ACTUARIAL EDUCATION

by James J. Murphy

Accompanying this issue is a letter from President Lautzenheiser introducing an attached statement, *Strategic Premise for Actuarial Education*. Developed by Michael J. Cowell, 1981-82 General Chairman of the E & E Committee, its concepts, although not previously assembled into one document, have been guiding the Society's education efforts for decades. It will now provide useful background for consistent and organized changes in our education system.

While it was being written, several Education Task Forces have been preparing recommendations for changes in our syllabus. Articles by two of these Task Forces that have completed their work are printed here, viz.:

    Operations Research and Applied Statistics

    Mathematical Aspects of Demography

As other Task Forces complete their assignments, we will present similar reports in *The Actuary*. Also, as new Task Forces are established, we will announce them and will call for ideas and volunteers. Keep your eyes open for more news from E & E!

Operations Research and Applied Statistics, (James A. Tilley, Chmn.)

Formed in September 1981, with members drawn from both the academic and business communities, and with representation from the Canadian Institute of Actuaries and the Casualty Actuarial Society, this Task Force began by establishing criteria to guide us to decisions on syllabus and course of reading. Our starting premise was that the scope of actuarial work will continue to broaden to embrace all aspects of the financial products and services business; hence, actuaries should become familiar with

TWO CENTURIES AGO, THE NORTHAMPTON TABLE

To mark this year's bicentennial of Richard Price's Northampton Table—the earliest mortality table to be constructed especially for life insurance premiums—we show here the contrast of its life expectancies with those of population tables of, respectively, one and two centuries later.

Complete Expectations of Life

Age	Northampton Table (Data of 1735-1780)	English Life Table No. 4 (Data of 1871-1880)	Calendar Year 1980 U.S. Life Tables *
0	25 yrs.**	43 yrs.	74 yrs.
20	35	41	55
35	26	30	41
50	18	20	28
65	11	11	16
80	5	5	8

*from *Actuarial Study No.* 87, Joseph F. Faber, Social Security Administration, Sept. 1982.
**q_0 in the Northampton Table was .258! .

Since the two later of the above tables are sex-distinct, these figures show for them the arithmetic means of the $\overset{o}{e}_x$ values for males and females.

Notes on the Northampton Table

Actuary Price, well experienced by having studied mortality in other English towns and aware that he was aiming to generalize from a tiny base (a single church parish), evidently felt free to take major liberties with his data. The many adjustments he made were not in the values of q_x but in the column of deaths. For example, he showed exactly 75 deaths at every age from 21 to 39, 82 deaths each year from age 51 to 61, and 80 deaths from 64 to 75, in a table whose radix was 11,650 at age 0.

The improvement in longevity between the Northampton Table and English Life Table No. 4 is attributable in part to acknowledged overstatement of mortality in the former, and in part to progress in sanitation and medicine. Vaccination was introduced into England by physician Edward Jenner in 1796.

The Northampton Table, though by no means the earliest—Halley's Breslau table dates from 1693 and Kerrsboom's in Holland from 1738—is bound up with the history of the Equitable Life Assurance Society (of London). Griffith Davies, in his *Treatise on Annuities* (1825) quotes Price's nephew, William Morgan, thus:

> "(T)he Society had computed all their premiums from the (early 18th century) London Table of Observations (but, after seeing their experience from 1768 to 1780) they determined to compute the premiums in future from a table which should give the probability of life *higher* (emphasis in original) than that which they had hitherto used; and for this purpose they adopted one which had been just formed by Dr. Price, from very accurate observations made in the town of Northampton."

PRE-TEFRA

S^* = the smaller of:

(a) S, or

(b) [(G' − T), if positive,] + L.

TEFRA

S^* = the smaller of:

(a) S, or

(b) the larger of

(1) [(G' − T), if positive,] + L, or

(2) Q + the smaller of (i) (1+f)∗(P+N), or

(ii) L+f∗(P+N).

where L is $250,000 pre-TEFRA and is now defined as $1 Million, reduced for S > $4 Million (to 0 when S = $8 Million), allocated proportionately to the number of companies in the affiliated group. And where f = .85 for stock companies and f = .775 for mutual companies.

Thus, a company's tax position can be classified in terms of the amount of Special Deductions allowed under Section 809(f). Assuming increasing levels of S^*, the classes for stock companies would be:

Category V	:	$S^* = L$
Category W L > (P+N)	:	$S^* = Q + 1.85 (P + N)$
Category X L < (P+N)	:	$S^* = Q + L + .85 (P + N)$
Category Y	:	$S^* = G' − T + L$
Category Z	:	$S^* = S$

The variable L introduces a factor into the tax calculation that may come from data not included in the company's tax return. Also, a new corridor situation develops when an affiliated group's total special deductions fall in the range from $4 Million to $8 Million. Interesting marginal tax rates develop within this corridor.

Comments are being made indicating a switch of the tax phase for most mutual companies from Phase I to Phase II−. While being basically true, the statement is not fully accurate in that only a few companies will find themselves in the old Phase II-position. It might better be said that the old Phase II-companies, which previously had a $250,000 limit on Special Deductions, will join the old Phase I companies in a new category, both having a variable amount of allowable Special Deductions. □

The Northampton Table

It is right for us today to remember and to acclaim Richard Price's work. James S. Elston, in the second edition of *Sources And Characteristics of the Principal Mortality Tables* (1932) gives this endorsement by an 1823 author:

"Dr. Price did as much as the nature of his materials would allow. For in those days no census or enumeration of the population had been made; and without (that) . . . an accurate Table of Observations cannot possibly be obtained."

My thanks to Howard W. Johnson, F.I.A. of London's Equitable Society for sending helpful material used in this account.

Wigglesworth's Table (1789)

"The first American table used at all for calculating life contingencies"—these words are quoted from *TASA* VII (1901), 3—made up from records in healthy portions of Massachusetts, was published, by Prof. Edward Wigglesworth of Harvard University, only six years later than was the Nortohampton Table.

E.J.M.

Golden Anniversary

remain. They became Fellows in the year in which the total number of Fellows went past the 400-mark; happily, 90 of those 400 are still with us.

The number of Associates who have 50 or more years as such is now 33.

The Society member who has been one for the longest time is Horace Holmes (F.S.A. 1921); he earned his Associateship in 1913 and is our only living member whose name is in the first published Index to the *Transactions* (1889-1914). Erston Marshall, though, is still our dean among Fellows, dating from 1919. □

THE PROPOSED NOTATION OF ENGELFRIET AND KOOL

by Frank G. Reynolds

(This is Article No. 6 in a series.)

Engelfriet and Kool explored the possibilities of using a linear form involving only the keys found on the standard typewriter keyboard. To replace the superscripts and lower left corner resort was made to an ingenious series of combinations of the special characters. For example, the double quotation symbol replaced the dieresis; ⚊ was used to indicate that annuity payments were deferred for a given period and then continued, and this for a limited period from the end of the deferment period; the apostrophe was used to indicate that the annuity was payable in advance. Thus, n|m ä$_x$$^{(h)}$ became ' "a ⚊ (x,n,m,h).

For a compound status an additional letter was added to the stem to indicate last survivor and other conditions. In general, the proposal met its design criterion of being linear, of being readily transformable into programming names, and of using only typewriter characters. The problem was the extensive use of backspacing to create characters such as ⚊ and the use of auxiliary symbols which made it difficult to relate symbols to the present notation. □