exam Q20) (c) Any two of the following items are acceptable:
    - It should accurately reflect the overall exposure to loss
    - It should be simple to compile
    - It should not be subject to manipulation
    - It should accurately reflect differences in exposure to loss
    - It should consider any pre-existing exposure base established within the industry
    - A leading indicator is preferred
    - A leading indicator should require few adjustments
    - It should use the latest information

FGIAA Chapter 5 Qualitative Information about the Insurer and its Environment

Syllabus

- 1-j)

5.1 Information Internal to the Organization

5.1.1 Internal and External Actuaries

- Internal and External actuaries are equally required to be knowledge about in insurer's processes
- Internal actuaries:
    - Are often involved in the annual planning process
    - Interact with the information technology department
    - Receive routine reports on key metrics
    - Are generally on the email distribution lists for key communications
- External actuaries:
    - Are required to more deliberate in seeking and collecting information

5.1.2 Actuarial Questionnaire – A Tool for Collecting Internal Information

- The questionnaire (Appendix G of Textbook) is one of the most valuable tools for collecting information
- The goal of the questionnaire is to ensure that
    - The actuary is knowledge about the operations and any changes in the operations of the insurer
- The questionnaire consists of nine sections:
    - Management and general information
    - Information and technology
    - Accounting
    - Claim management
    - Marketing and underwriting
    - Catastrophe exposure
    - Pricing and actuarial ratemaking
    - Reinsurance
    - Investments

5.3 Information External to the Insurer

Actuaries should be familiar with external conditions, such as changes in

- Economic
- Technology
- Medical
- Environment
- Legal
- Judicial
- Regulatory
- Political environments
- Social changes

- Trends within the board community

PRACTICE QUESTIONS

1. What are the nine sections of the Actuarial questionnaire?
2. Name three external factors that might impact the insurer?

ANSWERS TO PRACTICE QUESTIONS

1. The nine sections are:
    - Management and general information
    - Information and technology
    - Accounting
    - Claim management
    - Marketing and underwriting
    - Catastrophe exposure
    - Pricing and actuarial ratemaking
    - Reinsurance
    - Investments
2. Any three of the following factors are acceptable answers:
    - Economic
    - Technology
    - Medical
    - Environment
    - Legal
    - Judicial
    - Regulatory
    - Political environments
    - Social changes
    - Trends within the board community

FGIAA Chapter 6 Credibility

Syllabus

- 1-l)

6.0 Introduction

- Credibility is fundamental to virtually all actuarial work
- Credibility used when:
    - Projecting ultimate claims
    - Estimating unpaid claims for reserving purposes
    - Pricing

6.1 Credibility Defined

- **Credibility**: A measure of predictive value in a given application that the actuary attaches to a particular body of data
- **Full Credibility**: The level at which the subject experience is assigned full predictive value based on a selected confidence interval

6.4 Considerations for Credibility

Three basic criteria for the credibility of homogeneous risks:

- Between 0 and 1
- Increase as the number of risks increases, all else being equal
- Increase at a non-increasing rate

The other data with which the insurer's data is credibility weighted, known as the Complement of Credibility, include:

- An insurer's experience with industry experience
- A subsidiary company's experience from a larger, related company
- Experience in one territory within a state with statewide experience
- Experience in one line of business with similar lines of business
- Experience in one classification with all classifications
- Experience in one deductible or limit layer with experience in similar deductible or limit layers

Joseph Boor's four issues and six desirable qualities for the complement of credibility:

- Four issues
    - Practical issues
    - Competitive market issues
    - Regulatory issues
    - Statistical issues

- Six qualities
    - Accuracy

  - Biasness
  - Independence
  - Availability of data
  - Ease of computation
  - Explainable relationship to the subject loss costs

In addition, when working with credibility weighting, actuaries should:

- Consider homogeneity of the sets of experience
- Exercise professional judgment

6.5 The Credibility-Weighting Formula

The credibility-weighted estimate is equal to

$$(Z \times A) + (1 - Z) \times B$$

Where:

- A = estimate based on insurer's experience
- B = estimate based on relevant other experience
- Z = credibility assigned to insurer's experience
- 1-Z = credibility assigned to relevant other experience

PRACTICE QUESTIONS

1. When are credibility used?
2. What are the three basic criteria for credibility?
3. What are the six qualities for the complement of credibility according to Joseph Boor?

ANSWERS TO PRACTICE QUESTIONS

1. Credibility are used when
    - Projecting ultimate claims
    - Estimating unpaid claims for reserving purposes
    - Pricing
2. Three basic criteria for credibility are:
    - Credibility must between 0 and 1
    - Credibility should increase as the number of risks increases, all else being equal
    - Credibility should increase at a non-increasing rate
3. According to Boor, the six qualities for the complement of credibility are:
    - Accuracy
    - Biasness
    - Independence
    - Availability of data
    - Ease of computation
    - Explainable relationship to the subject loss costs

FGIAA Chapter 7 Trend

Syllabus

- 1-n)

7.0 Introduction

- Trend factors are used to reflect the dynamic forces that exist in our society that produce measurable changes in insurance experience over time.
- The forces include:
    - Economic
    - Social
    - Demographic

7.2 Types of Trend

In trending analysis, actuaries often consider the effects of:

- Economic inflation
- Deductible leveraging
- Utilization
- Changes in the mix of insureds and/or coverage
- Technology advances

7.5 Data Required for Trending Analysis

For trending analysis, actuaries rely on historical data from various sources:

- Economic inflation
- Superimposed inflation
    - The cost of claims escalates at a rate different from economic inflation
- Non-insurance data

When selecting data, actuaries should consider:

- The credibility assigned to the data by the actuary
- The time period for which the data are available
- The relationship to the items being trended
- The effect of known biases or distortions on the data relied upon

Trend can vary from one insurer to another due to:

- Regional cost variations
- Design of insurance product
- Demographics

Practice Questions

1. What are the considerations when actuaries select data?

Answers to Practice Questions

1. The considerations are:
    - The credibility assigned to the data by the actuary
    - The time period for which the data are available
    - The relationship to the items being trended
    - The effect of known biases or distortions on the data relied upon