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THE EDUCATION AND EXAMINATION OF ACTUARIES

by

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A thesis submitted for the degree of Doctor of Philosophy
to the City University

The research programme was carried out at the City of
London Polytechnic and also at the City University in
the Department of Social Science and Humanities.

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ABSTRACT

The thesis is an attempt to discover a right relationship between actuarial training and occupational practice. The problem is a vital one for a small but powerful profession seeking to adapt to significant changes. The dimensions of the problem were developed by obtaining information from actuarial surveys and interpreting this information to provide new knowledge.

The first part of the project was a study of actuarial training and occupational practice up to 1973. For comparison purposes, other British professions were briefly considered.

An initial survey was designed and pilot questionnaires were despatched in July 1973. The answers showed that the questions had not been ambiguous. The survey was accordingly extended to cover all 236 actuaries who qualified for the Fellowship of the Institute of Actuaries in the four sets of examinations spanning the two calendar years 1972 and 1973. Follow-up letters resulted in a response rate of 81% (192 replies).

A study of the education and examination of actuaries reveals a high withdrawal rate. The survey was therefore extended to seek information from students who have failed to complete the Institute examinations.

The whole data was coded for computer data processing. The results were then analysed.

Information was obtained concerning the educational and non-educational background of respondents. Their views were considered on the important areas of working practice at present and in the future. The working areas anticipated were expected to be compatible with the modifications in examination syllabuses proposed. Conclusions were reached concerning qualifying time, exemptions, development of personality and motivation as revealed by those who withdrew from the Institute examinations.

The final part of the thesis considers fields of further study relating to actuarial training and complementing the present project.

1. BACKGROUND TO SCOPE OF SURVEY

1.1 Introduction

It was decided in 1973 to carry out a survey of the actuarial profession by questionnaire. Details are to be found from chapter 4 onwards. We first consider the three earlier chapters. Chapter 1 is concerned with the background to the scope of the survey, as it existed in 1973. Chapter 2 considers education and training in other British professions, these professions having more or less in common with the actuarial profession. Chapter 3 returns to the actuarial profession, and discusses the development of actuarial education since 1950.

1.2 Growth of Institute of Actuaries

The origins of actuarial science and the actuarial profession go back to 1662, being associated with the name of John Graunt, although the profession did not really expand until the twentieth century. This thesis is concerned with the English Institute of Actuaries, and not the Scottish Faculty of Actuaries. The growth of the Institute is shown by the figures of Table 1.1.

Sphere of Activity	1895	1925	1972
British Assurance Offices	116	204	614
Dominion and Foreign Assurance Companies, Reversionary Society and Annuity Institutions	22	47	252
Friendly Societies	1	2	8
Consulting Practice	5	18	184
Pension Insurance Brokers	-	-	47
Government Service	8	46	52
Nationalised Life Insurance	-	-	89
Industry (Private and Nationalised) and Commerce	-	-	67
Stock Exchange	-	2	50
Miscellaneous	-	-	48
TOTAL 'ACTIVE'	152	319	1411
Retired	25	47	208
GRAND TOTAL	177	366	1619

Source: Institute of Actuaries' Year Book 1972-73. (1972)⁽¹⁾

TABLE 1.1 Analysis of the Occupations followed by Fellows of the Institute of Actuaries, 1895-1972

It can be seen that numbers approximately doubled from 1895 to 1925, and then more than quadrupled from 1925 to 1972. The reasons for the expansion were the general growth in the use of statistical and economic analysis in management and financial planning in government, industry and commerce. Life assurance is still the principal concern and sphere of occupation of actuaries, but ever since Sir Alfred Watson and W.P. Elderton became statistical advisers to the government during the first great war it has been recognised that actuarial training helps in solving the managerial problems of industry and commerce, especially in their financial and statistical aspects. Of recent years the number of actuaries associated with the Stock Exchange has risen sharply.

1.3 Changing Occupational Needs

All these avenues of expansion have led to a changing examination syllabus. Thus mathematical statistics, operational research, basic economics as a background to practical investment and investment itself, together with the fundamentals of computer science and data processing, have been given increasing prominence. In the traditional field of life assurance actuaries are responsible for the statistical investigation of such factors as mortality, interest and expenses, the determination of premium rates and surrender and paid up values. Periodically they value the liabilities and assets both of individual assurances and annuities. They also value pension funds, and prepare certain statements required by law.

1.4 Closely Knit Profession

The actuarial profession has always been a closely knit one. Unlike other professions, which will be considered in detail later in this survey, examination in England and Wales has been almost entirely in the hands of a central body, the Institute of Actuaries in London. Tuition has also been centralised in the Actuarial Tuition Service, inaugurated in 1937. There have been established no Departments of Actuarial Studies in English Universities or Polytechnics to correspond with Departments of Accountancy or Architecture, or Faculties of Law or Medicine. Indeed, the development in this country has been different even from actuarial development in other countries, namely in North America, Europe and Australia where for long there have been actuarial chairs at Universities. English actuaries tend to be less academic and most would probably regard their job-orientation as essential*.

1.5 Devolution to Universities and Polytechnics

Despite the benefits of non-academic development, many actuaries believe that the question of devolution to Universities and Polytechnics of the teaching of subjects covered under the present Intermediate Examination has become the more urgent owing to the expansion of the profession with the corresponding drain on manpower of recently qualified actuaries. Thus in 1973 the Board of Examiners for the Institute consisted of 33 actuaries, and there were in addition 121 actuaries serving on the panel of tutors. This combined total of 154

* The London School of Economics began offering a few actuarial courses before 1960. More recently, (in October 1975), a full-time actuarial degree course has been set up at City University. Outside the United Kingdom there are two universities where graduates can obtain exemption from most or all of the subjects of the Intermediate examination. MacQuarie University in Australia first accepted actuarial students as long ago as 1968, and a similar course was started at the University of Cape Town, South Africa, in 1975.

represented some 20% of "active home" actuaries, a startlingly high proportion and clearly a figure much higher than that which would apply if the service were voluntary. Indeed, the system would long ago have broken down had not all qualifying actuaries regarded themselves as under an obligation to the profession to act as tutors for a number of years, irrespective of their own personal inclination towards or against education and training. It was partly with this situation in mind that the Institute encouraged the City of London Polytechnic to set up daytime courses for the whole of the Intermediate Examinations on a day release basis. They did this despite the fact that Professor Pollard was firmly against such courses, having come to this conclusion from experience at MacQuarie University in Australia. In the event, the courses were successful for a limited number of students, particularly for those who had failed the examinations at a number of previous attempts.

1.6 Changing Academic Training

The Lever Committee set up in 1944, the Usherwood Committee in 1958 and the Skerman Committee in 1966, took a considerable body of evidence before making their recommendations for changing the examination syllabuses. They did not, however, send out questionnaires to obtain the opinions of qualifying actuaries. One of the few times such an investigation has been carried out in this country was in a survey by the Appointments Boards of the Universities of Manchester and Nottingham, which led to a report entitled "Graduates in Insurance and the Actuarial Profession" issued in 1968⁽²⁾. Non-graduates were not approached. The authors of this report, B.J. Holloway and N.T. Scott, were highly critical of the profession on two counts. They thought that the intensity and length of study necessary to qualify as an actuary were socially undesirable, and that employers were greatly

at fault in not supervising the progress of students through the examinations. They considered that salaries were no higher than those obtainable in the data-processing sector and operational research. They also believed that competition for the services of actuaries would become more, rather than less, intense. They therefore concluded that the profession needed to improve its own image. Towards this end they recommended the introduction of full-time sandwich courses*, with qualifications to be gained at an earlier age than at present obtains. They offered no guidance to make this possible, as they specifically excluded the solution of relaxation in examination standards. Part of their difficulty in understanding underlying problems no doubt stemmed from their not being actuaries. Nevertheless, they recognised some of the weaknesses of their investigation, and in particular they appreciated that some of the answers were difficult to use, due in part to the poor design of some of the questions.

1.7 "What Sort of People are Actuaries?"

If the fundamental question is asked "What sort of people are actuaries?", the chances are that the answer given will refer to Mathematics, perhaps put very loosely as "People who deal with the Mathematics of Insurance". In point of fact, advanced mathematical techniques are not involved, and a study of syllabuses shows clearly that management and business are just as relevant as Mathematics, for an actuary to succeed. Indeed, a degree course at the London School of Economics offers a far stronger base for actuarial study than does an honours Mathematics course. It may be that a broader view is taken, and "integrity" is cited as the prior necessity. Certainly

* Sandwich courses are academic courses incorporating a "sandwich" of six or twelve months spent in industry or commerce.

actuaries must have an ability to communicate, because the "backroom boy" image is false. General intelligence is also important, and breadth of outlook helps towards success.

Holloway and Scott considered that narrowness was likely to be engendered by the fact that over a third of actuarial students claimed to be studying for over seven hours each week. They considered this length of study too much, but most successful actuaries would disagree. The really vital statistic would appear to be the time needed to qualify. Students, like undergraduates, are prepared to forego a normal balanced social life for a limited period, even if this involves four nights' study every week and some weekend study. But if such sacrifices were called for over a longer period than say five or six years, most would consider there were real risks of an unbalanced development in personality. We would regard as wrong the statement by Holloway and Scott that "one of the causes of failure seems to be the unwillingness of the person concerned to continue to subordinate his personal life to what seem to him the excessive demands of study for the professional examinations". Answers to our questionnaire certainly tend to disprove this. Failure may well be due to unsuitability, and the sooner this is found out the better.

1.8 Experience and Judgement

We agree with another of Holloway and Scott's conclusions, namely that "only a minority felt they had been given adequate experience in fields such as finance and investment". We shall have more to say on this subject when we consider detailed examination syllabuses. If a topic appears not to be in the mainstream of actuarial work then we would question its inclusion in the earlier part of the examinations. We would thus tend to advocate its exclusion from the Intermediate Examinations and its transfer to the Final Examinations. Where topics

require a high level of experience and judgement, we would consider this the right course of action.

1.9 Summary

In Chapter 1 we have summarised the growth of the Institute of Actuaries in the twentieth century and the changing occupational needs of the profession. This led to a consideration of the devolution to Universities and Polytechnics of the teaching of subjects covered under the 1973 syllabus for the Intermediate Examination. A university report, following an investigation by questionnaire, was discussed (Holloway and Scott (1968))⁽²⁾.

In Chapter 2 we summarise certain features relating to education and training in other British professions.

2. EDUCATION AND TRAINING IN OTHER BRITISH PROFESSIONS

2.1 Introduction

It was felt that actuaries could learn from the education and training practised in other British professions. These professions have more or less in common with the actuarial profession, and brief mention is made of various features of training for accountants, lawyers and solicitors, doctors, dentists, architects, surveyors, secretaries, engineers and teachers. The information given is generally applicable to 1973, except where other explicit dates are shown.

2.2 Accountancy Profession

Many other British professions have areas of work which overlap with the work of actuaries. Chief of these is the accountancy profession, which has been investigated recently by Solomons. We shall have occasions later in this thesis to compare and contrast the results of this actuarial investigation with those arising from the questionnaires sent to accountants. The analysis is in Appendix B of "Prospectus for a Profession" by David Solomons with T.M. Berridge (1974). (The "Solomons Report")⁽³⁾. A few brief comparisons are made here.

Numbers in the accountancy profession are about 50 times larger than in the actuarial profession. Roughly 16% of the most recently qualified accountants were graduates, which compares with 73% for actuaries*. The lower figure among accountants has not stopped the current urge towards an all-graduate entry. Solomons himself advocates two years at a University or Polytechnic for all non-graduate entrants

* By 1975, the graduate percentage had increased to over 90 for actuarial new entrants.

to the accountancy profession. The comparable urge for an all-graduate entry to the actuarial profession has somewhat surprisingly met considerable resistance, largely on the grounds that the profession would thereby be deprived of many excellent recruits. Some actuaries regard the extra studying years spent at university as undesirable.

Solomons advocates a short period of work experience to precede full-time study for the accountancy profession or some alternative sandwich course arrangement.

Solomons also advocates a period of practical instruction to follow the degree or diploma for potential accountants leading on to practical experience with a final test of professional competence after two or three years. This would compare with the tuition and experience at work necessary for potential actuaries for the final parts of the actuarial examinations*.

For actuaries there never has been a system of articles, and the system has fallen into disrepute for accountants. Solomons believes it right to discourage trainees from moving from job to job too frequently, but it is felt that actuaries would want to preserve individuals' freedom to choose their jobs. Information was sought by our actuarial questionnaire to indicate whether mobility is associated with time to qualify.

2.3 Legal Profession

The Ormrod Report⁽⁴⁾ on the legal profession came out in March 1971. Legal education is available in professional law schools and also University and Polytechnic legal departments. England here differs from both Scotland and Ireland, as also from many other countries.

* In 1975, the Institute introduced the requirement for an experience qualification of four years, including at least two years after passing all the actuarial examinations.

There are two branches of the legal profession - the Bar and the solicitors' branch, both having over 80% graduate entry. Any class of degree gives exemption from Part I of the Bar and the solicitors' professional examinations. Current policy is towards entry mainly from law graduates, at the same time without excluding graduates in other subjects. The only exceptions considered are mature students and Fellows of the Institute of Legal Executives, who require practical experience as well as examination success. Roughly 35% of law graduates do not enter the legal profession, a figure which is clearly much higher than comparable disciplines for most other professions. The needs of the legal profession are for roughly 1,300 law graduates each year, which with a wastage of 35% means a production of 2,000. The Ormrod Report reveals that the majority of professional lawyers want to see law schools merged with the Universities. Sandwich courses are not generally recommended, although it is believed such courses may help to link practice with theory. Post-qualification training would be welcomed, as it is in both the actuarial and accountancy professions. In the medical profession it is not simply desirable but essential for any advancement as a specialist. The time to qualify in the legal profession consists of the three years for a degree course together with one years' training for barristers. Solicitors normally have five years' articles, with four years following Part I, reduced usually to two years for graduates. It would appear that the system of articles will soon be dropped.

It is of interest to note that the legal profession has attempted to rationalise its educational arrangements for at least 150 years. Against this background it is by no means so disheartening to consider the irrationality of the Institute and Faculty of Actuaries differing with regard to their emphasis on say law as a fundamental actuarial subject. Similar considerations apply to other disciplines. The

wonder is that the English and Scottish professions have so much actuarial education in common. For the legal profession itself the diversities are much greater.

University law departments are substantially larger even than accountancy departments, a factor of three having been suggested by Solomons. On the other hand, accountancy in Polytechnics is far stronger than law, and whereas in accountancy there are many private tutors, there are no important law coaches. This contrasts with the monopoly situation of the Actuarial Tuition Service.

Another important difference is in the field of training by the professional firms. In accountancy, this is common. In law, there are virtually no training departments. To this extent, the legal profession is not dissimilar from the actuarial profession.

2.4 Medical Profession

Most major professions have been the subject of special reports, and the medical profession is no exception, the Todd Commission having reported its findings in April 1968⁽⁵⁾. This revealed that medical education normally takes a period of five years for a medical degree, which is followed by a pre-registration year for interns, professional training lasting not less than three years thereafter, together with any training for a speciality. Roughly 25% of final-year students in British medical schools are married. Thus the long period of training may be said to result in deferment until after qualification of well over 50% of those who might well have married at an earlier age had it not been for the rigorous medical education necessary. It is useful to compare this information with that for the actuarial profession.

Post-graduate training is more important for the medical profession than for most others, being absolutely vital for all specialists. In fact undergraduate training has to be so wide and general that it cannot

really produce a fully-qualified doctor but only an educated man who becomes fully-qualified by post-graduate training.

The Todd Commission believed that the differing needs of the general practitioner, the specialist and the researcher should be met by options for special subjects late in the degree course, somewhat like the system for engineers and chemists.

All professions have the problem of integrating theory and practice. In medical training the terms "pre-clinical" for years 1 and 2, and "clinical" for years 3, 4 and 5 persist, and tend to perpetuate the problem of integration. In this context it should be noted that pre-clinical training consists not simply in a course in human biology as this is far too general and impersonal. It should satisfy the vocational need.

The Todd Commission favoured a module system, allowing a student to defer his decision to go into medicine. Each module would have minor examinations with continuous assessment. The Commission recommended the setting up of an examination board. They argued against a pre-medical year for the few non-A level candidates in "Physics and Chemistry with either Biology or Mathematics". They were in favour of a combined Physics and Chemistry A level subject with any other two A levels, provided a sufficient general science background was included at O level.

There are roughly 3,500 medical students coming forward each year. This is twice the number of legal students, and the Commission envisaged an increase to say 5,000 by 1990. These numbers have to be viewed with an associated wastage of some 16%, that is at only half the rate in the legal profession.

There are few failures for a medical degree, but between 50% and 65% for physicians, gynaecologists and surgeons. These percentages fluctuate considerably over the years, but would appear to be somewhat higher than the failure percentages for actuarial examinees. It must

also be recalled that there is competition at entry to the medical profession, for which there is no counterpart in the actuarial profession.

The size of the medical profession can be gauged from the fact that there are over 200 chairs in medical subjects in Great Britain, this comparing with one actuarial chair for England and Wales and another one for Scotland. Great Britain, of course, lags well behind North America, where there are over twenty actuarial chairs. Mention should also be made of the position on the Continent, with two actuarial chairs in Holland, one in Norway, one in Sweden, one in Denmark, one in Austria and one in Italy. This very short history for actuarial University education contrasts with the vastly longer period for medical University education - yet the governing bodies for both professions in Britain were set up in the middle of the last century. The actuarial profession may well cast envious eyes on the medical profession by virtue of its high degree of integration with the Universities for training, and also for its integration of theory and practice. The latter arises from the clinical stage of education which is spent at a teaching hospital linked to a medical school. Some students are able during this stage to obtain experience of general practice and of public health service work. The integration of theory and practice is further achieved by the period of compulsory internship. Post-graduate training is highly practical, often being carried out at the medical centres of general hospitals.

In 1966, the Association for Study of Medical Education and the National Foundation for Educational Research⁽⁶⁾ carried out a survey of medical students. A 95% response was obtained from questionnaires sent to final year students of 1961 and 1966, and first year students (pre-clinical) of 1966. This followed a pilot survey with fifteen finalists and twenty first year students, in which ninety-five questions had the

answers encoded on to three 80-column punched cards - exactly what our actuarial questionnaire used. Time was at a premium, and there were therefore very few open-ended questions, nearly all being pre-coded. The very high response rate was no doubt obtained from a personal handing out of the questionnaires, but it clearly stemmed from the localised interest in the survey which was not conducted anonymously, thus allowing a follow-up. The analysis of the results was conducted by ICL and Rothamstead. Many social questions were asked, including area of permanent home, sex, age, marital status, parental occupation, parental encouragement, type of school, pre-medical examination results with subjects, etc. Most of these questions concerned past background but the survey considered such present subjects as living arrangements, travel time, study time and habits, recreation, and examination failure and success record. Statistical significance tests, including χ^2 contingency tests, were applied. Finally, questions were asked relating to the future, such as choice of career and fields of interest. The answers were related to the background factors, sociological implications being studied in considerable depth.

2.5 Dental Profession

The dental profession has a training programme similar to that of the medical profession, all professional teaching being done at dental schools attached to Universities. The time taken to qualify is also similar, as is the system of post-graduate training.

2.6 Architectural Profession

The architectural profession was the subject of the Cambridge Report in January 1971⁽⁷⁾. Concern was expressed there at the wide dispersal of training resources amongst thirty-two "recognised" and five "listed" schools. The latter were forthwith closed down. It is to be noted

that half the recognised schools are at Polytechnics. In view of uncertainties in the building profession, it was felt that the demand for architects might fall, but the profession was not prepared to make estimates of future demand, being influenced partly by the poor estimation of future demand for doctors made by the medical profession.

Remembering the module system favoured by the Todd Commission for the medical profession, it is noteworthy that the day of the self-contained School of Architecture is over, the trend long since having been towards multi-disciplinary courses. Again there is an emphasis on post-graduate courses for specialists. There is the usual problem of integrating theory and practice. The size of the profession can be gauged from the numbers of qualified architects, amounting to some 26,000. The normal length of time needed to qualify is at least seven years. Membership of the Royal Institute of British Architects (RIBA) is voluntary but more than 90% of British architects are members. A minimum of two years' practical training is a condition of membership. The last part of the RIBA examinations includes a project. This again underlines the problem of integration of theory and practice. Our actuarial questionnaire asked if a project was suitable for the actuarial examinations.

2.7 Surveying Profession

Another profession whose foundation in this country can be traced back to the middle of the last century is that of surveyors. It has expanded to a current membership of over 30,000 making it comparable in size to the architectural profession. There are stipulations common to many professions. Thus there is an entry requirement of at least two A levels at the General Certificate of Education. The normal method of entry is via an under-graduate course. A project, here called a "Critical Analysis", is a feature of the training.

The policy of the Royal Institution of Chartered Surveyors is to encourage the development of exempting degree and diploma courses, and to run down its own examination system. Although the majority of candidates prepare for the examinations by correspondence courses, this is changing in favour of full-time study. In addition to the formal examinations, there is a two year experience requirement, usually obtained under articles, and there is post-qualification training.

2.8 Secretarial Profession

The Secretarial profession is a broad one, but the training incorporates the usual system of formal examinations together with an experience requirement. The average period taken to complete the examinations is five years. Post-qualification training is encouraged, but tends to be organised on an ad hoc basis. The profession numbers some 45,000. It may be considered that the Secretarial profession is not very comparable to the actuarial profession, yet it is interesting how common are parts of the examination syllabus. Thus the principles of statistics and economics are included.

2.9 Engineering Profession

The Engineering profession is again a wide one, including electrical and electronic engineers, civil, mechanical and chemical engineers, to name but a few types. Graduate entry is the norm, and again there is a two year experience requirement for membership of the Council of Engineering Institutions. Post-qualification courses are common, and training is likely to become broader, rather than more specialised. Examples of this broadening tendency are the inclusion of optional questions, the incorporation of essays on such subjects as "The Engineer in Society", and the setting of questions to rewrite verbose and woolly English passages in a direct clear style. It will be recalled that the

Preliminary Examination for the actuarial profession used to include such English questions.

The profession numbers in total some 200,000.

2.10 Teaching Profession

We consider, finally, the teaching profession, which has only recently had a requirement of the completion of an appropriate course of professional training for all teachers in State maintained schools. Prior to 1969, a degree was regarded as adequate training. For graduates, a further year "teacher training" is now necessary. For non-graduates, a three year teacher training course is the norm. This contrasts with the position at Universities and Polytechnics, where there is no training requirement for lecturers. Academic requirements are, of course, high, but it is quite common to learn how to lecture "on the job". It is interesting to note a suggestion made by the Institute of Actuaries Students' Society (1974⁸⁾). This suggestion was that tutors should be taught to teach and examiners taught to examine.

2.11 Summary

In Chapter 2 we first considered the accountancy profession, this being perhaps the closest to the actuarial profession. A report of the British accountancy profession was discussed. (Solomons with Berridge (1974)).

Various comparisons with other professions were then made. Many of these professions have been the subjects of recent reports. These reports have been briefly considered, and also the publicity booklets for entry into certain professions.

In Chapter 3 we consider in more detail the development of actuarial education since 1950.

3. THE DEVELOPMENT OF ACTUARIAL EDUCATION SINCE 1950

3.1 Introduction

Any consideration of actuarial education should take into account the way in which this has developed over the years. It was decided to make 1950 the starting point for this investigation, and we first looked at presidential addresses to the Institute of Actuaries in London. The development is considered up to 1973 when our questionnaires were devised.

3.2 Presidential Addresses to Institute of Actuaries

The need to broaden the actuarial profession has been appreciated for very many years. Menzler (1951)⁽⁹⁾ noted that the actuarial field extended not only to life contingencies but to "all contingencies to which the calculation of probabilities can be applied". Jellicoe, 100 years earlier, wanted the Institute to develop into a school, in which not only insurance but "the cognate subjects of taxation, currency, finance and political economy generally, should receive their fullest development". Menzler, in 1951, made a plea for the method of emerging costs rather than single-figure present values for valuation balance sheets. It is instructive that even as long ago as this Menzler was advocating a growing proportion of graduate entrants, with increased exemptions.

Bunford (1955)⁽¹⁰⁾ noted the similarities between the problems of the English Institute and the American Society of Actuaries. Thus the Society instituted half-yearly examinations in the post-war period, but manpower problems soon led this to be dropped. After early misgivings, the Society decided in favour of part-examination by multiple choice questions. Bunford would have none of the "too much intensive study" argument, and expected actuarial students to work hard during day-time

study periods as well as during most evenings. He professed himself "satisfied" with certain syllabuses, but considered the economics syllabus "too sketchy". He noted that European actuaries tended to be more academic than those in both this country and North America.

Wood (1957)⁽¹¹⁾ emphasised the importance of actuaries being able to communicate their ideas with their business colleagues.

Gunlake (1961)⁽¹²⁾ pointed out that there was currently too much emphasis being placed on the valuation of liabilities and too little emphasis placed on the valuation of assets. Attempts were made to remedy this imbalance in the investment sections of the examinations, but the criticism can still be made that present values are given too much importance. What is wanted is a series of statistical forecasts, having expected values and standard errors, the opportunity being taken later to vary the assumptions relating to interest, inflation, withdrawal etc. Goethe was quoted - "What you have inherited from your fathers, earn over again for yourselves or it will not be yours". This updating exercise is, of course, the very method used and respected for population projections.

Usherwood (1963)⁽¹³⁾ emphasised the essential actuarial qualities of "personal integrity, clear and precise thinking, balanced judgement", not necessarily high-powered mathematical ability. He considered that the examinations were difficult, but not unduly so for those who work hard. For him, probability was the key topic, but he reckoned it essential to be able to communicate in good English and in non-technical language.

Tetley (1965)⁽¹⁴⁾ quoted from the then recent annual conference of the Chartered Insurance Institute under President Cockerell, since the topics considered at the conference came under the title "The Future of Insurance Training". About this same time, the Students' Society held a debate on the training of an actuary. Tetley did not consider

the Preliminary Examination too stiff, as he pointed out that of the 122 candidates who fell below the lower quartile at the 1955 examination, 73 never passed another part, and only 6 became fellows, with another 6 attaining the associateship. The Institute of Actuaries told the Robbins Committee that Universities could teach all the Intermediate examination parts, with the exception of the topic of mortality. In practice, Universities were teaching very few actuarial students. Since 1921, only 20 graduates from the London School of Economics had applied for exemptions, only 14 continuing, 5 to become fellows and another 5 associates. Tetley said the Institute did not want to spread its manpower too broadly and therefore thinly. This policy was followed recently, so that Essex University has deliberately refrained from launching actuarial courses which might have competed for numbers with the new courses at City University.

The International Congress of Actuaries meeting in 1964 discussed articles by Dow and Kirton on actuarial training. Tetley mentioned these.

Tetley considered that exemption should seldom be given from the probability part of the Intermediate Examinations, thus re-emphasising his predecessor Usherwood's views on the importance of this topic. Tetley said he thought the compound interest examination ought to be complex, this being only realistic. Actuaries in training should not perform the routine calculation of surrender values, nor should they perform programming. There was more valuable work which they could be given.

Benjamin (1967)⁽¹⁵⁾ said that too many people wanted to extend the subject coverage for the actuarial examinations. He considered that the Institute had not kept up to date with regard to the teaching of probability. The Institute must obtain early re-directions to other careers, and without losing potentially good actuaries, some of whom might well be late-developers. Actuaries were not narrow technicians,

nor yet badly equipped general statisticians. He deprecated "do-it-yourself" programming as a wasteful diversion of professional manpower.

Skerman (1971)⁽¹⁶⁾ enumerated three processes in training. There was first the identification of a problem, second judgement brought to bear upon it, and third the techniques necessary to solve the problem. The fellowship was a qualification in numerate advice or management, not a qualification in a special branch of mathematics. Skerman favoured two possible routes to the fellowship, first by day release, and second by exemptions arising from a University sandwich degree. The first of these alternatives was likely to remain the route for the majority, since it allowed deferment of commitment to the actuarial profession.

3.3 Presidential Addresses to Faculty of Actuaries

Just as the presidential address to the Institute of Actuaries in London often alluded to actuarial education and training, so for the corresponding addresses to the Faculty of Actuaries in Edinburgh.

Reid (1958)⁽¹⁷⁾ expressed concern at the shortage of student recruits to the profession. He suggested that schools should seek to interest children in the work actuaries do, and he advocated Mathematics prizes, as is common in North America.

Haynes (1962)⁽¹⁸⁾ reminded his listeners that potential actuaries often entered the profession by personal recommendation, and he accordingly stressed the importance of "Careers Advisers".

The next substantial reference to actuarial training in a Faculty presidential address came in 1968, when Bromfield⁽¹⁹⁾ made use of the figure for the number of students expressed as a fraction of the number of fellows to obtain an index of recruitment. He said that this figure had reached a peak value of 1.42 in the early 1930s, declining to 0.89 by 1957. It was then subject to a slight rise, but fell back to 0.85 by 1967. This compares with the comparable Institute figure of 1.42 in

1960, rising to 1.65 by 1967, this being double the then current Faculty figure. The low Faculty figure of 0.85 seems to reflect difficult study years, averaging at that time not less than 6 or 7 years.

Bromfield quoted the report of Holloway and Scott, citing the fact that less than half of students study for more than 40 hours each month, that is, say 3 evenings each week. He clearly disagreed strongly with Holloway and Scott's views on how much study was good for a student, reckoning on a norm of 60 hours each month, that is, averaging $4\frac{1}{2}$ evenings each week, exclusive of any day-time study. He deplored too early specialisation in the actuarial examinations, and again stressed the importance of communication. He said also that actuarial training should be accepted as a suitable base for business administration, probably by the employer sending his employee on a suitable course.

As a link between the situation in Britain and the situation in North America, which is now to be considered, mention may be made of a review by Dow in 1964⁽²⁰⁾ on the development of the actuarial profession. He noted that in Canada some 30 years previously "Study Circles" were started for the fellowship examinations, groups of students meeting together to discuss specific past examination questions. It is interesting to compare the establishment of self-help groups set up for the examinations of the Open University. No directly comparable groups would appear to operate for the Institute examinations, and this despite strong reservations being held by actuarial students about the value of discussion classes. Questionnaire questions were asked to elucidate this point.

In North America, questionnaires were sent out to all fellows in 1952, 1956 and 1960, seeking information on education, time to qualification, pay, type of work, publications by actuaries, etc. It was revealed that the average qualifying period in the United States was some 7 to 8 years in 1964. The proportion of time spent in studying

purely mathematical topics was less in both the United Kingdom and the United States than elsewhere. In the United States, long and intense study was necessarily spent on the professional topics. In countries with tight governmental control, more emphasis was placed on legislation and less on judgement in the choice of valuation bases. The United States had a higher proportion (21%) in consultancy work than applied in the United Kingdom (8%). The United Kingdom had a low percentage of actuaries engaged in teaching - Belgium had the outstandingly high figure of some 30%. It was noted that University courses for actuaries in Norway, Sweden and Denmark usually lasted for 6 years.

3.4 Addresses to Society of Actuaries in America

In the United States, requirements for membership of the Society of Actuaries were considered in 1958 under Chairman Fitzhugh⁽²¹⁾. Interestingly, so long ago, questions were asked concerning the reduction advisable in mathematical rigour, the introduction of multiple choice questions, the possibility of open-book examinations, of vivas and theses. It was noted that the average qualifying period was then some 8 years, this representing a considerable improvement on the 11 years applicable in 1948.

The Society's program of education and examinations was considered again in 1960, under Chairman D.H. Harris⁽²²⁾. The so-called Y type examination system was advocated, in which advanced individual insurances covering life assurance, accident and health insurance were studied or alternatively employee benefit plans. Twice yearly examinations were favoured, but for any part only one paper had to be set each year. Reducing the scope of individual parts was considered, increasing the number of parts from 8 to 10, and total examination time was to be no more than 44 hours. In 1959 there were 11 Universities offering actuarial courses up to Part 4, Michigan University alone teaching 10%

of all American actuaries. Americans regard the subject of Life Contingencies as being basic, and they would like more Universities to offer it. In America, it is common for students to have a few hours off for 2 days each week just before the examinations, 3 or 4 days each week being not uncommon.

In 1961, President Warters⁽²³⁾ advocated a reduction in the number of examination parts to 8, with a total examination time of no more than 36 hours. The Society was working towards two examination periods each year, as had been advocated in 1960, and wished to extend the number of parts having multiple-choice questions.

In 1962, President Jenkins⁽²⁴⁾ advocated closer liaison with colleges, in order to attract new entrants. It was noted that the Public Relations Committee had developed an actuarial aptitude test.

In 1963, President Miller⁽²⁵⁾ made reference to the report of the Beers' Committee, with particular mention of Charles Spoerl's paper in the Transactions of the Society.

In 1965, President Henningsen⁽²⁶⁾ noted the strong background of economics, accounting, the fundamentals of law, statistics including operational research, and data processing.

In 1966, President Fitzhugh⁽²⁷⁾ listed seven actuarial characteristics, namely mental discipline, analytical ability, knowledge, communications, judgement, creativeness and integrity. He considered the probable wisdom of broadening the material on risk theory.

In 1967, 10 years after the trail had been blazed by the Fitzhugh Committee which instituted 5 Associate examinations, 3 basic Final and 2 specialised Final examinations, a committee under Moderator Lancaster considered "The Education of the Actuary"⁽²⁸⁾. They thought that the first awareness of the actuarial profession possibly came with the High School Mathematics Contests, given by the Mathematical Association of America. Yet very few winners of a contest became actuaries. It was

noted that many professions had transferred most of their education to the Universities, for example, law, medicine and engineering. The main reason why the actuarial profession had not done so arose from the economics of small numbers. Transfer had to come. Hickman thought "the sample survey does not seem to be the proper research tool for arriving at the essence of actuarial science", mainly because of the diversity of jobs actuaries do. He preferred "identifying the key elements in the body of knowledge that the profession develops and applies," namely the mathematical and statistical tools.

The debate in North America on the "Continuing Education of the Actuary"⁽²⁹⁾ continued into 1970, when a questionnaire was sent out to Fellows and Associates of the Society. It is interesting to note the relatively poor response rate, 48% from Fellows, and 29% from Associates.

Also in 1970 the so-called "Alternate Route"⁽³⁰⁾ was considered. It was pointed out that with a degree a student still had to sit comprehensive examinations set by the actuarial profession giving exemption from Parts 1 to 5 of the Society's examinations. These parts were slow to test their topics in an up-to-date manner, such subjects criticised being matrices, Laplace transforms, Bayesian probability etc. Vogel favoured concentration of the alternate route in fewer Universities. It was suggested that the alternate route might attract candidates of lesser self-discipline.

Another suggestion was that actuarial advances might well come from broadminded thinkers outside the relatively narrow examinations field. Savage's "Bayesian Decision Theory" (1954) was cited, Markowitz's "Investment Portfolio Selection" (1952), and also the Bohman-Esscher report of 1963 on solutions to the distribution problem in risk theory.

The content of the various examination parts was again considered in 1970⁽³¹⁾. Thus there were 3 hours of multiple-choice questions in parts 1 to 3, 5 hours in parts 4 to 8 (roughly half these parts),

whereas parts 9 and 10 were essay-type questions incorporating choice. It was noted that Universities and colleges were preparing more and more students for the Society's examinations, Northeastern University even lecturing for the Final parts. It was anticipated that the Society would look more and more to the Universities for text books and research, with developments encouraged from other disciplines applied to actuarial science, for example the field of operational research. Certain well-known actuaries' names were associated with certain topics - Professor Jordan with Life Contingencies, Professor Kellison with Compound Interest and Professor McGill with Numerical Analysis. Clearly, such men had built up a considerable expertise, which benefited the whole profession.

At the Conference of Actuaries in Public Practice held in 1970, it was noted in the Proceedings⁽³²⁾ with reference to the Alternate Route that the actuarial examinations were deficient in risk theory. Research was needed into skewed distributions and stop-loss insurance. North America's deficiency was slow to be appreciated in the United Kingdom, where a start has only recently been made to meet our even graver shortcomings.

In 1971, President Lancaster⁽³³⁾ made reference to the work of the Advisory Committee on Education and the Examinations. It was stated that more time was needed to study the Alternate Route. Since 1965, when the Canadian Institute of Actuaries had been set up, there were a number of professional bodies which catered for the needs of the profession. Some of those like the American Academy of Actuaries were umbrella-type organisations giving legal recognition to actuaries without offering their own examinations for the preliminary stages, but in the case of the Academy having its own examinations for the later stages. The Conference of Actuaries in Public Practice conducted no examinations, but it was considering instituting examinations more

suited to consultants, for whom the Society's examinations were deficient. Thus President Lawson⁽³⁴⁾ had favoured extending the Society's examinations to include property and casualty insurance, together with the work of consulting actuaries, with additional Canadian material. (1967)

3.5 Lever, Usherwood and Skerman Reports

We return to this country, to the year 1946, and the Lever Report⁽³⁵⁾, reviewing the tuition and examinations of the Institute of Actuaries. This report governed the period from 1950 onwards. The report noted that the mean qualifying period was some 11 years for Fellows qualifying in the immediate 10 pre-war years. The Committee's aim was for this period to be reduced by 5 years, an aim which was not realised. The median was about $8\frac{1}{2}$ years and is a more appropriate measure because the distribution is so skewed. A progressive approach was attempted, but this broke down in practice, and the next Committee interested in actuarial training abandoned the concept, it being unduly restrictive. The 1946 examiners' report proposed raising the pass mark for the Intermediate examinations from 50% to 65%. The philosophy underlying the Lever Report was a broadening of the profession by the inclusion of the elements of Statistics, Demography and Economics. Optional questions were advocated for the advanced Statistics paper, because of the breadth of the syllabus, perhaps in the form of two sections, only one of which would be optional. A broad base is laid by earlier Statistics parts, but the necessary mathematical level for the advanced Statistics would be achieved as and when required. Further details would be out of place in this survey, as they refer to a time 30 years ago, whereas the needs of the actuarial profession are progressive, and have certainly not stagnated since the second world war.

We come to the year 1958, and the Usherwood Report⁽³⁶⁾, again

reviewing the tuition and examinations of the Institute. It is strange to read early on in this report the recommendation that "the Entrance examination papers be set by our own Board instead of by professional examiners". This is strange not so much by virtue of aggravation of the manpower situation as by the fact that it now appears a retrograde step in a process which might well lead in the not too distant future to the Institute setting no examination papers prior to the final part papers.

Another recommendation is "that senior actuaries be encouraged to assume responsibility for advising those studying the early parts, with the object of discouraging, as early as may be, the candidates who have little prospect of success in a reasonable period". This is interesting when read in conjunction with the corresponding strictures by Holloway and Scott in their 1968 report. It would appear that the Usherwood recommendations were not carried out, or at any rate that senior actuaries were not taking upon themselves these responsibilities in 1968.

Again, the Usherwood Report departed from the Lever Report in recommending the abandonment of the "progressive approach" in certain subjects. The view was held that there should not be an abrupt break from "academic" to "practical" subjects. This problem of unifying theory and practice will no doubt always be with us, but may not always be approached as it was by the Lever Committee. They attached considerable importance to the two canons of parallel training and progressive approach, but perhaps their methods went too far in the interests of a systematic lay-out of the examination syllabus. The Usherwood Committee did not feel that either Compound Interest or Life Contingencies warrant being taken in two stages, nor did they approve of two different subjects in one section in which the candidate must pass or fail as a whole. In their view, it would have been a mistake to return to a syllabus divided into so few sections that each

represented a year's work; but fragmentation should have its limits. They favoured an examination framework which would encourage candidates to embark on practical subjects early, but which, by allowing the widest possible choice of subject order, would not rule out the candidate who, for special reasons, preferred to dispose of his academic subjects first.

Reading this in the light of the present trend towards the academic subjects being taught in Universities and Polytechnics, we think that this trend will over-ride lesser objections which demand greater unifying of theory and practice.

A major improvement arising from the Usherwood Report was in the total examination time. This had progressively increased with each change of syllabus over the years, from 51 hours in 1928 to 83 hours in 1950, and exceeded considerably the examination time of both the Faculty in Scotland and the Society in North America. The examination time for other professions is much less, ranging in 1958 from 30 to 39 hours for such professions as law, accountancy, and engineering, albeit with certain stipulations as to articles or their equivalent. The Usherwood Committee sought to bring the total examination time down to 53 hours.

The view was taken that means should be found to discourage, as early as possible, the many candidates whose very slow progress through the examinations did not help the examinees, tutors, examiners or the profession. To this end it was decided to impose a limited number of attempts at the Preliminary Examination.

Oral tuition was reckoned preferable to correspondence, being advocated clearly by the Universities and also by the Law Society, the Surveyors' Institution and the engineering bodies. Only the accountancy bodies seemed to rely largely on written methods and more recently these bodies have had significantly better results from oral tuition.

In 1966, there appeared an article entitled "The Education of the Actuary" by Haycocks, writing in the Journal of the Students' Society associated with the Institute of Actuaries⁽³⁷⁾. He maintained that actuarial training was stiffer than a degree course, and demanded an "above-average person". The Institute should not rely on the Universities for training. The Usherwood Report had led to less examination time, but Haycocks considered this gain of little consequence compared with the infinitesimal improvement in the qualifying time. He was surprised that only some 50-60% of May failures repeated in September each year. He was in favour of abolishing the Preliminary Examination, but this abolition was to take another 6 years. He did not favour the introduction of management studies to the actuarial examinations, but considered such studies should come after fellowship qualification. Most present day Fellows, it is felt, would agree. Haycocks was also in favour of the tutorial system, deeming it essential for students to have weekly reading, together with problem-solving.

In 1967, the Skerman Report⁽³⁸⁾ was issued, once more reviewing the tuition and examinations of the Institute. The policy of discouraging examinees who are likely to fail the examinations was followed by the recommendation to raise the standard of the entrance requirements, and also to extend the syllabus of the Preliminary Examination to take account for instance of "new mathematics". It was advocated that there should be less emphasis on finite differences but more on numerical analysis, and the fundamentals of computer programming should be included in the syllabus. The training and examination in compound interest should be simplified to give more emphasis to practical aspects, this practical application being extended in the life and other contingencies' examination to fundamental principles of pension and sickness benefits. In mortality and other investigations there should be less emphasis on mortality, and when suitable reading became available

questions should be set on non-life insurance. Demography should no longer be examined as a separate subject.

The Skerman Committee was anxious that the actuary's competence in the field of finance and investment should become accepted by non-actuaries. They therefore advised that the reading here should be based on a standard text-book by a non-actuarial author. In social insurance, there should be more stress on the emerging cost method, but less examination time should be devoted to this subject. The recommendation was made that the more advanced statistics syllabus should be replaced by one combining statistics and operational research. In an effort to ensure that candidates who found difficulty in memorising formulae were not thereby penalised, the Committee advocated the issue of a booklet containing standard formulae for use at each examination. A tutorial system should be introduced as an experiment for the more advanced Fellowship examination in life office work, and a special course of full time study should be introduced for the subjects of the Intermediate examination.

The Committee suggested that discussions should be initiated with the London School of Economics with a view to extending the subjects taught there, and also to start associations with technical colleges. Exemptions to University graduates and others suitably qualified should be granted somewhat more liberally. A question concerning exemptions was included in our questionnaire to find out if actuaries generally approved of this practice.

The qualifying time had not been shortened as the Usherwood Committee had hoped, and partly towards this aim it was proposed that half-yearly examinations should apply to the whole of the Associateship Examination, as it was called in 1967, which means the whole of the present Intermediate parts. The Skerman Committee took particular note of the fact that University graduate entrants qualified more

quickly than others and were appreciably more able to complete the examinations. The Committee went on to recommend closer liaison with Universities, hoping that this would lead in due time to sandwich courses under which periods of theoretical tuition by Universities would alternate with periods of practical training by employers.

3.6 Summary

Presidential addresses to the Institute of Actuaries in London, and to the Faculty of Actuaries in Edinburgh, often alluded to actuarial education and training. These presidential remarks were summarised in Chapter 3.

The addresses of presidents to the Society of Actuaries in America were similarly summarised. Various American reports were also discussed. (Lancaster (1967)⁽²⁸⁾. "Alternate Route (1970)⁽³⁰⁾).

We went on, in Chapter 3, to discuss three reports to the Council of the Institute of Actuaries. (Lever report (1946)⁽³⁵⁾. Usherwood report (1958)⁽³⁶⁾. Skerman report (1967)⁽³⁸⁾. Since 1973, when our questionnaires were devised, the first and second reports of the Cornwall committee have appeared (1975)⁽³⁹⁾, (1976)⁽⁴⁰⁾.

The remaining chapters deal explicitly with our questionnaires, reproduced in Appendices 1 and 2. Some planning details and cross-tabulations are shown in Appendices 3 and 4.

4. BACKGROUND OF QUALIFYING FELLOWS

4.1 Introduction

The main questionnaire was sent to all those qualifying in 1972 and 1973 as Fellows of the Institute of Actuaries. The covering letter made reference to the qualities and characteristics of actuaries, and it was hoped that from the largely factual details of the questionnaire a picture might emerge enabling recommendations to be made for the education and examination of future actuaries. The main questionnaire is shown in Appendix 1 together with the covering letter.

4.2 Size of Employing Firm

It was considered that the size of employing firm was of interest, yet it was felt that individual actuaries might apply differing standards of size. Accordingly the present employer's name was asked for and the size was established by reference to the firm's operations (for example, premium income for life offices) and numbers of actuarial staff. Solomons overcame his similar problem of classifying firms of accountants by adopting the two separate standards, number of resident partners and number of employees. An interest lay in the opportunity afforded to consult with colleagues in larger firms, and we found a strong association between size of firm and qualifying time.

(Significant at .005 level). Thus there appeared to be a distinct advantage in being employed by a firm, for instance, whose annual premium income exceeded £20 million. One interpretation of the association is probably that the larger firms are able to pick the best candidates from the market, and then to move them around within their organisations in a more planned way. They may be able to give their students more free time and more supervision from senior actuaries.

4.3 Type of Employment

Type of employment fell readily into a number of categories, as follows:

	(n=192)* %
Life Assurance	52
Pensions	16
Non-Life Insurance	2
Consulting	15
Public Service	4
Teaching and Research	3
Investments	8
	<hr/> 100 <hr/>

* In this and several of the following tables
n = number of respondents

No association was found between type of employment and overall qualifying time. On the other hand, performance at certain Final examinations shows strong association with type of employment. Thus, students outside the traditional life assurance field commonly have difficulty with the life offices examination (F2).

4.4 Change of Employment While Studying

The questionnaire asked for the years when each full-time employment began. To have asked for the names of all the employers, though useful, might have been deemed inquisitive. The following frequency distribution was built up for the number of employment changes while studying:-

	(n=192) %
Same employer	52
1 change of employer	29
2 changes of employer	13
3 or more changes of employer	6
	<hr/> 100 <hr/>

There was no apparent association between change of employment and qualifying time. Reference is made, however, in section 6.2 to the association between change of employment and will to qualify.

If an attempt is made to fit a Poisson distribution to the frequency numbers giving the above percentages, we obtain the following comparison between actual and expected frequencies:-

	Actual Number	Poisson Fit
Same employer	100	92
1 change of employer	55	68
2 changes of employer	26	25
3 or more changes of employer	11	7
	<hr/> 192 <hr/>	<hr/> 192 <hr/>

(Significant at .07 level from χ^2 goodness of fit test).

The Poisson distribution appears to fit reasonably well and this could imply a constant probability for change of employment.

4.5 Vacation Work

A high proportion of students (20%) had actuarial vacation work prior to their first employment. This did not affect their ability to pass the examinations, but gave a useful introduction prior to embarking on an actuarial career.

4.6 Rural or Urban Upbringing

The frequency distribution for upbringing was as follows:

	(n=192)
	%
Rural area	11
Small town (population less than 50,000)	22
Greater London	47
Other large town (population exceeding 50,000)	40
	<hr/> 100 <hr/>

These classifications were not related to qualifying time.

4.7 Secondary School

It was felt that it would be unwise to ask a direct question concerning type of school. Accordingly, the name of the last school attended was asked for, so that embarrassment might be avoided and also the risk of a respondent naming an incorrect type through re-classification. Clearly interest lies in the classification when the respondent attended the school, and this is not necessarily the same as at present.

The following frequency distribution was obtained:-

	(n=191)
	%
State secondary grammar	43
Other state secondary	9
Direct grant	12
Independent	13
Abroad	23
	<hr/>
	100
	<hr/>

There were surprisingly few respondents who had attended comprehensive schools, even when account is taken of the time concerned which relates to school leavers round about 1966. Perhaps there is more traditional thinking relating to actuarial employment at grammar schools, with poorer liaison between the profession and comprehensive schools.

No association was found between type of school and qualifying time, but reference should again be made to chapter 6 (section 6.3) for differences between qualifiers and withdrawals.

A comparison was made with the Solomons figures relating to accountants who were finalists in 1972. Comparison is difficult partly because the type of school varies considerably among the numerous accountancy bodies. After excluding the actuarial "abroad" category, the corresponding frequency distributions are:

	Actuaries	Accountants
State secondary grammar	82	2581
Other state secondary	18	1422
Direct grant and independent	47	1264
	<u>147</u>	<u>5267</u>

The "State secondary grammar" proportions are very similar. The actuarial "other state secondary" proportion is significantly lower and the combined actuarial "direct grant and independent" proportion is significantly higher. (Significant at .0003 level). The "abroad" category was excluded in the comparison because the accountancy figures did not have this category. In our investigation we separated the figures for direct grant and independent schools. The accountancy figures had these two categories combined.

4.8 A Level Subjects and Grades

Analysis showed that 60% of respondents achieved a grade A result in Mathematics and 34% (i.e. over half) of these achieved two A grades in Mathematics. A further 32% achieved a grade B or C result in Mathematics, and 18% (again over half) of these achieved two B or C grades in Mathematics. Somewhat surprisingly, only six people out of the whole group took the subject Economics, two of them achieving an A grade and the other four achieving a grade B or C.

A level results at Mathematics are strongly associated with qualifying time (Significant at .006 level). It thus appears that the popular image of a profession using high powered Mathematicians is supported by the facts, despite real efforts towards attracting students with a wider background. Any association from A level results at Economics was not able to be assessed.

Other research indicates only a weak association between A level results and mathematical ability. The above analysis must accordingly

be treated with extreme caution, since strong association between A level results at Mathematics and qualifying time does not necessarily imply strong association between mathematical ability and qualifying time.

4.9 Degree Subjects and Grades

Among the qualifying Fellows, 73% had degrees. This is a high percentage for any profession. It compares with a 1972 figure of 16% for accountancy finalists who responded to the Solomons questionnaires.

Speed of qualifying, as expected, was accelerated by possession of a degree, the association being extremely strong (significant at .0001 level).

The breakdown between universities is as follows:

	%
Oxford	6
Cambridge	24
London	16
Other UK university	32
University abroad	22
	<hr/>
	100
	<hr/>

The particular university was unrelated to qualifying time.

The main subject of the degree was Mathematics in over 80% of cases, Economics for 8% and either Statistics or Computing for 6%. If a subsidiary subject was taken this was usually a branch of science where the main subject was Mathematics, or Mathematics as subsidiary otherwise. No arts subjects featured at all, and only five respondents took sandwich degrees.

A comparison was made with two American surveys. In the first of these (Ref: Profile of the Actuary, Don Howard Personnel report, 1971⁽⁴¹⁾) 57% of qualified Fellows of the Society of Actuaries holding degrees majored in Mathematics and a further 5% read actuarial science. In the second (Ref: Temple University report, 1971⁽⁴²⁾) 75% of qualified

Fellows of the Casualty Actuarial Society holding degrees majored in Mathematics and a further 3% read actuarial science. This reveals less association between mathematical degrees and an actuarial fellowship.

The frequency distribution for class of degree was as follows:

	%
First Class Honours	16
Second Class Honours	51
Other Pass	30
Fail	3
	<hr style="width: 10%; margin: 0 auto;"/> 100 <hr style="width: 10%; margin: 0 auto;"/>

A very strong association was revealed between subject of degree and qualifying time (Significant at .0001 level). There was also an association between class and qualifying time (Significant at .037 level). There does not appear to be any difference in speed of qualifying between graduates with and without exemptions. On the other hand, those with a high class of degree seem able to qualify more quickly than others.

Only 15% of respondents claimed any other academic or professional qualification, chief of these being Masters degrees, Associateships of the American Society of Actuaries or Fellowships of the Royal Statistical Society.

4.10 Non-Educational Background

It is of interest to consider how students came to learn about the actuarial profession. In response to questions concerning relations, they gave answers showing that 38% had at least one parent engaged in professional work, mainly in teaching or insurance. Accountancy, medicine and the actuarial profession itself were well represented. Thus 13% had fathers who were actuaries. This compares with the Solomons' figure of 4½% for accountants having fathers who were accountants. Solomons himself considered 4½% surprisingly small.

Clearly the professions are more likely to attract children of professional parents, but it would appear that actuaries are now coming also from non-professional homes in considerable numbers. The position is much the same if account is also taken of close relatives, the few working in allied fields coming mainly from insurance and accountancy.

The average age for choosing an actuarial career was just under 20, mean, median and mode all lying very close together. This is fairly late in a student's education and cannot be explained by late entrants to the profession as only four respondents gave an age over 25, having transferred from other professions. Progress through the examinations was unrelated to the age of choice. It was also unrelated to the method of introduction to actuarial work. These methods were as follows:-

	%
Careers advisory service (school or University)	38
Relative or friend	30
Direct	20
Public advertisement	12
	<hr/> 100 <hr/>

If these figures are compared with those from the accountancy profession, we note that the Solomons' figure for "relative or friend" is more than twice the above figure of 30%. This underlines the general public's lesser knowledge of the actuarial profession and the need for greater actuarial publicity.

4.11 Career Satisfaction

The reasons given for choosing the actuarial profession were as follows:-

	%
Using Mathematics	59
Pay	23
Challenge	8
In financial field	5
Actuarial parent	2
Full time job while studying	2
Other	1
	<hr/> 100 <hr/>

Serious doubts were professed by 16% concerning their choice of career, slight doubts by 40% and none by 44%. Of those professing doubts, the three reasons of note were length of time to qualify (38%), dislike of certain aspects of actuarial work (35%) and interest in another career (27%). These doubts did not apparently affect qualifying time.

The following were the replies concerning career satisfaction:-

	When student started %	When qualified %
Highly satisfied	16	45
Satisfied	44	46
Neither satisfied nor dissatisfied	26	7
Dissatisfied	10	2
Highly dissatisfied	4	-
	<hr/> 100 <hr/>	<hr/> 100 <hr/>

Again, these attitudes did not apparently affect qualifying time.

Suggestions were sought for attracting new recruits. Of those given, the three of note were as follows:-

	%
Publicity, including talks to schools and universities	66
Broadening of the profession	20
Extending university courses for exemption from the whole of the Intermediate examinations	14
	<hr/> 100 <hr/>

4.12 Summary

In Chapter 4 we have analysed questions 1 to 8 of the main questionnaire and considered possible association with qualifying time. Various comparisons with other investigations have also been made (Solomons (1974)⁽³⁾; Don Howard (1971)⁽⁴¹⁾; Temple University (1971)⁽⁴²⁾).

The remainder of the main questionnaire is analysed in Chapter 5.

5. ACTUARIAL EXAMINATIONS

5.1 Introduction

In Chapter 4 consideration was given to analysis of data from the questionnaire sent to all those qualifying in 1972 and 1973 as Fellows of the Institute of Actuaries. This analysis is continued in the present chapter. Qualifying time is a measure of the efficiency in getting through the educational hurdles, and we use it when we wish to study any association with other variables of interest.

5.2 Qualifying Time, Exemptions and Failures

The median qualifying time was 5.6 years, with the mode at 4 years. This represents a considerable reduction from the median time of about $8\frac{1}{2}$ years for Fellows qualifying in the immediate 10 pre-war years. After the war the median was reduced by about a year but there was no appreciable reduction over the immediate 20 post-war years. The more recent reduction by a further 2 years may be attributed to the efforts of the Skerman Committee.

The Solomons' report does not give qualifying time for accountants, but working from the average ages given, the median time appears to be at least 5 years. Perhaps a more meaningful comparison is with Fellows of the Society of Actuaries in America, where the median time is about 8 years (Ref: Don Howard Personnel report, 1971⁽⁴¹⁾). For Fellows of the Canadian Institute of Actuaries, the time is about 7 years, and this is after an average of $3\frac{1}{2}$ actuarial examinations have already been passed while at university. (Ref: Canadian Institute of Actuaries Professional Survey Committee report, 1973⁽⁴³⁾). This longer average qualifying time in Canada compared with England is emphasized by the average age at fellowship, which is only slightly less than 30 years.

The Institute of Actuaries, unlike some professional bodies, imposes

no limit on the time needed to qualify. Accordingly, there were some students whose qualifying time was considerable. This resulted in the 80th percentile being 9 years.

The number of exemptions averaged out at one examination subject per person. Bearing in mind that it is possible for a graduate to obtain exemption from all subjects of the Intermediate examinations it is clear that a large number of students must still obtain none. This is confirmed from our respondents, 60% of whom gained no exemptions.

The number of failures averaged out at 3.2 subjects per person, with 22% failing at least eight times and 9% having no failures. This latter figure relates to 16 students, showing clearly that unbroken progress through the examinations is by no means unique. Indeed, if the weaker students having at least eight failures are excluded from the analysis, the number of failures for the remainder averages out at 2.5 subjects per person. Some failures undoubtedly occur through students attempting too many subjects at a sitting. Though ill prepared, they think they stand the chance of a marginal pass, and can thus save time. If these weaker students are excluded from the analysis of qualifying time, the median qualifying time for the remainder is reduced from 5.6 years to 4.6 years. This implies a qualifying age of under 26 as the "norm"; that is, the median age for 80% of Fellows.

5.3 Private Study

Employers allowed their actuarial trainees 5.3 hours on average each week for private study. Two half-days was the usual allocation. Only five students were given no time off. Trainees studied for a total of 14.2 hours on average each week. This implies, say, three evenings in addition to the day-time study, which is by no means excessive. Verbal comments from students indicate that four evenings is acceptable, but practice does not measure up to precept. These

study times are apparently not related to qualifying time, but it is clearly difficult to measure study intensity. An attempt was made to do this which revealed that 35% of the students studied most days, and at a fixed time; but as high a proportion as 32% either studied intensively only before examinations or allowed a week or more to pass without serious study. The median study period was $2\frac{1}{2}$ hours, with the lower quartile at 2 hours and the upper quartile at $2\frac{3}{4}$ hours. Only 37% admitted that their studies frequently interfered with sporting or social activities.

As mentioned in paragraph 1.6 of this thesis, Holloway and Scott in 1968 criticised as socially undesirable, the intensity and length of actuarial study deemed necessary. We would not dispute that study has to be intense and long, but we make the claim, substantiated by the findings of the questionnaire, that the social life and development of personality are not unduly distorted by actuarial training.

In 80% of cases, students married before qualifying, and half of these had children also before qualifying. This again would appear to support the argument that training does not unduly distort normal patterns of behaviour. Marital status was not related to qualifying time, but having children was (Significant at .003 level). It may well be the case that newly-weds spur their spouses to pass their examinations at least sufficiently to counter-balance the added distractions, but not sufficiently where children form part of these distractions.

5.4 Accommodation and Daily Travel

The frequency distribution for accommodation is of interest:-

	%
Home	69
Self-catering	27
Landlady catering	4
	<u>100</u>
	52

The frequency distribution for daily travel (one way) is as follows:-

	%
Up to $\frac{1}{2}$ hour	27
Exceeding $\frac{1}{2}$ hour but not exceeding 1 hour	56
Exceeding 1 hour but not exceeding $1\frac{1}{2}$ hours	16
Exceeding $1\frac{1}{2}$ hours	1
	<hr/> 100 <hr/>

Accommodation is related to qualifying time only when the travel time exceeds 1 hour each way. Thus students can cope with reasonable travel interference, but this interference adversely affects their speed of becoming Fellows when it exceeds a total of 2 hours every day.

5.5 Work Experience, Exemptions and Reading Lists

The following patterns of work experience obtain:-

	%
Premium rate calculations	81
Surrender and paid-up values	80
Policy alterations	75
Mortality and similar investigations	53
Valuation and analysis of surplus	74
Office procedure	68
Finance and investment	35
Insured pension funds	57
Other pension funds	40
Friendly societies	18
Sickness insurance	36
Other non-life insurance	13
Computing	6
Social insurance	3

Experience in none of these work areas is related to qualifying time. Bearing in mind the examination syllabus, it seems clear that it is the later sections of the examinations which are helped rather than the earlier. If work experience is lacking in certain areas, examination progress here may be delayed; but experience elsewhere

may expedite progress.

The earlier examination sections are helped very considerably by the subjects studied at school or university, the foundation laid at this stage being crucial to progress towards the Fellowship qualification. Grounding in Mathematics is essential, but Statistics and Economics are also of great assistance.

Students found the examination in mortality and other investigations, I6*, far and away the hardest examination. This topic was singled out by 58% of the respondents. A long way behind in difficulty came F3a, F2b and I4.

A question was asked concerning methods advocated for finding out at an early stage if a student was unlikely to make a satisfactory actuary. The frequency distribution of the replies was as follows:-

	%
Examination success	37
Actuarial work	23
Rigorous selection procedures for aptitude	15
Student determination	9
Employer judgment	4
Impossible	12
	<hr/> 100 <hr/>

Questions were asked concerning the help afforded towards examination success from practical experience, tutorials and lectures. Practical experience was considered most important for F2b, I4 and F1a. Tutorials were considered most helpful for F1a, F2b, F3a and I6. Lectures were reckoned most helpful for I6, I1, F1a and I4. Of these, only tutorials was associated with qualifying time (Significant at .0001 level). This would appear to show the value of tutorials. Where they are relevant to a student's particular needs, his examination prospects are enhanced; where they tend, on the other hand, to be "a complete

* For a list of the examination subjects, see p. 88.

waste of time", progress may be slow.

Forthright answers were obtained concerning any possible improvements to the exemption regulations. No changes were needed according to 42%, while a further 35% stated that the regulations should be stiffened or exemptions abolished. The need for consistency in application was singled out by 9%, and 6% reckoned that exemptions should be given only if practical experience could be demonstrated. Additional points were made by a few respondents, including the recommendation by 4% that exemption from I1 and I2 should automatically be given to First and Second class Honours Mathematics graduates. This was in fact instituted from October 1973.

The reading lists were considered by 60% to be old-fashioned. Satisfaction was expressed by 14% but 12% said that the reading should be extended. They asked for constant scrutiny of the lists. Several respondents made the point that it was essential for any new reading to be available on time.

5.6 Intermediate Examination Syllabuses

I1

The most important suggestion was for a change from Algol to Fortran (58%)*, together with more computer applications (20%). The proposal was made to increase the content of numerical analysis and graduation (8%). Another suggestion was to discontinue the subject altogether, since its present day importance was negligible (14%).

* In the interests of clarity, percentage figures are quoted throughout this thesis. Thus throughout chapters 4 and 5, the percentages apply to the 192 respondents. Exceptionally, the number of replies ranged from 50 to 100 for the analysis in paragraphs 5.6 and 5.7 respectively.

I2

According to 64% of the respondents, this section needed strengthening, particularly with regard to probability. Total abolition was advocated by 14%. A change from Algol to Fortran was again suggested (16%). Less arithmetic was demanded by 6% of the students.

I3

Comments on this section were much more diverse than on most others. The most common remark was that less arithmetic should be included (30%), or the use of calculating machines permitted (10%). Less emphasis was advocated on cumulative sinking funds (20%), but more on non-life problems and discounted cash flow (18%). The use of computer algorithms was suggested (8%). As compared with I1 and I2, this section was clearly regarded as extensive, and another suggestion was that the examination should be split into two papers (6%). The general use of higher interest rates was advocated, together with the analysis of gilt-edge securities (8%).

I4

There were 30% of respondents who considered that the testing of pension funds should be deleted from this section, and a further 14% that the manner of this testing was in any event too theoretical. Some wanted the stochastic approach developed and generally a stronger link with Statistics (18%). Some advocated less arithmetic or the use of machines (18%). Some considered it high time that a new text book had appeared (10%). A few wanted the use of more commutation functions (6%) and more sickness study (4%).

I5

A number of the students considered this section too easy (26%). Some stated that it lacked breadth (12%). The text book was criticised by 18% as being poor on theory, whereas 18% said that in any case I5 should be treated in a more practical way with calculating machines being allowed for the examination. Many respondents had specific

suggestions for extending the syllabus, 12% wanting more on stochastic processes, decision theory and risk theory, 8% wanting more on surveys and sampling and 6% wanting more on non-parametric statistics.

16

The generally recognised need to extend this section into non-life insurance was mentioned by 48% of the respondents, while 16% considered that the whole subject should be re-organised and unified. Some wanted a reduction in emphasis on continuous exposed to risk work (12%) while 10% suggested that graduation and associated tests should be removed from this syllabus and inserted with the subject of Statistics. Examination by two papers was proposed by 10%, and 4% wanted the reinstatement of Demography. The advocates for including the topic of replacement theory outweighed those against in the ratio 3:1.

17

Many of the students considered that this section needed stiffening (52%). Some said it should be more practical (24%), while 18% specifically advocated more analysis of accounts. A few wanted less orientation to the financial peculiarities of the UK and deletion from the syllabus of the study of national income statistics (6%). The advocates for excluding memorisation of the national income statistics outweighed those against exclusion in the ratio 2:1.

5.7 Final Examination Syllabuses

F1

A number of the respondents considered this subject too theoretical (30%), and 13% wanted the subject stiffened generally. Some advocated the complete exclusion of life interests and reversions (18%) and 17% favoured the inclusion of the construction of investment indices. Some wanted more accounting (13%) and 9% singled out the property section for improvement.

F2

A number of the students wanted this subject to have more practical questions such as the profitability of premium rates and bonus reserve valuations (27%). Many advocated the inclusion of the consideration of equity linked policies (26%), and 22% the inclusion of life company valuations for purchase and the study of estate duty and the finance acts. A few felt that the subject was too narrowly technical (9%); 10% wanted to include more computing and a further 6% considered the reading too long.

F3

Many of the respondents advocated deleting or drastically reducing the study of friendly societies (56%). Some wanted social insurance deleted or reduced (15%). A number said that the subject was too theoretical (15%), and 6% commented that the reading was too long. The remaining 8% included those who wanted more consideration of discounted cash flow and those who wanted to delete the study of projections.

F4

The most common suggestions here were for more non-life insurance, and an improvement in the tuition with some good text books. There seems little point in analysing the replies in detail in view of the Institute's decision to discontinue the subject.

One third of the qualifying Fellows were in favour of specialist options. Of these, 61% wanted a non-life option, 13% an option in income tax and law, and 11% a management option. A few suggested business administration (6%), a further 6% computing and 3% economics.

The advocates for inclusion of a project in the final examinations were very roughly balanced by those against (42% to 58% which does not differ significantly from a 50:50 split). Interpretation here is difficult; it may simply indicate relative apathy. On the other hand it could be argued that actuarial opinion shows a pronounced dichotomy.

	In present work				Ten years from now		
	Unim- portant	Average	Very Impor- tant	Median	Less	Same	More
	%	%	%		%	%	%
Premium rates, surrender and paid up values, policy alterations	4	28	68	2.76	14	75	11
Mortality and similar investigations	8	53	39	2.29	13	70	17
Expenses investigations	8	41	51	2.52	5	43	52
Valuation and analysis of surplus	1	25	74	2.83	3	77	20
Office procedure	23	62	15	1.93	9	69	22
Finance and investment	6	46	48	2.46	3	56	41
Insured pension funds	6	47	47	2.45	30	49	21
Other pension funds	9	36	55	2.59	7	45	48
Friendly societies	61	36	3	1.31	85	14	1
Sickness insurance	32	57	11	1.81	7	36	57
Other non-life insurance	57	36	7	1.38	2	12	86
Underwriting	24	69	7	1.88	19	74	7
Drafting of documents	41	52	7	1.68	17	73	10
Personnel and counselling work	50	46	4	1.51	10	64	26
Teaching	46	46	8	1.59	5	69	26
Management	7	51	42	2.35	2	48	50
Computing	13	67	20	2.05	8	33	59
Statistics and Operational Research	43	50	7	1.64	7	48	45
Demography	50	43	7	1.51	21	70	9

TABLE 5.1 Importance rating of listed topics in present and future work

In either event, there is no strong case for the inclusion of a project.

5.8 Future Working Practice

Having noted the working patterns of the present and past, it is now possible to look to the future, bearing in mind the changes suggested in training by our respondents. The important areas of working practice anticipated should be compatible with the modifications in examination syllabuses proposed.

An extensive list of working areas was given in the questionnaire, and the students were asked to assess the importance to actuaries both at the present time and ten years from now. Respondents were also asked to add to the list, thereby increasing its comprehensiveness.

Table 5.1 has been drawn up directly from the similar questionnaire table. Percentages calculated from the 192 responses are shown, and also the median response. Thus the first median 2.76 measures the great importance of work in the area of premium rates etc., the median scale running from 1 for unimportant to 3 for very important.

Other suggestions put forward were for an increase in importance for law, court damages, accounting and financial projections from a relatively unimportant present position.

5.9 General Comments

The frequency distribution for the most important general comments or suggestions relating to preparation for an actuarial career were as follows:-

	%
Suitable actuarial employment	41
Student determination	19
More direct help from the Actuarial Tuition Service	13
More official encouragement	9
University preparation	9
Block release	7
Reduced cost for the Actuarial Tuition Service courses	2
	<hr/> 100 <hr/>

5.10 Summary

Analysis of the main questionnaire was started in Chapter 4. In Chapter 5 we continued the analysis by considering questions 9 to 16. Various comparisons with other investigations have been made. (Solomons (1974)⁽³⁾; Don Howard (1971)⁽⁴¹⁾; Canadian Institute of Actuaries (1973)⁽⁴³⁾).

The median qualifying time of respondents was found to be 5.6 years, an appreciable reduction from the figure for Fellows qualifying in earlier years. The effect on qualifying time of exemptions and failures at the actuarial examinations was considered. The social life and development of personality were found not to be unduly distorted by actuarial study and training.

The working experience which Fellows had before they qualified was investigated. Detailed suggestions for improving the actuarial examination syllabuses were obtained. Then an analysis was performed of the work areas assessed by Fellows to be important in the future.

In Chapter 6 we analyse the replies to the withdrawals questionnaire. There is also further analysis of the replies from the qualifiers in comparison with the withdrawals.

6. WITHDRAWALS FROM THE ACTUARIAL EXAMINATIONS

6.1 Introduction

An attempt was made to contact those who had discontinued taking the actuarial examinations at about the same time as the other respondents who qualified as Fellows. It was felt that their experience could well be helpful to indicate possible methods of reducing such wastage from the profession. Accordingly, a special shortened questionnaire was sent out, with a covering letter. A large response was not expected, for two reasons. The last addresses available were not necessarily current, and there was a reduced incentive to answer the questions. There were 36 replies, which was a good response. (See Appendices 2 and 3).

6.2 Employment

The frequency distribution relating to the respondents' employment after discontinuing the actuarial examinations was as follows:-

	%
Employer unchanged	33
Employer changed, but in similar field	25
Complete change of employment	31
Retired	11
	<hr/>
	100
	<hr/>

It would appear that where students wanted to make a complete break from their actuarial employment they did not encounter insuperable difficulty.

It is interesting to compare the qualifiers and withdrawals with regard to change of employment while studying. We have already seen that change of employment was not related to qualifying time. Nevertheless the figures for qualifiers and withdrawals were significantly different (Significant at .0003 level). The implication would appear

to be that, although a considerable number of changes of employer while studying may not affect the speed of qualifying, it nevertheless affects the will to qualify. We conclude that the high number of employment changes by withdrawals was unhelpful.

6.3 Educational Background

A comparison was made between the type of secondary school attended by the qualifiers and withdrawals. There is some evidence of a significant difference (Significant at .038 level). A somewhat low proportion of withdrawals attended state grammar schools, with a correspondingly high proportion at other state schools. The same proportion attended independent and direct grant schools, and also schools abroad, as those for qualifiers.

Subjects and grades at A level were compared for qualifiers and withdrawals. There is no evidence of a significant difference. Analysis showed that 52% of the withdrawals achieved a grade A result in Mathematics, and 21% (ie, under half) of these achieved two A grades in Mathematics. A further 39% achieved a grade B or C result in Mathematics, and 16% (again, under half) of these achieved two B or C grades in Mathematics. Just two people in the group took the subject Economics, one of them achieving an A grade and the other achieving a grade C.

Among the withdrawals, 63% had degrees, compared with 73% for the qualifiers. The percentages at Oxford and Cambridge were considerably lower for the withdrawals. The same percentage attended universities abroad, being one third of all graduates.

Again, the main subject of the degree was Mathematics in over 80% of cases. No withdrawal had a first class degree, compared with 16% for qualifiers. The distribution was as follows:-

	%
First Class Honours	nil
Second Class Honours	52
Other Pass	44
Fail	4
	<hr style="width: 10%; margin: 0 auto;"/> 100 <hr style="width: 10%; margin: 0 auto;"/>

It is noted, with interest, that in the study of the background of poor performers at accountancy examinations, there was similarly none with First Class Honours.

6.4 Non-educational Background and Career Satisfaction

Analysis showed that 33% of withdrawals had at least one parent engaged in professional work, this being broadly the same as for qualifiers (38%). The average age for choosing an actuarial career was 20, the methods of introduction to actuarial work being very similar for withdrawals and qualifiers. Doubts about an actuarial career began to assail the withdrawals as follows:-

	%
From the beginning	14
Soon after the start of studying	47
Just before discontinuing membership of the Institute of Actuaries	30
After repeated examination failures	9
	<hr style="width: 10%; margin: 0 auto;"/> 100 <hr style="width: 10%; margin: 0 auto;"/>

The reasons for first choosing the actuarial profession were similar for withdrawals and qualifiers, the opportunity for using Mathematics being given an even higher rating (72% for withdrawals compared with 59% for qualifiers). It may perhaps be argued that fewer withdrawals showed appreciation of the fact that ability at Mathematics is insufficient for the making of an actuary. When doubts set in, the same three reasons were given for them, as shown in the following figures, contrasted with those for qualifiers:-

	Withdrawals %	Qualifiers %
Length of time to qualify	50	38
Dislike of certain aspects of actuarial work	30	35
Interest in another career	20	27
	<u>100</u>	<u>100</u>

An interesting analysis is obtained for career satisfaction:

	When student started %	For current employment %
Highly satisfied	37	43
Satisfied	24	36
Neither satisfied nor dissatisfied	33	21
Dissatisfied	6	Nil
Highly dissatisfied	Nil	Nil
	<u>100</u>	<u>100</u>

This would appear to indicate a greater initial degree of career satisfaction among those who withdrew than those who qualified. (Significant at .024 level). The distribution for the withdrawals is however unusual, having two peaks. If this is taken into account by combining cells, we obtain a non-significant result. This revised conclusion is reinforced by the similarity of the median responses (1.6 for withdrawals compared with 1.8 for qualifiers on a 5-point scale ranging from 1 for "highly satisfied" to 5 for "highly dissatisfied"). The similarity for present career satisfaction is even closer (Median 1.2 for withdrawals and 1.1 for qualifiers). A valid difference is however discernible in the change in career satisfaction. For qualifiers there is a highly significant improvement, but not for withdrawals.

The same three suggestions for attracting new recruits predominated:-

	%
Publicity, including talks to schools and universities	38
Extending university courses for exemption from the whole of the Intermediate examinations	33
Broadening the profession	29
	<hr/> 100 <hr/>

These compared with 66%, 14% and 20% respectively for qualifiers. This represents a significant change of emphasis (Significant at .041 level).

6.5 Actuarial Examinations

The frequency distribution for the stage at which the withdrawals discontinued the actuarial examinations is as follows:-

	%
Preliminary examination	25
I1	8
I2	6
I3	25
I4	8
I5	6
I6	Nil
I7	22
	<hr/> 100 <hr/>

Firm conclusions cannot be stated, but it would appear that the more usual stages for withdrawing are at the start (Preliminary examination), at the end of the Intermediate examinations (Associate stage) and about half way between (I3 stage). By this time, the median number of examination subjects failed is 1.6, if account is taken of those who withdraw without sitting any examination, or 3.8 if non-examinees are eliminated. As an average it is felt that this figure of 3.8 is indicative of a substantial waste of effort. It compares with a figure of 3.2 relating to all the examination subjects for the qualifying Fellows.

There is strong evidence that the withdrawals had been given less study time by their employers than the qualifiers (Significant at .0001 level). This is also borne out by the fact that the study time for the withdrawals averaged 4.2 hours each week compared with 5.3 hours for the qualifiers. Again, two half-days was very common, but no day-time study at all was equally common. It seems that despite the high number of employment changes by withdrawals they fared poorly for day release. Then, far from attempting to make good this shortfall in study time, they studied for a shorter time in total, averaging only 11.2 hours each week compared with 14.2 hours for the qualifiers. This represents only about two evenings in addition to the day-time study, and it is not surprising that it proved insufficient for examination success.

The study habits of the withdrawals were very poor, with only 9% studying most days and at a fixed time (35% for qualifiers), and an excessively high 69% either studying intensively only before examinations or allowing weeks to pass without serious study. In comparison with the qualifiers this is a highly significant result (Significant at .0001 level). The median study period of $2\frac{1}{2}$ hours was the same as for qualifiers, and study interference from sporting or social activities was also largely the same. A smaller percentage (53%) married before discontinuing the examinations, but since the years studying do not compare with those for qualifiers this fact is not significant. The accommodation percentages were almost identical, and the daily travelling times very similar.

Taking all these factors into account, we are forced to the conclusion that, on the whole, those who withdraw from the examinations have themselves to blame through insufficiently intensive study. Whether such students are unsuited to an actuarial career, and should not have started to take the examinations, is quite another matter.

There is evidence that the actuarial working experience was less

helpful for the withdrawals than the qualifiers. Thus, whereas comparable experience was obtained in routine jobs such as the calculation of surrender and paid-up values, little experience was obtained in such vital areas as premium rate calculations, policy alterations and valuation (Significance levels .001, .0003 and .0001 respectively). Clearly students need to choose an employer with great care. It may be true that progress through the earlier examinations is not hindered but motivation is almost certainly impaired.

Withdrawals found the examination in compound interest, I3, the hardest examination. It has to be remembered that the later examinations were not reached, but nevertheless it is interesting that the greatest hurdle is here. The subject of probability in I2 is often cited by actuaries as an excellent means of discriminating between potential actuaries and those examinees who may well fail to qualify, because of its centrality to actuarial expertise. Students themselves rate I2 second to I3 in difficulty.

The same ideas were put forward by the withdrawals for finding out at an early stage if a student will be unlikely to make a satisfactory actuary. Chief of these was examination success, which implies that withdrawals consider the examinations to be fair and reasonable. The withdrawals do not appear to appreciate, as the qualifiers do, the value of suitable actuarial employment. Their most important general comment was the necessity for student determination, which featured second in importance for the qualifiers.

6.6 Summary

In Chapter 6 we have analysed the replies to the withdrawals questionnaire. The withdrawals changed employer more times than the qualifiers, and it is suggested that too many changes affect the will to qualify. The educational background was investigated and it was

noted that none of the withdrawals had obtained a first class degree.

It is argued that, on the whole, those who withdraw have themselves to blame through insufficiently intensive study.

In Chapter 7 we take the conclusions from the previous chapters (in particular, Chapters 5 and 6) a stage further.

7. AN EVALUATION OF THE PROJECT
ON THE EDUCATION AND EXAMINATION OF ACTUARIES

7.1 Introduction

The first part of this final chapter considers the improvements suggested by the questionnaire respondents to the examinations of the 1973 Institute syllabus. Their views are then considered on the important areas of working practice at present and in the future. In the next section we draw out the chief conclusions from the whole project. Comparison is made, where possible, with the changes arising out of the Cornwall report (1975)⁽³⁹⁾ and (1976)⁽⁴⁰⁾. The chapter ends by summarising some thoughts relating to fields of further study.

7.2 Examination Improvements Suggested by Respondents

11*

The most important suggestion here was for a change from Algol to Fortran. The Institute decision to abolish computer program-writing from the examinations is clearly more fundamental. It has to be remembered that with a largely graduate entry into the profession it is likely that most actuarial students will have written programs as part of their degree course. The computing aspects of the actuarial syllabus will be more general than hitherto. The actuary should be master of certain specifically actuarial techniques. He must be aware of other techniques such as program-writing so that he can consult the relevant specialist when the need arises.

The suggestion to discontinue 11 altogether was put forward by a minority of the respondents, and the Institute has decided upon discontinuance. The Institute has accepted the argument that certain

* For a list of the examination subjects, see p.88.

topics should be covered by notes, which students should study but upon which they should not be examined. It can be argued that the majority of the questionnaire respondents still favoured examination of these topics.

I2, I5 and F4

Many students stated that I2 and I5 needed strengthening. The Institute has decided to retain a single examination paper for I2, but to strengthen I5 and to examine the subject by two papers. The Institute also decided to discontinue F4. All the explicit suggestions by respondents for extending the I5 syllabus are reflected in the new Further Statistics syllabus. Risk theory comes in the new General Insurance subject.

I6 and General Insurance

There were many explicit suggestions for re-organising I6, such as a reduction in emphasis on continuous exposed to risk work. The main suggestion was for General Insurance to come in to the examinations.

I3 and I4

Students pleaded for less arithmetic or the use of calculating machines. In practice, identical machines cannot be provided and none have been allowed. Less emphasis was advocated on cumulative sinking funds in I3. The Institute has decided to retain this topic, but the emphasis may be reduced. Respondents advocated more emphasis on discounted cash flow, and the new Compound Interest syllabus reflects this. Students criticised the testing of pension funds in I4. A new textbook is being prepared, and major changes from the present I4 syllabus are not expected.

I7 and F1

Respondents wanted the Finance and Investment syllabuses to be strengthened, to be more practical and to contain more on the analysis of accounts. All these suggestions are reflected in the new syllabuses.

Another topic suggested by respondents was the construction of investment indices. The latter is not explicitly mentioned in the new syllabuses. In the Final subject respondents wanted the complete exclusion of life interests and reversions. The Institute has decided to retain these at least until 1978.

F2

Students wanted the Life Offices syllabus to have more practical questions such as the profitability of premium rates and bonus reserve valuations. Consideration of equity linked policies was also suggested. The Institute has brought into the reading a new note dealing with unit linked business. A further suggestion was for the inclusion of life company valuations for purchase and the study of estate duty and the finance acts. Some of these topics are dealt with in the Institute taxation and legislation notes. Respondents drew attention to the length of the reading. The main text book is being revised and the Institute says that the number of original papers in the course of reading may then be reduced.

F3

The most important suggestion here was for the deletion or drastic reduction of the study of friendly societies. The Institute has decided to discontinue examination of the topic. Some students wanted social insurance deleted or reduced. The Institute will require examinees to be aware of the general provision of the United Kingdom National Insurance Scheme in relation to the integration of benefits with those of private funds. Students will not be examined on the Scheme itself, and it would appear that the views of our respondents support this.

One general point might be made concerning the suggestions expressed by our respondents. On many issues there is no disagreement between them. Their answers can then be analysed in a straightforward way. On other issues there may be disagreement. Where this has

occurred we have stated the facts and analysed the answers accordingly. Thus we discovered that some students were in favour of a project in the final examinations but just as many were against this.

It should further be noted that on a few issues there may be not only disagreement between students but inconsistency between the answers to different questions. Thus in response to a general question concerning reading lists, the suggestion was made to extend the reading, despite the fact that only reductions in reading were suggested for particular examination sections. We would maintain that answers to particular questions carry rather more weight than answers to a general question. This in fact was the reasoning behind our asking the specific questions, requiring detailed consideration by respondents. On the other hand, certain kinds of information may be obtained more readily from the general question. Thus we would cite the point made that it was essential for any new reading to be available on time. Talks with students confirm the fact that they have strong feelings on this issue. We do not wish to belittle the difficulties associated with the production of new reading material. Nevertheless, examinees maintain that the very fast learners are given an unfair advantage when new reading is produced late.

One third of the qualifying Fellows were in favour of specialist options, the foremost suggestion being a non-life option. The fact that the Institute has decided upon a compulsory General Insurance paper bears witness to the importance attached to the topic by the profession. A number of other suggestions relating to options were made by a few students. These included income tax and law, management, business administration, computing and economics. Such topics may be more suitably dealt with by way of post-qualification optional courses, and this is what the Institute proposes.

7.3 Future Working Practice

We stated in paragraph 5.8 that the important areas of working practice anticipated should be compatible with the modifications in examination syllabuses proposed. Accordingly we consider some of these anticipated areas.

Premium rates constitute an extremely important area, and it is reckoned just as important in ten years time. This has always been reflected in the Life Offices examination section. The importance is consistent with examinees asking for more questions on the profitability of premium rates.

Expenses investigations are given a fairly high rating and an even higher rating in the future. This again is linked with profitability. The Institute has a special note on the treatment of expenses in the new Life Offices syllabus.

Valuation and analysis of surplus have the highest present rating of all working areas, and the importance is not expected to decrease. The Institute has always recognised this in the Life Offices and Pension Funds syllabuses.

Finance and Investment are rated similarly to expenses investigations. The importance corresponds with questionnaire statements calling for strengthening of Finance and Investment sections in the examinations. The Institute has decided that the first examination in this subject should be listed earlier in the recommended order of subjects than hitherto, and that there should be two examination papers to provide a fairer test for candidates.

Insured pension funds are rated higher than average at present and almost as important in ten years time. There is special reading matter on this topic under both old and new syllabuses. Other pension funds are rated somewhat higher at present, and very high in the future. Old and new syllabuses reflect this. On the other hand, friendly societies

have the lowest rating of any topic both at present and in the future. The Institute's decision to discontinue the Friendly Societies examination is supported by these views.

Sickness insurance had a present rating somewhat below average, but an extremely high rating for the future. It is interesting that the notes attached to the new Life Assurance syllabus explicitly include permanent health insurance. Other non-life insurance had a very low present rating, but a higher rating for the future even than sickness insurance. This is reflected in the new compulsory General Insurance subject.

Management had a high present rating, and a higher one for the future. A certain amount can be taught in the Final examination subjects, but a great deal has to be learned from experience.

Computing had an average present rating, and a higher one for the future. We recall that students suggested computing as an examination option. An alternative would be a post-qualification course.

Statistics and Operational Research had a very low present rating, with a higher one for the future. Few examinees took the optional paper under the 1973 syllabus. Under the new syllabus certain areas of the subject from the old F4 are to be examined in the successor to the old I5. We would argue that the views of our respondents indicate a measure of support for the new arrangements.

7.4 Chief Conclusions from the Project

We have considered specific suggestions of students for improving the 1973 examination syllabus, in paragraph 7.2. We noted that anticipated areas of working practice should be compatible with any syllabus modifications, in paragraph 7.3. The chief conclusions from the project should not be obscured by the minutiae of paragraphs 7.2 and 7.3. In the present paragraph we accordingly set out these

conclusions, of which there are four.

The first conclusion comes from paragraph 5.2. We discovered that the median qualifying time for respondents to the main questionnaire was 5.6 years. Excluding students having at least eight examination section failures the median time came down to 4.6 years. This implied a qualifying age of under 26 as the "norm"; that is, the median age for 80% of new Fellows. We consider this age to be young enough. We would argue that a practising Fellow needs examination success, but also a certain minimum "level" of maturity and experience. We would endorse the wisdom of an experience requirement of four years, including at least two years after completion of all the examinations. The examinations may well be completed at even earlier ages in the future, particularly as a result of the increased numbers of actuarial degrees. There is thus all the more reason for an experience requirement.

The second conclusion comes from paragraph 5.5. Respondents consider that exemptions have gone far enough, and that the regulations should even be stiffened. It can be argued that students who obtain actuarial degrees constitute special cases. The number of graduates obtaining exemptions at City University in London, MacQuarie University in Australia and Cape Town University in South Africa is expected to increase slowly. For other students, there are a few changes. The subjects I1 and F4 have been discontinued. The same exemptions formula is to be applied to the successor to I2 as hitherto. On the other hand, a more stringent exemptions formula will apply to the successor to I7. Overall, it would appear that the number of exemptions granted is likely to decrease, and we maintain that respondents would welcome such a reduction.

The third conclusion comes from paragraph 5.3, where we maintain that the social life and development of personality are not unduly distorted by actuarial training. We discovered that trainees study

for an average of three evenings each week, in addition to the usual two half-days allowed by their employers. Verbal comments from students had indicated that four evenings would have been acceptable. Study intensity was not as great as it might have been, and a comparatively small percentage of students admitted that their studies frequently interfered with sporting or social activities. Patterns of marriage and having children were not unduly distorted by the need to study. All these factors appear to show that students continued to engage in social activities and to develop their personalities while studying for the examinations.

The fourth conclusion comes from paragraph 6.5. Taking a number of factors into account, we conclude that, on the whole, those who withdraw from the examinations have themselves to blame through insufficiently intensive study. These factors included study time and study habits. We further pointed out that respondents reckoned examination success to be the best method of finding out at an early stage if a student will be unlikely to make a satisfactory actuary. This implies that withdrawals consider the examinations to be fair and reasonable. Their most important general comment was the necessity for student determination. Thus "motivation" would appear to be a key word for success in the examinations.

7.5 Fields of Further Study

The project undertaken for this thesis has been a retrospective study of qualifying Fellows and withdrawals from the Institute examinations. The profession is a small one, and such a study can give only some of the answers to the problems of education and training. A similar study could be undertaken when the new syllabus has been operating for five to ten years. Valuable comparisons could then be made.

It would be useful to check the non-respondents for possible bias;

this would involve seeking up to date addresses and comparing with the Year Book addresses used for our project. It was felt that this would amount to an infringement of the anonymity which was promised in the covering letter attached to the questionnaires.

An alternative project would be a cohort approach, following through particular groups of new students. This method was ruled out of the present analysis because we did not have the necessary data. In any case, it would take a considerable number of years before a complete cohort had qualified or withdrawn. The analysis could then be completed. No doubt it would span at least one change of syllabus. The results would serve as a useful comparison with the present analysis.

The Institute of Actuaries is in possession of a certain amount of information about qualifying Fellows. There is very little information about those who withdraw from the examinations. The data obtained from our investigations are thus seen as filling a gap in knowledge and understanding. Much has been learned about the education and examination of actuaries, but there is always much more that can be learned.

Appendix 1

Copy of covering letter, follow-up letter
and main questionnaire

CITY OF
LONDON
POLYTECHNIC

Barry Spain MA MSc PhD FIMA
Head of Department

Department of
Mathematics and Statistics

Sir John Cass School of
Science and Technology

31 Jewry Street
London EC3N 2EY

Telephone 01-283 1030

Dear Colleague,

I am making an independent statistical study into the training of actuaries. As an actuary myself, engaged in actuarial training, I am particularly interested in understanding the qualities and characteristics of actuaries, and it is hoped that from the factual details of a questionnaire a picture may emerge enabling recommendations to be made for the education and examination of future actuaries.

Active support and encouragement is being given officially by the Institute of Actuaries, and it is urged that you give your co-operation so that a high response rate is obtained. Individual replies will be treated in the strictest confidence, only grouped summaries being prepared, so please spare time to help me by completing the questionnaire and returning it in the enclosed envelope.

Yours sincerely,

P.R. Goddard FIA
Principal Lecturer

Enc.

CITY OF LONDON POLYTECHNIC

Barry Spain MA MSc PhD FIMA
Head of Department

Department of
Mathematics and Statistics

Sir John Cass School of
Science and Technology

31 Jewry Street
London EC3N 2EY

Telephone 01-283 1030

Dear Colleague,

Recently I sent to you a questionnaire relating to an independent statistical study into the training of actuaries.

I do not appear to have received this back, but in the hope that you will be kind enough to complete the questionnaire I am sending you a further copy, together with the original covering letter. I would like to increase the response rate so that the results can be more useful, and I would earnestly beg for your co-operation.

Again, an addressed envelope is enclosed for your use.

Yours sincerely,

P.R. Goddard, FIA
Principal Lecturer

Enc.

CONFIDENTIAL

1. Date of Birth

2. (a) Employer's Name

(b) General nature of present work (please tick appropriate item)

Life Assurance

Pensions

Non-life insurance

Consulting

Public Service

Teaching and Research

Investments

Other (please specify)

3. (a) Year when you began work full-time

First Employer

Second Employer

Third Employer

Fourth Employer

Other (please specify)

(b) Did you have vocational actuarial work before your first employment
YES/NO

4. In which of the following have you lived more than half your life (from birth)? (Please tick appropriate item).

Rural area

Small town (population less than 50,000)

Greater London

Other Large Town (population more than 50,000)

5. (a) Last school attended Name

Address

.....

(b) Subjects taken at 'A' Level (or equivalent)

Subject	Grade of Result

6. (a) Have you a degree? YES/NO

If so, please state name of University (or college)

Year in which you began your degree course

Year in which you ended your degree course

Main subject(s) of degree

Subsidiary subject(s) of degree

(b) Class of degree (please tick appropriate item)

First class honours

Upper second class honours

Lower second class honours

Second class honours undifferentiated

Third class honours

Pass

Fail

Other (please specify)

(c) Did your degree course have a sandwich element?
(a period in industry or commerce).

YES/NO

(d) Please give details of any other academic or professional
qualification (eg HND, higher degree, ACII)

.....

.....

7. (a) Is (has) either parent engaged in professional work? YES/NO

Please give details (eg Father, Accountant. Mother, Physician)

.....

(b) Are (were) any of your relatives engaged in

(i) actuarial work?

YES/NO

or (ii) allied work?

YES/NO

Please give details (eg, Uncle, Insurance Broker.
Brother, Accountant)

.....

8. (a) At what age did you make up your mind to become an actuary?

(b) How were you introduced to the firm where you were first employed? (please tick appropriate item)

- By relatives or friends
- By public advertisement
- By the Institute of Actuaries
- By school careers or University Appointments Board
- By other means (please specify)

(c) Why did you choose the actuarial profession?
.....
.....

(d) Have you at any time had any doubts about your choice of career?
(tick as appropriate)

- Yes, serious doubt
- Yes, slight doubt
- No

(e) If you have had any doubts, what was the main reason?
(tick as appropriate)

- Length of time to qualify
- Dislike of certain aspects of actuarial work
- Interest in another career
- Financial difficulties
- Other (please specify)

(f) How satisfied are you with your work? (tick as appropriate)

	When you started	Now
Highly satisfied		
Satisfied		
Neither satisfied nor dissatisfied		
Dissatisfied		
Highly dissatisfied		

(g) What improvements do you suggest for attracting new recruits to the actuarial profession?
.....
.....
.....
.....

9. Actuarial Examinations

Examination Year	Subjects Attempted	Subjects passed (please add E if exempt)	Examination Year	Subjects Attempted	Subjects passed (please add E if exempt)
Before 1958 (please specify year)			1958		
1959			1960		
May 1961			Sept. 1961		
May 1962			Sept. 1962		
May 1963			Sept. 1963		
May 1964			Sept. 1964		
May 1965			Sept. 1965		
May 1966			Sept. 1966		
May 1967			Sept. 1967		
May 1968			Sept. 1968		
May 1969			Sept. 1969		
May 1970			Sept. 1970		
May 1971			Sept. 1971		
May 1972			Sept. 1972		
May 1973			Sept. 1973		

10. (a) How many hours per week on average were you allowed for private study in office hours?
- (b) How many hours in total did you study during a normal week?
- (c) Which of the following sentences most nearly describes your studying habits? (tick as appropriate)
- I study most days, and at a fixed time
 - I study most days, but not at a fixed time
 - I study intensively about once or twice a week
 - Sometimes I study intensively, but a week or more may pass without my studying seriously
 - I study intensively only before examinations
 - Other (please specify)

Question 10 continued ...

- (d) Irrespective of how often or regularly you study, how long is your normal study period (tick as appropriate)

Less than 1 hour

1 - 2 hours

2 - 3 hours

3 - 4 hours

More than 4 hours

- (e) Have your studies interfered with your sporting and/or social activities? (tick as appropriate)

Yes, frequently

Yes, occasionally

No

11. (a) Are you (have you been) married?

YES/NO

If so, in what year?

Did you have any children before qualifying as an actuary? YES/NO

- (b) Accommodation for most of period as trainee actuary (please tick as appropriate)

Home

Landlady catering

Self-catering

Other (please specify)

- (c) Daily duration of journey to work for most of period as trainee actuary, one way only (please tick appropriate item)

Less than $\frac{1}{2}$ hour

$\frac{1}{2}$ - 1 hour

1 - $1\frac{1}{2}$ hours

More than $1\frac{1}{2}$ hours

12. (a) In which of the following aspects of actuarial practice have you had actual working experience? (please tick appropriate item)

Premium rate calculations

Surrender and paid-up values

Policy alterations

Mortality and similar investigations

Valuation and analysis of surplus

Office procedure

Question 12 continued ...

(i) What improvements do you suggest to any of the Exemption Regulations?

(j) What improvements do you suggest to the reading list for any of the actuarial exams?

(k) Do you think sitting for I4, 5 and 6 should be disallowed until sitting (or exemption from) I1, 2 and 3?

YES/NO

13. What improvements (additions or deletions) do you suggest to each Intermediate subject?

(a) I1 Mathematics

(b) I2 Probability and Elementary Statistics

(c) I3 Compound Interest

(d) I4 Life and Other Contingencies

(e) I5 Statistics

(f) I6 The Analysis of Mortality and Other Actuarial and Demographic Statistics

(g) I7 Economic Background to Finance and Investment

(h) Should the study of replacement theory be included in I6? YES/NO

(i) Should memorisation of the components of the national income be excluded from I7? YES/NO

14. What improvements (additions or deletions) do you suggest to each Final subject?

(a) F1 (a) Finance and Investment (Less Advanced Level)

(b) F1 (b) Finance and Investment (More Advanced Level)

(c) F2 (a) Life Offices - Ordinary and Industrial (Less Advanced Level)

(d) F2 (b) Life Offices - Ordinary and Industrial (More Advanced Level)

(e) F3 (a) Pension Funds and Friendly Societies (Less Advanced Level)

(f) F3 (b) Pension Funds and Friendly Societies (More Advanced Level)

(g) F4 More Advanced Statistics and Operational Research

(h) Should there be any further specialist options besides Statistics and Finance? YES/NO

If so, please give details

.....

.....

.....

(i) Would you think it desirable for a project to be included in the final exams? YES/NO

15. Please tick according to your understanding of its importance to actuaries

	In present work			Ten years from now		
	Un- important	Average	Very Important	Less Important	Same as Now	More Important
	1	2	3	1	2	3
Premium rates, surrender and paid up values, policy alterations						
Mortality and similar investigations						
Expenses investigations						
Valuation and analysis of surplus						
Office procedure						
Finance and investment						
Insured pension funds						
Other pension funds						
Friendly societies						
Sickness insurance						
Other non-life insurance						
Underwriting						
Drafting of documents						
Personnel and counselling work						
Teaching						
Management						
Computing						
Statistics and Operational Research						
Demography						
Other (please specify)						
.....						

16. You are invited to make any general comments or suggestions here about your preparation for an actuarial career.

Appendix 2

Copy of covering letter and withdrawals questionnaire

CITY OF
LONDON
POLYTECHNIC

Barry Spain MA MSc PhD FIMA
Head of Department

Department of
Mathematics and Statistics
Sir John Cass School of
Science and Technology
31 Jewry Street
London EC3N 2EY
Telephone 01-283 1030

Dear Colleague,

I am making an independent statistical study into the training of actuaries. As an actuary myself, engaged in actuarial training, I am particularly interested in understanding the qualities and characteristics of actuaries, and it is hoped that from the factual details of a representative survey a picture may emerge enabling recommendations to be made for the education and examination of future actuaries.

Active support and encouragement is being given officially by the Institute of Actuaries, and it is urged that you give your co-operation so that a high response rate is obtained. I realise that you are no longer a potential actuary, as you appear to have stopped sitting actuarial examinations. In an effort to avoid the waste of effort involved I am trying to find out any features of the syllabus, tuition, etc., which have contributed to your withdrawal, with a view to their possible elimination.

Individual replies will be treated in the strictest confidence, only grouped summaries being prepared, so please spare time to help me by completing the questionnaire and returning it in the enclosed envelope.

Yours sincerely,

P.R. Goddard, FIA
Principal Lecturer

Enc.

CONFIDENTIAL

1. Date of Birth

2. (a) Employer's name when you were last an actuarial student

(b) General nature of work then (please tick appropriate item)

Life Assurance	<input type="checkbox"/>	Public service	<input type="checkbox"/>
Pensions	<input type="checkbox"/>	Teaching and Research	<input type="checkbox"/>
Non-life Insurance	<input type="checkbox"/>	Investments	<input type="checkbox"/>
Consulting	<input type="checkbox"/>		
Other (please specify)			

(c) Present employers' name

(d) General nature of present work

3. (a) Years when you began work full-time

First employer	<input type="checkbox"/>
Second employer	<input type="checkbox"/>
Third employer	<input type="checkbox"/>
Fourth employer	<input type="checkbox"/>
Other (please specify)	

(b) Did you have vocational actuarial work before your first employment? YES/NO

4. In which of the following have you lived more than half your life (from birth)? (Please tick appropriate item).

Rural area	<input type="checkbox"/>
Small town (population less than 50,000)	<input type="checkbox"/>
Greater London	<input type="checkbox"/>
Other Large Town (population more than 50,000)	<input type="checkbox"/>

5. (a) Last school attended Name

Address

.....

(b) Subjects taken at A level (or equivalent)

Subject	Grade of Result

6. (a) Have you a degree? YES/NO

If so, please state name of University (or College)

Year in which you began your degree course

Year in which you ended your degree course

Main subject(s) of degree

Subsidiary subject(s) of degree

(b) Class of degree (please tick appropriate item)

First class honours

Upper second class honours

Lower second class honours

Second class honours undifferentiated

Third class honours

Pass

Fail

Other (please specify)

(c) Did your degree course have a sandwich element? (a period in industry or commerce). YES/NO

(d) Please give details of any other academic or professional qualification (eg HND, higher degree, ACII)
.....
.....

7. (a) Is (has) either parent engaged in professional work? YES/NO

Please give details (eg Father, Accountant. Mother, Physician)
.....

(b) Are (were) any of your relatives engaged in
(i) actuarial work YES/NO
or (ii) allied work? YES/NO

Please give details (eg Uncle, Insurance Broker.
Brother, Accountant)
.....

8. (a) At what age did you consider becoming an actuary?

(b) How were you introduced to the firm where you were first employed? (please tick appropriate item)

- By relatives or friends
- By public advertisement
- By the Institute of Actuaries
- By school careers or University Appointments Board
- By other means (please specify)

(c) Why did you consider the actuarial profession?

.....

.....

(d) When did you first have doubts about an actuarial career? (please tick as appropriate)

- From the beginning
- Soon after the start of studying
- Just before discontinuing membership of the Institute of Actuaries
- Other (please specify)

(e) If you have had any doubts, what was the main reason? (Please tick as appropriate)

- Length of time to qualify
- Dislike of certain aspects of actuarial work
- Interest in another career
- Financial difficulties
- Other (please specify)

(f) How satisfied are you with your change of career? (Please tick as appropriate)

- Highly satisfied
- Satisfied
- Neither satisfied nor dissatisfied
- Dissatisfied
- Highly dissatisfied

When you started	Now
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

(g) What improvements do you suggest for attracting new recruits to the actuarial profession?

.....

.....

.....

.....

9. Actuarial Examinations

Examination Year	Subjects Attempted	Subjects passed (please add E if exempt)	Examination Year	Subjects Attempted	Subjects passed (please add E if exempt)
Before 1958 (please specify year)			1958		
1959			1960		
May 1961			Sept. 1961		
May 1962			Sept. 1962		
May 1963			Sept. 1963		
May 1964			Sept. 1964		
May 1965			Sept. 1965		
May 1966			Sept. 1966		
May 1967			Sept. 1967		
May 1968			Sept. 1968		
May 1969			Sept. 1969		
May 1970			Sept. 1970		
May 1971			Sept. 1971		
May 1972			Sept. 1972		
May 1973			Sept. 1973		

10. (a) How many hours per week on average were you allowed for private study in office hours?
- (b) How many hours in total did you study during a normal week?
- (c) Which of the following sentences most nearly described your studying habits? (Please tick as appropriate)
- | | |
|----------------------------------------------------------------------------------------------|--|
| I studied most days, and at a fixed time | |
| I studied most days, but not at a fixed time | |
| I studied intensively about once or twice a week | |
| Sometimes I studied intensively, but a week or more might pass without my studying seriously | |
| I studied intensively only before examinations | |
| Other (please specify) | |

Question 10 continued ...

- (d) Irrespective of how often or regularly you studied, how long was your normal study period? (Please tick as appropriate)

Less than 1 hour

1 - 2 hours

2 - 3 hours

3 - 4 hours

More than 4 hours

- (e) Have your studies interfered with your sporting and/or social activities? (Please tick as appropriate)

Yes, frequently

Yes, occasionally

No

11. (a) Are you (have you been) married?

YES/NO

If so, in what year?

Did you have any children before discontinuing study?

YES/NO

- (b) Accommodation for most of period as trainee actuary (Please tick as appropriate)

Home

Landlady catering

Self-catering

Other (please specify)

- (c) Daily duration of journey to work for most of period as trainee actuary, one way only (Please tick appropriate item)

Less than $\frac{1}{2}$ hour

$\frac{1}{2}$ - 1 hour

1 - $1\frac{1}{2}$ hours

More than $1\frac{1}{2}$ hours

12. (a) In which of the following aspects of actuarial practice have you had actual working experience (Please tick appropriate item)

Premium rate calculations

Surrender and paid-up values

Policy alterations

Mortality and similar investigations

Valuation and analysis of surplus

Office procedure

Question 12 continued ...

- Finance and investment
- Insured pension funds
- Other pension funds
- Friendly societies
- Sickness insurance
- Other non-life insurance
- Other (please specify)

(b) Which subjects studied at school or University were particularly helpful as a foundation for your actuarial studies?

.....
.....

(c) Which additional subjects at school or University might have been helpful?

.....

(d) Which actuarial exam did you find hardest?
second hardest?
third hardest?

(e) What method do you advocate for finding out at an early stage that a student will be unlikely to make a satisfactory actuary?

.....
.....

For questions 12(f), (g) and (h) see exam sections listed in questions 13 and 14.

(f) For what exam sections do you think it is most important to have practical experience?

.....
.....

(g) For what exam sections do you think it is most helpful to have tutorials (discussion classes)?

.....
.....

(h) For what exam sections do you think it might be most helpful to have lectures?

.....
.....

13. What improvements (additions or deletions) do you suggest to each Intermediate subject?

(a) I1 Mathematics

(b) I2 Probability and Elementary Statistics

(c) I3 Compound Interest

(d) I4 Life and Other Contingencies

(e) I5 Statistics

(f) I6 The Analysis of Mortality and Other Actuarial and Demographic Statistics

(g) I7 Economic Background to Finance and Investment

14. What improvements (additions or deletions) do you suggest to each Final subject?

(a) F1(a) Finance and Investment (Less Advanced Level)

(b) F1(b) Finance and Investment (More Advanced Level)

(c) F2(a) Life Offices - Ordinary and Industrial (Less Advanced Level)

(d) F2(b) Life Offices - Ordinary and Industrial (More Advanced Level)

(e) F3(a) Pension Funds and Friendly Societies (Less Advanced Level)

(f) F3(b) Pension Funds and Friendly Societies (More Advanced Level)

Question 14 continued ...

(g) F4 More Advanced Statistics and Operational Research

(h) Should there be any further specialist options besides
Statistics and Finance? YES/NO

If so, please give details
.....
.....

(i) Would you think it desirable for a project to be included
in the final exams? YES/NO

15. You are invited to make any general comments or suggestions here
about your preparation for an actuarial career.

APPENDIX 3

Planning the Surveys

Further details are given in this appendix of the planning of the surveys, the problems which were met on the way and how they were dealt with.

The abstract states briefly that the thesis is an attempt to discover a right relationship between actuarial training and occupational practice. We wanted to obtain factual details and there were several different groups of individuals from whom we originally planned to derive information.

The first of these groups was recently qualified actuaries. This group appeared to offer the greatest prospect of useful answers. Having completed the examinations they were more likely to have time to answer the questionnaires. They had completed the examinations recently, and were more likely to give accurate information about them. They had knowledge about Final subjects as well as Intermediate subjects and were in a position to view the relationship between these subjects.

The second planned group was actuaries with longer experience. There were several possibilities here. We considered making enquiries from members of Council, the body responsible for the management and superintendence of the affairs of the Institute. These actuaries would undoubtedly have had useful comments to make. Nevertheless, it was felt that they were part of the "establishment", and we wanted to get views from outside this area. We considered sending questionnaires to actuaries of say ten years standing. This would have presented many difficulties. Enquiries showed that many, perhaps most, of these actuaries, had forgotten a very great deal of the details concerning their education and examination. They had, in the main, taken actuarial examinations set under a previous syllabus. Their schooling

was undergone many years in the past. Compared with those who qualified in 1972 and 1973, a relatively small percentage had a university education. It was felt that all these considerations outweighed the advantages relating to greater experience, more mature outlook, etc.

It transpired that after our surveys were planned, a survey of needs and resources was carried out on behalf of the Council of the Institute of Actuaries (1973)⁽⁴⁴⁾. A few comments are relevant here concerning this survey. Questionnaires were sent to the chief actuarial officers of every organisation known to employ any Fellow of the Institute. It was thus "senior" actuaries who were approached. What was wanted was a ten year projection for the expected numbers of new Fellows and their anticipated work areas for 1982. The first comment then relates to the aims of the needs and resources survey. Anticipated work areas were one aspect of our own survey. We sought to relate this to the education and examination of actuaries. It might be fair to state that Council was mainly concerned with estimating future demand for actuaries, and then assessing the likely supply for meeting this demand. We were concerned with more than the matching of numbers. We were interested in education. We wanted to consider this together with examination records, both academic examinations completely outside the Institute examinations and also the actuarial examinations. Anticipated work areas in the future were of interest in indicating possible mis-matching of education and examination with occupational practice.

The third planned group was students who were part way through the actuarial examinations. On average, this group would be younger than the first or second group. Their school education would be more recent, and in the main any university education. Since our research was on the education and examination of actuaries, it appeared

that this group might offer the most useful information. A pilot survey in 1973, however, revealed substantial deficiencies in the replies. One difficulty was that these students had very limited work experience. A further difficulty was that they did not answer a large number of questions. One of the purposes of a pilot survey is to show whether a fuller survey of a particular group of people is likely to produce useful information. In this case it appeared that an extension to other students part way through the actuarial examinations would not be useful.

The fourth planned group was those who had discontinued taking the actuarial examinations. This part of the survey represented one of the greatest challenges in the whole project. It was known that the withdrawals would be difficult to contact because the last addresses available were not necessarily current, and there was a reduced incentive to answer the questions. A few questionnaires were, in fact, sent back by the Post Office marked "gone away". It was, nevertheless, remarkable how many questionnaires were returned even from overseas. It had been decided to make the whole survey comprehensive by seeking replies from respondents at home and overseas. This was done for the main, as well as the withdrawals, questionnaire.

It was important for the research to be planned and developed in a manner which took account of the present needs of the actuarial profession, and the way these particular needs were seen to develop into the future. It was felt that the way these problems had been tackled in other professions might help towards solving the problems of the actuarial profession. Thus the Institute of Statisticians appointed external assessors when they sought to revise their education and training procedures. These assessors received a considerable amount of information on syllabuses, examination papers, examiners' reports, etc. They were able to come to a broad understanding of the

needs of the statistical profession sufficient to make useful suggestions for change. The actuarial profession is more specialised, and we doubt whether external assessors would have sufficient insight into actuarial problems.

For other professions in this country, and for the actuarial profession in North America, surveys have almost invariably been conducted on a sample basis. It can be argued that the quality of the responses is a far greater variable than the random fluctuation that can develop from a careful sampling procedure. Nevertheless, the actuarial profession in this country is a small one, and a 100% investigation of qualifying actuaries was practicable.

There were a small number of actuarial surveys which were made in North America, but they were invariably carried out with a different motivation from our own. Thus, there was a survey designed by Dr. C.H. Fischer (1964)⁽⁴⁵⁾. The motivation for this was primarily recruitment, and this applied also to the 1963 report of the Canadian Association of Actuaries⁽⁴⁶⁾. (The Association subsequently changed its name to the Canadian Institute of Actuaries, and a more recent report is referenced in Chapter 5 of this thesis (1973)⁽⁴³⁾).

A small number of surveys were also carried out in Australia, in connection with the actuarial scheme of study at MacQuarie University. These surveys were very much orientated towards Australian practice. In some cases, they included investigations of salaries, pension rights, etc. Such topics were of great interest, but outside the general sphere of the education and examination of actuaries.

APPENDIX 4

Cross-tabulations

This appendix sets out some of the cross-tabulations which were used to arrive at the conclusions stated in the project. For conciseness we are not setting out all the tabulations, but we have taken five of them to illustrate problems and how they were met.

For many of the tables one or other of the variables was simply a classification. Thus we often compared the students qualifying with those withdrawing from the examinations. A suitable test was then the χ^2 test for a contingency table. It was decided in all cases to use this technique, and to determine from the result whether we should modify the test.

The first cross-tabulation of interest was that between size of employing firm and qualifying time. We stated on page 40 that we found a strong association between these variables (Significant at .005 level). The figures are given in Table A4.1.

In the original computer print-out, a number of the cells in the cross-tabulation contained no entry. In cases where such zeros occurred, a small number of cells were combined before the table was analysed. In the case of Table A4.1, the evidence for an association was strong, and we consider that we have dealt reasonably with the zeros problem.

The second cross-tabulation of interest was that between type of employing firm and qualifying time. On page 41 we stated that no association was found between type of employment and overall qualifying time. The figures are shown in Table A4.2.

There were zeros in a number of cells, and again we have combined cells before analysing the table. In the case of Table A4.2, there was fairly strong evidence against an association, since the approximate significance level was 0.11. We consider once more that we have dealt

reasonably with the zero problem.

The first two examples taken have provided cases where the evidence is fairly strong, either for or against an association. We proceed to consider three further examples, taken from Chapter 6, all of which led to the chief conclusions summarised in Chapter 7.

The third cross-tabulation considered enabled us to state on page 67 that there was strong evidence that the withdrawals had been given less study time by their employers than the qualifiers. (Significant at the .0001 level). The figures are shown in Table A4.3.

In this case a zero has been retained in one of the cells. It was clear that if we had combined cells in order to eliminate the zero the conclusion would not have been affected. We would still have strong evidence of a difference between the qualifiers and the withdrawals.

The fourth cross-tabulation of interest was the total study time per week with the two categories of questionnaire respondent. On page 67 we remarked that the withdrawals studied for a shorter time in total than the qualifiers. Figures are shown in Table A4.4.

There were zeros in a number of cells, and once more we have combined cells in order to eliminate the zeros. In the case of Table A4.4, there was strong evidence of a difference between the qualifiers and the withdrawals, since the approximate significance level was .0005. It should be noted in this table that eight qualifiers and eight withdrawals did not answer the relevant question. The percentage of such nil returns was usually well below 5%.

The fifth cross-tabulation of interest was the studying habits shown by the two categories of questionnaire respondent. On page 67 we noted that the study habits of the withdrawals were very poor in comparison with those of the qualifiers. We stated that the differences represented a highly significant result. (Significant at .0001 level). The figures are given in Table A4.5.

It might be contended that students would not be truthful in answering a question about studying habits. We see no reason why respondents should want to write falsehoods, since answers were requested on a confidential basis. In any event, the statistical result was far removed from the conventional level at which a hypothesis might be rejected as a borderline case. We conclude that there were real differences in studying habits between the qualifiers and withdrawals. The evidence mounted in favour of the conclusion that, on the whole, those who withdrew from the examinations had themselves to blame through insufficiently intensive study.

Qualifying Time Years	Size of Employing Firm			Total
	Large	Medium	Small	
2	2	3	1	6
3	10	2	4	16
4	16	7	11	34
5	13	2	10	25
6	13	2	7	22
7	2	3	16	21
8	6	7	4	17
9	2	6	2	10
10	4	4	6	14
11 or 12	4	1	5	10
13 or 14	1	4	3	8
15 or more	1	1	2	4
TOTAL	74	42	71	187

TABLE A4.1 Analysis of Size of Employing Firm with Qualifying Time, for respondents to the main questionnaire

Type of Employment	Qualifying Time		Total
	Up to 5 years	6 years or more	
Life Assurance	34	66	100
Pensions	19	12	31
Non-life Insurance	2	2	4
Consulting	16	13	29
Public Service	2	5	7
Teaching and Research	3	2	5
Investments	6	10	16
TOTAL	82	110	192

TABLE A4.2 Analysis of Type of Employment with Qualifying Time, for respondents to the main questionnaire

Hours per week allowed for private study in office hours	Qualifiers	Withdrawals	Total
None	5	10	15
2	8	0	8
3	13	1	14
4	24	6	30
5	26	2	28
6	42	5	47
7	56	10	66
8 or more	7	1	8
TOTAL	181	35	216

TABLE A4.3 Analysis of private study in office hours with category of questionnaire respondent

Total hours of private study per week	Qualifiers	Withdrawals	Total
	%	%	
5 or 6	4 (50)	4 (50)	8
7 or 8	3 (38)	5 (62)	8
9 or 10	27 (87)	4 (13)	31
11 or 12	33 (89)	4 (11)	37
13 or 14	18 (86)	3 (14)	21
15 or 16	38 (88)	5 (12)	43
17 or more	61 (95)	3 (5)	64
TOTAL	184	28	212

TABLE A4.4 Analysis of total private study with category of questionnaire respondent

Note: The figures 4,5,4,4,3,5,3 in the withdrawals column are close to a regular sequence of 4s. A more notable feature stands out from the percentage figures, shown in brackets. These percentage figures generally decrease as we go down the withdrawals column, whereas they generally increase as we go down the qualifiers column.

Studying Habits	Qualifiers	Withdrawals	Total
"I studied most days, and at a fixed time"	68	3	71
"I studied most days, but not at a fixed time"	36	1	37
"I studied intensively about once or twice a week"	27	7	34
"Sometimes I studied intensively, but a week or more might pass without my studying seriously"	37	16	53
"I studied intensively only before examinations"	24	8	32
TOTAL	192	35	227

TABLE A4.5 Analysis of studying habits with category of questionnaire respondent

REFERENCES

1. Institute of Actuaries' Year Book 1972-73. (1972).
2. Holloway B.J. and Scott N.T. (1968). Graduates in Insurance and the Actuarial Profession. A university report.
3. Solomons D. with Berridge T.M. (1974). Prospectus for a Profession. Published by the Advisory Board of Accountancy Education.
4. Ormrod Report (1971). Report of Committee on Legal Education. Published by Her Majesty's Stationary Office. Command 4595.
5. Todd Report (1968). Report of Royal Commission on Medical Education 1965-68. Published by Her Majesty's Stationary Office. Command 3569.
6. Association for Study of Medical Education and National Foundation for Educational Research (1966). Survey for the Royal Commission on Medical Education 1965-68.
7. Cambridge Report (1971). Strategies for Education in the Nineteen-Seventies. Report on the Architectural Profession.
8. Institute of Actuaries Students' Society (1974). Memorandum on the Education and Training of Actuaries submitted to the Institute's Review Committee.
9. Menzler F.A.A. (1951). Presidential address. Journal of the Institute of Actuaries. 77,I.
10. Bunford J.F. (1955). Presidential address. Journal of the Institute of Actuaries. 81,I.
11. Wood C.F. (1957). Presidential address. Journal of the Institute of Actuaries. 83,I.
12. Gunlake J.H. (1961). Presidential address. Journal of the Institute of Actuaries. 87,I.

13. Usherwood K.A. (1963). Presidential address. Journal of the Institute of Actuaries. 89,I.
14. Tetley H. (1965). Presidential Address. Journal of the Institute of Actuaries. 91,I.
15. Benjamin B. (1967). Presidential Address. Journal of the Institute of Actuaries. 83,I.
16. Skerman R.S. (1971). Presidential Address. Journal of the Institute of Actuaries. 97,I.
17. Reid A.R. (1958). Presidential Address. Transactions of the Faculty of Actuaries. 26,I.
18. Haynes A.T. (1962). Presidential Address. Transactions of the Faculty of Actuaries. 28,I.
19. Bromfield A.E. (1968). Presidential Address. Transactions of the Faculty of Actuaries. 31,I.
20. Dow J.B. (1964). National Reports on Development of Profession. Transactions of International Congress of Actuaries. 17,P.1.
21. Fitzhugh G.W. (1958). Chairman's Address. Transactions of the Society of Actuaries. 10,P.671.
22. Harris D.H. (1960). Chairman's Address. Transactions of the Society of Actuaries. 12,P.742.
23. Warters D.N. (1961). Presidential Address. Transactions of the Society of Actuaries. 13,I.
24. Jenkins W.A. (1962). Presidential Address. Transactions of the Society of Actuaries. 14,I.
25. Miller J.H. (1963). Presidential Address. Transactions of the Society of Actuaries. 15,I.

26. Henningsen V.E. (1965). Presidential Address. Transactions of the Society of Actuaries. 17,I.
27. Fitzhugh G.W. (1966). Presidential Address. Transactions of the Society of Actuaries. 18,I.
28. Lancaster E.B. (1967). The Education of the Actuary. Transactions of the Society of Actuaries. 19,D.346.
29. Transactions of the Society of Actuaries (1970). Continuing Education of the Actuary. 22,D.315.
30. Transactions of the Society of Actuaries (1970). The Alternate Route. 22,D.477.
31. Transactions of the Society of Actuaries (1970). The Education and Examination of Actuaries. 22,D.635.
32. Conference of Actuaries in Public Practice (1970). The Alternate Route. Proceedings 1970-71. p.349.
33. Lancaster E.B. (1971). Presidential Address. Transactions of the Society of Actuaries. 23,I.
34. Lawson H.R. (1967). Presidential Address. Transactions of the Society of Actuaries. 19,I.
35. Lever Report (1946). Institute of Actuaries Education Committee Report.
36. Usherwood Report (1958). Institute of Actuaries Education Committee Report.
37. Haycocks H.W. (1966). The Education of the Actuary. Journal of the Students' Society.
38. Skerman Report (1967). Institute of Actuaries. Report of Committee to review Tuition and Examinations.

39. Cornwall Report (1975). First Report of Committee to Review the Education and Training of Actuaries.
40. Cornwall Report (1976). Second Report of Committee to Review the Education and Training of Actuaries.
41. Don Howard Personnel Report (1971). Profile of the Actuary. Don Howard Personnel Inc.
42. Temple University Report (1971). Report of Casualty Actuarial Society. Temple University, Philadelphia, Pennsylvania.
43. Canadian Institute of Actuaries Report (1973). Report of Professional Survey Committee.
44. Needs and Resources Survey (1973). Report for the Institute of Actuaries.
45. Fischer C.H. (1964). Actuarial Students, Examinations and the Profession. Transactions of the Society of Actuaries. 16,I.
46. Canadian Association of Actuaries Report (1963). Special report for the promotion of mathematical careers.