Study Guide
Exam STAM: Short-Term Actuarial Mathematics
Society of Actuaries (SOA)

Alec James van Rassel

Table des matières

Preliminary

Information

Statements

The candidate will be **introduced** to

> A variety of models (frequency, severity, and aggregate) useful for short-term actuarial applications.

> A variety of tools for the calibration and evaluation of the models.

> The fundamental principles of pricing and reserving of some of the (more common) short-term insurance and reinsurance coverages.

The candidate will **learn and apply**

> The steps to the modelling process.

The candidate should be **able to** :

1. Analyse data from an applied business context.

2. Determine a suitable model and its parameter values.

3. Provide measures of confidence (for decisions based on the model).

4. Estimate losses using credibility procedures.

Notes

1. The weights are provided to indicate the relative emphasis on different sections.

2. Some questions may cover multiple learning objectives.

Keyword in the learning objectives are coloured according to bloom's taxonomy here.

create develop, construct, investigate, assemble, etc.

evaluate argue, defend, select, support, critique, etc.

analyse organize, relate, compare, distinguish, examine, test, etc.

apply execute, solve, use, demonstrate, interpret, etc.

understand classify, describe, discuss, explain, identify, recognize, select, etc.

remember define, list, memorize, repeat, state, etc.

Autres ressources

Links

> SOA site.

Subjects of study

1 Severity Models (10%-15%)

Information

> ### Objective
>
> The Candidate will understand and be able to perform calculations with commonly used severity models.

> ### Learning outcomes
>
> The candidate will be able to :
>
> a) Calculate :
>   - moments,
>   - percentiles, and
>   - generating functions.
>
> b) Describe how changes in the parameters affect the distribution.
>
> c) Recognize classes of distributions (incl. Extreme Value distributions), and their relationships.
>
> d) Create new distributions by :
>   - multiplication by a constant,
>   - raising to a power,
>   - exponentiation, and
>   - mixing.
>
> e) Identify the applications to which each distribution may apply and explain why.
>
> f) Apply the distribution to an application, given the parameters.
>
> g) Compare two distributions based on various characteristics of their tails, including :
>   - moments,
>   - ratios of moments,

> limiting tail behaviour,

> hazard rate function, and

> mean excess function.

Related lessons ASM

Section X : Interest

> 1a. Basic

Chapter summaries

1a. Basic

2 Frequency Models (2.5%-7.5%)

Information

> **Objective**
>
> The Candidate will understand and be able to perform calculations with commonly used frequency models.

> **Learning outcomes**
>
> The candidate will be able to (for the Poisson, mixed Poisson, binomial, negative binomial, and geometric distributions, and mixtures thereof) :
>
> a) Calculate moments and generating functions.
>
> b) Describe how changes in the parameters affect the distribution.
>
> c) Recognize classes of distributions and their relationships.
>
> d) Identify the applications to which each distribution may apply and explain why.
>
> e) Apply the distribution to an application, given the parameters.
>
> f) Derive and perform calculations with the zero-truncated and zero-modified versions of these distributions.

> **Related lessons ASM**
>
> Section X : Interest
>
> › 1a. Basic

Chapter summaries

> **1a. Basic**

3 Aggregate Models (2.5%-7.5%)

Information

Objective

The Candidate will understand and be able to perform calculations with aggregate models.

Learning outcomes

The candidate will be able to (for aggregate risk models) :

a) Define collective and individual risk models and calculate their expectation and variance.

> ❯

b) Use the normal distribution to approximate the aggregate distribution.

c) Use the recursive formula to calculate the values of the collective risk models with discrete distributions of severities.

d) Calculate the expected aggregate payments in the presence of an aggregate deductible.

e) Evaluate the effect of the coverage modifications on the expected aggregate payments.

f) Perform the exact calculation of aggregate loss distribution in case of the normal distribution of severities, exponential and gamma (Erlang) distribution of severities and a compound model with negative binomial frequency and exponential distribution of severities.

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Related lessons ASM

Section X : Interest

> ❯ 1a. Basic

Chapter summaries

1a. Basic

4   Coverage Modifications (2.5%-7.5%)

Information

> **Objective**
>
> The Candidate will understand and be able to perform calculations with respect to coverage modifications.

> **Learning outcomes**
>
> The candidate will be able to (for frequency, severity, and aggregate models) :
>
> a) Evaluate the effect of coverage modifications, in particular, deductibles, limits, and coinsurance.
>
> > ❯
>
> b) Calculate loss elimination ratios and increased limits factors.
>
> c) Evaluate the effects of inflation on losses.

> **Related lessons ASM**
>
> Section X : Interest
>
> ❯ 1a. Basic

Chapter summaries

> **1a. Basic**

5   Risk Measures (2.5%-7.5%)

Information

Objective

The Candidate will understand and be able to perform calculations with common risk measures.

Learning outcomes

The candidate will be able to :

a) Calculate Value at Risk and Tail Value at Risk.

b) Explain the desirable properties of a risk measure and determine whether a given risk measure has these properties.

Related lessons ASM

Section X : Interest

> 1a. Basic

Chapter summaries

1a. Basic

6 Construction and Selection of Parametric Models (20%-30%)

Objective

The Candidate will understand and be able to construct and estimate parameters for parametric models.

Learning outcomes

The candidate will be able to :

a) Estimate the parameters (for severity, frequency, and aggregate distributions) using Maximum Likelihood Estimation for :

> Complete, individual data.

> Complete, grouped data.

> Truncated or censored data.

b) Estimate the variance of the estimators and construct confidence intervals.

c) Use the delta method to estimate the variance of the maximum likelihood estimator of a function of the parameter(s).

d) Estimate the parameters (for severity, frequency, and aggregate distributions) using Bayesian Estimation.

e) Perform model selection using :

> Graphical procedures.

> Hypothesis tests (incl. Chi-square goodness-of-fit, Kolmogorov-Smirnov and Likelihood ratio (LRT) tests).

> Score-based approaches (incl. Schwarz Bayesian Criterion (SBC), Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC)).

> **Related lessons ASM**

Section X : Interest

> 1a. Basic

Chapter summaries

> **1a. Basic**

7 Credibility (20%-25%)

Information

Learning outcomes

The candidate will be able to :

a) Apply and critique limited fluctuation (classical) credibility.

b) Explain and apply Bayesian credibility.

c) Apply conjugate priors in Bayesian credibility.

d) Apply Bühlmann and Bühlmann-Straub models and understand their relationship to Bayesian models.

e) Explain and apply empirical Bayesian method in the nonparametric and semiparametric cases.

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Related lessons ASM

Section X : Interest

> ❯ 1a. Basic

Chapter summaries

1a. Basic

8 Insurance and Reinsurance Coverages (5% - 10%)

Information

Objective

The Candidate will understand the basic insurance and reinsurance coverages for short-term insurances.

Learning outcomes

The candidate will be able to :

a) Describe different types of short-term insurance coverage including auto, homeowners, liability, health, disability, and dental.

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b) Describe the types of policy limits and coverage modifications for short-term insurance.

c) Describe the operation of basic forms of proportional and excess of loss reinsurance.

d) Derive the distribution of claim amounts paid by the insurer and reinsurer under various forms of reinsurance.

Related lessons ASM

Section X : Interest

> ❯ 1a. Basic

Chapter summaries

> **1a. Basic**
>

9 Pricing and Reserving for Short-Term Insurance Coverages (15%-25%)

Information

Objective

The Candidate will be able to use basic methods to calculate premiums and reserves for short-term insurance coverages.

Learning outcomes

The candidate will be able to :

a) Explain the role of rating factors and exposure.

b) Describe the different forms of experience rating.

c) Describe and apply techniques for estimating unpaid losses from a run-off triangle, using the following methods :

> Chain ladder.

> Average cost per claim.

> Bornhuetter-Ferguson

d) Describe the underlying statistical models for the methods in (c).

e) Calculate premiums using the pure premium and loss ratio methods.

Related lessons ASM

Section X : Interest

> 1a. Basic

Chapter summaries

> **1a. Basic**
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