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ACTUARIAL MATHEMATICS COURSE AT THE CLAREMONT COLLEGES

by Murray Projector

The Claremont (Calif.) Colleges offer an actuarial mathematics course, which began its second year of operation in February. The course is provided by the mathematics department of Harvey Mudd College, but is available to all undergraduate students in the cluster of independent colleges comprising the Claremont Colleges.

The course, which draws students from Pomona College, Claremont Men's College, and Harvey Mudd College, is a two-semester sequence, spring and fall. During the summer vacation, students are given an opportunity for actuarial employment with Los Angeles companies.

Designed as a six-credit academic mathematics course for mathematics majors, as well as for those interested in actuarial careers, the course is based on Kellison's *Theory of Interest*, and Jordan's *Life Contingencies*.

A Society examination center has been established at Harvey Mudd College, which attracts not only students enrolled in the actuarial course but qualified outside students as well. Passing ratios for the examinations are high, because of the Colleges' high academic standards.

Career and placement guidance is also furnished not only for those students who are native to Southern California but for those from other parts of the country. More than half the members of the undergraduate student bodies at the Clarmeont Colleges are from out of state.

The course was first proposed by the Los Angeles Actuarial Club, and implemented by its members through financial support and other help. Arrangements were worked out with two members of the Harvey Mudd Mathematics faculty,

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"WHAT'S IN A NAME?"

by Ralph E. Edward

Mr. Gerald Hutchinson of the Social Security Administration talked to the Baltimore Actuaries Club recently on the subject of surnames. For their records a surname has six or fewer letters, so Smith is separate, but others like Martin, Martinez and Martinson are deemed identical. It follows that their count understates the number of different surnames.

By frequency, Smith (2,383,000) is most frequent, grading down through, in order, Johnso, Willia, Brown, Jones, Miller, Davis, Martin, and Anders to Wilson (788,000). The list has 3200 names before the count is under 10,000, 468,700 before the count is under 10 and 839,600 before the count is less than two, leaving 447,000 where the surname is unique, for a total of 1,286,600 different surnames. These correspond to the total number of names (239,928,000) from 1936 to June 1972, living and deceased. This exceeds the number of different social security numbers (207,027,000) because of name changes, such as at marriage.

The frequency of initial letters (by number of records) goes from S (10.1%) to M B H C W R G P D L K F T A J E N O V Y Z I U Q to X (less than .05%). The frequency of initial letters (by number of different surnames) goes from S (9.8%) to B M K D P C G L A T H R F W N V O E Z J Y I U Q to X (.1%).

The surname Hutchi appears 105,943 times and it ranks 232nd in frequency of appearance. (Edward ranks 50th with 317,197 appearances).

Surnames range from Aa to Zyzys. Q is the only letter of the alphabet not a surname by itself, while Fifteen is the

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ENVIRONMENT, CHEMICALS, CANCER

National Association of Swedish Insurance Companies, *Evaluation of Genetic Risks of Environmental Chemicals*, Royal Swedish Academy of Sciences, Ambio Special Report No. 3, pp. 27, 1973.

by Arthur Pedoe

This is a report of a symposium held in Sweden in March 1972, which was initiated and sponsored by the Swedish insurance companies. Thirty-four specialists participated included five from the U.S.A. and four from Great Britain. They were drawn from departments of medical genetics, environmental hygiene and biochemistry from various universities, hospitals and research institutes. The subject is of major interest to actuaries; no actuaries participated, because the views of these other specialists was evidently the purpose of the symposium. We should thank the Swedish insurance companies; it might lead to similar action on this side of the Atlantic.

The reports on the various matters discussed are quite brief and addressed to fellow specialists with references to 86 technical books and papers on the subjects under review.

The opening paragraph states: "Side effects of the development of modern chemical industry are pollution problems of entirely new dimensions. Living organisms, including human beings, are constantly exposed to a variety of chemicals released in the environment. It is almost a truism to state that the biological consequences of the pollution are largely unknown." It is stated that in the U.S.A. the production of synthetic organic chemicals approaches 10,000 million kilograms a year including pesticides, food dyes and many additives to plastics, rubber, paper and detergents.

The release of known toxic metals into the water and air has reached enormous magnitudes. The danger of lead

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Environment

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poisoning is well known, but others representing real or potential hazards include nickel, cadmium, beryllium and mercury. It is stated that in North America since 1923 the automobile has added about 5,000 million kilograms of lead to the atmosphere from which it eventually reaches man. Some of the metals are released as or are eventually converted to volatile, organic forms and hence more active in the biological and genetic sense.

The problems are the long term effects as hereditary changes, cancer induction and degenerative cellular effects leading to poor health and the production of abnormalities. The ability of certain chemicals to alter hereditary material has been known for three decades, but even geneticists were reluctant to appreciate the consequences. Only in recent years has general recognition been given to the danger. In the U.S.A. the *Environmental Mutagen Society* was founded. The dissemination of relevant knowledge should be beneficial.

Mankind has always been exposed to toxic agents naturally present in the environment, including foods. However, advances in science and technology have led to their extraordinary growth. Further, unlike earlier eras, the fraction of the total population being exposed has approached 100% because of easier communications.

One of the sections of the report is headed, "The Relation of Cancer Induction and Genetic Damage." The following quotations are from this section. (1) "It seems likely that exposure to environmental chemicals is the determining factor in the causation of many types of human cancer." (2) ". . . chemicals which modify genetic material may cause a variety of diseases of unknown etiology, such as chronic degenerative diseases and congenital abnormalities."

The difficulties of research in this area is illustrated by the following quotation: ". . . it is difficult to predict with confidence the genetic effects of chemical exposure by man. Some uncertainty will always remain unless observations are made on man himself. Human metabolism is different in many details from metabolism of other mammals . . ."

This report is in the Society library. Copies can be obtained from Svenska Försäkringsbolags Riksförbund, Att.: Olle Grönstedt, Strandvägen 5 B, S-114 51 Stockholm, Sweden. □

TO BE CONTINUED

Editor's Note: This is another in the series of articles from the Committee on Continuing Education and Research. Comments will be welcomed by the Committee and the Editor.

Social Security Approval Rates

by Richard C. Murphy

In the development of a group long term disability (LTD) premium scale it is necessary to consider the level of credit that should be given for offset of Social Security benefits. The amount of the Social Security award and the proportion of LTD payments that will be made while the individual is receiving that award should be considered. In this article I will describe how a study of Aetna Life experience was made to determine the percentage of LTD payments made during the time of Social Security receipt and will present some of the results of that study.

The study analyzed 8,000 claims incurred under contracts that reserve the right to offset the amount of the Social Security benefit being received. The Social Security benefit that is considered is usually both the disability benefit (primary and family) and the early retirement benefit (primary and family). While the right of early retirement offset is used infrequently, it appears that there may be a considerable number of individuals first disabled between ages 60 and 64 who are applying for this early retirement benefit after their disability application has been denied by Social Security. In some cases there is a financial incentive for the individual to apply for this benefit since some LTD contracts may not offset the Social Security benefit until the sum of the LTD and Social Security benefit exceeds a high percentage of salary.

The available claim records did not include the Social Security effective date and so it was not possible to directly determine the approval rates. Analysis of individual claim records showed that in better than 95% of the cases examined the Social Security award amount reflected retroactive payment to the 6th month of disability regardless of the point in time at which the award was actually made. Each claim was examined as of a particular point in time on a retrospective basis so as to reflect the frequency and importance of the retroactive Social Security award. The procedure used examined claims as of the duration attained in December of year Y−1 by capturing the Social Security approval status from the claim records available in March of year Y + 1. Claims terminated before March of year Y + 1 received the Social Security status effective at the time of claim termination.

Claims were grouped in intervals according to their attained duration as of December 31, Y−1. The duration intervals are 6-9 months, 9-12 months, and so on to 48 months and over. For each of these duration intervals the ratio of approved claims to total claims was calculated for age at disability brackets—less than 40 years, 40-44 and quinquennially to 60-64. Finally, financially effective approval rates used for the Social Security offset credits were developed from the formula:

$$ {}_{6\text{-}9}k_x \frac{N_{x+6\text{mos.}} - N_{x+9\text{mos.}}}{N_{x+6\text{mos.}} - N_{to\,65}} + \cdots $$

$$ \cdots + {}_{\substack{30\text{ mos.}\\ \text{over}}}k_x \frac{N_{x+30\text{mos.}} - N_{to\,65}}{N_{x+6\text{mos.}} - N_{to\,65}} $$

In this formula ${}_yk_x$ represents the proportion of approved claims for duration interval y and age group x. The Nx functions were taken from the Aetna LTD reserve basis. They can be closely approximated by a reserve basis developed from the intercompany LTD experience presented in the 1972 Reports.

Table I shows the December, 1971 approval proportions for duration 12-14 months and 24-29 months as well as the financially effective approval rates developed from all the claim intervals.

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