Notation and Terminology Used on Exam FAM

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Introduction

This notation and terminology note completely replaces similar notes used on previous examinations.

The primary purpose of this study note is to present standard terminology to be used on the FAM examination for situations where (1) there are multiple ways of referring to concepts in the textbooks for the examination, (2) there is ambiguity in the textbooks for the examination, or (3) there are varying interpretations in actuarial practice. In addition, this note provides a set of abbreviations that will be utilized on the exam without additional supporting context for a limited number of terms. For terminology not discussed in this study note, the definitions in *Loss Models: From Data to Decisions* (5th edition) (*LM*) and/or *Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance* (5th edition) (*IRLR*), and/or *Actuarial Mathematics for Life Contingent Risks* (3rd edition) (AMLCR) will apply.

The format of this note is to list common alternative notations for a given item. The specific notation(s) that will be used on the FAM examination will then be provided.

Abbreviations

AY	Accident Year
ALAE	Allocated Loss and Adjustment Expenses
CY	Calendar Year
ULAE	Unallocated Loss and Adjustment Expenses
IBNR	Incurred But Not Reported (for reserves)

Unless otherwise noted in a question on the examination, both Accident Years and Calendar Years are assumed to begin on January 1 and end on December 31.

Notation and Terminology

Coinsurance can be viewed from the insurer's perspective or the insured's perspective. On this examination, the term coinsurance refers to the proportion of a loss that is paid by the *insurance company*. Under a coverage with $c\%$ coinsurance, the insurance company pays $c\%$ of the loss and the policyholder pays $(100-c)\%$.

Deductible, when used as a stand-alone term on the examination, refers to an ordinary deductible as defined in *LM* or a fixed-dollar deductible as defined in *IRLR*. Other types of deductibles will include additional wording consistent with the definitions presented in the source material (e.g., franchise deductible).

In practice, **policy limit** can refer to either the maximum insurer payment provided under a policy or the loss (or total losses) above which no additional benefits are paid. On the examination, policy limit will refer to the maximum insurer payment provided under a policy and **maximum covered loss** will refer to the loss (or total losses) above which no additional benefits are paid.

Arithmetic average, **average method**, and **average factor model** all refer to the same method of

calculating a single age-to-age loss development factor for each column of a loss development triangle. On the examination, the term "arithmetic average" will be exclusively used to represent this method.

Volume-weighted average, **mean method**, and **mean factor method** all refer to the same method of calculating a single age-to-age loss development factor for each column of a loss development triangle. On the examination, the term "volume-weighted average" will be exclusively used to represent this method.

The **force of mortality** may be represented by μ_x or $\mu(x)$ or μ_{x+t} or $\mu(x+t)$ where x and $x+t$ are attained ages. The symbol $\mu_{[x]+t}$ indicates selection at age x and attained age $x+t$. The symbols $\mu_{x,}$ μ_{x+t}, and $\mu_{[x]+t}$ will be used on the FAM examination.

The **survival function** may be represented by S or s. For the survival function, there are multiple symbols (all involving S) used in *AMLCR*. When the symbols for the survival function are used on the FAM examination, the definition will be clear from the context of the question, or the question will define the symbol.

The **number of lives** at age x can be represented by ℓ_x or l_x. Either symbol may be used on the FAM examination.

The **complete future lifetime of (x) random variable** can be represented by T_x or $T(x)$. The symbol T_x will be used on the FAM examination.

The **curtate future lifetime of (x) random variable** can be represented by K_x or $K(x)$. The symbol K_x will be used on the FAM examination.

The **present value of future losses random variable** may be represented by L or ${}_0L$ or L_0 for loss at issue and ${}_tL$ or L_t for loss from t years after issue. Superscripts may be included. When the symbol L is used to represent the present value of future losses random variable, the symbol including any subscripts or superscripts will be defined in the text of the question.

Duration subscripts can be used differently. For example, something happening in the first duration (between ages x and $x+1$) may be identified with a 0 or 1. The text of the question will define any notation used.

If benefits can vary continuously, the **benefit** at time t is represented by b_t. If benefits vary but as a step function, the **benefit** at the end of period k is represented by b_k. The text of the question will define the benefit either by formula or in words.

Actuarial present value and **expected present value** are terms used for the expectation of the random variable representing the present value of one or more contingent future payments. Either term may be used on the FAM examination.

Fully discrete insurance is an insurance where both the premiums and the benefits are paid only at discrete time points. **Semi-continuous** insurance is an insurance where the premiums are paid at discrete time points and the death benefits are paid at the moment of death. **Fully continuous**

insurance is an insurance where the premiums are paid continuously, and the death benefits are paid at the moment of death. Unless stated otherwise in the text of the question discrete time points are the beginnings of years for premium payments and the ends of years for death benefit payments.

Special insurance is an insurance that has either non-level benefits or non-level premiums or both. The non-level aspects of the insurance will be described in the text of the question. If an insurance is not defined as "special" then premiums and benefits are assumed to be level, unless there is explicit information in the text of the question to the contrary.

Net premium is the premium determined by the equivalence principle and assuming no expenses. In the MLC exams this was called benefit premium. The term benefit premium will no longer be used on the FAM examination.

The **net premium for fully discrete insurances** will be represented by P with the appropriate symbols attached. P_x , $P_{x:\overline{n}|}^{1}$, $P_{x:\overline{n}|}^{\frac{1}{}}$, and $P_{x:\overline{n}|}$ may be used on the FAM exam.

The symbols are defined in terms of an insurance, A, and an annuity, $\ddot{a}$, as follows:

$$P_x = \frac{A_x}{\ddot{a}_x} \ , \ P_{x:\overline{n}|}^{1} = \frac{A_{x:\overline{n}|}^{1}}{\ddot{a}_{x:\overline{n}|}} \ , \ P_{x:\overline{n}|}^{\frac{1}{}} = \frac{A_{x:\overline{n}|}^{\frac{1}{}}}{\ddot{a}_{x:\overline{n}|}} \ , \ P_{x:\overline{n}|} = \frac{A_{x:\overline{n}|}}{\ddot{a}_{x:\overline{n}|}}$$

The symbol P will be defined within the text of the question if it is not one of the symbols shown above.

Unless stated otherwise in the text of a question all expenses are equal to zero. If expenses are specified in the text of a question, then the expenses need to be considered in the solution to the question.

A **policy value** is the expected value of the future loss random variable. This is consistent with the usage in *AMLCR*. LTAM exams and their predecessors used the term reserve for that expected value, and that term is still regularly encountered in literature and practice. On the FAM examination, **policy value** will be used.

In practice, the financial statements of an insurance company will include a liability amount in respect of future outgo on a policy in force, and this amount is called the reserve. *AMLCR* calls this "the actual capital held in respect of a policy" and uses the term reserve only in this context. (*AMLCR* discusses its distinction between reserve and policy value on page 225 and in chapter 13. Chapter 13 is not part of the FAM readings.)

The **policy value** at time ***t*** may be represented by ${}_tV$ or V_t. The symbol ${}_tV$ will be used on the FAM examination.

The **gross premium policy** value for a policy inforce at duration $t \geq 0$ is the expected value at that time of the gross future loss random variable based on the policy's actual gross premium. The mortality, interest and expense assumptions for the reserve would not necessarily be the same as those used in that gross premium calculation. That gross premium may not be the gross premium that would be determined using the equivalence principle. In MLC exams and LTAM exams these were called gross premium reserves. That term will not be used on the FAM examination for policy

values.

The **net premium policy value** for a policy inforce at duration $t \geq 0$ is the expected value at that time of the net future loss random variable assuming no expenses. It uses the premiums calculated on the policy value basis using the equivalence principle, not the actual premiums payable or the net premiums calculated on the premium basis at issue. In MLC exams these were called benefit reserves. In LTAM exams these were called net premium reserves. Neither the term benefit reserve nor net premium reserve will be used on the FAM examination for policy values. Additionally, the term expense reserve would have previously been used on the LTAM exam to represent the portion of the gross premium policy value from expenses. On FAM the term **expense policy value** will be used.

As noted on page 225 of *AMLC*R, those definitions of policy value apply to more general types of policies beyond those with cash flows occurring only at the start or end of a policy year. These definitions of policy values for more general types of insurance, including policies with cash flows occurring continuously, may be tested on the FAM examination if the techniques to calculate the expected present value of premiums and benefits are covered in the course of reading.

A **modified reserve** is a reserve computed without expenses but adjusting the valuation premiums to allow implicitly for initial expenses. A full preliminary term reserve is an example of a modified reserve. All modified reserves have the expected present value at issue of the benefits equal to the expected present value at issue of the valuation premiums; valuation premiums are typically lower in the first year or first few years than in later years. Any modified reserve questions on the FAM examination other than full preliminary term reserves will specify the modification basis in the question.

Modified reserves calculations are extremely comparable to policy value calculations. On the FAM examination (as in *AMLCR*) we call these reserves rather than policy values because their purpose is to be used as reserves for financial reporting, and because their valuation premium pattern may be very different from the policy's premium pattern.

If a **table of select and ultimate values** is presented in a question the format of the table will either follow the convention of (i) reading across the row of select rates and then down the column of ultimate rates for the values corresponding to each age at selection or it will follow the convention that (ii) all row entries indicate a current age but differ as to the age at selection. On the FAM examination, the table method can be inferred from the table headers.

Unless stated otherwise in the problem, the terms **death benefit**, **face amount**, **sum insured**, and **sum assured** are synonymous terms. Any of these four terms may be used on the FAM exam.

The terms **certain period** and **guarantee period** are synonymous terms. Either term may be used on the FAM exam.

Other terms and common equivalents

Terms used on the FAM examination	Equivalent or similar terms (**not** used on the FAM examination)
annuity due, annuity-due	due annuity
annuity immediate, annuity-immediate	immediate annuity
temporary life annuity	term annuity
temporary expectation of life	term expectation of life
premium paying period	premium paying term
net amount at risk	death strain at risk, sum at risk, amount at risk
net premium	benefit premium
gross premium	contract premium, expense-loaded premium, expense-augmented premium
net premium policy value	net premium reserve, benefit reserve
gross premium policy value	gross premium reserve
Variance, Var	V

Unless specified otherwise within the FAM examination question, the following assumptions should be made:

1. Unless stated otherwise, all given interest rates are annual rates and there are no arbitrage opportunities in the market.
2. The force of interest is constant and is greater than 0.
3. Future lifetimes are independent.
4. All lives in a question follow the same mortality table.
5. Expenses are payable at the start of each period.
6. Expenses (including commissions) that are expressed as a percent of premium are payable when the corresponding premium is payable and end when the premiums are no longer payable.