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Ulpian's Table

(*Continued from page 1*)

Table I

Age	Expectation of Life Macer	Ulpian
19 years and under	30 years	30 years
20 - 24	30	28
25 - 29	30	25
30 - 34	29 - 25*	22
35 - 39	24 - 20*	20
40	19	19
41	18	18
42	17	17
43	16	16
44	15	15
45	14	14
46	13	13
47	12	12
48	11	11
49	10	10
50 - 54	9 - 5*	9
55 - 59	4 - 0*	7
60 and over	—	5

**Expectation of life by Macer's Table decreases uniformly by one year for each year increase in age in the interval. If this were the exact rate of decrease throughout any age interval, a necessary consequence would be that no deaths occurred in the interval. Strictly interpreted, Macer's Table would imply that those living at age 29 all survived to age 59 and then died before attaining age 60, while Ulpian's Table would imply that those living at age 39 all survived to age 50.*

Through a misinterpretation of the Latin text, the values according to Macer's Table for age 30 and over have been taken to be one year greater than those shown in the above table. Critical examination of the text establishes the correct values and makes clear that the two tables coincide from age 39 through age 50, as well as at the ages below 20. Such coincidence makes plausible the assumption that Ulpian's Table is a refinement of Macer's Table with corrections introduced in the two ranges where the latter was most seriously in error—that is, in the neighborhood of age 30 where the expectation of life had been overstated and of age 60 where no survivors had been assumed. In consequence, we believe that the basis of values in Ulpian's Table was not purely arbitrary and that investigation of the underlying mortality is justified.

In order to develop the mortality rates, let it be assumed that the values in Ulpian's Table represent the curtate expectation of life and that the mortality rates from age 25 upward follow Makeham's Law. The three ages for which the values would seem to be most reliable are 27, 45, and 57. Age 45 lies in the middle of the range where the two tables coincide and presumably where no correction to Macer's Table was deemed necessary. The other two ages are in the ranges where Macer's Table was most seriously in error and therefore where corrections would be most carefully considered. Thus we seek values of the Makeham constants A, B, and c that will reproduce the complete expectations of life:

$\mathring{e}_{27} = 25.5$; $\mathring{e}_{45} = 14.5$; $\mathring{e}_{57} = 7.5$.

A set of first approximations for the constants is readily found from Calderon's generalized Makeham tables (JIA, Vol. XXXV, p. 157). These are tested by substitution in the series expansion of $\mathring{e}_x$ due to McClintock (*The Assurance Magazine*, Vol. XVIII, p. 242). First order corrections are applied and final values are obtained as follows:

$$A = .01613025;\ B = .0000213685;$$
$$c = 1.14536554.$$

The resulting mortality rates for quinquennial ages are set forth in the following table, together with mortality rates from other tables for comparison.

Table II

$1000q_x$

Age x	*Ulpian*	*All India Male* 1901-1911	*Halley (Breslau* 1687-1691)	1958 *CSO Male*	*U.S. Total Population* 1959-61	*Ulpian as % of U.S. Total Population* 1959-61
25	16.67	20.3	12.35	1.93	1.26	1323%
30	17.32	23.5	15.07	2.13	1.43	1211
35	18.60	27.8	18.37	2.51	1.94	959
40	21.12	32.3	20.22	3.53	3.00	704
45	26.07	37.2	25.19	5.35	4.76	548
50	35.74	42.8	31.79	8.32	7.74	462
55	54.54	49.9	34.25	13.00	11.61	470
60	90.52	59.8	41.32	20.34	17.61	514
65	157.47	75.5	52.08	31.75	26.22	601
70	275.37	101.7	77.46	49.79	38.66	712
75	461.64	148.0	113.64	73.37	57.99	796

SYSTEMS, COMPUTERS AND USERS

by Malcolm D. MacKinnon

The LOMA Systems Forum was held in New York, March 15-17, with a program including 99 speakers, 15 of whom were members of the Society. Forum proceedings are being sent to member companies and to registrants in two mailings.

The range of topics was very broad. Space permits the mention of only a few of the papers. In *The Corporate Financial Model—Its Application and Development*, George W. Gershefski gave a first-rate overview. "In the simplest of terms," he stated, "a corporate model is a simulation of a company's operations used to provide a fast, reliable method for forecasting the future of the company. At a minimum, it will produce an income statement, a balance sheet, and a cash flow statement. It may also project manpower, equipment and space requirements."

Application of modeling techniques to life insurance was covered by Michael Rosenfelder in a paper describing the work of the LOMA Management Research Techniques Committee. He described a model composed of submodels relating to marketing, policies, administration, assets, the mandatory securities valuation reserve, federal income tax, liabilities, operations and surplus. In another paper, Richard C. Murphy described models for projecting manpower and for evaluating capital investments.

T. J. Gordon, Vice President of the Institute for the Future, predicted a trend to benefits measured in terms of services rather than dollars.

Other topics included the use of remote terminals, the application of management science to life insurance product design, policy issue systems, data entry by optical scanner, the data processing department as a profit center and systems requirements for the Investment Company Act of 1940.

Proceedings of the LOMA Systems Forum are available at $12 each. ☐