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GENERAL

A. What have been some of the recent developments in the use of (*a*) sampling techniques and (*b*) quality control in actuarial work?
B. What have been the more important administrative measures taken to reduce expenses on small Ordinary policies? What success has attended such measures?
C. In view of the shortage of college graduates entering actuarial work, is there anything that the Society of Actuaries or the local clubs should do at either the college or secondary school level to improve the situation?

MR. J. T. BYRNE, in discussing section A, stated that while sampling techniques had been used for generations, until recently they were unscientifically used, the size sample not being related to the degree of reliability needed. He indicated that it was helpful to have a preconceived idea of the frequencies to be determined in deciding the size of sample and the reliability of the results. In connection with idle time he mentioned that the Metropolitan has produced a set of IBM cards bearing random digits which have been converted into random weeks, days, moments, and clerks, thereby solving any bias in the matter of idle time since the observer merely follows instructions.

As to quality control, Mr. Byrne cited an example where, after a 10% sample audit was instituted, the indicated error rate was consistently less than 3/10%. Since the objective was to keep the error rate at 1% or less, a sharp reduction in the sample size was recommended. The Metropolitan has for some time been supplying line management with tables for quality control sample sizes and corresponding 3σ danger limits associated with various error densities. The sample sizes were a compromise between precision and expense. Management is encouraged to take single samples of appropriate size and to institute remedial action where indicated. Conversely, if extremely low error rates are indicated, consideration is given to loosening controls. He closed by quoting Aristotle:

> It is the mark of an educated intellect to seek only so much exactness as may be required by the nature of the subject matter, and the purpose to which it is to be put.

MR. N. F. JONES pointed out that it was difficult to apply sampling techniques to most technical actuarial problems because of established practices and regulations. He pointed out, however, that sample analysis has certain properties which can reduce clerical error and under certain

circumstances permit the sample to reflect more accuracy than examination of all items. He stated that the Prudential has found that most of the data behind insurance statistics contain subpopulations with conventional distributions and that they are presently exploring the use of stratified sampling along the following lines:

1. Determine the allowable error and level of confidence (usually 95%) for the final answer,
2. Estimate from preliminary samples or previous data the number of items, means and variances for each of the population's strata,
3. Select samples on the basis of these estimates. Depending on the costs of sampling, size of the variances and similar considerations, these samples may be proportional or optimal. Optimal sample sizes are computed by using the estimated variances and number of items in the subgroups. The optimal samples usually yield the smallest total standard error for the number of items sampled,
4. The standard errors for each of the strata are combined for the error of the final estimate, using Student's t as the multiplier for the confidence limits.

He felt that machine methods would not conflict with sampling and, in fact, that they would supplement each other.

Mr. Jones stated that quality control has been used for several years in such areas as underwriting of new business, policy changes, and reinstatements, and coding of data for mortality studies and that they are pleased with the results. The cost of the added review has been more than offset by the improvement in quality. He pointed out that gains through the use of quality control can be lost if the sample review is completely discontinued.

MR. R. E. SLATER, in discussing section B, said that the John Hancock has found it necessary to seek ways of reducing operating costs on small Ordinary policies in view of the rising costs in the last decade. John Hancock started issuing two lines of Ordinary business in May 1954, with one line covering policies under $3,000 and the other for policies of $3,000 and over. They found that many procedures were followed primarily for the benefit of larger policies and could be eliminated on the smaller contracts.

MR. J. T. HOYT of the Metropolitan mentioned that they started issuing Ordinary policies under $1,000 on a monthly debit basis early in 1955. These policies now cover amounts to $2,000 in multiples of $250. The minimum for their larger series of monthly debit policies is $2,500.

MR. J. A. CAMPBELL indicated that the London Life standardized the benefits and the amounts of insurance in the beginning of 1955 for all policies with a face amount of less than $2,000. These are issued only in

multiples of $500 up to $1,500, with the $500 contract issued only as a debit contract.

All three of the previous speakers mentioned several ways of reducing expenses and simplifying procedures on these smaller policies. Among these were the following:

1. Limitation of the number of different policy forms available. Mr. Campbell believes now that their 15 plans could be considerably reduced further in number.
2. Shortening both the application and the medical examination and simplification of the policy forms. In addition, the John Hancock uses the new NCR paper to give ready carbons without the use of carbon paper so that actual photostats may be eliminated.
3. Automatic inclusion of disability and double indemnity benefits. Premiums may be level for the entire premium paying period to avoid administrative expense in reducing premiums.
4. Reduction in the records kept—*e.g.*, elimination of complete dividend record, use of premiums for agents' production records instead of amounts of insurance, and elimination of an alphabetic file of these policyholders.
5. Simpler underwriting rules and a limited number of substandard classifications.
6. Limited settlement options.
7. Decentralization of policyholder service functions to the field offices.
8. The London Life shows exact premiums for each amount and plan, both standard and substandard, in the rate manual and thus simplifies the completion of the application by the agent and reduces the task of checking. Also, only one premium has to be recorded and one valuation card is required.
9. The John Hancock is using large scale digital computers to handle premium billing and accounting and all similar functions to reduce expenses on all policies. Since 60% of their policies are less than $3,000, this will benefit the smaller policies considerably.

Mr. Campbell also pointed out that about 40% of their policies are for less than $2,000; 20%, between $2,000 and $5,000; and 40%, $5,000 and over. He felt that, because they are issuing substantial numbers of policies in all amounts, they must be very careful in charging expenses properly in relation to the size of the policy, while a company that issues very few small policies or very few large policies may use a broader approach.

MR. MITCHELL DEZUBE of the Manhattan Life was also concerned over the reduction of expenses on small Ordinary policies. Their minimum $10,000 policy within a year produced new paid-for business in excess of 30% of their total new paid-for and consequently has left the smaller policies with a greater than usual share of overhead expenses. In

order to help reduce the rising costs on smaller policies, they have developed a family policy providing $4,000 endowment insurance on the life of the husband, $2,000 term insurance on the life of the wife, and $1,000 term insurance on the life of each dependent child. Their first few issues average $8,700 per policy.

MR. R. T. SCHWARTZ stated that the New York Life has taken several successful measures in the correspondence, change, and cash value sections to eliminate the overtime that had been required, to reduce their expenses, and to release some people for work on electronic studies. These changes in general apply to all Ordinary business regardless of size. They have improved their methods by using branch office records in conjunction with cash value and change requests and have thus avoided the time and expense of obtaining premiums paid and dividend information from home office records. In addition, they have placed several experienced change calculators near the Selection and Rating Department to handle only cases where all necessary requirements are submitted, reducing the average calculation time to two hours by eliminating routing of material from one department to another. In granting more authority to experienced employees, they have first eliminated reviewing of letters by a second correspondent and, secondly, they have eliminated checking routine surrender value and change quotations. Random samples of all letters are read and discussed each week, and 20% of calculations on a random basis are checked daily. Where cash values exceed $1,000 and where the case is unusual, special scrutiny is given.

Several discussions under section C emphasized the seriousness of the problem and outlined the following general reasons for the shortage of actuarial students:

1. Competition for mathematics majors with other industries where mathematics is applied to physics, chemistry, electronics, aviation, engineering; these other fields having excellent recruiting material.
2. Other fields, such as engineering, have higher starting salaries and are more glamorous and do not have the reputation of the high failure rate and effort involved in the actuarial examinations.
3. Shortage of mathematics teachers and poor grade of mathematics instruction in both elementary and secondary schools, resulting in shortage of students interested in mathematics.
4. Outdated mathematics curriculums.
5. Poor incentives to teachers in form of pay and prestige in the community.
6 More colleges allowing degrees with no required mathematics courses.
7. Decrease in proportion of mathematics, science, and engineering graduates.
8. Low birth rates in the 1930's.

MR. E. J. MOORHEAD stated that the Actuaries Club of Boston had formed a committee for ways and means of developing future actuarial students, which has contacted the local universities urging them and helping them (1) to inform students about the opportunities in the actuarial profession, (2) to encourage and help students to pass the preliminary examinations while in college, and (3) to develop actuarial courses. They have also offered summer employment in the companies for promising students who enroll for the preliminary examinations. He mentioned that one of the larger colleges is now considering an actuarial mathematics course covering finite differences and life contingencies. Mr. Moorhead also mentioned a statewide mathematics contest among Massachusetts high school students, which they had the opportunity to sponsor. Every Massachusetts life company is financially supporting this project so that cash prizes, medals, and certificates may be given. The committee intends to send congratulatory letters to all the leading contestants to acquaint them with the actuarial profession.

He offered the following six suggestions from the committee for consideration by the Society:

1. Move the enrollment deadline for Parts 1 and 2 from March 15 to, say, April 15 so that students just becoming aware of the examinations may still enroll.
2. Reduce the examination fee for Parts 1 and 2, even though this may require subsidies from other sources.
3. Release the results more promptly on Parts 1 to 3, both to eliminate the suspense and to permit companies to operate their summer employment and educational programs more effectively.
4. Remove the ban on publishing examination questions to avoid the bootlegging which now exists and to provide illustrated material for talks with mathematics professors.
5. Expand greatly the publicity about the actuarial profession to reduce the ignorance and misinformation now prevalent.
6. Form a committee of the Society to collect and promulgate facts concerning starting salaries to college graduates entering actuarial work in companies, government work, and actuarial firms.

MR. A. A. WINDECKER very much approved the Massachusetts mathematics contest and suggested that the Society offer an annual competitive mathematics examination to graduating seniors in the United States and Canadian secondary schools. He suggested that the prize might be an amount sufficient to pay a year's tuition or possibly a variable amount depending on the needs. He was in favor of a number of scholarships to encourage wide participation and in addition suggested that a number of participants might be given honorable mention. He felt

that this would give a large address list for the Society to send publicity material to periodically and that it would help build for the future in obtaining new actuarial talent.

MR. W. A. THOMPSON felt that contact with mathematics students in college through a summer employment program was very desirable and said that the New York Life had such a program which included scholarship awards as well as a wide exposure to actuarial work and encouragement to take actuarial examinations. As part of their recruiting program, they prepared a booklet concerning an actuarial career in the New York Life, which they have furnished to placement offices at various universities.

MR. R. W. WALKER felt that the companies and local Actuaries Clubs should be much more active in getting to undergraduates and high school students with the actuarial story. He said that the individual companies have a responsibility and that the actuaries have left too much to the personnel departments whose sights are kept too close to the clerical level, while they should be selling high schools on the need for professional people as well as clerical work. Mr. Walker also mentioned a weekly school publication called the *Junior Review*, which has an article "Jobs Ahead." He felt that this would be an excellent type of place to have an article on actuarial work since it has a wide distribution.

MR. B. L. DALY agreed with Mr. Moorhead that it would be an excellent idea to obtain facts on starting salaries, but thought that perhaps even more important than starting salaries would be ultimate salaries. He felt this could be done with no publicity as to individual salaries or company salary levels. He also felt we should find out exactly what the demand for actuaries really is. He thought that perhaps this was a job of the Public Relations Committee and that after obtaining facts they could review them and publish them to everyone's advantage.

MR. M. A. LINTON reported that one mathematics professor to whom he talked said that he could not recommend actuarial work to a student majoring in mathematics because the student would not be able to practice the type of mathematics that he was interested in and, in addition, he would have all the examinations to pass. This professor felt that a good average man who has had quite a bit of economics might be better for the job. Mr. Linton felt that we should consider more thoroughly exactly what type of man we need.

MR. ARTHUR PEDOE spoke in support of Mr. Linton's statements. He believed that a standard of mathematical attainment was insisted on in the earlier examinations which was not necessary and might even be undesirable; he considered that many who would have made good actu-

aries were discouraged in the first year or two of actuarial work by this barrier. Mr. Pedoe stated that personnel executives, seeing the shortage of actuaries and noting that the situation showed no signs of improvement, felt that the actuarial profession was deliberately creating a closed shop. Mr. Pedoe questioned whether the increasing gap between junior actuaries' salaries and those of others in the business was a good thing.

Referring to the number of years' experience he had had as Chairman of the Education Committee of the Society, Mr. Pedoe expressed the view that the preliminary examination should be abolished. Further, the examinations covering purely mathematical subjects (present Parts 2 and 3) should be held in September as well as May and should be of a straightforward nature, presenting no special difficulties to anyone with mathematical aptitude who had spent, say, half or more of his time at college on mathematical studies. In this way, such a man without being a mathematical wizard could complete the present Parts 2 to 4 within a year of leaving college.

MR. R. A. HOHAUS reported that Notre Dame is exploring the viewpoints expressed by Messrs. Linton and Pedoe. Mr. Hohaus has arranged a conference with the Dean of the School of Business and the head of the Department of Mathematics to investigate the possibility of developing some actuarial training in the School of Business in conjunction with appropriate mathematics courses.

MR. R. G. STAGG expressed great concern over the shortage of actuaries. He felt that a portion of the Society's accumulated surplus could be used to good advantage to develop a public relations and recruiting program. He suggested hiring a man to coordinate the program with colleges and to educate colleges as to just what an actuary is. He felt that most colleges thought the only insurance jobs were those of salesmen. He agreed with some of the previous speakers that we should probably set our sights on developing individuals with broader backgrounds.

MR. A. L. MAYERSON felt that teachers in secondary school and in the early university years would be most influential in steering young men into the actuarial profession. He suggested that these teachers and professors be invited to visit companies, perhaps taking summer employment, so that they would be familiar with the type of work involved. He also felt that it might be helpful along these lines for actuaries to become active in local mathematics associations.

MR. G. G. MYER and MR. HARWOOD ROSSER concurred with Mr. Mayerson's views on the advisability of contacting secondary school teachers, suggesting direct contact by actuaries with both local schools and their own schools in person or by writing. They felt the Society's

booklet *Preliminary Actuarial Examinations* was helpful and that contacts should be continued year after year. Mr. Myer suggested that in view of apparent loss in both the pay and prestige of the teaching profession in the last 50 years, we should do whatever possible to reverse this undesirable trend and raise teachers' status in the community. Mr. Rosser reported having given a talk on "Opportunities in Insurance for the Mathematically Trained" for a group of mathematics teachers attending summer school at U.C.L.A., which was very well received. He felt that this was an excellent method of getting to the teachers and suggested that the Society get up a clearing house of such speeches for the use of others who had similar opportunities. He offered reprints of his speech to anyone interested.

MR. F. E. RATHGEBER recommended rekindling of interest in mathematics in the secondary schools through continued mathematics tournaments, with follow-up information on all types of mathematics careers. In the college area, he felt that our publicity material should be brought up to date particularly as to salaries and opportunities, and that the number and size of the Part 2 prizes should be increased. He thought that summer actuarial students could be excellent recruiters among their classmates if they were given a broad picture of actuarial work. He reported that apparently state qualifications for mathematics teachers have been relaxed and suggested that the Society lend its weight towards stiffening the requirements.

MR. J. W. MORAN approved of holding the preliminary examinations in the fall as well as the spring. Working with a company for the summer might build up enthusiasm for actuarial work and give opportunity for some review of algebra and calculus. The student would then have a better chance at Part 2, and could take Part 3 the following spring.

MR. G. K. FOX reported that the Ontario Department of Education had forecast a need for at least 1,000 fully qualified teachers per year for the next decade, while the current rate of graduation from teachers' colleges is only one-third of this rate, with little sign of improvement. In addition to approving many of the proposals of previous speakers, he proposed that the regional actuarial associations establish committees which would assemble information concerning comparative employment opportunities in competing industries and professions. Through these committees the regional clubs could also become more familiar with local educational problems. This would point the way to many opportunities for giving practical assistance to the schools and colleges, thereby earning a good measure of gratitude and cooperation from the educational authorities.

Mr. Fox stated that scholarships to students entering teachers' colleges would be helpful in attracting good students into the teaching profession. He felt that the problem of shortage of teachers could be eased if actuaries were to offer their services, as lecturers or by conducting seminars in the colleges. In addition, he suggested sending extracts of pertinent actuarial proceedings to teachers, and inviting them to regional actuarial meetings or special get-togethers, as an effective means of helping them become familiar with the actuarial profession.

He recommended that the regional committees submit annual reports giving the results of recruiting each year, including the number of men going into each of the various professions, the range of starting salaries, details of on-the-job training programs, etc. He felt that greater publicity could be given to actuarial matters in the local press and in school publications. Opportunities for this would arise when students received actuarial prizes, when actuaries received important appointments either in business or in public service, and when important actuarial papers were written.

MR. E. B. LANCASTER was concerned over the shortage of high school mathematics teachers and of college mathematics students. He suggested that the Society cooperate with various engineering societies, chemical societies, etc., in acquainting high school juniors and seniors with the opportunities available in such fields. For example, in New York, some twenty such organizations jointly sponsor an annual "Scientific and Engineering Career Conference." He felt these programs could be implemented through local actuarial clubs and by the Society contacting the engineering, chemical, etc., society headquarters.