

THE EDUCATION AND TRAINING OF ACTUARIES

BY W. W. TRUCKLE, F.I.A., F.S.S.

[Submitted to the Institute, 25 January 1982]

“I would live to study, and not study to live”

FRANCIS BACON

1. INTRODUCTION

1.1. The title of this note encompasses such a wide range of topics as to be beyond the scope of a single paper. The purpose of the note is therefore restricted to providing a framework for an Institute discussion. It lays no claim to being a paper in the generally accepted sense of forming a part of actuarial literature; nor does the compiler venture his own opinions except as they may intrude by implication in the rhetorical form of the questions posed.

1.2.1. A wide-ranging discussion of all aspects of the subject could hardly be contained within the span of an Institute meeting; and it seems desirable to focus attention on a limited number of key issues in the hope that this may lead to a more concentrated and constructive debate.

1.2.2. The meeting provides a rare opportunity for members of the profession to express their views on the direction of the Institute's educational activities; written contributions would be more than usually welcome from those who may be unable to take part in the discussion itself.

1.2.3. Education is a subject on which it is all too tempting to indulge in idealistic considerations. That is not the intention here; rather it is hoped that the debate will produce ideas and suggestions which it might be feasible to translate into action over, say, the next five to ten years.

1.3.1. It is useful to distinguish between education *policy* on the one hand, and the *implementation* of policy on the other. The distinction is not always clear-cut, and the two aspects interact to some degree; for example, policy may be dictated by the limitations of the resources available for implementation. Nevertheless, it is useful to recognize this broad conceptual division by presenting this note in two main sections corresponding to the two concepts.

1.3.2. Within this general framework the format of the note is to enumerate some key issues; and in each case to summarize the relevant features and to pose the questions which seem to arise for consideration.

1.4. The note is written primarily in the context of the educational requirements of actuaries qualifying as members of the Institute and the Faculty. These qualifications necessarily reflect conditions in which actuaries perform their professional role in the United Kingdom. This is an unavoidable constraint if the scope of the discussion is to be confined to practical proportions; nevertheless,

many of the issues are of more general application and may be of interest to a wider audience.

2. POLICY

2.1. *What an actuary needs to know*

“A smattering of everything, and a knowledge of nothing”

DICKENS

2.1.1. The actuary seems to be a jack-of-all-trades. In addition to being expert in those subjects that are specifically ‘actuarial’ (i.e. compound interest, life contingencies, mortality investigations) he shares common ground with other specialists such as statisticians, economists, accountants, investment analysts and underwriters; also he needs to know something of the law, computers and the art of management.

These catholic interests lead to some difficulty in determining the scope and depth of knowledge to be included in the profession’s educational menu. Also there is the danger that in encroaching too far into the domains of other specialists the actuary merely becomes a shallow know-all.

2.1.2. Another way of looking at this matter is to consider whether the examination syllabus determines the actuary’s role; or whether the role should dictate the required syllabus. One has the impression that in the field of general insurance neither the syllabus nor the role was the determinant.

2.1.3. Obviously the extent of the examination syllabus is a limiting factor; if it becomes too extended or involved it leads to an unnecessarily protracted course of study. Our reputation for being a profession for which it is difficult to qualify should not be carried to such lengths as to become masochistic.

In any case, that ‘difficult’ reputation, whilst it may have enhanced the profession’s image in the past, may now prove to be a distinct handicap at a time when most young people expect to make their mark at a relatively earlier age.

2.1.4. *Question: What are the limits of knowledge to be demonstrated by a qualified actuary, distinguishing between essential subjects (to be examined) and incidental subjects (to be treated as post-examination education)?*

2.2 *Adaptation to change*

“Knowledge advances by steps, and not by leaps”

MACAULAY

2.2.1. It is almost a cliché to say that we live in times of rapid change; yet it is true that, in the study of what may be termed ‘business science’ there has been an eruption of new ideas. Many of these ideas originate in non-actuarial disciplines but can be adapted and applied to actuarial problems. It is uncomfortable for the profession that the potential of these ideas as actuarial techniques are often first recognized by non-actuaries.

2.2.2. It is fascinating to see actuarial science through the eyes of a non-actuary

such as W. S. Jewell⁽¹⁾. His view of the insurance process challenges the immutability of established actuarial concepts. To him, the stochastic approach to the risk process, the development of risk theory and the view of insurance as an adaptive control mechanism seem to be natural ways of approaching actuarial problems. Yet they find little place in current actuarial literature.

2.2.3. Jewell also discusses the challenge posed by the changing conditions of society. He cites the need to develop techniques to cope with high rates of inflation; he also refers to the introduction of anti-discrimination legislation which undermines fundamental actuarial risk-classification concepts.

2.2.4. The danger of actuaries encroaching incautiously into wider fields (see §2.1.1.) is matched by the contrary and embarrassing possibility that non-actuaries may enter *our* domain to expose the inadequacy of conventional actuarial techniques.

2.2.5. The monitoring of new ideas and their exposure to the test of actuarial research is at present a hit-or-miss affair; and the incorporation of new techniques into the education system seems to be haphazard and leisurely.

2.2.6. *Question: How do we ensure that developments in the actuarial and allied fields are adequately monitored and tested?*

2.2.7. *Question: Do we need to clear a route by which the results of research into new ideas are filtered into the educational and examination system so as to create and maintain a momentum of change?*

2.3. *The scope of actuarial education*

“I don’t know why they make all this fuss about education”

MELBOURNE

2.3.1. The total range of knowledge required of the qualified actuary (see §2.1.) can be acquired during three possible stages:

- (i) The pre-entry educational qualifications which are a prerequisite to securing admission as a student.
- (ii) The course of study undertaken for the actuarial examinations.
- (iii) Post-qualification courses.

2.3.2. It is apparent that these three elements are complementary; and that there is some freedom of choice as to how the total requirements are allocated to the different stages.

For example, if all new entrants were required to possess good honours degrees in statistics it might be possible to eliminate that subject from the examination syllabus.

Again, the content of the syllabus depends upon the extent to which it may be thought feasible to leave specialized and advanced techniques to be covered by the post-qualification courses.

2.3.3. The three stages in question are discussed in the following sections.

2.4. Admission standards

“Abandon all hope, you who enter!”

DANTE

2.4.1. It may be supposed that the *raison d'être* of having a minimum educational requirement to secure admission is that the student member should demonstrate the competence to have a reasonable prospect of passing the examinations and pursuing a professional career. It might be added that this objective should be achieved within a fairly short period of time.

2.4.2. The qualities that are sought are not necessarily those of the high-powered mathematician. Many entrants *are* good mathematicians, and they often make the best students; but other attributes seem to be important also.

2.4.3. Most actuaries are called upon to practise in a working environment which calls for a fairly commonsense approach; it is not usually the place for the narrow theorist. It could be said that flair, imagination and judgement are as important as mathematical ability.

2.4.4. It does seem essential for the actuary to have a complete command of English and the ability to communicate and explain complex ideas to the layman in non-technical language. It appears that examination candidates frequently fail because of an inability to marshal their thoughts and express them in an orderly and coherent manner.

2.4.5. One has the impression that motivation is a major factor distinguishing the successful student from the remainder. Examples abound of academically well-qualified students who founder from a lack of application and determination.

2.4.6. The following figures provide some idea of the probable history of a typical cohort of new entrants to the Institute:

Duration since entry (years)	Ceased membership (%)	Qualified (%)	Remainder (%)
5	45	17	38
10	55	32	13
15	60	35	5

These figures suggest that:

- (a) The drop-out rate may be regarded as uncomfortably high; implying that too many entrants are obliged to change to other careers.
- (b) The time taken to qualify is generally rather long. Members currently completing the Institute's examinations will have taken on average $6\frac{1}{2}$ years; if this continues, the corresponding time to qualify will be $8\frac{1}{2}$ years after adding two years of experience requirement. This implies an average age at qualification of about 30 years.

2.4.7. The above figures are consistent with an examination pass rate which,

taking one year with another, seems to be in the region of 30–35% for most subjects.

2.4.8. As a consequence of these patterns of examination performance and membership there is much wasted effort in the administration of the educational system; and precious qualified manpower is absorbed in unnecessary examining and tuition.

2.4.9. The profession has a long tradition of having a liberal approach to admission requirements, providing an opportunity for people to enter who might not have had the advantages of university education. There are senior members of the profession who are non-graduates and who were able to benefit from this open philosophy.

2.4.10. On the other hand it might be considered that the present-day image of the profession is impaired by the evidence that so many entrants abandon an actuarial career; and that the benefits of qualification are, for many members, deferred until their 30's.

2.4.11. *Question: Should the selection criteria for entry to the profession be made tougher?*

2.4.12. *Question: Should the entry requirements include some sort of aptitude test to identify those attributes which may not be associated with academic qualifications alone?*

2.5. The subjects to be examined

“This'll sort out the men from the boys”

SPORTS COMMENTATOR

2.5.1. The present examination syllabus divides into (a) subjects that are concerned with actuarial principles and (b) those that deal with the practical applications of the principles.

2.5.2. The basic principles (Institute Group A subjects, Faculty Parts 1 to 5) are the tools of the trade and must suffice to equip the student to tackle the current range of applications likely to be found in actuarial practice. This segment of the syllabus offers little scope for reduction in content unless some of the subjects (e.g. statistics) become pre-entry qualifications.

2.5.3. It is observed that many students progress fairly rapidly through the actuarial principles only to encounter difficulties in tackling the practical applications found in the Group B subjects (Faculty Parts 6 to 8); indeed some stop short at that stage. It is understood that such people often find useful and satisfying employment as ‘actuarial technicians’.

2.5.4. The content of the examination syllabus is a compromise between the need to contain the total length of study for an average student, and the need to ensure that he is properly trained to practise as an actuary. The matter is finely balanced in the area of practical application in deciding which topics require to be examined (and at what level of specialization) and which topics could be left to post-qualification study.

2.5.5. *Question: (a) Is the present course of study too extended; and consequently should the content of the examination syllabus be reduced?*

(b) If so, how?

The options seem to be:

- (i) To examine existing subjects in less depth.*
- (ii) To transfer part of the actuarial principles to pre-entry requirements.*
- (iii) To transfer part of the practical applications to post-qualification study.*

2.5.6. *Question: Should there be a qualification to recognise formally the status of 'actuarial technician'?*

2.6 *The role of post-qualification education*

"It is a melancholy truth that even great men have their poor relations"

DICKENS

2.6.1. It has been brought out in § 2.3 that actuarial education is not confined to the examination syllabus.

Qualified actuaries are all too well aware of the limitations of their knowledge and of the need to extend it both in scope and depth in order to practise successfully.

2.6.2. It is probably true to say that during the working life of a competent actuary he will acquire more knowledge after qualifying than he learned during the course of studying for the examinations. Post-qualification education is therefore a continuing process reflecting the changing needs of actuarial work and the development of new ideas and methods.

2.6.3. At present the formal arrangements for post-qualification education comprise:

- (a) ATS refresher courses.
- (b) Professionalism courses.
- (c) Courses arranged by the Research Committee, including Actuarial Workshops.
- (d) Courses arranged by the Students' Society.

These are not mandatory and it may be supposed that the majority of actuaries continue their education on a 'self-help' basis to solve problems as and when they arise in the natural course of their work.

2.6.4. There is a distinct impression that on a formal level post-qualification education is not generally well supported. Its neglect is probably due in part to the undue emphasis usually placed on the examination syllabus which is often seen as an end unto itself.

Students, understandably, expect to enjoy a period of relaxation following the completion of the examinations; and are generally unenthusiastic at the idea of immediate involvement in continuing educational activities. In due course many

are brought into the system as examiners or tutors the demands of which probably act as a continuing deterrent to being involved in other formal post-qualification education.

2.6.5. We thus have the paradox that the weight of effort and attention goes directly or indirectly into the examination syllabus to the neglect of extra-examination activities which are, in terms of knowledge, of at least equal importance.

There is, of course, a problem of manpower, which is a recurring theme in this note. The more resources we put into the examination system the fewer we have left for other activities. It is important to remark in passing that some of those resources could come from outside the profession. The role of universities in all three stages of the educational process is discussed elsewhere in this note.

2.6.6. *Question: Should more resources of manpower be diverted into post-qualification education?*

2.6.7. *Question: Does the structure of post-qualification courses need to be strengthened and expanded?*

2.6.8. *Question: Should there be some element of compulsion to participate in post-qualification education (e.g. as a condition of being allowed to sign actuarial certificates)?*

2.7 Limitations on examination attempts

“To spend too much time in studies is sloth”

BACON

2.7.1. Section 2.4 discusses admission standards and suggests that one purpose is to limit entry to people of a calibre such that they have a realistic prospect of attempting and completing the examinations within a reasonable time.

This initial filtering on entry is based on *external* educational criteria which by their nature can only provide an imperfect test of suitability for an actuarial career.

2.7.2. It is a logical extension to envisage further filtering at a later stage by which continued membership is made conditional upon achievement of certain minimum standards of *internal* examination performance, on the basis that this provides a more reliable test of competence.

2.7.3. The distribution by duration of Institute entrants who subsequently lapse their membership is broadly as follows:

Duration since entry (years)	Percentage of original cohort who cease membership	Duration since entry (years)	Percentage of original cohort who cease membership
0	3	6	2
1	19	7	2
2	11	8	2
3	6	9	2
4	4	10	2
5	2		

It is to be expected that a proportion of students should drop out within the first few years, having discovered their unsuitability. But it is a matter for concern that a significant percentage seem to take a long time to come to that conclusion.

2.7.4. The introduction of some form of limitation on examination attempts (or alternatively, a time limit for completing part or all of the examinations) should be seen as fulfilling the purpose of providing the student with guidelines against which to assess his own suitability for an actuarial career; and to assist him in facing the difficult decision of whether or not to continue with it.

2.7.5. So long as the possibility exists of continuing to sit the examinations without limit some students are tempted to soldier on in the hope of eventually passing when it might pay them to face up to a change of career at an early stage. The application of a limitation rule might therefore be in the best interests of the students.

2.7.6. There has been a long tradition that the examinations should be open-ended; and that students should feel free to study at their own pace without regard to any limitation in time.

No doubt there are successful actuaries who took a long time to qualify and who would have fallen foul of any limitations had they then existed.

One might comment that the existence of a limitation rule would have acted as a spur and they would consequently have taken rather less time to qualify!

2.7.7. There may be a tendency for 'long-term' students to come to regard the examination syllabus as an end in itself; and to lose sight of the wider aspects of actuarial education. Section 2.6 has drawn attention to the importance of post-qualification education.

2.7.8. It may be supposed that a significant effort on the part of tutors and examiners is absorbed in advising and examining students who in due course will drop out of the profession. Given the chronic shortage of education manpower any saving of resources in this respect could be more effectively applied in other areas.

2.7.9. *Question: Should there be a limitation on the number of examination attempts, or on the time allowed to pass part or all of the examinations?*

[Note: One such rule which has been discussed is to allow 4 years to complete the Institute's Group A subjects; and to allow a maximum of 3 attempts at any subject of the Group B examinations.]

2.8. *The decision making structure*

"Grant unto her whole Council and to all that are put in authority under her, that they may truly and indifferently minister justice"

BOOK OF COMMON PRAYER

2.8.1. It seems appropriate to end the main section on 'policy' with a brief review of the structure of committees which gives rise to the formulation of educational policy and its implementation.

This topic is included mainly for the purpose of information rather than discussion.

2.8.2. The diagram on page 10 illustrates the relationship between the various committees, etc., concerned directly or indirectly with educational matters. It covers Institute and Faculty in recognition of the extensive co-operation which takes place between the two bodies.

2.8.3. It should perhaps be mentioned that the structure is serviced by the permanent officials of the Institute and Faculty who, with the Director of the ATS, provide a common link between the different parts. There is a tendency within the Institute for more of the implementation to be delegated to the permanent officials, leaving the committees to concentrate on policy questions.

2.8.4. This structure of policy making may be germane in considering the questions posed in § 2.2.

3. IMPLEMENTATION

3.1. *The relationship with policy*

The matters contained in this main part of the note are predominantly concerned with the implementation of policy; although in some respects there are consequential implications for the policy itself. For example, the role of universities can be viewed either as a fundamental question of policy or as one of the channels through which its aims are to be achieved.

3.2. *The form of the examinations*

“Examinations are formidable even to the best prepared, for the greatest fool may ask more than the wisest man can answer”

COLTON

3.2.1. The examination for each subject, whether concerned with actuarial principles or their application, is conducted by written papers. A candidate passes or fails solely on his performance in the examination judged by the script submitted.

There is no choice of questions in the examination paper; all must be answered to maximize the total marks awarded.

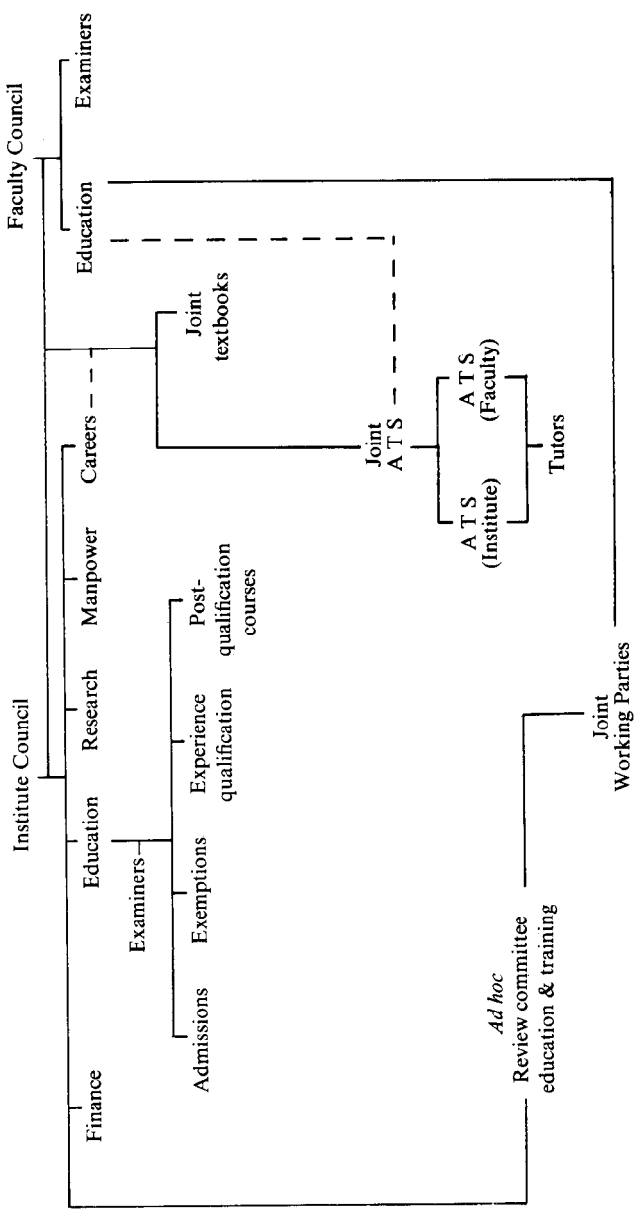
The subjects in actuarial principles (Institute Group A, Faculty Parts 1–5) are examined twice a year in the spring and autumn. The ‘application’ subjects are examined annually in the spring.

3.2.2. The examination course of reading is reviewed once a year with a view to keeping the syllabus abreast of current developments.

3.2.3. It is customary at most universities to employ a process of continuous assessment of a student’s work rather than rely solely on his examination performance.

It seems something of a lottery that a whole year’s study should stand or fall by the student’s performance on one day in a paper in which there is no choice of questions.

The decision-making structure for educational matters



In the Institute's spring 1980 examinations there were 372 candidates with a good ATS study record (i.e. they had completed all the test papers and obtained average marks in excess of 70% for Group A subjects or 65% for Group B). Yet 112 of those candidates failed the examination. It must be demoralizing for such students with a track record of hard study, to see a year's work come to naught.

3.2.4. Throughout the examination syllabus candidates are required to demonstrate that they have a practical approach to practical problems. Most questions are designed to test this attribute, particularly in the subjects concerned with the practical applications.

All papers have to be completed within a fixed time limit, usually three hours. Students vary in their speed of thought, and their ability to write quickly. Candidates therefore suffer varying degrees of handicap in being constrained by a rigid time allowance. Bearing in mind that in real life much actuarial work requires deliberation and diligent research it is difficult to see why speed should be regarded as *of the essence* in the examination room.

3.2.5. It is common practice in university examinations to permit the candidate some degree of choice in the questions to be answered. This may be seen as an attempt to reduce the 'lottery' element, on the supposition that few, if any, candidates ever enter the examination with complete mastery of every aspect of the subject.

Much the same may be said of candidates for the actuarial examinations; the 'no choice' approach therefore introduces an element of lottery which applies with particular harshness to the later parts of the examinations where there are usually no more than four questions in each paper.

3.2.6. The holding of twice-annual examinations for the earlier subjects gives failed candidates the opportunity of a re-sit without having to wait a whole year. This merit might be seen as having even greater force for the later subjects and it is difficult to see the logic for the differentiation, apart from the additional workload on examiners.

Perhaps if the existing 'lottery' element were reduced it would be feasible to revert to annual examinations for all subjects as there would be fewer 'hard luck' cases among the failed candidates. Tutors and examiners would then be relieved of much pressure at an awkward time of the year.

3.2.7. It seems admirable that the examination syllabus and course of reading should be kept fully up-to-date. However, the 'lead-time' in the examination timetable is very long; for example, the course of reading for the 1983 examinations was decided in December 1981. The degree of up-to-dateness is therefore somewhat ancient by the time the examinations take place.

It may be questioned whether there is in fact any particular merit in continuously striving to be up-to-date. A newly qualified actuary will be out of date within a short time of completing the examinations; indeed his knowledge of the earlier parts will already be out of date long before he qualifies. The essence of the examinations is to test his grasp of principles and practicability, not his knowledge of up-to-the-minute detail.

The assiduous annual pursuit of up-dating the course of reading therefore achieves an entirely spurious impression. Bearing in mind the disproportionate workload created for Institute and ATS staff, examiners and tutors, there may be considerable merit in changing the course of reading at less frequent intervals.

3.2.8. *Question: Should the examinations be augmented by some form of continuous assessment (based for example, on ATS tuition records)?*

3.2.9. *Question: Is there a case for relaxation of the fixed time limits for completing the examination papers?*

3.2.10. *Question: Should candidates be allowed some choice of questions in the examination papers?*

3.2.11. *Question: Should we reconsider the frequency at which examinations are held?*

3.2.12. *Question: Is it necessary to revise the examination course of reading every year?*

3.3. Examination standards

“To be, or not to be: that is the question”

SHAKESPEARE

3.3.1. Most aspects of examination standards are covered incidentally in § 3.2.

It remains to consider in this section the question of the pass rates in recent years as giving an overall impression of the stringency of the examination standards.

3.3.2. The following are the average pass rates at all examination centres combined for the Institute examinations held over the *two years* to May 1981 inclusive.

Subject	Total number of candidates	Number of passes	Pass rate (%)
A1	402	113	28
A2	1380	487	35
A3	919	370	40
A4	833	248	30
A5	669	252	38
A6	948	303	32
Group A	5151	1773	34
B1	991	238	24
B2	741	206	28
B3	769	207	27
B4	858	270	31
Group B	3359	921	27
All subjects	8510	2694	32

3.3.3. The following statistics relate to candidates at the *home* examination centres. They provide an indication of the number of times students sit the same examination.

Percentage of candidates sitting			
	1st time (%)	2nd time (%)	3rd time or more (%)
Group A	61	13	26
Group B	41	27	32
			Total (%)
			100

Pass rate of candidates sitting			
	1st time (%)	2nd time (%)	3rd time or more (%)
Group A	43	40	32
Group B	35	33	25
			Overall (%)
			40
			32

The significant proportion of 'multi-fail' candidates reflects the relatively low pass rates; it also provides a measure of the workload incurred in respect of failures by examiners, tutors and, of course, the students themselves.

Also noticeable is the deterioration in the pass rate with each successive sitting.

3.3.4. It has been understood that practical experience of an applied field is not necessary in order successfully to approach the relevant examination. Nevertheless, students generally find that subjects in which they have no experience present greater difficulties than those with which they are familiar.

After the May 1980 examinations an analysis of home students who were within 1 or 2 parts of completing the examination syllabus showed the following number who had failed an outstanding subject 3 or more times:

Subject B1	14
Subject B2	29
Subject B3	33
Subject B4	38
	<hr/>
	114
	<hr/>

These figures prompted the ATS to arrange special seminars for some of the students concerned; the corresponding position after the May 1981 examinations was as follows:

Subject B1	6
Subject B2	27
Subject B3	52
Subject B4	35
	<hr/>
	120
	<hr/>

There is some evidence here of a significant number of students who, within a stone's throw of completing the examinations, are frustrated by being stuck on particular subjects in which they are generally without practical experience.

3.3.5. It is axiomatic that we must ensure that the quality of our qualified members fully accords with the competence required to maintain the status and standing of the profession. The stringent standards of the examinations are designed to safeguard the excellence of that reputation.

3.3.6. *Question: Would the excellence be significantly diminished if there were some relaxation of the examination pass standard? (Note: Consideration of this question might be linked with that posed in § 2.7.9, an increased stringency in one respect balancing a relaxation in another.)*

3.3.7. *Question: To assist students who lack practical experience in particular subjects (especially B3) should the Group B subjects be examined at a two-level option (ordinary and advanced)?*

3.4. *The role of the examiners*

"The quality of mercy is not strain'd, . . . It blesseth him that gives and him that takes"

SHAKESPEARE

3.4.1. Traditionally the examiners have operated at arms-length from other parts of the educational system. The setting and marking of papers, and the determination of the pass standard have been the sole prerogative of the examiners.

3.4.2. The Board produces three types of report on the examination results:

(i) A report to each failed candidate indicating a grading:

FA—A modest improvement in performance is necessary to reach the pass standard. Attention to the detailed comments provided in the examiners' report [see (ii) below] should enable the candidate to deduce in which respect his answers fell short of the standard.

FB—A substantial degree of improvement is necessary to reach the pass standard.

FC—A very substantial degree of improvement is necessary if the pass standard is to be reached. If the candidate has genuinely applied sufficient time and effort to his preparation, and has had previous reports similar to this one, the result suggests that he should consider discussing his future course of action with an actuary or with the Institute's educational staff.

These grades are normally defined by marks in the following ranges where the pass mark is 50% and proportionately for other pass marks.

FA 42–49%; FB 30–41%; FC under 30%.

In FA cases there is also an indication of how individual questions were answered in relation to the possible marks:

Slightly below standard	(42–49%)
Weak	(30–41%)
Showed little knowledge	(under 30%)

- (ii) A summary report on how each question was answered by students in general.
- (iii) A statistical report on various aspects of examination performance analysed by a number of criteria.

3.4.3. Understandably, the examiners firmly resist becoming involved in inquests into the results of individual candidates. And, in general, they are unwilling to expand on the curt comments in the report to each failed candidate. These comments are not always useful, and can sometimes be positively misleading.

In special circumstances (e.g., where a well prepared candidate has inexplicably failed the same subject several times) the relevant examiner may accede to a request to elaborate on the student's performance. This imposes on the examiner the task of retrieving and re-reading the original script in order to identify and extract the salient weakness. It is not, therefore, a facility which is encouraged or widely used.

3.4.4. The examiners decline to publish model or guideline solutions to the examination questions; failed candidates are therefore unable to discover where they went wrong in their attempts.

3.4.5. The above philosophy contrasts sharply with the arrangements to be found at many universities. There, the roles of tutor and examiner become merged, or at least there is open co-operation between them. And examination attempts are freely discussed and dissected presumably on the principle that students learn best from their mistakes.

3.4.6. It may be supposed that there is a wealth of material hidden away in the marked examination scripts of failed candidates which would be of inestimable value to them in re-directing their future studies.

3.4.7. In recent years there has developed a useful exchange of views between the principal examiners and tutors which has been particularly helpful to the latter in planning ATS tuition courses.

There seem to be several avenues along which this co-operation might be extended to the benefit of students without breaching the autonomy of the examiners.

3.4.8. *Question: Is there support for the suggestion that the examiners should publish at least outline notes of guideline solutions to the examination questions? (After the examination of course!)*

3.4.9. *Question: Should the examiners make marked examination scripts available to failed candidates (direct or via their tutors); on the understanding that there would be no question of their being used to challenge the marking?*

3.5. Tuition: the choice of methods

“Example is always more efficacious than precept”

SAMUEL JOHNSON

3.5.1. The examinations are conducted specifically on the basis of the prescribed course of reading. It is possible, and permissible, for a student to prepare for the examinations without recourse to any formal tuition arrangements in the knowledge that the items in the course of reading define the limits of the examinations.

3.5.2. Nevertheless, at each examination sitting over 90% of candidates will have an Actuarial Tuition Service course in the relevant subject; and during their examination career virtually all students will take an ATS course at some stage.

3.5.3. Several universities offer degrees or diplomas in actuarial science leading in some cases to the possibility of exemption from parts of the examinations. This may be seen as a substitute for ATS tuition; and is discussed more fully under the role of universities.

3.5.4. The geographical dispersal of actuarial students world-wide and country-wide has meant that the primary method of tuition provided by the Actuarial Tuition Service has been the postal correspondence course. The main value of such courses lies in the series of tests which may be worked by the student and submitted for marking by the ATS panel of tutors.

3.5.5. The weakness of the correspondence course method is the absence of direct contact between student and tutor. Although tutors endeavour to help students with written comments on their test attempts this is less effective than face-to-face discussion of problems and difficulties.

3.5.6. An analysis of the examination performance of ATS students who had conscientiously completed the entire course of study tests shows that when they sat the subject in question the *failure rate* was:

31% for Group A subjects

53% for Group B subjects

For less dedicated students the failure rates were considerably higher.

These results suggest that actuarial students do not in general find correspondence course tuition an altogether effective method of study.

3.5.7. It is not, therefore, surprising that there is a strong demand from students for various forms of oral tuition.

The provision of tuition classes encounters several awkward problems:

- (a) It makes considerable demands on the time of tutors.
- (b) It is difficult to organize except in areas where there is a sufficient concentration of students to support classes of viable size.
- (c) As a corollary of (b), it may be regarded as divisive to offer the privilege of special tuition facilities to students in certain locations and not in others.
- (d) It seems to lead some students to regard classes as a substitute for, rather than a reinforcement of, regular private study.

3.5.8. Despite these problems the ATS has endeavoured to organize various types of class tuition. The present facilities are summarized as follows:

Discussion classes. The usual practice is for the tutor to select particular topics for discussion; the topics may be selected by the tutor after sounding out the needs of the students attending. The numbers of students participating varies widely depending upon the location and the subject; the greatest benefit is probably derived if the number does not exceed about 15, otherwise discussion tends to be inhibited.

Tutorials. These are conducted in groups of 6–8 students who attend a series of meetings with their tutor to discuss in sequence the ATS tuition tests which will have been worked and marked beforehand; they are confined to Institute Group B subjects. Each meeting is focussed on a particular test and each student's attempt is discussed in relation to the model solutions. Tutorials are probably the most effective and popular form of face-to-face tuition; they are also expensive in terms of tutor manpower and time.

Seminars. These are a recent innovation to try to assist students who have nearly completed the examinations but are stuck on a particular subject having failed it several times in succession. They last a whole day and are normally conducted by a senior tutor with past experience as an examiner. The number of students is limited to 6–8, the object being to discuss in depth their performances in previous examination papers with a view to identifying and resolving underlying difficulties in their approach to the examination. They also are expensive in terms of tutor manpower especially in view of the fact that the tutors are usually actuaries of considerable experience.

University lectures. The ATS has made arrangements with certain universities for their academic staff to give a series of lectures in the subjects of the syllabus concerned with actuarial principles. This is a new venture which initially has been heavily over-subscribed; it therefore seems likely to be a growth area.

3.5.9. Subject to a few restrictions, students have considerable freedom in arranging their individual schemes of study. There is no fixed timetable of study or test working, except in the case of students attending tutorials who are obliged to synchronize their work with the class meeting. Nearly one-half of ATS students fail to submit any tests for marking; their pass rate of less than 20% compares with a pass rate of nearly 60% among students who complete all the tests.

This generally relaxed approach is not a good basis for disciplined study (a major benefit of the tutorials is that they do impose a regulated and orderly system of study on the students concerned). A more rigidly structured timetable for working ATS courses might help students; and might be welcomed by tutors.

3.5.10. Most of the textbooks in the course of reading are written by actuaries in their spare time. Successive chairmen of the Joint Textbooks Committee have learned that in this activity the road to hell is indeed paved with good intentions.

The pursuit of up-datedness in the course of reading (see § 3.2.7) means that textbooks rapidly become out of date; and have to be up-dated and augmented by Special Notes, for which further authors need to be recruited.

The ATS tuition courses (which are not part of the official course of reading) are written by the Principal Tutors, again in their spare time. And inevitably the annual revision of the course of reading creates the necessity of corresponding up-dating of the tuition courses.

Apart from the question of frequency of up-date (see § 3.2.12) the above processes involve duplication of effort. If the ATS course material were integrated into the official course of reading there would be scope for rationalization of the work involved.

3.5.11. *Question: Leaving aside the problem of resources (which is considered in § 3.6) should the ATS continue to develop the provision of various forms of class teaching as a more effective form of tuition than correspondence courses alone?*

3.5.12. *Question: Should ATS tuition courses become part of the official course of reading?*

[*Note: This would imply that it would be mandatory for all students to purchase ATS courses.*]

3.5.13. *Question: Should the ATS issue its courses for each session on the condition that lessons and tests had to be worked and submitted for marking according to a pre-determined timetable?*

3.5.14. *Question: Should entry for an examination be permitted only to students who had completed a satisfactory course of study with the ATS? (See also § 3.2.8.)*

3.6. *Tuition: the tutors*

"But where's the man, who counsel can bestow, still pleas'd to teach, and yet not proud to know"

POPE

3.6.1. Most of the panel of ATS tutors are working actuaries pursuing full-time careers in the usual fields of actuarial work. Their service for the ATS is contributed in their spare time.

3.6.2. They are normally recruited one or two years after completing the examinations and serve as tutors on average for about 3 or 4 years. In many cases they may serve as assistant examiners before becoming tutors; sometimes the other way about. A member cannot be both examiner and tutor at the same time in the same subject.

3.6.3. Service as a tutor or examiner is not obligatory; all who participate in these activities do so from a sense of obligation to the profession and to the next generation of students.

3.6.4. Tutors are paid an honorarium dependent upon the number of tests marked and the number of classes conducted. The amount does not represent the true economic value of the work performed.

3.6.5. As a general rule tutors will not have received any training as teachers; nor will they necessarily have any particular aptitude for teaching.

3.6.6. Most tutors will be in the age groups where they have considerable domestic and family responsibilities.

They will also be at a critical stage in their career development where they are taking on additional responsibilities; current trends suggest that actuaries may be reaching positions of seniority at younger ages than hitherto.

It is natural and inevitable that tutoring duties will take third place to the prior demands of domestic and office responsibilities.

3.6.7. In the course of a year about 15,000 tests will be submitted for marking, the work being spread over about 220 tutors.

Obviously the greater the number of tutors the lighter is the spread of the marking workload among them. The lighter the work the easier it becomes to recruit tutors and to persuade them to extend their period of service.

3.6.8. A Principal Tutor is appointed for each examination subject; he or she will usually have served for some years as an ordinary tutor. The responsibilities of the Principal Tutor include giving assistance and advice to the ordinary tutors, consulting with them with regard to the course of reading, liaising with the Principal Examiners and submitting recommendations to the Director for changes in the course of reading.

The Principal Tutor is responsible for the writing and up-dating of the tuition courses, possibly assisted by ordinary tutors.

The Principal Tutor usually becomes a member of the ATS Sub-Committee (Institute or Faculty as appropriate).

3.6.9. It is no criticism of tutors to say that the quality of ATS service to the students is necessarily limited by the conflicting demands on the tutors' time.

It is apparent that some of the questions posed in § 3.5 would involve an expansion in ATS activity which would be insupportable on the existing basis of the panel of spare time tutors.

3.6.10. This poses the *Question: Should the ATS reinforce its panel with full time tutors?*

The problems are daunting. It is difficult to envisage how to develop for such tutors a career structure which would appeal to suitably qualified actuaries. And an appropriate salary structure would radically alter the financial basis of the ATS.

3.6.11. This gives rise to an alternative *Question: Should we look to where full time teaching staff already exist, namely the universities? (See § 3.8 the role of universities.)*

3.7. Tuition: the students

“Hope springs eternal”

POPE

3.7.1. At any one time the total number of students actively studying for the

examinations of the Institute and the Faculty is about 3,000; the total number of ATS tuition courses in issue is in the region of 4,000.

Roughly one-third of the students are outside the United Kingdom.

3.7.2. About 95% of students are university graduates, the remaining 5% having entered straight from school.

3.7.3. Most students are employed full time in actuarial work with insurance companies, consultants, etc.

Most employers allow time off for study and in general the annual allowance is on a scale comparable with the official recommendation of one day a week for 40 weeks or its equivalent.

3.7.4. Students are conditioned by their school and university background to a structured and guided method of study. The unsupervised and self-motivated approach required by current actuarial tuition does not always come easily to them.

3.7.5. A conscientious average student probably needs to spend between 2,000 and 2,500 hours of concentrated study to complete the entire examination syllabus within a reasonable time span. This is a daunting task. Assuming a 35-week study year, the times taken to complete the examinations at various levels of dedication would be, for example:

- | | |
|---|----------|
| (a) Daytime study leave only (assumed to be 7 hours per week) | 10 years |
| (b) Daytime study leave plus 3 hours of private study per week | 7 years |
| (c) Daytime study leave plus 11 hours of private study per week | 4 years |

3.7.6. This study commitment needs to be viewed against the competing demands of office work, domestic responsibilities; and attitudes towards leisure and other outside activities.

3.7.7. The effects of 'consumerism' influence the views of students with regard to the quality of service offered by the ATS. Considerations of 'value for money' are deferred to a later section (3.9).

3.7.8. *Question: In modern conditions does the above time-honoured philosophy of part time study any longer provide the best approach to the education and training of actuarial students?*

3.7.9. *Question: If the answer to § 3.7.8 is 'yes' do we need a more controlled and disciplined system of tuition?*

(See question § 2.7.9 re limitations on examination attempts; and also the questions in § 3.5.)

3.7.10. *Question: If the answer to § 3.7.8 is 'no' should we develop and expand a tuition system based, at least in part, on full time study? (e.g., full time university courses in actuarial science.)*

3.8. *Tuition: the role of the universities*

"Study is like the heaven's glorious sun,
That will not be deep-search'd with saucy looks;
Small have continual plodders ever won,
Save base authority from others' books."

SHAKESPEARE

3.8.1. The following universities offer honours degrees in actuarial science of such calibre as may lead to exemption from some or all of the professional examinations on subjects of actuarial principles (Institute Group A, Faculty Parts 1 to 5):

Cape Town
City, London
Heriot-Watt, Edinburgh
London School of Economics
Macquarie, Sydney
Kent (proposed)
Witwatersrand, Johannesburg (proposed)

In addition, Southampton University includes in certain of its degree syllabuses topics in actuarial science which may qualify for exemptions.

3.8.2. City University offers a 2-year post-graduate Diploma in Actuarial Science on a part time basis; holders of the Diploma may be considered for exemption from some of the examination subjects in actuarial principles.

3.8.3. The ATS has arranged with certain universities for lecture courses in actuarial principles to be provided for outside students:

City
Heriot-Watt
Southampton

3.8.4. The universities bring to actuarial education the strength of its being taught by full time tutors who are by aptitude and training professional teachers; also tuition is conducted on a face-to-face basis through lectures, classes and tutorials.

3.8.5. The above activities lead naturally into an involvement of the universities in post-qualification education. They have the expertise to offer teaching in advanced topics and techniques; and they have the resources to conduct and co-ordinate research projects.

3.8.6. *Question: Is there support for the continuing evolution of the above roles for the universities?*

3.8.7. *Question: Do we envisage that eventually the role of the ATS might be confined mainly to the Institute Group B subjects (Faculty Parts 6-8)?*

3.9. Tuition: finances

“Annual income twenty pounds, annual expenditure nineteen nineteen six, result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery.” (Mr Micawber)

DICKENS

3.9.1. Ostensibly the ATS is financially self-supporting. It receives no explicit subsidies from members generally; and each year the tuition fees are fixed at the

levels required to cover the anticipated running costs of the service. With one exception these costs are determined on a realistic commercial basis; the exception being the honoraria paid to tutors who therefore, in effect provide a hidden subsidy.

3.9.2. It is a conjectural exercise to try to estimate the value of the subsidy; some clues may be provided by the following cost comparisons (although they are not strictly like-with-like).

City University's part-time Diploma course in actuarial science covers Institute subjects A2, A3, A4 and A6 at a total non-residential fee of £600; the corresponding ATS tuition fees for the same subjects amount to £265.

3.9.3. Most actuarial students are assisted in the payment of tuition fees in whole or part by their employers. It may appear a strange sort of generosity that actuarial employers should be the ultimate beneficiaries of the tutors' self-sacrifice.

3.9.4. The comparison in §3.9.2 is not strictly between equals. The ATS represents a 'cut-price' self-help system using spare time tutors. The university diploma represents a de luxe structured approach using full time professional teachers.

The latter may be a means of shortening the time taken to pass the examinations and should be welcomed by the profession. Perhaps employers may be less enthusiastic.

3.9.5. The ATS tuition fees may appear comparatively modest but in absolute terms they represent a considerable outlay for what students may regard as a fairly basic service.

The cost effectiveness of the ATS is impaired by :

- (a) The immense workload that is incurred in annual course revisions made necessary by frequent changes in the course of reading.
- (b) The costs of providing revision courses for the high proportion of examination failures.
- (c) The costs of tutoring the high proportion of students who eventually abandon their studies and leave the profession.

Although the structure of tuition fees is intended to reflect the relative costs of the various courses and facilities, it is to be expected that students with difficulties will tend to absorb a disproportionate amount of administrative and tutorial effort.

Some filtering of students by an examination limitation rule would enable the ATS to concentrate its resources more effectively on the survivors.

3.9.6. *Question: Should the tutors' honoraria be on a more generous basis? If so, should the cost be met by increasing tuition fees so that the burden is borne by the students (or their employers); or should part of the cost be subsidized by the membership generally through increased contributions?*

3.9.7. Apart from the specific question posed in this section some of the above considerations are germane to questions raised elsewhere in this note.

3.10. Students overseas

"All happy families resemble one another."

TOLSTOY

3.10.1. About one-third of the students are outside the United Kingdom; they are therefore an important group which deserves some special consideration.

3.10.2. An investigation of the Institute 1980 examination results reveals the following pass rates.

	Group A (%)	Group B (%)
U.K. and Republic of Ireland	37	31
Australia, New Zealand & South Africa	33	24
Elsewhere	19	9

These comparative results are a reflection of several factors acting singly or in combination:

- (a) Lack of class tuition.
- (b) Unfamiliarity with the U.K. working environment.
- (c) Absence of actuarial contacts and advice.
- (d) High costs of ATS courses and textbooks in terms of local currency (aggravated by escalating postal charges for overseas mail); students being obliged to share tuition material or to make-do without courses.

3.10.3. There is probably not a great deal that can be done with regard to (a), (b) and (c). It might be possible to mitigate the effects of (d) although it may not greatly affect the outcome. Nevertheless, perhaps some consideration could be given to this problem.

3.10.4. *Question: If it were decided as a matter of policy to charge lower scales of ATS fees to non-U.K. students who would provide the implied subsidy:*

- (a) *U.K. students (or their employers), through correspondingly higher fees;*
- (b) *the general membership, via increased subscriptions (all members or U.K. members only)?*

3.11. Manpower

"Never in the field of human conflict was so much owed by so many to so few."

CHURCHILL

3.11.1. During the course of a year something like 400 qualified members will be actively engaged in the educational process as examiners, tutors, authors of textbooks and special notes; all on a spare time basis.

3.11.2. This represents a significant proportion of resources (almost entirely from U.K. members) which is tied up in the examination system; to the detriment of research and post-qualification education.

3.11.3. If there is general recognition of the need to develop these areas of

continuing education then we must seriously consider how we can release some of the resources from the examination system.

3.11.4. *Question: How can we use the limited resources of manpower to be most cost effective (in terms of the performance of the educational system in providing trained and qualified actuaries)?*

3.11.5. *Question: How can we best use outside professional teaching to assist and to release our own limited resources for educational work outside the examination system?*

3.11.6. These are themes which, explicitly or implicitly, have run through many of the topics considered in this note.

4. CONCLUSION

4.1. Although this note has brought up a number of topics there are many others which remain unmentioned. Even so, the material presented here provides a generous menu of issues for discussion. Many of them are inter-related and it is difficult to discuss them in isolation; to edit out some of them would impair the full consideration of those that remain.

4.2. This note does not set out to be a carefully researched paper; had that been the intention the compiler would have been constrained to concentrate on no more than one or two particular issues.

Rather the approach has been to throw out a number of ideas, some possibly contentious, with the intention of provoking discussion. That may have required the compiler to reveal more of his own views than he might otherwise have intended.

4.3. Perhaps what may emerge from the discussion is an impression of a consensus of sentiment as to the general direction in which the educational system should move in the next 5–10 years. If that provides a basis for action the discussion will have been justified.

“This is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning.”

CHURCHILL

REFERENCE

- (1) W. S. Jewell: “Generalised Models of the Insurance Business” (ICA, 1980).

ABSTRACT OF THE DISCUSSION

Mr R. W. Douglas (opening the discussion): The question in § 2.1.4 is fundamental to any debate on the education of actuaries. An examination of the Royal Charter of Incorporation of the Institute and the current potential statutory duties of an actuary indicate a core syllabus which should provide all actuaries with a knowledge of probability, statistics, life contingencies, compound interest as well as a somewhat ill-defined knowledge of investment theory and financial markets. Therefore we must question the inclusion of B3 within our existing examination syllabus and also significant elements of the material relating to accounts and investment analysis.

My aim is not to impose an unnecessarily restrictive definition upon essential actuarial knowledge, but to delineate between the core syllabus and those subjects where actuaries, with extended training or experience, may make valuable contributions. The most efficient way to extend the boundaries of actuarial employment is by co-ordinated and structured post-qualification training. If we extend the syllabus, we shall court the criticism of being "shallow know-alls" as noted by the author.

A considerable change of emphasis is required in the volume and character of post-qualification training. The Institute currently provides refresher courses, planned study notes, research and a professionalism course. The first three items are difficult to promote to a wide audience. However, the professionalism course, and the courses organized by the Students' Society on marketing, computer appreciation and effective speaking, have a wider appeal. A more efficient use of resources would be achieved through the planned development of a structured set of seminars or courses designed to deal with the extended training in basic actuarial subjects, to develop interest in peripheral areas of actuarial employment and to encourage the continued education of Fellows.

Their creation would demand substantial resources and this could be greater than any manpower savings due to a contraction in core syllabus. However, significant use could be made of the resources available through universities, colleges and commercial training organizations, as has been demonstrated by courses organized for the Students' Society by outside agencies.

A well-planned, wide-ranging set of post-qualification courses could provide an acceptable means of introducing some element of compulsion into continuing professional education. It is not unreasonable to require all qualified members to attend at least one such course of their own choosing every 3 years. Even the most reluctant should be able to find a subject where their working knowledge could be enhanced in a relevant and practical manner.

The establishment of satisfactory post-qualification courses may ease the revision of reading material for examination. Such courses could provide a suitable forum for disseminating information relating to technical, financial and economic development. The system could also answer the question posed in § 3.3.7. Post-qualification courses could deal with the 'advanced' level aspects of the Group B subjects, whilst all students would be examined at the 'ordinary' level.

However, this system of increased post-qualification training would be inapplicable to overseas members and could lead to a formal recognition of two classes of qualified members, i.e. those working within the U.K. and participating in post-qualification training, and those employed overseas who are unable to partake of such training and would be barred from performing certain U.K. statutory duties. This is unfortunate, but may be unavoidable if the training and educational functions of the Institute are to meet the needs of home members.

A systematic approach is needed for the monitoring of technical developments and the revision of the examination syllabus and post-qualification training courses. No such formal monitoring system exists at present and there are strong grounds for converting the *ad hoc* review committee on education and training into a formal committee to create policy. The committee would review continuously developments in actuarial and associated fields and put forward recommendations for the incorporation of new material into the examination syllabus, the post-qualification courses and areas of potential research.

I do not believe that any wholesale raising of the academic requirements for admission to the Institute would serve any significant purpose. As non-graduate students represent only 5% of the

total, they cannot be blamed for the substantial failure rate in the examinations. Motivation plays an important rôle in distinguishing the successful students from the remainder, and an increase in the graduate requirement from a third-class honours degree to a second may deter those whose capacity for rigorous study is limited. I am not in favour of an aptitude test in the entry requirements, since there is no test capable of assessing motivation with greater success than the existing entry requirements to the Institute.

The possible recognition of the status of 'actuarial technician' as in §2.5.6, is worthy of serious consideration. The existing qualifying procedures do not provide any formal recognition until all examinations have been passed. A significant number of people find satisfying employment as 'actuarial technicians' having passed most or all of the Group A subjects, and a formal recognition of their status would provide a concrete reward for their efforts. Such a title would help employers in distinguishing between jobs which require qualified actuaries and jobs for which 'actuarial technicians' would be sufficient.

The status of 'actuarial technician' could be given on completion of the Group A subjects, and I am not in favour of establishing a separate set of examinations since there is not sufficient demand to warrant such a development, nor sufficient resources available to establish the necessary structure. This does not mean that such developments should be rejected forever, since similar devices work well for the Chartered Institute of Public Finance and Accountancy and the Association of Certified and Corporate Accountants, who have jointly supported the development of the Association of Accounting Technicians.

Mr S. Haberman: Actuarial departments and groups in U.K. universities have not realized their full potential, particularly in respect of part-time teaching. There are five activities that could be developed and they are the full time 3-year degree courses, the lectures for students enrolled with the ATS, the part-time diploma courses, the post-qualification courses, and research.

The problems with tuition by correspondence courses concern principally the intensive use of part-time manpower and the failure of correspondence courses to work satisfactorily as a means of education without direct tuition. Universities are experiencing pressures to restrict their intake of undergraduates and have financial problems.

Therefore the universities' rôle should develop by providing part-time courses and lecture series for trainees in employment studying the Group A subjects. Encouraging the universities to assist with part-time courses would benefit the education of students and would indirectly benefit research and the organization of post-qualification courses by freeing tutors and examiners currently otherwise involved in the system. The geographical spread of the universities could be used to match the corresponding spread of the profession.

The only course run completely by a university to replace the ATS courses is the 2-year part-time diploma in Actuarial Science at the City University. Its aim is to accept graduates, probably exempt from subject A1, and to cover subjects A2, A3, A4 and A6 up to exemption standard as well as to provide some optional courses such as an introduction to A5 or Group B subjects.

In §3.9.2 the cost of this course is compared with the corresponding ATS courses. The diploma began in 1981, with the course fee for 2 years being £690. The cost for the corresponding ATS courses was £265, to which should be added £81 for examination fees. So we should compare £690 with £346 and ask what the difference buys. The ATS courses provide some limited course material, tests and a marking service. The diploma covers four Group A subjects and provides over 350 hours of lectures and tutorials with a professional teacher, full sets of lecture notes to supplement and extend the textbooks, extensive example sheets and the marking of the student's solutions. Pricing these extra items at £344 is not excessive, even more so when comparing this cost with the cost of management courses or courses run by similar professional bodies, for example, the Institute of Chartered Accountants, or the forecasting course at the City University where the charge to participants is about £7 per hour.

The diploma began with an intake of five, and is probably running at a loss to the University. If support continues at this level it is likely that the programme will have to be terminated, given the financial problems being experienced by universities. However, this is one major area where universities should be encouraged to participate in actuarial education.

At least three universities have co-operated with lecture series to supplement ATS tuition courses. This is an important area where collaboration should be encouraged, but the expertise of professional teachers has not been tapped for developing course material including the provision of test questions and model solutions.

The universities' potential will not be fulfilled unless two further problems are solved. First, there would need to be more co-operation in the decision-making structure. When my department at the City University was set up in 1973 with considerable financial help from the industry and the profession, extensive advice was given by the Institute and the ATS on educational matters. Now we believe that our former mentors may be able to learn something from us and our colleagues at other universities. The second proviso is the financial cost involved in the need for more manpower in the universities. The problems involved in setting up a suitable career structure for full-time tutors, as raised in § 3.6.10, remain unsolved.

Mr C. D. Daykin: A broad indication of the lapse rates by duration is set out in § 2.7.3, which, in effect, represents a projection of what might be the experience of recent cohorts of entrants, although they take account of experience at later durations of much earlier cohorts. I would not expect the total proportion lapsing within 10 years to be much over 50% for the most recent cohorts of home entrants, whereas § 2.7.3 suggests 55%. This pattern represents a very significant change from the position a few years ago when the proportion lapsing in the first 2 years was only about 20% compared with over 30% for more recent cohorts and over 40% for the 1978 cohort. This is evidence that students are realizing at a much earlier stage than hitherto that an actuarial career might not be for them.

Considering the table in § 2.4.6, I do not think it very likely that ultimately 60% of home entrants will drop out. Recent experience has shown that 40% of most cohorts complete Group A examinations within 5 years, whereas this figure was less than 25% in the early 1960s. The ultimate breakdown of recent cohorts might be at the most 55% withdrawn, about 40% qualified and 50% having completed the Group A examinations with possibly one or two Group B subjects. Of the 40% who qualify, a quarter will complete the examinations in 4 years, a further quarter at durations 5 and 6, a third quarter by duration 9, and most of the rest before 16 years. More people will complete at durations 4 and 5 than at any other duration, but the average time for completing the examinations will still be over 7 years because of the long tail of the distribution.

Over the last 10 years 155 students have completed the examinations within 3 years of enrolling, so it cannot be deduced either that the syllabus is too long or that the examinations are too difficult. The delays in getting through the examinations are often because students choose to take them steadily. The opportunities for effective study when employed full-time are limited when compared with university life, and many prefer not to devote themselves 100% to studying for examinations.

A number of students who are making a real effort to understand the subjects fail the examinations because of an inability to cope with the pressures of the examination situation or because of a weakness in their ability to express themselves in English. This last observation derives mainly from my 5 years as a tutor for the Institute examinations, where I found considerable lack of clarity in students' answers to test questions, even when studying for a Group B subject. For those failing because of examination pressures, there is a good case for including a dissertation or written report prepared outside the examination room. There is also scope for tightening up on the entry standards to ensure that students have the ability to communicate both orally and in writing.

The principal wastage of qualified manpower is in tutoring and examining students several times over for the same examination. I am sceptical as to whether an overall limit on the time to qualify would have the desired effect of limiting wastage other than in a rather brutal and non-discriminating fashion. A more productive approach would be to ensure that candidates do not take on more subjects at a time than they are prepared to devote themselves to whole-heartedly, and that candidates are not permitted to present themselves for examination until they are reasonably well prepared.

Mr D. E. Purchase: Throughout the mid-1970s the mean time taken by U.K. candidates to complete the examinations was reasonably constant between $5\frac{1}{2}$ and 6 years. It has increased steadily since 1978 and the latest value is 6.9 years. Mr Daykin has pointed out that it is affected by the long tail, but even

the median time has correspondingly increased. It was steady at 5 years and is now 7. This trend is disturbing, and I wonder how much it is the result of the introduction of a fourth compulsory Group B subject.

We should pay particular heed to the author's comments in § 2.4.3-4. Ours is a practical rather than a theoretical profession, and if the emphasis in the examination is moved too far, we may place difficulties for some who might previously and deservedly have qualified.

The author has suggested that an annual updating of the course of reading is unnecessary, but he has also asked how we ensure that new developments are filtered into the examination system. The opener proposed that the *ad hoc* review committee on education and training should have a permanent duty in this regard. An alternative is to continue with occasional major reviews, but to ask the Research Committee to take on the continuous monitoring suggested. The problem of producing updated textbooks in Group B subjects may be even greater than the author suggests. The rate of change mentioned is so great that the actuaries capable of writing these textbooks are those most deeply involved in the relevant areas of work in their normal occupations, and so are least able to take on the additional burden. Perhaps we need to consider moving to a course of reading consisting primarily of the ATS courses, special notes and published papers. The process of updating could then become more continuous, with a corresponding smoothing of the work to tutors and others, including the ATS office, who have to cope with it.

Paragraph 3.2.5 advocates some degree of choice in examination questions. I would agree, and I see the need far more in Group A subjects where one small section of the reading missed or forgotten can spell disaster. However, the choice must not be too wide or candidates will be tempted to omit whole sections during their study. A choice is less necessary in Group B as reasonable answers can be given on the principles even if some detail has been forgotten. I am sympathetic towards some relaxation of the time constraint, although many candidates will submit even more irrelevancies than they do at present. I would not favour any form of continuous assessment because students could so easily seek unofficial guidance before submitting each test.

I would prefer to avoid the imposition of a time limit on examination attempts but it may become inevitable. Indeed, some students who have spent many years without qualifying have suggested that the Institute has a responsibility to introduce such a limit. If this comes about, I would plead for a limit expressed in terms of overall speed of passing rather than any limit on individual subjects or individual attempts. The rule might be that the number of subjects passed must be at least equal to the number of years taken. There are too many instances of students stuck on one particular subject for me to be happy with individual limits.

We worry too much about the need to cover the whole syllabus in every subject. Some relaxation to help candidates with blind spots would be desirable even if it meant a slightly higher pass standard being required. Perhaps the actuary with a good understanding of most subjects, albeit with a few small gaps, is better equipped for his professional career than the one with borderline passes all the way through.

Mr S. A. Carne: The paper shows that of each cohort of entrants approximately 60% fail to finish the examination course. This has been a consistent story for the past 20 years. Of any cohort no more than 40% have passed the examinations. About half of those who lapse are currently doing so after 1 or 2 years, and many begin a new career. There is something wrong with a system which attracts young graduates into a career plan and discards them a few years later as rejects. The paper suggests that an aptitude test might answer this dilemma, but I think there might be an alternative.

In the company where I work the lapse rate is much lower than 60%. It is closer to 6% and there are other companies like it. There are two possible reasons for this. Either these employers are more perceptive at spotting potential actuaries, or some employers, willingly or knowingly, take on students whom they realize will not eventually qualify. Presumably they take them on because they have a job for them in the early years. The Institute could benefit from conducting some research into this, with a view to either educating employers into detecting potential successes at an early stage or, if appropriate, discouraging the relevant employers from knowingly taking on people whom they realize are not going to qualify.

The time taken to pass the examinations has had a mean of 7 years and is rising, which is an

inordinately long time for a professional qualification. It is difficult to compare one profession with another. For example, lawyers have full-time study, and architects and doctors take about 7 years including a vocational degree. Probably the closest point of comparison is chartered accountancy where it is not unusual for a graduate to complete his examinations after 3 years, and very many have completed after 4. Not very many of our profession have completed the examinations after 3 or 4 years. Why do our examinations take so much longer? Broadly speaking, our examination system serves two purposes. It instils knowledge in a candidate and also tests the candidate for quality. It must be the instilling of knowledge that is taking the time and not the testing of quality. I am convinced that it is not necessary to take so long. Many Group A subjects contain very few basic principles. The bulk of the study is devoted to developing these few principles into problems which are progressively more complex. In other words, much of the examination system is geared to testing the ability to solve problems. This is true for compound interest, life contingencies, probability and statistics. Is it necessary to test problem-solving four times over? Once should be enough and twice ample. Why not condense compound interest and life contingencies into one course? It could cover all the basic principles, and yet there would be only one examination—still also testing the ability to solve problems. The same sort of approach could apply to probability and statistics. The entire syllabus could thus be condensed. The development of pension fund commutation functions is included in both A3 and B4. Questions occur in both examinations which are virtually identical. Why is there this repetition? In B1, life interests and reversions has not been examined for several years. It is in the syllabus but not in the examinations. Why should a student spend valuable time studying it? Could it not be included in post-qualification studies? I should like to see the unnecessary, the irrelevant and the repetitive work removed from the syllabus.

The usual argument against having a choice of questions is that the professional man gets no choice in the problems he will be asked to tackle. This is very true; but in the context of an examination it is not a valid argument. Consider a candidate who has studied the ten lessons of a course, but has had trouble with Lesson 4. Another student might be equally well-prepared, but his weak spot may be Lesson 6. Both go into the examination room, and Lesson 4 is tested, whereas Lesson 6 is not. The first student cannot make a sensible attempt at that question and is likely to fail. You may think that he deserves to, but what about the other student? His weak spot has not been tested, and so he has a much better chance of passing. In any examination having the right questions come up on the day has always been very important, but the element of lottery can certainly be reduced by allowing a choice of questions instead of making them all compulsory.

Profesor J. R. Gray, F.F.A.: Any examination failure is a waste of trained ability and potential. We have a duty to improve students' chances of succeeding while maintaining standards. It follows that if we improve the preparation, we must not also raise the hurdle or we will be back where we started. A high failure rate is partly due to the continuing unfair time element persisting in some of the examinations, and perhaps also to insufficient co-operation between the examiners and tutors. Excessive anonymity of examiners is something that perhaps should be broken down.

Another problem is the shortage of trained qualified manpower to do the range of things that have to be done to keep the profession healthy. Some attention should be given to streamlining certain of the procedures for examinations, and in particular, of joint examinations with the Faculty, where at the moment there is only statistics. I would hope that in future there will be other examples of this co-operative activity, and to achieve real savings we want to try to reduce the present structure of a Joint Panel, two Boards of Examiners, two Education Committees and two Councils. There is an excessive duplication of people looking over other people's shoulders.

I agree with the necessity of considering removing some theoretical probability and statistics from the professional syllabus, and including it as an entrance qualification. It does not necessarily mean that we have to move to a graduate profession, because there are quite respectable sixth-form school syllabuses covering that work. If we do not make such a move, there is a danger that the statistics component of the professional syllabus will become unacceptably large if desirable relevant applications are to be adequately included.

Specialized statistical topics, which may be relevant to general insurance, probably do not lend themselves to inclusion in a compulsory syllabus for all. It is difficult to imagine adequate instruction,

examining and learning in some of the more esoteric aspects of stochastic processes, time series, multivariate analysis and generalized linear models. It might be more realistic to ask universities to provide short courses or one-day seminars, not necessarily with associated examinations, to provide an opportunity for those interested in these topics to learn them. It is the opportunity to learn that is important. We do not need to require everybody to sit additional specialized examinations.

To help the manpower problem consideration should be given to a more extended use of the university dimension; of the provision of statistics examiners; of the before-mentioned special topic seminars, and perhaps a component of continuing professional education where universities could provide regular updating refresher courses at a lower level to indicate relevant developments in the subject. The universities could produce lectures and tutorials to complement the ATS and they should be a focus for research.

Mr S. P. L. Kennedy: We are told that there are 400 actuaries engaged in the examination process, and this represents something like 5 years' output of qualified actuaries in the U.K., and, furthermore, it is taking longer to produce them. The average time to qualify has been drifting up, but a number of universities, hampered though they may be by current financial stringencies, wish to introduce actuarial courses. Against this background I want to alter § 3.11.4 to "Question: How can we make the best use of the actuarial manpower available for education and training and research by, first, reducing the demands on practising actuaries; second, reducing the time taken to qualify, and, third, and most important, making fuller use of our universities?" If the time taken to qualify is reduced, the demands on practising actuaries will also be reduced and the supply of actuaries will be increased.

I believe that some form of continuous assessment should augment examinations. I have been very disturbed when in recent years principal tutors, particularly those for Group B subjects, have said that students have failed whom they expected to pass on the evidence of the tests submitted. This is at variance with my own experience when I was a tutor in the 1960s. I could predict the passes among my students with considerable accuracy, and, as far as I can make out, so did my fellow tutors. It indicated that tuition and examination were very much in tune. The present divergence between the assessment of the tutor and the examiner is very disturbing.

In his paper to the Bristol Actuarial Society Mr Purchase demonstrated that 37% failed in category FA in Group B subjects. A fair proportion of the FAs might have passed with the benefit of some small credit for evidence of completing the ATS course or some equivalent university course conscientiously. It might be very helpful if examiners had recourse to ATS records in marginal cases not for precise marks but for the tutor's corroborative evidence. The Institute fosters a relationship with City University but we must ask ourselves whether we do enough. All universities are currently short of money and perhaps the Institute should provide financial assistance. Indirectly, members are probably contributing at least £30,000 a year by offering their services as tutors at nominal rates, and it must be questionable whether this sacrifice of their time is wholly necessary. Perhaps the profession ought to contribute more directly through the Institute and less indirectly through the sacrifice of individual actuaries.

It is very significant that about eight universities account for well over half of our U.K. graduate intake. It would seem natural for this small number to have a special relationship with the Institute and to include at least some subjects with a strong actuarial flavour. Oxford, Cambridge and Bristol each provide around twenty entrants to the profession each year and that surely is enough to justify special attention. We ought to be ready to put our hands into our pockets at this time of financial stringency for the universities.

Mr P. N. S. Clark: In a large company many actuaries make less than full use of their actuarial qualifications. There are many who would be content to fulfill the rôle of 'actuarial technician' as mentioned in § 2.5.6. The examination syllabus for this qualification could be the Group A subjects together with some or all of the Group B subjects at a less advanced level. Thereafter anyone would have the opportunity to proceed to the full qualification if so desired. I have no desire to alleviate the reputation of the difficulty of our examinations for those thinking of the full qualification. Any claim that we might make, rashly or otherwise, to be in the top professional drawer would carry very little weight if entry were considered easy. Given this, it is far better that the unwary be deterred by a

difficult image before they start rather than half-way through. As a university liaison officer, I dissuade undergraduates from joining the profession. Determination to overcome this dissuasion strikes me as an indispensable quality in a potential actuarial student.

Considering § 2.7.9, setting a lower threshold for 'actuarial technicians' may cut down the number of fruitless examination attempts. A considerable responsibility rests with the senior actuaries in any given organization. More time must be spent discussing examination progress with students and forcing students to consider their future career in the light of their examination record. A little extra time spend here could save many hours on the part of both tutors and examiners. I am most reluctant to suggest a limitation on the number of examination attempts, but there could be a sliding scale of examination fees. The more attempts made in a particular examination subject the higher the fee charged for the next sitting.

Professor P. G. Moore: The actuarial profession does not have a completely unblemished image in university eyes for three reasons. Two of these are mentioned in the paper: namely, only 40% of recruits ever qualify and, of those that do, the average age at qualification is about 29, i.e. some 7 years or so after graduation. Also, the actuarial profession has not been a steady recruiter of graduates. For example, it took 402 U.K. graduates in 1973 and 172 in 1976, a drop of some 60%. The number has since risen slowly to 268. Such swings do not inspire confidence and open up the question of expectations. It is recognized that great success in the actuarial world is commonly linked to senior positions in the management field of the insurance industry. The Institute is already in the position where, of the 1,263 qualified home actuaries under 65 years of age, 76% are under age 45. Moreover, insurance companies are taking in more high quality youngsters from other areas of competence, e.g. accountancy and computer science, and in future they will compete with actuaries for senior managerial posts. Can we expect to provide the long-term opportunities *pro rata* for the rising generation if we expand the intake?

We should be striving not so much to increase the flow of entrants as to ensure that we advance the overall quality. Shortening the time taken to qualify would have two major benefits. It would release graduates for productive activity such as research at an earlier age, as well as attracting good quality graduates. Coupled with shortening of qualification time is the desire to release more of the time of newly-qualified actuaries away from purely education activities and into research. It has been suggested that to meet these twin objectives must mean the greater use of outside help for the study part of the curriculum. Two basic models are relevant here. Model A is to develop more actuarial courses along the lines we have at City and Heriot-Watt universities. This model generates visibility, some research centres and opportunities for those who know what they want to do at the age of 18. It can cause problems if taken too far in relation to the profession's needs, in that the industry may not want to offer studentships to all, or only to actuarial graduates, and this will cause friction at the universities concerned. I would not like to see an undue proliferation of such courses while recognizing that to have a few is excellent.

Model B would be to restrict such specialized courses, and to continue to take graduates from a wide range of mathematically orientated disciplines. The problem then becomes how to cope with these graduates in an expeditious manner. This could be achieved by providing a foundation year run either by universities or polytechnics, or even by the profession itself, to cover Group A in 1 year on a full-time basis, or in 2 years on a part-time basis. At this stage students would already be actuarial trainees, and have surmounted the first hurdle of being accepted within the professional fold. The profession would then be left to its own resources in dealing with the Group B subjects which would be covered within the profession itself.

Generally speaking Model B with its infusion of graduates who have a perspective wider than solely mathematics in many instances will be beneficial to us in the long run. While actuaries need to be numerate, to have an eye for detail, to be able to spot linkages between apparently disparate pieces of information, the long-term rôle of actuaries is bound up with their ability to hold their own on a wider stage than actuarial science alone.

Miss S. M. Cooper: For a number of years the Students' Society has run courses suitable for actuaries on such topics as marketing, computer appreciation, effective speaking and investments. The

response to these courses has been very satisfactory, but even allowing for the companies that arrange their own training courses in these subjects, many qualified people have never attended a course outside their examination syllabus. If they are encouraged to do so and the demand for Students' Society courses increases, we must consider whether it is reasonable to continue the administration of these courses in the present rather amateurish way which relies upon a few people working in their spare time, and also upon the goodwill of their employers.

To administer a method of continuous assessment fairly it is necessary to control very carefully the standard of marking of papers. This would be difficult to maintain with our system of part-time and relatively inexperienced tutors. However, it is reasonable to insist that each student completes a certain number of tests and obtains a reasonable level of marks before being allowed to enter the examinations.

I think that students should be required to follow a study timetable. It is much easier for tutors to mark consistently if they are dealing with ten test papers on one topic, rather than ten separate papers on different topics. There is no need to lower the standards of the examinations, but we should seek help from outside experts in the preparation of course material and textbooks. Well-prepared professionally written notes would aid the tutors as well as the students, and in the same way as we brief computer specialists to write complex computer systems, we should employ a professional course-writer to prepare tuition notes.

Mr G. B. Hey: The answer to the question "Should there be a qualification to recognize formally the status of 'actuarial technicians'?" is "Yes; he was called an Associate". I do not know why we did away with that qualification and it should be revived.

Some form of continuous assessment sounds very attractive, but in addition to what Miss Cooper said about the difficulty of fixing marking standards, I have suspected as a tutor that many of the tests I have marked have either been prepared over a space of several days and then carefully copied out, because there are never any crossings out on them, or they have been copied from the model solutions, because they follow them so closely.

I would definitely not like to see a relaxation of the fixed time limits for completing the examination papers. Everybody writes far too much as it is. Any examination can be passed by 2 hours' writing and 1 hour's thinking. I would like to allow 15 minutes before the examination starts in which candidates can read the questions and decide how they are going to answer them. It would help ease a candidate's tension, and his present anxiety to start writing immediately.

A choice of questions is a better idea, but it is very hard on the examiners, particularly in Group B subjects, to set questions of equal weight.

ATS tuition courses should become part of the official course of reading because they give the opportunity of up-dating the textbooks. They should be issued separately from the test and marking service, and, charged for separately.

It would be financially impossible to employ full-time tutors. A full-time tutor would cost around £25,000, including salary, pension, insurance and accommodation, which is not far short of the total amount paid to all the 220 part-time tutors.

I do not think that entry criteria should be tougher. The ability to do abstruse mathematics has nothing whatsoever to do with the ability to be a successful actuary. An aptitude test would be fine if one could be devised.

There should be a limitation on the number of examination attempts but the overall number of permitted entries should be used as candidates wish. If we allow three entries per subject it will not reduce the total number of entries very much whilst if only two are allowed the candidate who fails at the first attempt will have the Sword of Damocles hanging over him at the second. This will increase tension, and make failure more likely.

If there are ten subjects and, say, twenty entries are allowed, this makes provision for those who find particular difficulty with just one or two subjects. At least we shall not have candidates who manifestly do not care whether they pass the examinations or not. I think that if a candidate receives two FCs or similar he should be debarred from further progress, with possibly a right of appeal.

Mr E. A. Johnston, C.B. (closing the discussion): I do not remember a previous paper on education

being presented to the Institute, and I find this surprising considering how much time is spent on educating and examining.

Manpower is basically qualified actuaries, and we must think of the other things that they might be doing. There could be other aspects of education, such as post qualification education, seminars and continuous assessment, but education is not the end of it. We have to carry out research, and keep up with research outside the profession. The results have to be channelled not only into education and examinations, but also into the work of the profession. We have to keep up to date. This is very important in a world where other people are working on cognate subjects, and I echo Professor Moore's observation that actuaries are not alone in the work that they are doing. People from other disciplines provide competition. The same applies to research; enough must be done, for if we do not, others will. The profession should make its proper contribution to matters of public interest. This is done partly through Council making representations to government and partly in other more public ways where, I would suggest, our record is not as good as it should be.

The demand for tutors and examiners is the most immediate of the Institute's requirements. It tends to crowd out the others, as Mr Kennedy mentioned. It seems to me that the Faculty carries a greater weight in the intellectual activities of the profession, and makes a bigger contribution for its size than we do. It is perhaps no coincidence that for various reasons, demographic and other, the burden of educating and examining students bears less lightly on the Fellows of that body. Several speakers looked longingly to universities to solve this problem, but they have financial limitations as well. It was suggested by Mr Kennedy that we should provide more financial support to universities. There is a problem in that the Institute is financed entirely by personal subscriptions, and it is hardly possible for it to support universities. Money can be channelled through the Institute, but it must come from business donors.

We are clearly the kind of profession which has a heavy qualification, and we are relatively specialized compared with solicitors or accountants. Have we put too much into the syllabus? Is the intensity of study and examination about right? I did sense a certain amount of unease that perhaps we have gone a bit too far. The very heavy requirement on study for the actuarial student can crowd out other forms of training and experience. In the traditional actuarial employment there may be little disadvantage, but, following up Professor Moore's remarks, it may be a competitive disadvantage when compared with people from other disciplines.

The relationship with universities is worth a careful look. At present most of our U.K. recruits are exempt from A1, roughly a quarter from A5, and some from other Group A subjects. There are obvious advantages to exemptions in the saving of manpower, and students have fewer examinations to take. Many of our subjects are not attractive to universities as course material, however, except for statistics. We could do more to encourage universities to prepare students for exemption from A5.

It would be interesting to know how the universities manage continuous assessment. I cannot believe that the ATS has the capacity to do this now, and problems would arise with overseas students. We are a worldwide qualifying and examining body. Although many countries now set their own examinations, a number of others still rely on our qualification. It is not just a matter of old-fashioned pride that we want to keep this, as the spread of British influence does have its advantages for trade.

I can appreciate Mr Carne's point about life interests and reversions. A subject cannot be examined below a certain level. At the same time the profession holds itself out as providing the capability of advising people on that subject. It is a problem that we have to solve somehow.

WRITTEN CONTRIBUTIONS

Mr H. A. R. Barnett: Many of the problems posed by the author could be solved by making more use of the universities. First, more universities could be urged to set up optional courses in some of the elementary actuarial subjects which, while not going so far as to lead to exemptions, would help to bring the pre-entry knowledge up to a level which would render more suitable entrants. Secondly, courses for those degrees which lead to exemption from some of the subjects of Group A or Faculty Parts 1-5 could be revised to obtain total exemption from these subjects. Thirdly, if the Group B (or

Faculty Parts 6-8) subjects were confined to slightly less advanced levels, universities could be urged to set up 4-year courses aimed at complete exemption; each of the later subjects could be substantiated in the post-graduate period at the more advanced level by a system similar to the submission of theses, which would be prepared by the graduate during the first 2 years of his practical experience.

This appears an unfavourable time to suggest any university expansion, but there may be preference for courses which will be of direct use to students after they have graduated. The universities would need additional staff, who could be recruited from experienced actuaries taking early retirement.

Much of the tutorial work at present supplied by the ATS would be performed by the universities, although the non-academic actuaries would act as external examiners as well as examining the post-graduate theses.

Section 2.4.6 (b) refers to the 2-year experience requirement. Valuable experience in practical work may be obtained once a candidate is half-way through Group B. Can the experience requirement not be waived or reduced in such cases? I believe that the syllabus should be regarded as a marathon rather than a sprint, and it is for those who sprint that the additional experience requirement becomes necessary. The tuition of a first-timer is often much easier than that of a second or subsequent timer who has to learn to puzzle things out for himself. Hence the feeling amongst some members of the profession that the subjects you take 2 or 3 years to pass are those in which you become comparatively expert.

Unless more advanced problems can be left to the post-graduate period, reference books should be available for some subjects. It should not be necessary for the candidate to know complicated laws (mathematical or statutory) by heart, as in practice he will always be able to refer to them so long as he knows where and how to look them up.

The limitations suggested in §2.7.9 would inhibit the candidate's choice of the order in which he takes different subjects. I would prefer to see an overall limitation of perhaps 15 years which can only be extended in cases of protracted ill-health.

Mr P. S. Carroll: The author has brought to our attention a great danger facing our profession. Insurers are appointing statisticians or even accountants to posts that actuaries should fill when the task is the statistical analysis of insurance data using computers. Actuaries completing the examinations in the last few years have had no chance to specialize in statistics, although statistical methods capable of application to insurance have been developed. The use of linear models has gained much impetus through the availability of interactive computer packages such as GLIM. Likewise, methods for the analysis of contingency tables are now more powerful. It is further regretted that actuaries in general insurance are usually unfamiliar with multivariate methods. Regression analysis which was covered in the old syllabus is more widely used than ever. Whole new subjects have grown up in the last 10 years very close to the traditional expertise of the actuary. Investigation of lapses and withdrawals in life insurance may be possible using the techniques of survival analysis. A course on survival analysis could be run in conjunction with a course on the traditional actuarial methods of constructing a life table which are shaped by the use of calendar-year intervals and require large amounts of data.

There is an opportunity to remedy these deficiencies. The methodological content of B3 could be improved. More post-qualification courses of a statistical nature could be introduced. Links with universities and with the Royal Statistical Society could be strengthened. If this opportunity is not taken the Institute will become a society of insurance practitioners. Would it not be better for actuaries to build on the reputation they have inherited from their distinguished predecessors of being experts in applied probability and statistics?

Mr P. J. Cooper: The universities' rôle in actuarial education and training has come a long way during the last few years. The Institute has recognized the advantage of face-to-face teaching as a supplement to and, in some cases, a replacement for tuition by correspondence. At the University of Southampton, these developments have been rewarding for us. Demographers and statisticians with no previous contact with the actuarial world have been made aware of actuarial problems and their

current solutions. These contacts lead to collaboration in solving research problems and should be exploited to the full to aid research and development, as opposed to the views expressed in § 2.2.1 and § 2.2.4.

Non-actuarial attempts to help in the solution of actuarial problems often invoke one of two responses. Firstly, "I'm afraid you don't understand our difficulties. We could never get data such as you require for your analysis" indicating a lack of inventive imagination on both sides. The imaginative adaptation of theoretical models and the inventive recasting of a problem are usually the hardest parts of any research project. Secondly, "I'm afraid I don't understand the mathematics and statistics, but is all this sophistication really necessary for what is essentially a very practical problem?"—indicating the Luddite approach.

Both responses were very common in the accounting environment but accountants are now working with statisticians and/or scientists to produce useful solutions to real problems using modern mathematical and statistical developments. Can we not learn from the accountants' experiences and implement policies which will lead to a similar development in the actuarial world?

One possible scheme works like this. The employer has a problem requiring a long-term appraisal of, say, 3 years. A keen employee with a good knowledge of the background is granted study leave of about 1 day per week. He registers for a part-time M.Phil. degree at an appropriate university at about £400 per annum. For this he obtains library and computing facilities together with tuition and research supervision. He spends the first half of his time building up his background in the recently-developed techniques, which have been identified as being important for the research problem, and then writing a review of the substantive problem and the technical material. During this time his supervisor will have become familiar with the actuarial problem. The imaginative adaption of the problem and the available theory to provide a practical solution to the problem represent the remaining 18 months of the project. At the end we have (i) an employee complete with an M.Phil. degree trained in research techniques and hopefully keen to do more, (ii) an academic interested in the solution of actuarial problems and in contact with practicing actuaries, and (iii) an employer with a problem solved.

We have used this scheme, at Southampton, successfully for accountants and probation officers. It requires both the employer and the university to alter their traditional practices. The employer grants study leave for research and does not place too great an emphasis on the confidentiality of data and results. The university bends its degree regulations to suit the potential student and to supervise research outside its more traditional fields.

Mr R. H. Daw: The introduction of a choice of questions would not be a new development as the papers for advanced statistics had a degree of choice. I would support the introduction of a choice but the greater the degree of choice available, the longer it will take the candidate to read the paper and decide which questions to attempt. The introduction of a 15-minute period solely for reading the questions should meet this difficulty.

Another method of reducing the 'lottery' element is to set more papers. I dislike single-paper examinations—as I do not think a subject can be adequately covered.

At present a single paper is set for A1, A2 and A6 with the other subjects having two papers. The table in § 3.3.2 indicates that the four lowest pass rates for Group A include all three of the one-paper subjects. This may be due to chance but it could be the 'lottery' effect. However, two other features support the 'lottery' effect. Firstly, A4 (Investment), a two-paper subject, has the second lowest pass rate among the Group A subjects, while B1 (Institutional Investment), another two-paper subject, has the lowest pass rate amongst the Group B subjects. Secondly, A1 (Probability and Elementary Statistics), a one-paper subject, has a pass rate of 28%, whilst for A5 (Further Probability and Statistics), a two-paper subject, the pass rate is substantially higher at 38%.

It is possible that the setting of a second paper for subjects A1, A2 and A6 would improve the pass rates. Further tables of pass rates should be prepared for other years to see to what extent their patterns reproduce that of the table in § 3.3.2.

Mr R. W. Douglas: I would not be in favour of continuous assessment. Set against the advantage of removing the 'lottery' element are the following problems: some students may find it impossible, due

to justifiable work pressures, to maintain the necessary schedule imposed by a continuous assessment system; there may be problems of ensuring consistency of marking; the establishment of such a system may utilize further scarce resources; and high marks under such a system may indicate the quality of assistance given to students by their employers and colleagues, rather than the effort and ability of the students themselves. If there is thought to be an overwhelming need for continuous assessment despite the above problems, it should relate to no more than 20% of the marks.

I would strongly support the suggestion in § 3.4.8. that outline solutions to examinations should be published after the results of the relevant examinations had been announced. However, it should be made clear that students would not be allowed to question their examination results after observing the outline solutions. There is little to gain by secrecy concerning examination solutions, since the aim of the education system is to provide information and knowledge to students.

I also support the suggestion in § 3.4.9 that marked examination scripts be made available to failed candidates under certain circumstances. In order to avoid an unnecessary profusion of unwarranted requests for scripts, they should only be available to those candidates who have failed a subject twice, with the equivalent of an FA each time, or one FA and an FB. In addition, the candidates should have completed the tuition tests for their latest attempts at the relevant subjects. These conditions should ensure that only deserving candidates are provided with this additional service, and such a facility would only be provided on the understanding that examination results could not be challenged.

I must disagree with the suggestions for a more rigidly controlled tuition format, set out in §§ 3.5.12–14. Although the prescribed controls may help some of the weaker-willed candidates, such an approach may be counter-productive for our more able students, who may rebel against a system which treats them like school-children. Self-discipline in studying should have been developed already by those entering the Institute and any lacking such an ability may well not be the type of candidate which the Institute should be seeking.

The concept of full-time tutors seems initially rather attractive in that they would possess or develop a high degree of expertise for the job and be able to expand the functions of the ATS through more discussion classes or tutorials. However, the practical problems noted by the author are virtually insuperable and, I do not believe that the majority of able students require an expanded, more costly tuition service. Linking this point with the rate of payment for tutors, I do not believe that some 'subsidy' by tutors is a bad feature. Work within the ATS can be considered a useful element of post-qualification training and perhaps some element of compulsion should be applied to this duty.

There is great scope for the employment of university teachers and perhaps also commercial training organizations within an expanded post-qualification training programme. However, I should not wish to expand their rôle dramatically within the examination system. We do not have to be defensive or critical of the standards of tuition offered by our part-time system. The fact that the tutors work in a practical environment tempers their attitudes with a strong feel for the practical and realistic elements in any given problem. My own experience of university staff contrasts strongly with the remarks made in § 3.8.4. I have found that many have no aptitude or formal training as teachers and are often so involved with academic theory as to be virtually incapable of successfully imparting useful knowledge to others.

In answer to the question raised in § 3.7.8, I would strongly support the continued use of this system. Although better tuition and more serious study time may result from a full-time system of tuition, I do not believe that these advantages outweigh the enormous loss of in-depth practical experience which currently is gained via the part-time system. As a professional body we cannot completely ignore the wishes of the employers of the majority of our members and it is unlikely that they would be enamoured of a system which provided them with academically qualified staff with little true feel for practical problems. If students were under a system of full-time education, but paid a salary by their employers whilst absent from the office for long periods, we would experience a significant contraction in the number of employers wishing to take on the heavy, non-productive burden of actuarial students. Thus, the larger employers would be forced to accept the costs of training a profession whose trained members would then be snapped up by the smaller employers at a far higher rate than presently experienced. Additionally, the prospect of a further spell of full-time academic training would dissuade a significant number of graduates from joining the profession. Alternatively, if it is suggested that degree courses for school leavers should form the basis of training

for the Institute, I believe that, in addition to the problem of practical experience already noted, we would be expecting people to make a career decision far too early in life. There must be many graduate actuaries who would not have been aware of an actuarial career upon leaving school, and, even had they been aware of the profession would have been loathe to commit themselves to such an apparently narrow career-path so early in life.

Turning to § 3.10.4, I do not believe that the general membership (and certainly not home students) should provide a subsidy for overseas students. It is common practice for overseas students to receive the same level of financial assistance from their employers and their tuition fees are currently purchasing the same material and resources. If we are to consider such a subsidy as a form of philanthropy rather than due to an acknowledgement of a provision of a second-rate service, this point should be made known to the general membership and openly debated.

Mr E. J. W. Dyson: The concept of a periodical review committee is a valuable one; it enables a balance to be kept between too rare and too frequent major alterations in the structure of the Institute's education and examinations. Whilst some adjustments to syllabuses and courses of reading may be necessary between reviews, these should be minor and deal only with urgent matters which cannot wait for the next general review. The present interval of 8 or 9 years between review committees is about right; the time from the appointment of a review committee to the completion of the implementation of its recommendations is something like 6 years, so that no great shortening of the interval is practicable.

To ensure that the committee is made aware of new developments in the actuarial and allied fields, the research committee of the Institute should be specifically given the responsibility for monitoring such developments continuously, and the attention of members generally should be drawn to such developments by the incorporation of brief précis of articles in the series 'Notes on Other Actuarial Journals' and 'Articles, Papers and Publications of Actuarial Interest' in *J.I.A.* and, where appropriate, by the commissioning of articles to be deposited in the Library. At the same time the chairman of the research committee should continue to be a member of every review committee.

I hope that the Institute will remain an international body, and that potential actuaries living overseas will be encouraged to join the Institute and to take its examinations. To do otherwise would be a retrograde step, although bodies of actuaries in other countries may wish to institute their own qualifications appropriate to their own conditions. The needs of the profession in the U.K. must be paramount but in deciding on the methods by which these needs are to be catered for, the requirements of the substantial body of students resident overseas, and the considerable contribution that they and other overseas members make to the work and finances of the Institute and the ATS, must never be forgotten.

One of the principal constraints on possible courses of action lies in the shortage of suitable manpower. This constraint could be relieved by adopting as a general principle that neither the Institute nor the ATS should engage in any educational activity which could equally well be done by others thereby enabling the Institute's resources to be employed more profitably elsewhere. The Institute and the ATS should cease respectively to examine in, and to provide tuition in, statistics. The present Joint Institute/Faculty Examination in statistics should be discontinued and replaced by a Joint Preliminary Examination in Statistics. This could be organized on similar lines to the old Joint Preliminary Examination in Mathematics, that is to say, with the examination papers being set and the candidates' scripts being evaluated by professional examiners responsible to a Joint Committee of the two bodies, having a Secretary who would be responsible for liaison between the professionals and the Chairmen and Secretaries of the Boards and with the officials of the Boards considering draft questions and deciding on the pass standard. No formal tuition for this proposed examination would be provided by the ATS but any member of the Institute could provide such tuition if he so desired. I would hope that some polytechnics might find it possible to provide suitable courses. The possibility of including English in the syllabus could also be considered; if this were done there might be some beneficial effect in the ability of students to communicate, referred to in § 2.4.4. Entry to the Institute would take place only after passing (or being exempted from) the Joint Preliminary Examination in Statistics, and the number of attempts at the examination permitted could be limited to, say, four.

There is much to be said for giving candidates 15 minutes for perusal of the paper before allowing

them to commence writing their answers. This simple step would prevent candidates starting to answer questions without adequate thought, a perennial source of complaint by the examiners. I am in favour of a choice of questions, although this would impose an extra burden on the examiners as more questions would need to be devised, and all questions in a section of a paper (if it were to be divided into two or more sections) would need to be of equal weight. However, these difficulties are minor and to provide a choice of questions would be fairer to candidates and improve the quality of the scripts submitted. It would also be worth considering 'open book' examinations, where the candidates are allowed to bring textbooks or notes into the examinations.

I do not favour the inclusion of ATS course notes in the official course of reading. Textbooks, and special notes incorporated in the official course of reading, are subject to a prolonged process of scrutiny. If ATS course notes were to be incorporated in the official course of reading, a similar process of scrutiny would be necessary and this would slow down considerably the writing or revision of such courses. When I was a student there was a very strong feeling among us that there should be official textbooks for every subject included in the examinations. This need was then supplied by the Students' Society Consolidation of Reading Series, which aimed to direct the students' attention to relevant passages in Institute and other papers incorporated in the course of reading, and to provide brief comments thereon. This provided an acceptable solution.

Mr B. Hayes: September examinations should be open only to those who achieve an FA in the preceding set and those who can produce a medical certificate covering absence. All subjects should be covered, but the manpower requirement would be much the same as at present. Apart from the advantage of helping people through the Group B subjects faster, without lowering the standard, it would eliminate the higher incidence of rushed attempts at September examinations whereby students sacrifice their summer and ask tutors to sacrifice theirs. It would also help to correct the practice of awaiting the results of the September examinations before embarking on serious study for the next set. Serious study is often delayed until the New Year, because having delayed it until November, it is then all too easy for students to delay it beyond Christmas.

Furthermore, students would adhere more to the natural sequence of the examinations. Sometimes B1 and B2 have been taken before A6. There may be an unsatisfactory September attempt at A6, and a student may go forward with three subjects to repeat.

Mr H. B. Johnson: Over the last 30 years, there has been considerable discussion regarding the examinations, mostly directed towards making it easier for students to pass the examinations and qualify in a shorter period of time. To this end the length of the examination papers has been reduced, trick questions and those with a simple solution provided that it can be seen have been removed, and it is possible to sit Group A subjects twice each year. Consideration needs to be given as to whether the present position arises as a result of or in spite of the changes that have been made.

Ignoring students overseas, the solution to the poor pass rate is already contained in the information available to the Institute and in part from the statistics published in the paper. A fairly high pass rate is obtained by students who complete all the tests in the ATS Course and also devote adequate time to study. I would suggest that the indicated time of 11 hours study per week in addition to the daytime release for 35 weeks in the year is low and would have been regarded as inadequate 30 years ago. There are now considerable distractions to students but those who wish to progress should devote a substantial amount of time to studying in order to achieve qualification.

It might be fruitful to examine the background of the students to see if this is related to their pass rate. At some of the more modern universities there is a trend to teaching undergraduates how to pass the examinations and obtain a reasonable honours degree rather than in teaching them how to study. Consequently, when such a graduate is faced with the Institute examinations and a correspondence course he is unable to achieve satisfactory results and rapidly becomes disillusioned.

No weight should be attached to the feature noted in §3.2.3. The fact that a student obtains reasonable marks in the test papers is of little value as in many cases considerably longer time than intended is spent in completing the questions and, furthermore, where difficulties are encountered reference is made to the Course or to the textbooks.

It is essential to maintain the standard needed to qualify as an actuary. There is a very definite

requirement that a qualified actuary can identify a particular problem and come up with a correct solution speedily and under pressure. The examinations are intended in part to eliminate those who cannot fulfil this requirement. It does, however, seem reasonable to adopt a somewhat lower qualification—the 'actuarial technician'—but such a qualification should only be obtained by those who can show that they have knowledge over the whole of the subjects taken. This means that it is inappropriate to have alternative questions, certainly in Group A subjects, which enable students to pass by concentrating only on a limited part of the syllabus.

I am in agreement with some requirements being imposed as to a reasonable rate of progress in the examinations but doubt if it will be practical to achieve this by any other means than passing the requisite number of parts of the examination within a stated time. It would also seem necessary that we put greater emphasis on the recruitment stage; an investigation should be made as to whether it is not possible to identify better those who will devote sufficient effort to passing the examinations and also have the ability to study by their own efforts.

Mr H. P. J. Karsten: The main criticism of full-time degree courses in actuarial science is that the education being offered is not supported by simultaneous practical experience. However, many students are able to obtain experience by employment in the summer vacation and this should be encouraged. There are considerable advantages in schemes where an employer offers work training to an actuarial student during summer vacations with a view to possible eventual employment after graduation.

A further point worth making about full-time degree courses concerns the cost to the Institute. The special feature of this method of education for home students is that the Government picks up the cost as part of its programme of assisting students with their university education. The cost to the Government may itself be small if those studying actuarial science would be otherwise studying at university but with a different main field.

Mr C. G. Lewin: Too many people are entering the actuarial profession who will never become actuaries. A 60% failure rate is too high. I suggest that we overcome this difficulty by raising the entry requirements, in particular by insisting on an educational qualification at an appropriate level in English language, and by reducing the number of examinations, while still insisting on a reasonable standard in order to pass.

A candidate should be able to opt for an alternative method of qualifying, whereby he would not need to reach such a high standard in the final examinations but would be required to submit a good quality thesis describing a project of actuarial research he has undertaken. This would accommodate students who have difficulty with examinations and would provide the Institute with research material, some of which might be suitable for further development or publication.

Mr J. A. McKinnell: Section 3.2.3 shows that 31% of students with a good ATS study record for the spring 1980 examinations failed. If I have interpreted the figures in the 1980–81 *Year Book* correctly, only 11% of the candidates in the spring 1980 examinations had a good ATS study record. Is it possible that the 1980 record is a freak one? If not, the pass rate of these students is worrying and no good for the image of the profession. I note the point in §3.4.3 about examiners not wishing to become involved in individual cases. Nevertheless, if 30% of ATS students with a good study record do fail, a determined effort should be made to find out why. Perhaps examiners should have to explain why a well-prepared candidate failed. How else can the candidate take corrective action? Mr Kennedy indicated that when he was a tutor in the 1960s he could forecast which of his students would pass. This is as it should be, but I wonder if tutors can be so confident today.

Mr D. H. Miles: Would it not be worth looking into the use of actuaries who are retiring and who might welcome part-time work? I can see the problems: there is a double generation gap, and actuaries at retirement are probably set in their ways and might not be in line with requirements for the courses. Against this, in many cases they would have practical experience which might be helpful in tutorials or seminars.

Mr G. W. Mills (Deputy Secretary, Institute of Actuaries): Finance is a constraint to be reckoned with when significant changes of policy are being considered. In several respects the possibility of restricting the number of students making use of the ATS is suggested—for example, by restricting entry, by reduction of the course of study, by limitation of the number of attempts at examinations, by relaxation of pass standards in the examinations and by transfer of tuition to universities. A consequence of each of these suggestions would be a reduction in the scale of operations of the ATS which would threaten its economic viability to varying degrees.

At the present time the ATS is struggling to keep up with the problems of inflation and the need to fix fees many months in advance. Only by very substantial increases in fees, has it been possible to eliminate the deficits of 1978/9 and 1979/80. The preliminary accounts for 1980/1 show a tiny surplus. The expectations for the current year 1981/2 are that a small surplus will be achieved, but much depends on the number of courses taken up by students. A reduction of only 4% would probably produce a deficit. The financial consequences will ultimately dictate the effectiveness of a particular solution to a problem unless support is provided from another source.

The provision of a service for the numbers of students necessary to make the operation cost-effective may involve manpower problems. On the other hand, students are enjoying bargain prices at the expense of voluntary part-time tutors who are not being paid a proper rate for the job. There is surely a correlation between the number of tutors, or the number of hours they are prepared to give, and the level of the rewards.

Limitations of the number of attempts at examinations are discussed in §2.7. The more examinations any candidate passes, the less chance there is of a change of career. How could anyone with only one subject left be told that he would not be allowed to attempt it again? Perhaps a graduated scale would serve best—the more subjects passed the more attempts at the remainder.

Mr J. M. Pearce: In discussing the implementation of tuition you note the choice of methods and the position of all interested parties except employers. I suggest the modern conditions in which companies find themselves are a clue to some of the problems you raise. We have moved in the last 15 years from the situation in which many companies felt able to allow their qualified personnel substantial office time for professional matters to one where the office responsibilities mentioned in §3.6.6 weigh heavily on them. No longer is the professional expertise of the actuary seen as the key rôle to company prosperity—marketing, electronic data processing, accounting, investment and managerial skills are now given equal prominence and although the actuary can make a special contribution to each, he is not automatically accepted as an expert in any one of them. Indeed, these specialist areas appear to have better prospects than many of the traditional actuarial matters covered in the examination syllabus. The environment that has been created is one where the importance of an actuarial qualification has diminished for the employee who is not the Appointed Actuary or whose aspirations do not reach such heights. This situation has caused many an able student to make less than a whole-hearted effort to complete his studies. The lure of electronic data processing has proved a satisfying and remunerative alternative.

All students are convinced of the value of daytime study leave, but for the wrong reasons. It is a perk available to individuals but it is also an encouragement to pursue the 10-year course postulated in §3.7.5. Eleven hours of private study a week is the only option which can guarantee completion of the examinations within the timescale most would find acceptable. Forty days per annum is too generous for the student tackling the earlier examinations and probably gets the student off on the wrong foot as to the necessary commitment of his own time. There is much scope for employers to encourage their students but in as much as a proficient, yet unqualified, man may be 'cheap labour' compared to the more 'marketable' qualified man, we should not assume that an employer acting in his own best interest will supply the necessary encouragement.

It is a good time to consider what we mean by an actuarial qualification as is asked in §2.1.4. At the moment we are in a no-man's land between (a) a basic working ability to utilize actuarial data and concepts under qualified experienced supervision, and (b) a professional experience capable of the application of actuarial concepts within general business situations and of assuming the responsibility publicly for the decisions taken therein. As a result a young Fellow wishes to do more than surrender value calculations yet has insufficient experience to be the Appointed Actuary to a large

fund. My suggestion is that a practitioner's certificate could cover level (a) above and that a specialist advanced qualification (e.g. investment, life offices, general insurance, or pensions) could be pursued by the more able.

The practitioner's qualification would provide a satisfying career for many without involving the student in a lengthy qualification period. The number of practitioners going on further would be dictated by the demand for such expertise and would involve a more advanced knowledge than the existing examinations.

The practitioner examinations would cover the Group A subjects and, at a much simpler level than at present, the Group B subjects. A more stringent entry qualification should solve the problem of attracting students who are not intellectually equipped to complete the course. I could envisage the universities assisting here by setting a suitable introductory examination testing *inter alia* the ability to express oneself in English, numerical aptitude and logical reasoning. Such an examination would be of tremendous assistance to employers generally when recruiting graduates. I would prefer to keep the control of the subsequent professional examinations out of the universities' hands so that they do not lose their actuarial 'flavour'. There is a good case for a more simplified approach to the correspondence courses if we exclude the more advanced parts of the Group B subjects. I would restrict the examinations to once a year to reduce the burden on the existing membership. In many cases the second chance in September encourages lack of preparation for the first attempt.

More able practitioners would study a particular speciality in depth under the guidance of a senior, experienced actuary. The student would pay a market rate for the senior actuary's time but, in view of the value of the qualification being sought and the quality of the personal tuition, this would be good value for money. In many companies this could be the student's own manager training his potential replacement in the technical aspects of his job. A combination of examination and continuous assessment would be suitable for this part of the course.

With regard to the writing of textbooks and course notes it would become more difficult for the Institute to compete for the time of those able to contribute. Perhaps something could be done to encourage and enhance the talents of those who do not come forward to assist—it is more a question of confidence and ability though additional monetary advantage would change a few minds at the margin. With the advent of the word processor, I see little advantage in hard-backed textbooks and the suggestion of incorporating all the reading into the ATS course notes makes a lot of sense.

I do not have much sympathy with the ideas put forward about the examination 'lottery'. Whatever system is employed will never be perfect and although some students will be lucky and pass without sufficient understanding of the subject, many who fail deserve to and I would be loathe to lower standards unless the resulting qualification was seen as something less, such as the 'practitioner' idea above.

As regards § 3.2.4, I doubt if any employer would wish to encourage those who take 4 hours to complete 2 hours' work. In my experience time is only seen as a constraint by those who find difficulty in selecting the precise information to be set down and is therefore an excellent test of the student's powers of discrimination.

I see no reason why model solutions should not be published for the Group A examinations but I am against publishing guidelines to the Group B examinations where there is usually no absolutely correct answer and the student's ability to argue his case is being tested as much as his ability to repeat any particular actuary's opinion.

Mr J. B. H. Pegler: Formal written examinations are an unsatisfactory means of testing ability, but we need some test and so far have no better available. The ATS and the universities can only hope to teach and test an understanding of actuarial principles, leaving practice to be learned on the job. I do not think that this is best done by facing candidates with a rich meal of complicated practical questions to be digested and answered in a very limited period of time. We must look beyond the obvious on the surface and, to take just one example, not fall into the error of supposing that to give more time would increase verbosity and irrelevance. If candidates were not so obsessed with the inadequate time limit, which makes them write away madly with their first thoughts, they would write better organized and more coherent answers.

Regarding § 3.4.8, it would be helpful if the ATS (not the Board of Examiners, but no doubt after

consultation in some cases) provided an indication of the type of answer which might be considered suitable. Since any conscientious student will attempt past examination papers and tutors must be prepared to answer queries about them, the additional workload would not be great.

I am strongly opposed to the suggestion in §3.4.9 that candidates should be given the right to see marked scripts. It is often difficult to indicate in writing exactly where an answer is inadequate and in spite of any possible disclaimer about challenging the verdict such a suggestion would place a heavy burden on examiners and stimulate fruitless argument about the marks allotted. I suggest nevertheless that in suitably restricted cases, for instance where a candidate has failed twice at the same subject with FB or better, he might be permitted to enquire through the ATS for more detailed advice about his deficiencies. The Institute might also consider appointing a panel of 'senior tutors' who would act, not as an appeal board, but to give advice to candidates in suitable cases. The improvement in morale would justify the comparatively small additional work involved.

Mr J. P. Ryan: I would like to contrast the Institute with the Casualty Actuarial Society. The CAS mainly concerns itself with general insurance but despite having been in existence for nearly 70 years it has yet to produce its first textbook. The Institute, despite having examined general insurance for less than a tenth of that time, is already contemplating its second textbook. The Institute has only limited resources available for education and as these are even scarcer in the general insurance field, I feel that producing tailor-made written study material is a luxury that the Institute cannot afford. I do query whether it is necessary to pre-digest everything for a student to the extent that is currently done by the Institute. Section 2.6.2 suggests that an actuary will learn more after qualification than before, and surely all that learning will not be pre-digested. The corollary to this is that less effort is needed in updating courses each year.

Much more use could be made of outside written material including that published by other actuarial bodies and this is particularly true in general insurance. In the discussion much was heard of the growth of actuarial departments in universities but there has been a parallel growth in insurance departments as a whole in various universities. Much of their material is of relevance in the general insurance field and could be used in the course of reading thus considerably reducing the Institute's efforts. Further, there are very many papers published in the proceedings of the CAS and other publications which are of immediate relevance to the work carried on in general insurance. Surely some of these could be used to avoid duplicating work when preparing study material. Anyone who has the ability to become an actuary has the ability to discern which parts of an article are relevant to his studies.

In §2.7.9 the author suggested the possibility of imposing a time limit on the examinations. Other bodies have operated such a system, e.g. the C.I.I. However, it may encourage students to take examinations for which they are not ready, thereby increasing failure rates, and it would possibly encourage the person who may be doubtful about qualifying to continue until the time limit has expired. There would be cases where personal difficulties have forced students to take some years off, which would require the need for dispensations.

In the paper there were a number of suggestions about how frequently the exams could be taken, but one idea would be to split the Group B exams so that they could be taken at two separate dates in the year, say, December and April, each examination only being set once a year. Even numbered exams could be taken in December and odd ones in April: this would allow the student to concentrate on one subject at a time.

In the discussion the emphasis has been on the need to educate and train actuaries for the tasks which they are expected to carry out. Another fundamental point has been overlooked and that is the necessity of giving supervisory authorities, the public and other relevant bodies, confidence that the actuary has undergone the appropriate training for the task that he has to carry out. The profession cannot rely on post-qualification education to satisfy the public that it is capable of carrying out its statutory responsibilities. A good example is in general insurance. The present syllabus is a failure; it either teaches too much or too little. No supervisory body or any other body can be satisfied that a student, having passed that examination, is fully prepared to certify reserves. On the other hand, many people who are not going to be involved in the general insurance field find that there is far too much ground covered. Some of the non-life techniques are relevant in the life area, particularly in the

group field, but, nevertheless, it does impose an additional burden on an actuary who is going to spend his working life in life or pensions. The answer is to have different levels of specialization in the Group B subjects. A general insurance option could be set up so that much more ground could be covered.

Post-qualification experience requirements may satisfy some of the professional conduct requirements of the profession but it cannot satisfy the regulatory requirements. It is important to examine events in other parts of the world to see the problems that actuaries meet when endeavouring to demonstrate that they are competent to sign such returns. There was a long and protracted negotiation in the U.S.A. before the CAS was able to demonstrate its members' competence to sign returns and, subject to a 'grand-father' clause, to obtain a monopoly of such certification. I know of one territory where an Institute of Actuaries' qualification is not recognized as deeming the individual competent to sign a certificate for non-life claims reserves whereas the holder of a CAS qualification is deemed competent. Unless the U.K. profession wishes to lose out in this respect it will have to demonstrate that its examination in general insurance provides a better basis for preparing actuaries to sign returns, than at present. Insurance regulators are not prepared to rely on an Institute conduct guide as a definition of competence.

Mr J. L. Savage: The examinations sort out the men and women from the boys and girls. There is a very high correlation between those students completing the examinations and those students whose ability and determination, as evidenced by their work in the office and attitude to the examinations, lead us to expect them to be successful.

The low pass rates are a serious cause for concern, and must deter some prospective entrants by making the examinations appear more difficult than they are. We do not attract really good candidates in the same numbers as we did in the early 1970s despite the economic situation which must have reduced the availability of alternative employment.

It would be desirable to amend the examination arrangements to smooth the path of the better candidates as too many get stuck on one or two subjects. I doubt the value of claiming much expertise in investment analysis or non-life business for the vast majority of actuaries who have no practical experience of these subjects. A choice of Group B subjects would be more sensible, although we should retain B2 and B4 as compulsory subjects.

We should continue to recruit candidates with very good 'A' levels straight from school but we could raise the standard of admission for graduates. Perhaps it is even more important to raise the standard for exemptions; with the increasing number of exemptions now granted, I would have expected the median time to complete the examinations to be falling not rising.

We should act more quickly to persuade students who are making little progress with the examinations to seek alternative employment in some other field. However, I would be unhappy at the prospect of some limitation on the time taken to qualify or the number of the attempts at the examination being introduced by the Institute. The student and the employer both have to indulge in a delicate balancing act for the student to achieve satisfactory progress through the examinations and to make a proper contribution to office work. It would be very awkward if a final attempt coincided with heavy pressure at the office. Could we not achieve the desired result, and yet retain flexibility to deal with hard cases, by asking employers to stiffen the conditions on which study time is granted?

Mr V. I. Sessa Ayyar: Several students in India have completed the Group A examinations of the current syllabus or the Associate examinations of the previous syllabus but have been unsuccessful with subsequent subjects. One reason is the unfamiliarity with the U.K. economic scene and another is the absence of actuarial contacts and advice.

The Life Insurance Corporation of India as the major employer of actuaries in India has been concerned about this and now reimburses the cost of ATS courses and examination fees. Research cells have been set up in five cities and actuarial students have been posted to work under the guidance of actuaries. The success of students during the recent past has improved.

I do not think any change in the syllabus is necessary in Group A, but perhaps students could be examined in only three of the four subjects in Group B, leaving the fourth subject as post-qualification study.

Although post-qualification education is necessary for the survival of the profession it should not be mandatory for all actuaries. New Fellows from India are on average between 35 and 40 years of age; thus, they find it difficult to pursue further education or to be involved in continuing educational activities.

It has been suggested that there should be a limit to the number of examination attempts, at least to motivate the candidates to finish the examination quickly. My suggestion would be that a student should be allowed 5 years to complete Group A subjects and not more than four attempts should be allowed for each Group B subject. However, if there is only one subject required to complete the examinations there should then be no limit to the number of attempts.

Relaxing the standards for passing the examinations is not a practical solution. Many students with one or two subjects left for completion get frustrated, but with the recent change in ATS courses of providing solutions to the last 4 years' examination papers, a student should know the areas where he lacks understanding or preparation.

Mr M. S. Youngman: I agree with the author in § 2.4.3 that flair, imagination and judgement are as important as mathematical ability to the actuary. Ability in these cannot be examined and to raise the entry standard could exclude many who might otherwise qualify as an actuary, and have more desirable attributes for an actuary than those with better academic qualifications.

Although the drop-out rate is high, this is not necessarily a waste of resources. Many will continue to make an important contribution to their company using the actuarial training they have received. If it is a waste of actuarial resources, it is equally likely to have been a waste of employer resources and perhaps they would welcome some new techniques which allow them to identify the successful student.

There is not a large demand for post-qualification educational courses, but there seems to be no reason why the experience requirement should not include post-examination education. This may encourage more post-qualification demand for further education.

A method of continuous assessment using ATS records to augment the examinations would ensure that all students went into the examinations better prepared and could result in higher pass rates. There are problems because of the different standards of marking between tutors and it is difficult to introduce a system which provides consistency of marking between tutors.

A year is a long time to wait for a re-sit for candidates who only just fail a Group B subject. To examine in the Group B subjects again in September would stretch the resources of the Institute too far, but is there some way in which an additional test could be provided for those who were close to passing which would give them a pass without involving a full examination?

There is a case for a two-tier level for Group B examinations as not all students obtain practical experience of the four subjects in their working life prior to the examinations. It also allows a student to equip himself better for the field in which he wishes to operate. It does not mean a separate examination paper, merely a higher standard to obtain a pass at the 'Advanced' level. Students would need to have one 'Advanced' level pass in the Group B subjects in order to complete the examinations.

The author has submitted the following written contribution: The purpose of my paper was to provoke a discussion, the airing of my own opinions being subordinate to the wish to hear the views of members. Clearly I have reason to be gratified with the response; the many interesting views put forward at the meeting have been splendidly reinforced with an avalanche of written contributions.

The analysis of this wealth of material is complicated by the fact that contributors took full advantage of the freedom of choosing from amongst the thirty-five questions to answer. I certainly find it difficult at this stage to identify areas where there is a clear consensus. It is perhaps more appropriate to regard the record of the meeting as an on-going source of reference for those of us involved in formulating and administering educational policy.

The nature of the debate does not lend itself to a reply from the author according to the usual custom. In due course, as we begin to translate ideas into practice, it may be advantageous to follow the suggestion of Mr E. A. Johnston by having further 'exposure' papers dealing with specific policy propositions.