What Constitutes a Good Actuarial Programme

Frank Reynolds

University of Waterloo

Actuarial science is at a cross roads. Many are urging that our highly successful examination process be partially abandoned in favour of accepting university courses in a number of basic subjects. This drive is based in part on the difficulties in supporting the present system, the experience elsewhere and a misplaced confidence in the quality of the university system.

This paper will explore where the university system is and where it needs to go in order to adequately sever the interests of the actuarial community.

Current Programmes

In Canadian universities, the undergraduate actuarial programmes are typically an addendum on either business or mathematics programmes. Depending on the university, a student may be able to graduate with as few as six term courses in actuarial science (Waterloo) or may need to take as many as 13 (Toronto).

As an addendum, actuarial science is generally made to follow the concepts familiar in mathematics, statistics, English, languages, and other academic disciplines. The emphasis is on the instructor having a PhD and conducting an active programme of research. Integrated with this is that the research should attract grants and permit the instructor to support 1 or 2 graduate students. Consulting and professional activities are discouraged and often severely restricted if not prohibited. Interestingly, the advertisements for positions in actuarial science do not require the applicant to meet the Canadian Institute of Actuaries definition of actuary and may even go so far as to indicate that any knowledge of actuarial science per se will be considered a bonus!!!

Because of the orientation of the instructors, these programmes normally emphasis technical mathematics – calculus and statistics in particular. This, of course, helps to bolster the numbers in related programmes considerably. So that the programme can be at least self-supporting, if not a contributor to the faculty's economic well being, it is important that the programme attract a large number of students. The prestige of the profession will do this provided, the instructors recognise the need to provide the students with good marks and fail relatively few students.

Emphasis in these programmes is with acquainting the bulk of the students with a small group of basic courses – typically compound interest, life contingencies, risk theory and survival models plus the odd advanced course in an area of interest to a particular faculty member. Notice, I said "acquainting the bulk of the students". By this,

is meant, that the emphasis is upon 10-12 basic concepts with most of the material glossed over or omitted. There is no intention that even the best students would be prepared for the Society's examinations. Typically, 10-20% of the graduates proceed as far as student status i.e. ASA or equivalent. The rest drift into jobs in the financial services and other industries.

These programmes are very popular with Deans and other university administrators for an number of reasons. Tenure and promotion activities follow familiar patterns. The numbers of students help the faculty's budgets. Good marks and low failure rates help ensure that there are few complaints from the students about individual professors and their eccentricities.

Other Professional Disciplines

Other professional disciplines follow one of two paths. Typically, law and medicine require 2-4 years of pre-law or pre-medicine in which the prospective professional takes core courses from basic disciplines followed by three or four years of specialised training.

Engineering and accounting tend to follow a different pattern. The students enter the undergraduate programme directly from high school and take a very restricted programme thereafter. For example at the University of Waterloo, Engineering students will typically take 40 courses in Engineering and 4 non-Engineering courses. Most Accounting students at the undergraduate level take a minimum of 19 accounting courses plus 15 prescribed courses in other departments. The remaining eight courses are free electives. This is followed by a Masters programme which requires a further 6 accounting courses and 4 electives. (In Accounting, but not Engineering, these electives may be additional accounting courses.)

In all these professions, a minimum of 1 year of work POST-academic training is needed to practice.

Based on these models, the actuarial profession should be considering a 4 to 6 year educational programme, of which 60-80% should be courses of a purely actuarial nature. This lead to the question of what education an actuary needs.

Needed Courses

a) Background courses

There seems to be a consensus that accounting, algebra, calculus, computer science, corporate finance, economics, English composition and statistics are needed components of an actuary's education. Typically, two well taught one term courses will suffice, except for calculus and statistics where up to two additional courses seem appropriate. I would argue since most of an actuary's time is spent supervising others and/or dealing with clients that at least two courses on interpersonal relations should also be included. These courses are sufficiently generic that they should not require actuarial professors and could form a two-year pre-actuarial science programme.

b) Technical courses

With the expansion of compound interest topics to include derivatives and CMOs, not just one but two courses would seem to be needed. Life contingencies requires three courses to cover in proper depth. One or two courses in risk theory and loss models are needed.

Construction of life tables breaks down into two components. The survival models used by physicians and statisticians in studies used in underwriting and actuarial methods use to compile inter-company studies of lapse, morbidity and mortality. Each of these components is needed and represents a full term of study.

I would argue that the subjects of interpolation, extrapolation and graduation are even more necessary than in the past as we move increasingly to the use of a company's own data and/or general population studies as primary sources of data.

Finally, a course in how the major tables in use have been constructed, and what data are available, and their limitations and methods of adapting them for use is needed.

Combined, these subjects require about 10-11 courses to properly cover.

c) The work of a practising actuary

An actuary in the workplace does not work in a vacuum or solely with other actuaries. In the case of the company actuary, there is a staff, superiors and personnel in other departments as well as occasionally the outside world to consider. For those working in benefit consulting, there are employers and employees as well as internal people with whom the actuary must work. Each of these groups regards the actuary as

the expert on insurance. To fulfil this role, an extensive non-technical knowledge is needed. Perhaps, some examples will illustrate.

A small branch office operation did not employ an actuary on a full time basis. A major sales opportunity was uncovered by a branch manager. The heads of the sales and underwriting departments met and decided this was in fact an excellent opportunity and that the extra mortality cost could be covered by charging premia three times the standard premium. This was done for some months and some 500 cases sold. The statement actuary came in to do the preliminary year end work and in the course thereof discovered these policies. Because of the actuary's knowledge of underwriting, he checked further and found that the premia were grossly inadequate to pay the 18,000% of standard mortality involved. As well many actuaries testify as expert witnesses each year evaluating losses due to additional morbidity and mortality. This requires a knowledge of underwriting – both the process and the mortality associated with particular diseases.

In the early 1980s, there was a brief period of very high interest rates. During this period, the actuary of a medium sized company used the forward commitment rates on mortgages for annuity quotations based on the assurances of the investment division. Eighteen months later when the money was to be paid out, rates were much lower and the borrowers either did not take down the money or re-negotiated the rates. The actuary's lack of understanding of the process cost the company its independence. Thus, a detailed knowledge of investments and their characteristics is needed.

The failure of American General recently points to the need to understand the contracts and how assets interact with liabilities in the face of changing economic and market conditions. This points to a need to understand coverages and asset/liability matching techniques.

Some years ago, I was approached by several members of my staff who had a very funny look on their faces. It turned out that a 20 pay life group policy had been written by a lawyer and not checked by the actuarial staff. Benefits were paid on death but premia were being collected for several long dead employees – just as the contract provided. The ability of the actuary to determine the economic value of a policy turns very much on a knowledge of the legal interpretation that will be put on its language. Thus, a knowledge of insurance and pension law is a requirement.

Many products, today, are priced to make a certain return on investment after tax. To do this pricing, a detailed knowledge of the tax law is needed. Some would argue that this is just a matter of asking the accountants for the information, as this area is well within their purview. It is not. Consider a concrete example. Some years ago, I was a "visiting foreman" at a large reinsurer. A point with regard to pricing and interest rates was repeatedly made. I questioned it. The reply was that that was the way it was done and they had had the top insurance accounting tax advisors spend six months the preceding year setting up their tax work. The third person with whom I questioned the practice decided to shut me up. After lunch, I was taken to the accounting department

and shown exactly where in there return they were doing exactly what they said. My reply was to point to a different section under which a much larger deduction could be taken, provided one understood the contracts and the mechanism involved. Finally, the actuary is involved in the preparation of reserves and expense amortisation schedules for the tax returns, if not the returns themselves. All of these point to a need for extensive knowledge of taxes.

All of these anecdotes point to the need for specialised courses for the practising actuary. For convenience, I will divide them between coverages and professional.

d) Coverages

Currently, most actuarial programmes attempt to teach actuarial mathematics without giving the student any idea as to what the mathematics applies. A general broad based introduction to insurance, its coverages, its social functions and its administration ideally should be provided before any of the actuarial mathematics is introduced in order to provide the students with a framework into which to fit the mathematics.

Once the actuarial mathematics has been mastered, courses in life insurance, group insurance and pensions should be provided, preferably integrated with the implications of premia and reserves. With coverages, an in-depth study of investments should be undertaken both to acquaint the students with the available products and to provide a basis for asset/liability matching. Finally, a course on business, personal and professional ethics should be added.

In all, about 10 term courses are needed to provide a reasonable coverage of the basics.

e) Professional courses

The final group of courses have been referred to earlier in subsection c). These include two terms of each of underwriting and taxes. To these courses, I would add law, financial reporting, reserves laws and social insurance. The need to understand the coverages and funding implications of social insurance are obvious. The legal, professional and practical aspects of reserves warrant a course. Financial reporting must be understood as otherwise the reserves may not be accurate and the ability to determine the risks to which an insurer is subject impaired.

Finally, there is the subject of insurance record keeping. Some might suggest this is highly automated and a subject within the purview of computer science. I disagree. Business computing had its origins in insurance record keeping and for many generations, computers were designed with such applications in mind. In some ways, a knowledge of the record keeping systems and their strengths and weaknesses determines the actuary's ability to administer and to value insurance products.

In all, another 10 courses are needed to adequately cover this material.

Course Organization

The above needed courses total about 50 – 20 background courses, 10 technical, 10 coverages and 10 professional. This is well beyond the capacity of the normal honours undergraduate programme which can accommodate 40 such courses. Thus, the model of Waterloo's accounting programme (4 years of undergraduate and 1 year of graduate) immediately comes to mind. The models of law and medicine are also feasible.

At this point, someone will question the viability of this programme as it does not provide "breadth". That is true. The problem can be solved in several ways. Another year can be added to the general portion to bring the required courses to 60. This introduces problems with Crown funding, etc. A second alternative is to regard the professional and coverage courses as optional and only require 10 of the 20, possibly in option groups. This would seriously undermine the proposal. A third alternative would be to recognize actuarial science as a profession, with a profession's agenda. With this approach, the problem disappears. It is the one we must begin to espouse.

Ramifications

The model I am proposing here is common in the professions but non-existent in actuarial science. A complete and total re-thinking of our educational process would be necessary. Three areae stand out in my mind: status, qualifications, and standards.

a) Status

Most professions are large enough that their students can form recognized facilities at a limited number of universities in most provinces eg law, medicine and engineering. Accounting typically is a school within the business faculty. This is possible with undergraduate student numbers running around 400 and the number of professors exceeding 20.

In contrast, the typical actuarial programme has at most 75 students and three professors. Typically, actuarial science is not even recognized as a portion of the department it is in. (eg notice that the abstracts for this conference come under the Statistics Department at Waterloo).

There are a number of ways to affect change. One way would be to borrow a leaf from the Certified Professional Accountants in Canada in the early 1950s. At the time, they started, the typical accountant's training was 5 years of articling post-high school with a number of courses, generally taught by high school teachers or practicing accountants. In order to upgrade their status to a profession, they undertook to endow chairs at several Canadian Universities – I believe Toronto, Queen's, McGill and the University of British Columbia. Over a short period, the process worked and accounting programmes became common in Canadian universities, along with a requirement for a university degree in order to be an accountant. There is no reason the actuarial profession could not do similarly. The cost of six chairs at six carefully selected universities would be about $300 US per Society of Actuaries member per year for five years. If a few of the larger insurers and consulting firms could be enticed into adding a second chair, the core would be present. With the offer of two chairs as a lever, the possibility of professional programmes becomes a reality.

A second lever would be to offer a basic accreditation process. This would involve the students from designated universities being allowed to write a series of specialised comprehensive examinations over a week long period subsequent to graduation. Those meeting the grade would achieve professional status. Those not passing by the third attempt would be dropped. They would then have to pass a long series of individual examinations (as would those attending non-accredited institutions) before retrying their comprehensives.

Of course, there is an interaction here. Employers seeing the effects of early qualification might well be more prepared to provide the needed chairs. Students seeing the effects of early comprehensives would gravitate to the programmes providing direct access to the comprehensive examinations and the numbers swell. The effects would be to provide the numbers and finances to support professional programmes.

A third way to effect change is for the professors in the larger existing programmes to institute a plan of attack to gradually move actuarial science from an academic programme to a focussed professional one.

b) Qualifications

Today, most actuarial educators obtained a degree in mathematics and then wrote some actuarial examinations. Very few have ever worked full time as a practising actuary. Their ability to teach the coverages and professional courses is very limited or non-existent. The plan outlined above stresses these topics. How can the two be reconciled?

Again on must look to the other professions. Both law and medicine face the same problem. They solved it by recognising two streams of appointments – the traditional academic and the professional.

Within the professional stream, the emphasis is on the professor having or quickly obtaining fellowship in the Society of Actuaries, the CIA and/or the Casualty Society. Normally, these people bring 10 or more years of practical experience both with the industry and with the examination system. Ideally, they have extensive practical experience post-fellowship and have signed an actuarial opinion.

Activity of the professor will not be judged primarily upon the number of papers published but rather on the person's standing in the professional community. Participation in consulting work will be encouraged on the basis that it brings valuable practical and current knowledge to the classroom as well as enhancing the professor's personal reputation and professional development.

Some of these people are recruited on a half load basis, from the ranks of the more distinguished practitioners. From their perspective, they enhance their contacts within the profession and help their practice by attracting the best of the students. For the students, the person who has real experience with the subject usually provide a better learning experience.

A second source of people is those who use an academic appointment as a bridge to retirement. These people often teach on a half to full load basis for a five-year period.

Finally, exchanges with industry can be attempted. In this model, an intermediate or senior practitioner joins the university faculty on a full time basis for 2 years while a faculty member joins the practice for the same period. In this case, the programme benefits not just from the practitioner's expertise but also from the expertise developed in the academic.

c) Standards

Of all the problems with the use of universities for training actuaries, this is by far the most difficult. In the traditional academic model, quality of output is tertiary to the need to attract large numbers and students and ensure they have an enjoyable experience in the course.

In the professional model, quality is everything. A programme whose people cannot pass the comprehensive examinations does not attract students and soon loses its accreditation. However, this model requires 2 to 4 times the amount of work per course – instead of being acquainted with 10 – 12 basic concepts, the student must master the 40 – 50 major concepts and be familiar with many more. Where professionals who take pride in their work and know the level of knowledge expected in the workplace are in charge of a programme and are not under the thumb of an academic, these standards are normally met.

For actuarial science, the freedom from outside interference is currently not there. Until it is, standards will remain the Achilles heel of any attempt to use the university system for actuarial education.

d) The profession's actions

Training will be needed for the actuarial science professors as few have any training in examination setting techniques. To prevent a deterioration from the high level of questions currently asked by the actuarial examination committee, intensive training in the philosophy, methods and techniques of examination setting will be needed. Particular attention will need to be paid to multiple choice writing techniques. Even more importantly will be the inappropriateness of examining only a narrow range of topics with recycled questions. This will mean the teaching of creativity.

The examining boards will need to look very closely at department, faculty and institutional practices with respect to minimum averages and maximum failure rates. At a number of institutions senior professors have been disciplined and/or dismissed for requiring a certain basic level of knowledge of all passing members of the class. For example, at the University of Waterloo, students in a number of courses are guaranteed pass and a respectable mark even if they are not capable of handling the material. Scandals, such as these, must be very carefully monitored and the effects on actuarial courses completely negated.

One particular point that occurs is that an institution or programme will claim that its selection of students out of high school is so superior that virtually no one admitted should fail to graduate. For highly competitive programmes which require considerable undergraduate performance, selection criteria may be able to reasonably select a group 90% of whom will graduate. For admissions from high school, with all the attendant changes in teaching methods, extracurricular activities, learning expectations and parental supervision the students experience, this is not realistic.

e) Programme assessment

One academic suggested that the method to select good programmes would be to look at the number of papers produced by the faculty each year and require say, five. This follows the traditional academic model.

A professional model requires a very different assessment. The ability of the students to pass comprehensive professional examinations on the first try is the appropriate criterion. While initially pass levels of 10 – 25% will need to be tolerated as the professorate's knowledge builds, ultimately a criterion of 75% should form the minimum.

Will this turn the universities into mindless examination orientated factories as some will be quick to suggest? It is the pattern for all the other professions so why should the results be so different for actuarial science.

Where a university is consistently under performing (eg 3 times in 5 years), despite the investment the profession should be quick to withdraw its accreditation. If it is not done, the profession will lose credibility and the whole process become a joke.

Conclusion

Many of the ideas I have proposed will be ridiculed and called unrealistic to those pushing for the universities to control actuarial education. However, the more serious thinker will realise that I have provided a first attempt at writing the future if we are to successfully use the university system as a component in actuarial education.