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ABSTRACT

Recently there has been increased interest related to the Actuarial Science field. An actuary is a business professional who uses mathematical skills to define, analyze, and solve financial and social problems. This paper examines: (1) the interface between Statistical and Actuarial Science training; (2) statistical courses corresponding to particular Actuarial examinations; (3) advantages of supporting Actuarial Science courses; (4) impact on the major; (5) how to promote statistics through actuarial training; and (6) how to obtain information and test preparation materials. Lists 3 references. (Author/YP)

THE UNDERGRADUATE STATISTICS MAJOR - A PRELUDE TO ACTUARIAL SCIENCE TRAINING

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ABSTRACT

Recently, there has been a great deal of interest in the Actuarial Science field. Entering undergraduate students are asking college admission counselors which courses (or majors) are appropriate to prepare them to work as an actuary. This paper examines: the interface between Statistical and Actuarial Science training, statistical courses corresponding to particular Actuarial exams, advantages of supporting Actuarial Science courses, impact on the major, how to promote statistics through actuarial training, and how to obtain information and test preparation materials.

1. INTRODUCTION

In May, 1988, "The Jobs Rated Almanac" listed "actuary" as the top career in America. This rating gained the attention of many newspapers throughout the country, which in turn stimulated feature articles on the actuarial field by such leading journals as "The Wall Street Journal" and "USA Today". Until this outburst of publicity, very few people had ever heard of the actuarial profession. The Equitable Life Insurance Company of America publishes a brochure describing their Actuarial Development Program. In this brochure the

following statement is made, "The actuarial profession may be the best-kept secret in business today. It is a small, elite profession with fewer than 15,000 members." Further evidence of the actuarial field's relative obscurity is the fact that the U.S. Department of Labor's publication, "25 Terrific Careers for the '90s" does not even list the Actuarial Field.

Paul Creegan's article "So ... you want to be an Actuary" in "UME (Undergraduate Mathematical Education) Trends", May 1989, states:

> "The newspaper articles that followed the release of 'The Jobs Rated Almanac' did little to dispel popular misconception or spread useful information about the profession and the opportunities that it offers. Unfortunately, many mathematics departments, which have historically been the greatest source of entrants into the profession, generally offer little information and even less encouragement to potential candidates."

Several schools (approximately 35) offer full-fledged Actuarial Science degree programs, and are so noted by the Society of Actuaries. Several schools (approximately 50) are listed by the Society as schools offering a pre-Actuarial Curriculum. These tend to fill the vacuum described by Paul Creegan. For those schools that offer statistics courses, but are not listed by the Society as schools offering actuarial courses, this paper proposes that they list separately the statistical courses which lend themselves to Actuarial Science course preparation in their college/university course catalogue. It has been the authors' experience that the statistical curriculum is enhanced by doing so. We have also had a greater number of students take our statistical courses due to their interest in Actuarial Science.

This paper will also examine the how-to's: giving information on curricula, Actuarial Science courses, the catalogue material for the examinations given by the Society, and catalogue course listings.

2. CURRENT TRENDS AND VIEWS

After the recent exposure of the actuarial field by the news media, entering undergraduate students began to ask college admission counselors what courses (or majors) were appropriate to prepare them to work as actuaries. The students encountered several responses to their query. At the admissions level, the counselors were generally unfamiliar with the Actuarial Science field. If they were familiar with it, they usually referred the students to the business departments, who then referred them to the math departments. The mathematics departments' chairpersons are on a mailing list from the Society of Actuaries, and they periodically receive information which is intended to keep them informed about the actuarial field. However, the general preconception of actuarial work by most chairpersons is usually limited to the calculus sequence. This has given students a narrow view of the actuarial field, especially concerning the subsequent emphasis of this field upon statistical training.

Some prevalent views often expressed by faculty of statistically oriented departments are typified by the following statements: "What good does it do for students to take these exams?" "I took these exams as a student and what relevance do they have toward doing statistics?", "This is such an obscure field, who is interested enough to pursue it anyway?"

The reason for these views are severalfold: there are few actuaries and the field is exclusive. Compared to the business curriculum, few schools have opportunities for formal programs of training. The profession is not a high

profile profession even though the California Referendum on insurance and an appearance on Nightline by several actuaries may have changed this. Finally, professional certification, at the Associateship level averages three to five years training after the baccalaureate degree.

In spite of the difficulty and apparent subtle obscurity of the field, the recent news media coverage has piqued student interest in and demand for actuarial training. For the student who can pursue mathematics and understand statistical thought, and who can successfully complete the certification examinations given by the Society of Actuaries, the field offers tremendous reward, challenge, and career advancement opportunities. Our students have been extremely successful in finding employment, and working in student summer job actuarial training programs. The field is expected to grow, and there is a constant need for more actuaries.

Actuarial Science training induces a great need for appropriate training in probability and statistics. This is indicated by the fact that the Society of Actuaries has recently begun offering a summer training course in Applied Statistics (Course 120). Therefore, whereas in the past major training of actuaries has taken place in mathematics departments, it is our view that the training should be centered in Probability and Statistics Departments. With this background established we turn to some basic information about the field.

3. WHAT IS AN ACTUARY?

If a student is skilled in mathematics and statistical thought and is looking for a career which will provide a satisfying outlet for his talents and energy to make a worthwhile contribution to society, then he should consider becoming an actuary. An actuary is a business professional who uses mathematical skills to define, analyze and solve financial and social prob-

lems. In dealing with such problems, actuaries create and manage programs which reduce the adverse financial impact of the expected and unexpected things that happen to people, like illnesses, accidents, unemployment, or premature death.

The actuary helps design these plans and then evaluates the financial risk a company takes when it sells an insurance policy or offers a pension program. In performing these duties, actuaries have many responsibilities. First, the actuary must make sure that there is enough cash on hand to pay benefits when people make their claims on their insurance policies or draw income from their pension plans. Secondly, the actuary must also see to it that the price charged to participants in an insurance or pension plan is fair. Actuaries must understand the entire operation of the insurance and employee benefit fields, because their evaluations often influence organizational policies and practices. In fact, actuarial calculations and judgement can commit organizations financially for many future years. Because of this long-range financial commitment, actuaries are frequently involved in many phases of an organization's business, such as general management, marketing, research, underwriting, investments, accounting administration and long-range planning. Since actuaries develop such broad-based knowledge and experience, they often have highly responsible management positions, frequently working as insurance company vice-presidents and presidents or as senior partners in actuarial consulting firms.

4. TRAINING PROGRAM

While there is a growing trend for Actuarial Science to be a separate major at the undergraduate level, most actuaries have received their undergraduate degree in mathematics. Those universities which offer graduate

degrees in Actuarial Science, usually do so at the master's degree level. A complete listing of colleges and universities which offer at least some Actuarial Science courses is available from the Society of Actuaries.

Actuarial clubs, correspondence courses, workshops, and self-study are the most common methods of training after one's formal education is complete. Again, the Society of Actuaries can supply more detailed information.

5. EXAMINATION STRUCTURE

Course	Description of Exam	Length (Hrs.)
100	Calculus and Linear Algebra	3.0
110	Probability and Statistics	3.0
120	Applied Statistical Methods	1.5
130	Operation Research	1.5
135	Numerical Methods	1.0
140	Math. of Compound Interest	1.5
150	Actuarial Mathematics	4.5
151	Risk Theory	1.5
160	Survival Models	1.5
161	Mathematics of Demography	1.0
162	Construction of Actuarial Tables	1.0
165	Mathematics of Graduation	1.0

All examinations are multiple choice, except for a 1.5-hour portion of Course 150. A listing of textbooks for each course is given in the SOA "Associateship Catalogue". The Society also publishes notes to supplement some of these courses. The exams, with the exception of Courses 100 and 110, are given in November and May. The tests for Courses 100 and 110 are also given in February. More details may be obtained from the SOA.

6. IMPLEMENTATION OF AN ACTUARIAL PROGRAM IN YOUR DEPARTMENT

The first step in implementing an actuarial Science Program is to become familiar with the Society of Actuaries Course and Test Structure. To do this, write the Society of Actuaries, (SOA), 475 N. Martingale Rd., Suite 800, Schaumburg, Illinois 60173-2226, and ask for the latest "Associateship Catalogue". This will give the necessary information in terms of the sequence of tests the student must pursue. The next step is to correspond the courses that your school offers with the SOA courses. This will give the student an idea of the preparation he may obtain at your institution. For a comparison, obtain a listing from the SOA of schools that offer a pre-Actuarial Curriculum and also a listing of schools that offer Actuarial Science Courses, including life contingencies. This listing will give you some guideline as to the extent to which you may need to change your existing curriculum.

Most departments have a brochure describing their faculty and programs. List in this brochure that you have courses for Actuarial Science and also note this fact in your college catalogue. To list information in one's college catalogue might require approval of the college curriculum committee or one's department curriculum committee. Our experience was one of support and interest. By listing the statistical courses concurrently with the actuarial science courses, we were better able to utilize our statistics curriculum. We have had a substantial increase of students taking upper level statistics courses such as: junior-senior level Probability and Statistics, Design and Analysis of Experiments and Regression Analysis. Based on our tracking system, this increase was largely due to an interest in the Actuarial Field.

We believe it is important to have these courses listed in the college catalogue. This serves as a source of information, not only to the perspec-

tive student, but to parents and other faculty. Many students and parents are very "market conscious" and one needs to advertise the program to obtain these students. Listing these courses in the catalogue also helps admission counselors in their recruitment. We believe that the Actuarial Science student needs a strong background in probability and statistics. For the SOA Course 110, we recommend the freshman introductory Statistics course plus a two term Mathematics and Probability and Statistics course at the junior-senior level. The next course, SOA Course 120, essentially utilizes three college or university courses: Time Series, Regression, and ANOVA. At many colleges and universities ANOVA is incorporated in a Design and Analysis of Experiments course or in a Linear Models course.

To cap off the Actuarial Curriculum at the Undergraduate Level, in addition to Operations Research and Numerical Analysis, one should consider adding Theory of Interest and Actuarial Mathematics or Risk Theory. The Actuarial Mathematics course is a good applications course to illustrate many of the theoretical principles developed in the previous courses.

Our recommendation is to teach these courses at the undergraduate level and combine the Actuarial Science Curriculum with the Statistics Curriculum.

7. BENEFITS OF AN ACTUARIAL SCIENCE PROGRAM IN YOUR DEPARTMENT

Since Actuarial Science is an attractive major to many students who would not normally be mathematics or statistics majors, it allows your department to compete successfully with Business Schools and Computer Science Departments for very talented students, who are interested in the "business" applications of mathematics and statistics. This increase in talented majors, will also allow you to teach more of your courses at the upper division level. Such

courses will offer your faculty the opportunity to learn new and interesting applications of their previous knowledge. This in turn will tend to revitalize and rejuvenate your departmental faculty professionally.

More than fifty percent of the actuaries in America are employed by insurance companies. This then offers students the opportunity to work for "Big Business", which brings with it the opportunity for high-level management and rapid career advancement, which many students seek. Since many actuaries are indeed high-level managers, the profession calls for training which emphasizes liberal arts knowledge and communication skills, and not just the narrowly defined skills of a mathematical specialist. This is an attractive feature of an Actuarial Science program to one's colleagues in other departments of the college or university.

Finally, because of the difficulty of the SOA examinations and the many hours spent in study for them, Actuarial Science students have a sense of comraderie and esprit d'corps which fosters enthusiasm for their school work and their major. Strong social bonds are developed with one another and their faculty mentors during the long hours of studying and problem solving spent in preparation for the examinations. These strong ties to the department often carry over past graduation and beyond, creating a pool of enthusiastic and loyal alumni who are successful and influential in their chosen careers.

8. CONCLUSION

In summation, Actuarial Science is a little-known alternative to computer science, business, and traditional mathematics and statistics for mathematically talented students. It is relatively easy to implement an Actuarial Science program in any mathematics or statistics department; minimally, one should arrange courses into segments related to the SOA examinations and per-

haps add one or two courses not usually found in the curriculum of a mathematics or statistics department, such as, Theory of Interest, or Risk Theory. The benefits of such a program are an increase in talented majors, an opportunity to teach new and significant mathematics and statistics courses, a rejuvenation of departmental faculty, and the creation of a pool of influential and enthusiastic alumni.

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