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DIGEST OF INFORMAL DISCUSSION

SELECTION, EDUCATION AND TRAINING OF ACTUARIAL STUDENTS

A. Are we attracting the right type of person to the actuarial profession?
B. Is our course of study adequate, or should more topics be included, *e.g.*, electronic machine methods? Is there any topic now included which should be dropped?
C. Should the syllabus contain advanced reading courses beyond the scope of the examinations to facilitate a higher degree of competence in specialized fields?
D. Are our examination standards proper? Has there been any appreciable change in recent years?
E. What are the prospects of inducing more colleges to provide instruction in actuarial subjects? What additional educational aids might be made available to students?

MR. K. M. DAVIES stated that one of the biggest recruiting problems is making actuarial work attractive to the type of individual who is desirable for the profession. The person to attract is one with a substantial amount of native mathematical ability which has been developed through study of mathematics in college and with personality and potentiality to develop into a well rounded business manager. The number of mathematics majors in colleges seems to be at an all-time low, and the rare individuals who excel in all the qualities we require do not seem to be interested in the actuarial field.

Our recruiting specifications call for a college mathematics major with a very high academic average. Evaluation of other necessary characteristics is of sufficient importance to preclude offering employment to a topnotch mathematician who is seriously lacking in them. However, not more than 1 in 5 or 1 in 10 of the mathematics majors who take jobs immediately upon graduation apply for interviews for actuarial work. Also, it must be recognized that to the man who has spent two or more years in service, forgetting both his mathematics and his good study habits, the series of examinations looks quite formidable.

There is considerable competititon on the one hand from professors who direct topnotch individuals toward higher mathematics and teaching and, on the other hand, from jobs in industry requiring mathemati-

cians. Many of the industrial jobs protect the individuals from the draft at least for a period of time. The fields of operations research and electronic data processing are becoming the most dangerously competitive to actuarial recruiting. Authorities in the large scale digital field state that mathematicians will comprise an important part of those employed. In all of its phases there are some 2,000 to 4,000 presently employed, but it is expected that there will be about 1,000,000 by 1964. Better publicity, addressed to high school seniors and college freshmen as well as to the more advanced college students, is needed to compete with the glamour which surrounds these new and rapidly expanding fields. Recruiting must stress the opportunities in the actuarial profession and jobs offered must provide competitive salaries, particularly in view of the examination program an actuarial student must face. It is very important that the examination program be put in proper perspective.

One might raise the question of whether we should change our specifications for prospective actuarial students by looking for individuals who have majored in Business, Economics, History or English, and who have completed two substantial years of mathematics while in college. An extensive mathematics background may not be as important a prerequisite in the actuarial profession as formerly and simplification of the early mathematics examinations might be in order. Some good publicity on the part of the Society of Actuaries might encourage Liberal Arts students to take the additional mathematics that would interest them in the actuarial field. In fact, the broad definition of Actuary is more likely to be equaled by a student following a Liberal Arts course with a proper emphasis on mathematics. From this point of view our activity might be to induce more colleges to urge Liberal Arts, Economics and Business students to take mathematics rather than to induce more colleges to offer actuarial courses.

MR. E. H. WELLS expressed the opinion that the right type of person is being attracted to the actuarial profession if we recognize the deviation from the traditional concept of the type of individual that we should recruit. The preconceived pattern of the ideal recruit once was a man age 21 to 24, graduate of a first class college, a major in mathematics with a minimum grade level of "B" in that subject, and the first two parts of the examinations passed before graduation. Such a preconceived pattern has been altered by demographic factors and the ever expanding effects of automation.

The chief demographic elements are the low birth rate of the depression years which has curtailed the number of entrants into all lines of productive activity, drains on the employed population caused by more prevalent

automatic retirement at age 65, military service at young ages, and the vastly increased percentage of youth now taking time out to attend college. One might think that more young people attending college would lead to more applicants for our profession. However, there is a noticeably diminishing number of Mathematical Science and Engineering majors in the college population. A committee of teachers, representatives of scientific societies and prominent industrial men, which recently met in New York City, agreed that the point of attack on the scarcity of students of Mathematical Science is at the grade school and high school levels. It might well be that it would be a good thing for Actuarial Science to be set up as a separate subject simply because it might attract students who find mathematics, as such, outside of their sphere of supposed interest.

In the field of automation, the advent of electronics will certainly change the personnel constituency of life insurance home offices. It will also increase the problems and demands made on the actuarial profession. A vastly increased crop of new Fellows and Associates will be needed. We have in the United States in proportion to the population only one-fifth of the number of actuaries in Great Britain and one-third of the number in Canada. The shortage so indicated, combined with the different requirements of the new employment opportunities appearing, raises two basic questions. First, are we, as the older and traditionally trained actuaries, capable of changing our sights? Is traditional mathematics going to continue to fill our background needs? The answer to the first question can be "yes," but we cannot be so confident of a positive answer to the second because of the new demands arising through automation.

Actuaries, like engineers, do not always find the prestige and appreciation of their training which they are led to expect at the time of employment. A type of training with more of a slant toward human relations, both at the college level and after becoming employed, has been suggested to broaden the base of training.

A challenging observation as to one reason for the shortage of actuaries is that many of the older Fellows of the Society of Actuaries advance to the executive group where successively less use is made of painfully acquired technical knowledge. Thus, advancement to the point of bringing actuarial judgment to the top conference table aggravates the shortage faced by the profession.

MR. J. W. MORAN ascribed part of the shortage of actuaries to the fact that many professionally qualified actuaries are assigned to work in related fields, such as group insurance, on semitechnical or special problems which do not require professional actuarial ability. Laxity in past insurance company recruiting for nonactuaries has led to the need for

actuaries to be used on such assignments. Better promotion of the wide variety of careers in the insurance business should lead college students in business and economics to become interested in insurance. Many of them can be trained for work now done by actuaries, and some of them may be attracted to the professional actuarial field. Integration of actuarial recruiting with that of other groups seeking talent for the insurance industry may locate individuals who are not mathematics majors but who may develop into better actuaries because of greater ability to do mathematical and logical thinking.

MR. G. C. THOMPSON urged that the actuarial recruiting handicap of the smaller company located in a somewhat smaller community be reduced by assistance under the aegis of the Society of Actuaries. State educational bodies, teachers' associations, or guidance counselor associations could be supplied with more direct material elaborating on the possibilities of the actuarial profession.

MR. ARTHUR PEDOE said that attracting the right type of person to actuarial work in Canada has been facilitated by study circles, which United States students are encouraged to join. Attracting candidates must be a project of local actuarial bodies. Each company must look after its own problems, starting with local universities and local high schools. It is not impossible for a bright young man to start from high school.

A choice of subjects with special advanced reading courses has been introduced by the British Institute of Actuaries. It was his opinion that this is a mistake because the examinations are best set to a certain standard of all-round attainments for an actuary, not a pension actuary, a fraternal actuary or other specialty. Graduation as a Fellow is just the beginning of education.

MR. E. E. STROCK cited the Prudential's summer program for students as being one of their best selection tools for locating men who not only have the ability to pass the actuarial examinations in relatively short time but also have promise of administrative talent. Liberal arts students with a mathematics major, good grades, and judged by the professors to have ability are candidates for two months' summer work. Even with this program an adequate supply of better students is not available. The present high level of employment, the low birth rate of the depression years, the draft, and the decline since 1950 in number of G.I.'s returning to college, combine to deplete the supply of men that can be attracted to the actuarial profession. If the high level of employment continues it will likely be 1963 or 1964, when the high birth rate of the early 1940's will be reflected in college graduating classes, before recruiting becomes easier. The increasing popularity of graduate study, attractive

offers to engineers and the popularity of nuclear physics have interfered with the past source of many students for the actuarial profession. Two bright spots in this rather dismal picture are the slightly greater number of registrants for Part I this year and the possibility of a Universal Military Training bill which would draft 18 year olds for a half year instead of two or three years after college.

MR. C. A. SPOERL reported that a study has just been completed which indicates success on the job to be significantly and substantially related to performance on the actuarial examinations. Job success was measured by a questionnaire developed by Bruce Gerhard and Dr. Selover which provided for rating expected performance on fifteen specific tasks, some theoretical, some involving a lot of detail, some having to do with taking care of the public. Ratings were obtained from 15 or 20 large and medium sized companies on 276 individuals who took one or more of the last four examinations between 1947 and 1953. Performance on the examinations was considered according to five different measures—length of time to finish the examinations, number of failures, average of grades on first attempts, average of grades upon passing, and number of years required to complete the last four examinations. In spite of there being so many intangible and nonmathematical factors involved, the conclusion was reached that any one of the five measures showed examination success as being related to job performance measured by the rating form. The best correlation resulted when using the average grade on Parts 5, 6, 7 and 8; people with the highest average grades were rated, in general, as best on the job.

MR. A. A. WINDECKER suggested that we should not lower our standards of selection and education but, nevertheless, we should take a fresh look at our examination system in order to determine whether it can be modified so as to improve our competitive position. The type of person able to become a successful actuary generally is capable of success in any one of a number of other fields where demand for high caliber men has increased many-fold in the last ten years.

He advanced several possible modifications for consideration: accept appropriate college credit as a substitute for Part 2 and portions of Part 3; eliminate or drastically reduce the emphasis on finite differences; introduce a level of membership below that of Associate, perhaps upon completion of Part 3 or Part 4; make certain of the examination subjects optional; grant different Fellowship degrees depending upon the subjects taken; permit a Fellow to take examinations in subjects previously passed over; give the later examinations twice a year in order to shift the emphasis from selection to education.

MR. R. G. ESPIE pointed out that a number of organizations look

upon their actuarial training program as a means of offering higher starting pay to exceptional college students in the hope they eventually will add to the executive strength of the organization. The examination system, designed to distinguish those who are qualified to be actuaries from those who are not, should not be criticized for failing a man who nevertheless has excellent management potential.

During the past ten years the Examination Committee has reduced the total number of references on the syllabus from 201 to 132. The list of books, journals and miscellaneous recommended publications now totals 29 rather than 61 as in the 1945 course of reading. These reductions in many cases have been made possible by the preparation of more comprehensive sets of study notes representing much thought and effort on the part of members of the Society to improve educational aids over those of 10, 20 or 30 years ago. The modern Life Contingencies and Interest textbooks recently adopted eliminated older texts and eight references. Study notes and other publications are due within the next year or two on the subjects of Construction of Tables, Life Insurance Law, Pension Algebra, Accident and Sickness Insurance, and Selection of Risks. It is further recognized that references on Accounting and Distribution of Surplus directed primarily to the requirements of students are needed. The many contributions to the study notes, the papers written for the *Transactions* to fill gaps in the Course of Reading, and the suggestions by members are greatly appreciated by the Committee.

MR. D. C. DUFFIELD was of the opinion that there are more subjects than can be handled within the framework of eight examinations. More and shorter half-questions would enable fairer testing of the "reasonable knowledge" of each subject, without which the entire examination would be failed. Three or three and one-half questions per topic would be an improvement over only two. He suggested increasing the number of examinations without increasing the amount of required reading.

MR. J. M. BLACKHALL pointed out that the 17 Fellowship subjects might be allotted 3 hours each to permit 5 questions to be asked. Also, the Syllabus would thereby be more flexible for future changes. Textbooks published by the Society on each subject and correspondence courses to assist students in remote areas would be helpful. Consideration might be given to accrediting college courses toward Associateship qualification. Such credit might be contingent upon some specified type of insurance experience.

MR. D. H. HARRIS spoke for the Education and Examination Committee in saying that there had been no deliberate changes in the examination standards one way or the other in the last five years. The thought that goes into selecting new members for the Committee from different

backgrounds and points of view is a most valuable safeguard against any tendency for the Education and Examination program to move away from the standards set for it by the Advisory Committee and, through them, by the Society's membership as a whole.

Figures do not tell the whole story but the accompanying table sets forth the proportions of successful candidates for the period 1950–1954. The data continue the series presented for 1939–1949 by Mr. Spoerl in *TSA* I.

EXAMINATION RESULTS—1950 TO 1954 INCLUSIVE

	No. of Candidates	No. Successful	Ratio	Effective Ratio	No. of Candidates	No. Successful	Ratio	Effective Ratio
	Part 1				Part 2			
1954	584	330	57%	60%	691	167	24%	35%
1953	534	311	58	60	687	169	25	35
1952	631	371	58	62	815	240	29	34
1951	654	396	61	64	879	202	23	30
1950	945	553	59	61	1,166	269	23	30
	Part 3				Part 4			
1954	433	111	26%	36%	285	99	35%	40%
1953	468	111	24	32	298	101	34	40
1952	505	143	28	35	264	90	34	40
1951	553	114	21	29	240	83	35	42
1950	630	134	21	29	247	95	38	45
	Part 5				Part 6			
1954	176	80	45%	50%	81	39	48%	49%
1953	144	70	49	52	129	56	43	45
1952	112	52	46	50	130	65	50	52
1951	91	42	46	49	125	57	46	47
1950	179	84	47	50	134	63	47	50
	Part 7				Part 8			
1954	132	57	43%	44%	144	62	43%	45%
1953	116	48	41	43	74	31	42	44
1952	104	36	35	36	86	42	49	49
1951	67	17	25	26	93	46	49	50
1950	123	61	50	50	98	39	40	40

NOTE—"Effective Ratio" is the ratio of the number of successful candidates to the number of candidates whose grade was greater than 50% of the pass mark.

In a broad sense, every activity of the Education and Examination Committee is concerned either with establishment or maintenance of standards for professional qualification. In its most specific form, the question arises each year, after the examinations have been graded, in setting the passing marks. This would present no problem if the examination questions for a given Part were always of exactly equal difficulty year by year; then a constant passing grade would serve to maintain a constant standard. Conversely, an identical group of candidates year after year would justify using a constant ratio of successes to failures as a criterion of constant standard. However, neither of these situations prevails. It is exceedingly difficult to infer from the raw results of a year's examinations just what effect each of the variable elements has had. The Part Chairman, the Examination Chairman and Vice-Chairman and the General Chairman study the results independently and together before reaching a decision. The final result is sensitive to any particular conditions of the current year, but is primarily a reflection of the Committee's wish to produce a result which does in fact maintain the going standard of required performance.

MR. H. M. SARASON observed that examination passing standards can change for different groups of students. For example, Canadian students some years ago were presumably not as successful in passing as U.S. students. They got organized by improving their preparation and self-help methods. A greater percentage of Canadians are now passing but there does not seem to be any appreciable increase in the over-all pass percentage.

He pointed to the difficulty of obtaining objective judgment from individual members, each of whom has had specific personal experience with the examinations. Research on standards should be in a few but competent hands. Also, pertinent opinions can come from outside the circle of those who think they know about the examinations.

MR. J. B. MACDONALD felt that the preliminary examinations are weighted heavily in favor of the college undergraduate. They could be redesigned to place a smaller premium on speed, while testing knowledge just as intensively, and be given twice a year to aid those who are already employed. Half credit for certain of the Fellowship examinations, which consist of distinct parts, would enable a student to salvage half an examination when a personal or business crisis prevents adequate preparation for a whole one.

MR. L. F. SLEZAK did not favor having the Syllabus provide for advanced study in specialized fields. Individuals on their own initiative increase their proficiency in particular phases of the profession in order to

keep the general membership informed and in order to attain prestige in some specialty. The Syllabus, in some way, should better convey to the student one fundamental of the actuarial profession, namely, that it deals with human behavior. Human behavior basically determines whether a particular individual conforms to the average or fits the broad groupings from which generalizations are made. No one should become so stupified by calculus, graduation, probability, accounting or even electronics that sight is lost of the fact that actuaries are dealing every day with the lives, the hopes and the dreams of millions of people.

The question of including the topic of electronic machine methods in the course of study was discussed by several members. MR. J. B. MACDONALD favored it. MR. L. F. SLEZAK cited the great amount of discussion at recent meetings as proof of the importance of electronics but it is primarily a tool which many actuaries will use to allow expansion into new areas of investigation. He felt such a subject would not be proper in the examinations because the Syllabus, for the most part, contains fundamentals which all actuaries should possess. MR. R. G. ESPIE related that the Education and Examination Committee has not recommended new methods of data processing as a subject for the Syllabus because the field is in too immature a state and because the impact of electronic computers on actuarial science, as contrasted with processes for getting actuarial work done, is too conjectural at present. However, the Committee is carrying out its obligation to continually study possible changes in the Syllabus.

MR. C. H. TOOKEY described the activity of his company in promoting installation of a graduate actuarial curriculum at Occidental College. Preliminary investigation had revealed that people with enough mathematics to consider the examinations were already in electronics, physics or engineering and weren't interested in changing. Other prospective actuarial students did not want to leave the part of the country where their family, their wife's family or their friends were located. Meeting the recruiting problem pointed to establishing a good instruction program in a small liberal arts school willing to take an interest in specialized requirements such as those of the actuarial profession. It was thought preferable to have a college close enough so that a man would be able to work half time while taking actuarial mathematics.

Publicity for the new actuarial program will include contact with high schools to interest advisors in recommending mathematics to their best pupils. Insurance companies and consulting firms are being approached to provide scholarships.

Stimulating qualified students to go into actuarial work must include

a description of just what an actuary is and what he does in order to clear up the misconception that an actuary is a mathematician. More publicity should be given to the salary level of experienced actuaries. Both students and their professors need to know that there are good futures for qualified students even though starting salaries are often not as high as for engineers.

MR. GEOFFREY CROFTS listed the subjects he will teach at Occidental College as finite differences, statistics, mathematics of finance, life contingencies and a general course in life insurance. The objective is to conduct formal studies through the first four parts with a beginning on Part 5. Mr. Crofts felt that, in the past, the emphasis on mathematics has been too great. The mathematics needed by the actuary is fairly elementary compared to all the mathematics that is available in college. The essentials could be covered by the end of the junior year. A mathematics minor or a major in either mathematics or economics will likely be the undergraduate background which students will have who enter the new graduate program.

MR. R. E. LARSON emphasized the importance of cooperation between the companies and the colleges in designing an effective actuarial teaching program. Local publicity is extremely important both for finding qualified students and for having the college program on a workable basis, internally. The teacher of actuarial science can be in the very peculiar position of being a nonmathematician in the minds of the mathematicians and an impractical mathematician in the minds of people in the economics and commerce departments. Proper understanding of the actuary's work and prestige for the instruction program can be developed by suitable publicity.

In appraising educational aids for the examinations, Mr. Larson felt that inequity arises because students in the larger centers generally have accumulated prior years' examination questions while those in more remote locations often have not. He also expressed preference for the old style of question for the early examinations, feeling that the students would do a better job of studying and be able to better demonstrate ability in carrying through a fairly complicated problem to a successful conclusion.

MR. PEARCE SHEPHERD commented that the difficult but important job of keeping the examinations and education of actuaries under control in these changing times requires that members of the Society assume individual responsibility for knowing the circumstances in their local communities. Teaching of mathematics in elementary and high schools is a vital part of the educational program because of the shortage of actuarial applicants from the colleges.