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The Actuary

AN ACTUARIAL NOTATION BASED ON SYMBOLIC LOGIC

by Frank G. Reynolds

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To many mathematicians, the expression in Symbolic Logic

$$A (((x, {\sim} x) \cap u \cap v \cap ({\sim} z) \cap {\sim} y) > (x \cap u \cap v \cap z \cap {\sim} y) > (x \cap u \cap v \cap z \cap y))$$

is readily understandable, and certainly easier to work with than the corresponding actuarial symbol.

In April 1974, G. C. Taylor F.I.A. of Macquarie University, Australia, undertook to explore the potential of symbolic logic as a means of communication by actuaries. Symbolic logic uses three basic symbols.

Symbol	Meaning	Example
$\cap$	and	$p \cap q$
$\cup$	inclusive of	$p \cup q$
$\sim$	not	${\sim}p$

From these basic symbols Taylor developed expressions for many actuarial functions. For example, the expression $(x, {\sim}x)$ means that a status at the time when x changes to not x and the expression $p > q$ means that p holds and q held before the attainment of p. Some modifications were found to be needed to take properly into account lives that were both present but had identical characteristics (e.g. same age) and to distinguish terms certain from ages. The notation had some advantages. First, it was highly compatible with the computer once different symbols were adopted for the three relationships. Secondly, some complex actuarial concepts can be clearly formulated in symbolic logic so that perception of the inner workings of the concept are clearer. Finally, simulation is often much easier.

In general, however, the method is unwieldly and $A \, {}^{3}_{xyzuv}$ is clearer to most actuaries than the elegant expression that began this article. Taylor's greatest long run achievement will probably be the negative one of showing the difficulties with symbolic logic as a means of communications among actuaries. □

VARIABLE UNIVERSAL LIFE INSURANCE

by Leonard E. Odell, Jr.

Ed. Note: Mr. Odell contributed this at the invitation of our Continuing Education Committee.

The growing popularity of universal life and variable life products has generated industry interest in a product that combines features of both. This product, Variable Universal Life, is a flexible premium life insurance product whose cash values vary, in whole or in part, in relation to the investment performance of an underlying separate account. As with most true innovations, regulatory changes, both state and federal, are needed before this one may be sold.

About half the states have regulations governing sale of variable life insurance products, most of them closely patterned after the Model Variable Life Insurance Regulation that was drafted at a time when the objective was to avoid dual state-federal regulation of such products.

In 1973, the Securities and Exchange Commission adopted Rule 3c-4 under the Investment Company Act of 1940, exempting only those separate accounts funding a narrowly defined range of variable life insurance policies. Accordingly, the NAIC, in drafting its regulation, limited its scope to accommodating policies described in Rule 3c-4. But in 1975, the SEC rescinded that Rule and reasserted jurisdiction over all forms of variable life insurance. Consequently, the industry has been in the unenviable position of being subject to very restrictive state regulation and full federal regulation.

The New NAIC Model

The first major step to remedy this state of affairs was taken in December 1982 when the NAIC adopted a revised Model Variable Life Insurance Regulation, differing in two major respects from its predecessor. First, the unnecessarily restrictive product design criteria of the old Model were eliminated. Second, the regulation has been streamlined by eliminating provisions that parallel or duplicate provisions of the federal securities laws.

Under the old Model, a variable life insurance policy was defined as any individual policy which provides for life insurance that varies according to the investment experience of the separate account. This definition could be construed as requiring that the amount of death benefit vary to reflect that investment experience. Such a construction would ban a design in which perhaps only the duration of coverage would vary with investment experience. The new Model provides for amount or duration varying with investment performance.

Also, the old Model required that these policies provide level premium coverage for the insured's lifetime. Further, the ratio of the initial death benefit to the level premium could not be less than a specified "minimum multiple" which varied by issue age and was comparable to the value of this ratio for a conventional participating whole life policy. These prevented companies from offering term or endowment forms, and forms with unlevel scheduled premiums.

The new Model, by eliminating these straight jackets, will give companies freedom to design a wide array of variable life forms, but the insurer is required to demonstrate that "the reflection of the investment experience . . . is actuarially sound".

Changes in the new Model also bear upon the insurer's investment flexibility and separate account management. Rather than listing permitted and prohibited investments as the old Model did, the new one simply requires that "the separate account shall have sufficient net investment income and readily marketable assets to meet anticipated withdrawals". It also permits variable life, variable annuities, and qualified and non-qualified products to be funded in the same separate account. Formal approval of changes in investment policy by the Commissioner is no longer required, and limitation on the type and amount of charges that may be levied against the separate account has been removed.