Article From:

The Actuary

AN ACTUARIAL NOTATION BASED ON SYMBOLIC LOGIC

by Frank G. Reynolds

(This is Article No. 7 in a series)

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 $A\,{}^{3}_{12}\,xyzuv$ 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.

Universal Life

Among other changes that will simplify life for the companies: the requirement of written state approval of variable life contracts has been eased to the usual state requirements applicable to non-variable forms; thus, companies will be able to use deemer provisions in states that have them, i.e., allowing companies to deem their forms approved if the Commissioner has not responded within a prescribed time—requirements for filing sales literature and for commission disclosure have gone—the "standards of suitability" provision has been lightened by removing the filing requirement, formal Board of Directors action, and lapsation measurement.

Yet To Be Done

The primary need now is to get the new Model adopted in individual states. And at the federal level, relief must be sought from the 1940 Act as has been granted for traditional variable life policies. The focus of this is to get the exemptions of SEC's Rule 6e-2—particularly the part that permits companies to pay commissions of the life insurance pattern—made applicable to the new variable products. It's expected that the industry and the SEC will agree during 1983 on a new exemptive rule.

In general, the outlook is that by early 1984 companies will have authority to offer these new products through their regular distribution channels in about half the states. The prospect for sales shown by the growing market shares of both universal life and variable life individually, by the TEFRA 101(f) amendment that specified rules under which benefits of flexible premium life insurance qualify as "life insurance proceeds", and by the growing aversion to disintermediation risk inherent in non-variable forms, suggests that those who regard any kind of variable life insurance as permanently in the doldrums are likely to prove mistaken.　　☐

NOTE TO "FRUSTRATED"

Your message is relevant and poignant, but, alas, we don't print unsigned contributions. Please tell us who you are.

The Editor

THE THREAT OF TOO LITTLE KNOWLEDGE—A VIEW FROM LONDON

by Patrick S. Carroll, F.I.A.

Ed. Note: As was clear from William W. Truckle's J.I.A. paper reviewed in our April 1982 issue, North American actuaries aren't the only ones puzzling over the curriculum questions aired elsewhere in this issue. We are grateful for Mr. Carroll's permission to print excerpts from his discussion of Mr. Truckle's paper, and parts of his reply to an enquiry that we sent him.

From J.I.A. 109, Part II, 178:

"(Mr. Truckle) has brought to our attention a great danger facing our profession. Insurers are appointing statisticians or even accountants to posts that actuaries should fill when the task is statistical analysis of insurance data using computers. Actuaries completing the examinations in the last few years have had no chance to specialize in statistics, although statistical methods capable of application to insurance have been developed. The use of linear models has gained much impetus through the availability of interactive computer packages. Likewise, methods for analysis of contingency tables are now more powerful. . . .

"Regression analysis is more widely used than ever. Whole new subjects have grown up in the last 10 years very close to the traditional expertise of the actuary. Investigation of lapses and withdrawals in life insurance may be possible using the techniques of survival analysis. . . .

"There is an opportunity to remedy these deficiencies. More post-qualification courses of a statistical nature could be introduced. Links with universities and with the Royal Statistical Society could be strengthened. If this opportunity is not taken, the Institute will become a society of insurance practitioners. Would it not be better for actuaries to build on the reputation they have inherited from their distinguished predecessors, of being experts in applied probability and statistics?"

From Mr. Carroll's Letter To "The Actuary":

I regard the updating of the statistics content in actuarial training as the central issue determining the future of the profession. It would be very sad if the Institute puts up a sign saying, "Statisticians Not Wanted".

Statistical expertise now is given little scope in the Institute's examinations. For example, the Institute has a tradition of not employing matrices in its mathematical and statistical papers.

There is a growing awareness among actuaries that (our educational) system, which absorbs so much of our precious manpower, is leaving us out-of-date and ill-equipped to analyze the data insurers have on their computers today. (But) there is no popular demand among actuaries for more advanced statistics.

As a lecturer in Statistics I don't hope for popularity among actuaries but I do hope for understanding that statistics can be taught and examined satisfactorily, whereas the practice of insurance is frustrating when made the subject of examinations. Tutors and examiners differ as to what is the right answer to a question; students struggle for years, not knowing what is required of them. When it is difficult to advise a good student of probability and statistics to embark on actuarial training, the profession's standing is being eroded.

Yet I don't advocate introducing advanced statistical theory en bloc throughout the syllabus. Rather I think the major statistical topics should each be considered for inclusion on their merits.

(Mr. Carroll goes on to discuss separately the merits of including Multivariate Methods—"Actuaries ignorant of these are at a disadvantage in analyzing market research data"—; Regression Analysis—"One would like actuaries to know more about this"—; Econometrics—"I don't advocate including this"—; Survival Analysis—"Actuaries are remarkably uninterested in this subject which is very close to their traditional expertise with life tables, but I don't think they can ignore it much longer"—; Risk Theory—"Now a feature of the Institute's syllabus"—; Mathematical Demography—"Should be a basic skill for actuaries"—and Time Series—"The Institute has fostered their use in connection with maturity guarantees for unit-linked policies".)

I favor introducing much that is new. But I don't advocate dropping much of what is traditionally taught. Rather I find after two years of teaching Survival Analysis that the two subjects complement each other rather well.　　☐

— REMINDER —
SOCIETY'S ANNUAL $500 PRIZE

Members' attention is drawn to the particulars on page 66 of the 1983 Yearbook, of the Society's prize for the best paper released to members between July 1, 1982 and June 30, 1983, to be repeated annually provided a paper meets the judges' requirements.

One reason for mentioning this here is to prevent it from being confused with the L. Ronald Hill Memorial prize announced elsewhere in this issue.