The Newsletter of the Society of Actuaries
VOL. 25, NO. 4
APRIL 1991

THE Actuary

Editorial

An actuary's concerns: Employee benefits/ pensions in our current economy

by Mary Hardiman Adams

A few months ago, after the stock market lost some 20% of its value, and after a tremendous number of employers announced significant downsizing of their workforces, it was still difficult to get a consensus among the economists that the United States was in a recession. Part of the problem was to get agreement on a definition of "recession." It might be two consecutive quarters of decrease in the Gross National Product; alternatively, it might be a decrease which feeds on itself. Neither the Persian Gulf crisis nor the low value of the U.S. dollar appeared to clarify the situation.

The economists now admit we are in a recession. Their questions are how deep, or how much deeper will this recession be; and how long will it last? Some authorities say three months, others say six months; still others say the end of 1991, and then we hear of a tie-in to the end of the Persian Gulf conflict.

But whatever these speculations, those of us who work in the employee benefits field must come to grips with making decisions as to how the benefits plans, for which we are the actuary, may be affected. At the time this editorial was written, we were in

Continued on page 2 column 2

Variable interest rate funding assumptions

by Robert S. Byrne, Jr.

Much discussion has taken place in actuarial circles concerning funding assumptions for defined benefit pension plans. For plans subject to minimum funding standards (IRC section 412), the IRS generally requires using explicit assumptions (or contribution equivalent assumptions). Two articles on choosing the interest rate assumption appeared in the SOA *Pension Section News*, December 1990.

This article introduces the concept of a variable interest rate basis, which explicitly reflects current market rates in an actuarially appropriate manner. The methodology meets all IRS requirements for a reasonable funding method and should prove useful if called on by the IRS to defend the interest rate assumption. Under this basis, the interest rate can change each year according to a prescribed formula. For example, the interest rate assumption might be equal to the yield of a 30-year U.S. government bond plus 2%.

Pension actuaries have become accustomed to variable interest rate assumptions in the context of financial accounting standards. However, applying the concept of variable interest rates for determining contributions adds a new wrinkle – a way to recognize the real differences between a fully funded plan and an unfunded or poorly funded plan. Fully funded plans are those that have assets sufficient to provide some level of benefits that are attributable to a prior period of time. Poorly funded plans are more dependent on future contributions and the prevailing investment environment when those contributions are

Continued on page 4 column 1

In this issue:

THE Actuary

The Newsletter of the Society of Actuaries

VOLUME 25, NO. 4
APRIL 1991

Editor responsible for this issue
Mary Adams

Correspondence should be addressed
The Actuary
P.O. Box 105006
Atlanta, GA 30348-5006

The Actuary is published monthly (except July and August) by the SOCIETY OF ACTUARIES, 475 North Martingale Road, Suite 800, Schaumburg, IL 60173-2226.
Daphne D. Bartlett, President;
David M. Holland, Vice President and Secretary;
Michael R. Winn, Vice President and Treasurer;
Kenneth A. McFarquhar, Director of Publications.
Non-member subscriptions: students, $6.00; others, $15.00. Send subscriptions to: Society of Actuaries, P.O. Box 95668, Chicago, IL 60694.

Editorial cont'd

the planning stages for actuarial valuations of pension plans which have a December 31/January 1 valuation date and, which, in my case, are most of those for which I am responsible. I expect that the majority of us spend most of our time throughout the year in a consulting capacity where our concerns about this recession are generally in helping employers cope with the design of benefits programs, the employee-relations aspect of changes, and the corporate financial implications. While our actuarial knowledge is part of our educational background, we are not acting in a specific role as an actuary.

Now is the time when we must be the actuary. What this boils down to is that we have to decide on actuarial assumptions. The actuarial "art" of designing eloquent formulas, of making approximations of the values of smaller component benefits when the work to make the calculations seemed too onerous for the value of the benefit, is no longer with us. This is because of the development of computer technology to its current state. Valuation methodology is generally quite mechanical. For financial accounting, there is no choice; for the determination of the employer's contributions, it is the same as last year, unless there is a prevailing need for change. We have to consider the assumptions, particularly in the context of the current economy of recession and cutbacks. We must not just consider the economic, but also the demographic, assumptions.

At this moment, the financial information as of December 31, 1990, is not yet generally available, but we can speculate that the value of common stocks and real estate is likely to be down and cash and bonds may be stable. If the values are down but income is likely to remain constant, perhaps the valuation interest (discount) rate should increase. But if interest rates are down (the Federal Reserve just reduced its rate for loans to member banks), the valuation rate should reflect this.

However, we need to turn back to the question of how long this recession will last. Is three months, or a year, or three years a significant period in the actuarial valuation process? What will the economic scene be like when the recession is over? What will be the cost of money? What will productivity look like? How high will inflation be? Although these will affect all economic assumptions, the interest assumption, with consideration of inflation in a recessive period, is likely to be most sensitive. Perhaps there should be select and ultimate interest assumptions. If so, there can be a question as to whether the "select" should be the expected recession period or whether it should be with respect to the current portfolio.

The demographic assumptions may not be as difficult to deal with in some cases, but may be more difficult in others. If an employer is downsizing, is it being done by normal attrition or by a formal program, perhaps with a window? When the downsizing is completed, we need to consider what the remaining employee group will look like and what its turnover and retirement trend characteristics might be. If the downsizing has not been completed, perhaps select and ultimate (by duration from the valuation date) decrements would be appropriate. And, we must not forget that in recessionary periods the incidence of disability and disability retirement increases. Each element seems to add to potential cost.

Traditionally, the pension actuary attempted to maximize the stability of the contribution bases for each plan while maintaining some flexibility for employers to contribute on the basis of current financial viability. In recent years, because of U.S. tax laws, this has not been practicable in most instances. If a plan has reached its full funding limit, no contributions should be made because of excise taxes. If a plan is underfunded (as described in the Internal Revenue Code), significant additional contributions are needed. (A personal observation is that last year there were very few plans that were not either overfunded or underfunded.)

This year we might expect some overfunded plans to need some, if not full, contributions. Because of the asset situation, underfunded plans are likely to be in worse condition. What we see are contribution increases at a time when the employer can least afford extra money.

We have to look into the future and not just at the moment. We do not know how long this moment might be. We do favors to no one – to the plan participants, the employer, or the government (IRS and PBGC) – by

Continued on page 5 column 3

Early-retirement, delayed-retirement factors in Japanese social security system

by Robert J. Myers

Social security benefits (old-age, disability, and survivor pensions) in Japan are provided by a two-tier system. The National Pension Scheme (NPS) provides a uniform, flat benefit for all individuals, and the Employee Pension Scheme (EPS), sometimes referred to as the Welfare Pension Scheme, provides additional earnings-related benefits. After retirement, the benefits are indexed for cost of living changes.

This article will describe and analyze the factors applied to the NPS benefits when they are initially applied for, either before or after the normal (or full-rate benefit) retirement age. More details on the various provisions of these plans not discussed in this article can be found in the Social Security Administration's Research Report No. 61, November 1988, "Social Security Programs throughout the World – 1987."

The EPS allows for the insured (employed) person to receive full-rate benefits at age 60, plus an amount equal to the full-rate NPS benefit, even if claim is made before age 65. The minimum retirement age for women under the EPS is being phased up to age 60. Such age was 55 for those born before April 2, 1931, and was increased by one year for each following successive two-year birth cohort until it reaches 60 for those born after April 1, 1941. In 1989, the ruling party proposed a gradual transition from age 60 to age 65 for both men and women, but the legislature rejected the proposal (although it is believed that this will eventually be done). All persons not eligible for EPS benefits, including the non-insured spouse of an insured worker, can receive an NPS benefit, but this is reduced permanently when claimed before age 65 (and increased if claimed after age 65, up through age 70 at claim).

The factors for early retirement and for delayed retirement under the NPS, which were established nearly 25 years ago, are as follows:

Age at Initial Claim	Proportion of Full-Rate Benefit
60	58%
61	65
62	72
63	80
64	89
65	100
66	112
67	126
68	143
69	164
70	188

Surprisingly, there is no pro-rata adjustment (i.e., linear interpolation) between the factors when the initial claim is not an exact age. For example, a person who first claims the benefit at age 60 and 11 months has the same reduction factor as if claim were made at age 60. Correspondingly, a person who first claims benefits at age 66 and 11 months receives only the same amount as if claimed at age 66. This lack of equitable treatment and the resulting creation of significant notches (breaking points or abrupt junctions) is most surprising in a country as economically and scientifically advanced as Japan. A Japanese pension expert told me that this approach was adopted for "simplicity" and that quite naturally, well-informed individuals claim benefits at the time they attain an exact age.

Let us consider whether these factors are "actuarial" in the sense that they are equitable to the beneficiary (i.e., are not actuarial bargains or actuarial penalties, as against taking full-rate benefits at age 65). The opposite side of the coin is whether they are equitable to the program. On the general basis of the reduction and increase factors used in the U.S. Social Security program, the factor for initial claim occurring five years before the normal retirement age should be 70% (instead of 58% under the NPS), while the factor for initial claim occurring five years after the normal retirement age should be 140% (instead of 188% under the NPS).

The ultimate increase factor (for individuals attaining the "normal" retirement age in 2009 – when it is age 66 – and after) is 8% per year. The ultimate decrease factor (for individuals attaining the "normal" retirement age in 2027 and after, when it is age 67) for those initially claiming benefits five years before the "normal" retirement age is 70%.

It has been shown that the reduction and increase factors used under the U.S. Social Security program are very close to "actuarial" when, considering that the benefits are automatically adjusted for increases in prices, a reasonable real interest rate (say 2-3%) is used, regardless of the mortality-table basis utilized. Thus, the fact that Japanese mortality at the retirement ages is significantly lower than that of the United States is probably not very relevant in this analysis. (In Japan the expectation of life at age 65, according to 1988 life tables, was 19.54 years for females and 15.95 years for males, as against corresponding figures of 18.6 and 14.7 years for the United States in 1986.)

A Japanese actuary told me that the factors used under the NPS are based on the 10th Japanese Life Tables (for 1955) at 5½% interest. The factors were calculated separately for females and males at each age, and then were simply averaged. This probably explains what I would term the "unactuarial" nature of these factors – namely, the use of an unduly high interest rate in connection with benefits that are automatically increased for rises in the price level.

Continued on page 5 column 1

Assumptions cont'd

made to the fund. The variable interest rate basis I'm suggesting automatically compensates for funding distinctions among well and poorly funded plans.

Actuarial assumption review

Actuaries tend to be slow in moving their interest rate assumptions. Since IRS minimum funding standards first appeared in the mid-seventies, survey information reveals that the average assumed interest rate has increased steadily from close to 5% to about 8%. During this period, long-term risk-free U.S. government bond yields have risen from about 6% to 14% and then dropped back down to a fairly narrow 7.5% - 9.5% range. The average interest rate assumption used by actuaries exceeded long-term U.S. government bond yields only in 1987 and 1990.

One would ordinarily expect that a diversified investment portfolio would lead an actuary to use interest rate assumptions higher than current risk-free market rates. Of course, all plans wouldn't have the same rate or a rate higher than current risk-free rates. For example, the size of the plan, the variability of the benefits, the expectation of future earnings on assets, and the level of investment expenses are all valid influences on the interest rate assumption. Furthermore, it will be natural for the actuary to assume that the best estimate assumption requirement allows room for some conservatism, given the unknowns associated with returns on different investments.

The prevalence of odd interest rate assumptions (odd in the sense that there is no link to risk-free rates) has led to problems for actuaries and plan sponsors. Pressure to immunize certain liabilities, FAS 87 accounting requirements, annuity purchases, and interest rate limitations for the current liability determination are all examples of what can happen when the actuary's interest rate assumption is not current.

Why are actuaries so loathe to adjust assumptions? I suspect that it is due to a misunderstanding of what is meant by a "long-term" assumption. If a plan sponsor has $1 in hand today, is a savvy investor, has freedom to invest the money advantageously, and if that dollar is to provide a benefit 20 years from today, then a risk-free, 20-year rate is certainly an appropriate point to start one's interest rate assumption for that $1.

Actuaries and plan sponsors also may be concerned about the volatility of contributions and additional valuation costs associated with a variable interest rate assumption. In practice, these issues are more imagined than real. My studies indicate no real volatility difference between variable and static interest assumptions. Nor are the required calculations complex to the point that they create unwarranted expense for the plan sponsor.

An overview of the method

Let's return to the basics of funding methods. In all cases, funding methods are essentially based on the following equation: the present value of all future expected benefit payments, minus the assets, equals the present value of future contributions. This implies that the present value of future contributions is equal to the present value of future normal costs plus the unfunded actuarial accrued liability. The determination of normal costs for the entry age and unit credit actuarial cost methods, for example, is really a determination of future contributions to the fund under patterns reflective of the cost method. The determination of the unfunded actuarial accrued liability includes a look at assets, i.e., amounts currently in the fund.

In this discussion, I am assuming that an actuary is using explicit assumptions. The first step is to project expected benefit payments. Where benefits are linked to some economic index (inflation, Treasury bill rates, etc.), special attention must be paid to the current economic environment. For example, where benefits are linked to inflation, using an underlying future inflation assumption of 5% in a risk-free yield environment of 8% is more reasonable than using the same 5% inflation assumption when risk-free yields are 13%.

The second step is to determine a future earnings rate. No one is sure where yields are going to go or what rates of return will actually be achieved by different asset classes. If an actuary had to make an interest rate assumption in a vacuum, the traditional building of rates (assumed future inflation plus a historic real return assumption) is probably appropriate for returns on amounts to be contributed in the future. As with the way these rates are usually determined, they would not be subject to change (unless the actuary was changing the assumption basis).

The third step is to determine a current earnings rate. One thing we can be sure of is current yields. Current risk-free yields should be the starting point on investment expectations for assets currently invested. The current return assumption derivation would actually depend on the investment mix and its expected relationship to risk-free rates of return. This is the rate subject to automatic change.

The fourth step is to use the projected benefit payments, the present value of future normal costs (using the future earnings rate), and the benefits covered by the current earnings rate to determine the contribution requirement. The following example is such an illustration. All capitalized terms refer to the terminology used in Actuarial Standard of Practice No. 4, *Recommendations for Measuring Pension Obligations.*

An example

For simplicity, the plan chosen is a flat dollar plan with benefits unrelated to pay. The actuary uses the Aggregate Actuarial Cost Method, where the excess of the Present Value of Projected Benefits over the Actuarial Value of Assets is allocated on a level basis over the service of the group between the valuation date and assumed exit.

The actuary believes that in a future economic environment an investment return of 8% is sustainable. In the current environment, however, the actuary believes that assets currently invested should be able to earn 10%.

Table 1 summarizes the results at 8% and 10%.

One way to combine the results is to assume that the Actuarial Value of Assets will earn 10%; future contributions will earn 8%. For this illustration, assume that the Actuarial Value of Assets will be used to cover benefit payments as they come due until exhausted. Results on this basis are in Table 2.

Note that the Normal Cost using the two rates is closer to the Normal Cost using just the 10% interest assumption since the plan is well funded. When applying the variable interest rate basis to the Entry Age or Unit Credit Actuarial Cost Methods, the goal is to determine the unfunded actuarial accrued liability [4 – 5 – 6]. In our example, the amortization payment would be determined using an 8% interest rate.

Discussion on this topic as well as a detailed explanation and historical research have been presented by the author to the Pension Committee of the Actuarial Standards Board. A presentation will be made at the annual meeting of the Conference of Actuaries in Public Practice.

The ideas described here have been used by the author in his consulting work. The views and opinions are the author's only, are not necessarily the views of his firm, nor are they necessarily the views of the Pension Committee of the Actuarial Standards Board.

Robert S. Byrne is Partner, Kwasha Lipton.

Table 1

	8%	10%
Present Value of Projected Benefits	$ 368,729,579	$ 293,661,179
Actuarial Value of Assets	$ 268,561,756	$ 268,561,756
Present Value of Future Lives	30,121	27,668
Active Lives	4,216	4,216
Normal Cost	$ 14,020,369	$ 3,824,605

Table 2

1. Present Value of Benefits Covered by Present Assets, at 10%	$ 268,561,756
2. Present Value of Benefits in Item 1. Recalculated at 8%	$ 325,086,557
3. Present Value of All Projected Benefit Payments at 8%	$ 368,729,579
4. Present Value of Projected Benefits using two rates: [3 + 1 − 2]	$ 312,204,778
5. Actuarial Value of Assets	$ 268,561,756
6. Present Value of Future Normal Costs at 8%: [4 − 5]	$ 43,643,022
7. Present Value of Future Lives at 8%	30,121
8. Normal Cost Accrual Rate: [6/7]	$ 1,448.92
9. Active Lives	4,216
10. Normal Cost: [8 × 9]	$ 6,108,661

Japanese social security cont'd

If a 2% interest rate had been used along with the 1955 life tables, the factor at age 60 would have been 67% instead of 58% (or close to the U.S. factor of 70%). Furthermore, using a more modern table, 1985, along with a 2% interest rate, would produce a factor of 73% (also close to the U.S. factor of 70%), and a combination of modern mortality with a 3% interest rate would give a factor of almost exactly 70%.

Considering age 70 at retirement, the factor based on the 1955 life tables and 2% interest would have been 165% instead of 188% (as against the U.S. factor of 140%). Further, combining the 2% interest rate with the 1958 life tables produces a factor of 147%, or close to the U.S. factor of 140%.

Recently, an even stranger matter has occurred. All individuals who attain age 65 after March 1991 can follow an alternative course of action. Previously, claim for the increased pension could be made at any time up to age 70. If death occurred first, the pension was "lost." This contingency was considered in the foregoing analysis as to the proper size of the increase factors. Now, instead of the previous procedure, the individual can file at any time between ages 65 and 70 and obtain retroactive benefits at the age-65 rate back to age 65. Or, if the person dies before claiming the increased deferred-retirement benefits, the survivors can file for these retroactive benefits. Talk about the anti-selection possible for persons who suddenly find themselves in poor health (even to the extent of dying)!

This bonanza windfall is primarily available to wealthy individuals who can afford to defer receipt of benefits or to those with private pensions if they can have such pensions "reallocated" actuarially to be payable in larger amounts for only the temporary period up to age 70 (or, at least, substantially more before age 70 than thereafter). It would certainly seem that the Japanese authorities should review this aspect of their social security system.

Robert J. Myers, a Past President of the Society, was Chief Actuary for the Social Security Administration from 1947-1970.

Editorial cont'd

overstating or understating contribution requirements. In the same vein, we do no good to the financial community by having pension expense too high or too low. What a difficult time to come to grips with the concept of best estimate!

Perhaps we can think optimistically that by the time this is in print the Gulf War will soon be over and a glimmer of light will be showing at the end of the dark tunnel of recession. Even so, the problems that caused the turbulence in the economy in the first place will remain. Although we want to take an optimistic look at the present, we need to deal with the real-life situation that the effects of this period will be visible in the years to come.

Requests for proposals

The Society of Actuaries is soliciting requests for proposals (RFPs) for two projects: "Option Pricing Models as an Alternative to Cash Flow Testing" and "Long Term Bond Yields of Life Companies with Junk Bond Portfolios."

An insert in this mailing of *The Actuary* contains details on the Bond Yield project.

There are two parts to the Options Pricing Models project: Applications of Option Pricing Methodology and Option Pricing Methodologies/Models. Proposals for one or both parts are acceptable. For more information on the RFP package, contact Mark G. Doherty, Director of Research, at 708-706-3570. Deadline for proposal submission is July 15, 1991.

Statistical and research activities at the Social Security Administration

by Bert Kestenbaum
and Eli N. Donkar

Four federal agencies have been profiled in past issues of *The Actuary*: Bureau of the Census, September 1988; National Center for Health Statistics, November 1988; Bureau of Economic Analysis, December 1988; and Bureau of Labor Statistics, January 1989. Unlike these four, the Social Security Administration (SSA) has as its primary mission the administration of two major income-support programs, rather than the collection, analysis, and dissemination of statistical information. Nonetheless, the statistics and research function is recognized as crucial to SSA's need for evaluating how best to serve, both now and in the future, its client populations: the aged, the disabled, and the widowed/orphaned. Two offices in the Social Security Administration involved in research and statistical activities are the Office of the Actuary (OACT) and the Office of Research and Statistics (ORS).

Office of the Actuary

The Office of the Actuary evaluates and projects the financial status of the OASDI (Old-Age, Survivors, and Disability Insurance) program. Among the major statistical and research activities OACT engages in as part of its responsibilities are:

- Analyses of total population mortality and fertility data and of OASDI program data on disability incidence and termination rates, all specific to age and sex and, in the case of termination rates, to duration
- Preparation of population projections, both of the total population arrayed by age, sex, and marital status and of special subpopulations, such as the labor force and the disabled
- Analysis and projection of economic parameters, such as the Consumer Price Index, the Gross National Product, and interest rates, which affect the magnitudes of outgo from and income to the OASDI program

An inventory of OACT's most interesting products would include life tables of both the conventional and cohort varieties and tables for disabled lives with decrements of death and recovery; the calculation of the present values of selected Social Security benefits; and the examination of the trend towards the increased prominence of fringe benefits in the total compensation package.

The Office of the Actuary also has taken the lead within SSA in responding to the need for information about the AIDS population. It has done this by synthesizing a complete file of persons who are beneficiaries of either the OASDI or the Supplemental Security Income programs because of disablement by AIDS or symptomatic HIV infection. Besides demographic and geographic information, the file contains the date of entitlement to disability benefits and the date of death (if death occurred) for each individual. Although confidentiality strictures prohibit the release of data on individuals, summary information will be published periodically.

Some of OACT's statistical products appear in the annual report to Congress by the trustees of the OASDI program. The office also maintains two publications series, "Actuarial Studies" for reporting the results and methodology of major undertakings, and "Actuarial Notes" for other interesting findings or information. A list of available OACT publications may be obtained by calling 301-965-3015.

Office of Research and Statistics

The Office of Research and Statistics, staffed by statisticians, economists, and social science policy analysts, is veritably the agency's statistical arm. Although the distinction is not a sharp one, generally ORS is concerned more with the "people" aspects of the program and less with the "dollars and cents" dimension than the Office of the Actuary.

We can broadly characterize ORS statistical and research activities as falling into two areas. First, this office is responsible for an extensive publication program of basic statistical information relating to social insurance programs. The centerpiece of this program is the *Annual Statistical Supplement* to the *Social Security Bulletin*, featuring more than 200 tables covering five broad topics: the OASDI program, the Supplemental Security Income program and other public assistance programs, health-care programs, miscellaneous social insurance programs, and social welfare and the economy. More current data are published monthly and quarterly in the *Social Security Bulletin*. Profiles of the beneficiary population and summaries of employment and earnings covered by Social Security at various levels of geographic detail are published in separate statistical compilations.

The other major area of activity of this office is economic and social research. This activity is carried out primarily by in-house ORS staff, but ORS also funds a small external grant program. Research priorities include the economic status of the aged, work patterns of older workers, Social Security financing, the value of Social Security, and the relationship between health and work. Other priorities are the development of microsimulation models to analyze the effect of the Social Security program and changes in the program on individuals and families. ORS also occasionally conducts national surveys of the beneficiary population. The most recent is the New Beneficiary Survey (NBS), in which a first round of interviews was conducted in 1982, with a second round planned for 1991.

Research findings are disseminated via the *Bulletin* and other publication vehicles. The Office of Research and Statistics maintains a catalog of publications. Current listings and abstracts of ORS publications are organized by type and by subject matter, and available microdata files are described separately. This useful catalog may be obtained from the ORS publications staff by calling 202-282-7137.

Bert Kestenbaum and Eli Donkar work in the Social Security Administration's Office of the Actuary.

Review of the Social Security Technical Panel's Report

by Dwight K. Bartlett, III

The Social Security Act mandates the appointment of an advisory council quadrennially to broadly review the Social Security Administration's programs and financing. In turn, successive councils have traditionally appointed actuaries and economists to review the methodology and assumptions used both in the projections of the programs' future financial status and other related economic and actuarial matters.

The 1991 council appointed five economists and four actuaries to review the Old-Age, Survivors, and Disability Insurance (OASDI) financial projections. They were:

Peter Diamond, Massachusetts Institute of Technology
Donald S. Grubbs, Jr., FSA, Grubbs and Company, Inc.
Sam Gutterman, FSA, Price Waterhouse
Michael Hurd, State University of New York-Stony Brook
Stephen Kellison, FSA, College of Business Administration, Georgia State University
Warren R. Luckner, FSA, Society of Actuaries
Alicia Munnell, Federal Reserve Bank of Boston
Lawrence Summers, Harvard University
Finis F. Welch, Unicon Research Corporation

Incidentally, the advisory council includes one actuary, Phillip Briggs, FSA, who is Vice Chairman of Metropolitan Life.

The report of this nine-member technical panel contained several important conclusions:

- A contingency reserve equal to at least 100% of annual expenditures be built and maintained throughout the 75-year projection period.
- The Board of Trustees of the OASI and DI trust funds adopt tests of the funds' soundness, both for the short and long range. Failure to meet these tests would alert policymakers and the public to the need for improving the financial status of the system.

- Three of the most critical economic assumptions used in making financial forecasts be changed: 1) the assumed ultimate real interest rate be increased, 2) the assumed ultimate real wage differential be decreased, and 3) the assumed ultimate rate of inflation be increased.
- The projection methodology appears reasonable, with no discernable bias.
- The projection methodology be externally reviewed and validated.

The recommended contingency reserve of 100% of annual expenditures is more conservative than past analysts have found necessary. This recommendation is supported by a study performed by Richard S. Foster, Deputy Chief Actuary, SSA, which is included in the report as an appendix. Foster projected the difference in trust fund levels which would occur if the "most likely" assumptions for the 1990 Trustees Report were replaced by worst case economic assumptions based on the actual experience of 1973-77. He also assumed that Congress would take five to ten years for corrective action.

The question of what test to use in measuring the trust funds' soundness has been debated by Society and Academy committees. A consensus suggests that the tests traditionally used in the Trustees Report have not been adequate. In recent years, OASDI financing has been said to be in actuarial balance if the effective payroll tax revenues fell within 5% of the average benefits and expenses over the 75-year projection period as a percentage of covered payroll. More recently, this has been done on a present value basis. The adequacy of short-range (five years) financing was judged on the basis of year-by-year projections of trust fund balances. These projections are done under "best estimate" assumptions.

The panel report recommended several changes to the long-range test. It includes provision for the build-up of the recommended contingency reserve. It also recommends that the test become one-sided, i.e., the program would be said to be out of actuarial balance only if the income rate falls short of the cost rate by the 5% tolerance level, but not when it exceeds the cost rate by that level. This recognizes that financing of the program has adopted a partial reserve system under present legislation and anticipated experience.

The panel also recommended that the Trustees Report highlight four additional measures of the systems' financial well-being:

1) The year in which the trust funds are projected to exhaust their reserves, as well as the first year in which the reserves fall below a fund ratio of 50%
2) The amount of any tax or benefit changes needed to bring the system back into long-range actuarial balance
3) The amount of transfers to and from federal general revenues needed as special treasury obligations are purchased and redeemed
4) The difference between the cost rate and the income rate in the 75th year of the projection period, which is a measure of ultimate balance in the system

The panel also recommended extending the short-range test to 10 years. That would be met a) only if the fund ratio at the beginning of each year is 50% or more or is projected to achieve a fund ratio of more than 50% within five years and remain at or above that level, and b) has revenue sufficient to pay benefits in each month at the beginning of that month.

If all this has you confused, you are in good company. How do you

Continued on page 8 column 1

Review cont'd

characterize what are complex, detailed, and extensive financial projections in a way which justifies the projections while fulfilling the desire for brevity and conciseness sought by politicians, the media, and the public at large? The report notes that the tests are "binary," i.e., they are either met or not met. Reality tends not to be that simple. The full projections are oversimplifications, in that they are based on stated assumptions with four alternatives.

Incidentally, the report recommended eliminating projections in the annual Trustees Reports using the so-called "alternative II-A" economic assumptions which are based on federal budget assumptions. Thus it would return to the earlier practice of having three sets of projections instead of four, based on "low cost," "best estimate," and "high cost" assumptions.

In an ideal world that is a sensible recommendation. But it ignores the political realities which led to the use of the alternative two-way assumptions beginning with the 1981 Trustees Report. That grew out of a dispute between the staffs of the trustees and the economists and actuaries at SSA. In the opinion of the latter, the federal budget assumptions were too optimistic, reflecting wishful thinking about the efficacy of federal economic policy based on supply-side economics.

As a matter of fact, I would argue that that bias on the part of the trustees will always exist. These trustees are appointed by the U.S. President and quite properly are expected to espouse the efficacy of the administration's economic policies. To adopt economic assumptions in the Social Security projections which are less favorable than those used in the federal budget would appear to be a lack of confidence in the President's program. Therefore, unless an independent board of actuaries and economists sets these assumptions, I would be loath to abandon the present policy of doing the projections on the four sets of economic assumptions.

In a related matter, the report also recommended that the projection methodology be externally reviewed and validated. In this reviewer's view, both the methodology and the assumptions should be continually reviewed by an independent group of actuaries and economists. While the technical panels have filled this function, they are appointed only once every four years. They do not always review the OASDI projections, so a decade or more could conceivably transpire between reviews.

The report does not directly discuss whether OASDI should be financed on a "pay-as-you-go" basis or on a temporary or permanent trust fund build-up basis. It simply notes that from an actuarial point of view, the programs can be financed in any of these ways. Decisions about which financing method to use should be based on the economic impact of trust fund buildup rather than any actuarial consideration.

The report further recommended that among the highlighted items from the projections there be included the amount of transfers to and from federal general revenues that may be needed as special treasury obligations are purchased and redeemed. This appears to ignore that the interest payments on the special treasury obligations which form the assets of the trust funds also are a drain on federal general revenues.

The panel recommendation for the long-range test also calls for applying the test to subintervals of the projection, but with the tolerance level set at 5% for the full 75-year period being graded uniformly to 0 at the beginning of the first projection period. This reflects the greater reliability of shorter term projections and is consistent with the recommendation made by this reviewer a decade ago (See "Measures of Actuarial Status for Social Security: Retrospect and Prospect," *TSA* XXXIII, 1981), although the recommended tolerance level is somewhat tighter than what was originally suggested.

In reviewing demographic and economic assumptions, the panel also recommended that the ultimate best estimate of the real wage growth assumption be decreased from 1.3% per year to 1.0%. This change reduces projected income more than projected benefits, because of the lag effect in determining benefits based on wage histories and of the indexing of benefits currently being paid, using the usually lower increase in the CPI, rather than wages.

On the favorable side, the panel recommended to increase the ultimate best estimate real interest rate assumption from 2.0% to 2.8% and the ultimate inflation rate from 4% to 5% annually.

The report recommended no change in the demographic assumptions other than a small change in the number of immigrants in the lower cost projections. The most controversial of the demographic assumptions has been the ultimate total best estimate fertility rate, presently set at 1.9 children per woman when childbearing years are finished. One of the panelists, Finis Welch, dissented, in the belief that 1.7 births would be more appropriate. Such a change would significantly reduce the long-range actuarial balance of the program.

The effect of the changes in the panel's three economic assumptions, as well as the inclusion of the provision to build up the contingency reserve to 100%, would improve the long-range actuarial balance by 0.21% of the payroll, an amount a little more than 1% of the program cost over 75 years.

The advisory council's charge to the technical panel necessarily constrains it to view the financial operations of the programs as a closed system, without considering the implications of their operations in a larger socioeconomic context. Nevertheless, the panel did not comment on the projections in the Trustees Report which estimate the long-range costs of the program in relation to the Gross National Product (GNP). In fact, the economic burden of the programs are not the payroll taxes which Congress may legislate but rather program expenditures. Payroll taxes and other revenue sources simply determine how that burden is to be distributed throughout the economy. Sustaining the cost of the program at any time, therefore, will be determined by how much of the GNP is being consumed by Social Security programs. Therefore, it would have been useful if the panel had commented on the reasonableness of these projections.

The report concludes with recommendations for further research and study: improving the integration of methodologies for short- and long-range projections, using stochastic simulations to judge projection sensitivity, improving the consistency of relationships between assumptions, and considering the appropriate balance between complexity and simplicity in the projections. Also

recommended is developing a systematic approach to compare projection results with subsequent actual experience. Among the actuarial assumptions recommended for study are fertility rates, particularly as they relate to changes in our society, and mortality rates affected by smoking habits by sex.

Finally, and consistent with its originally recommended research agenda, the panel suggested that additional in-house resources should be made available to the Office of the Actuary and the Office of Research and Statistics, SSA. Having had responsibility for the Office of the Actuary for a time, I strongly support that recommendation. At the same time, it is difficult to recruit, train, and maintain a highly competent staff because of on-again/off-again hiring freezes, salary caps, and the generally low regard in our society for government employment. We can only be thankful that a few dedicated and highly competent individuals have chosen public service in spite of the disincentives to do so.

Dwight K. Bartlett, III, Past President of the Society and former Chief Actuary of the SSA, presently is Visiting Executive Professor at Wharton School of the University of Pennsylvania.

Spread the news – SOA in New York for spring meeting

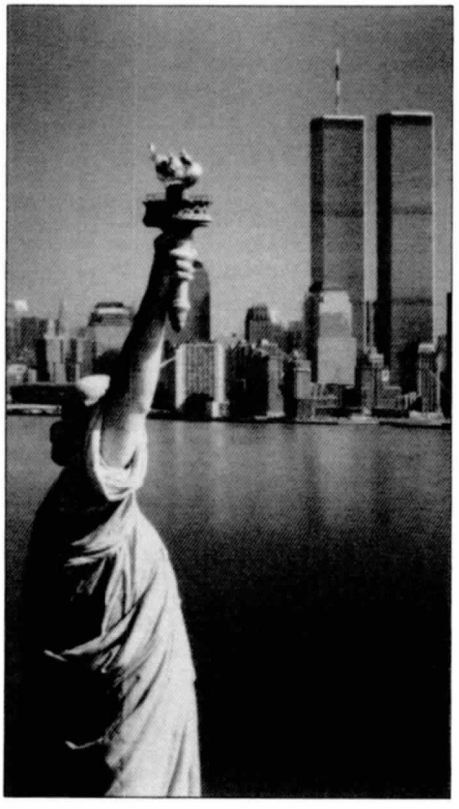
Start spreading the news. The Society of Actuaries will take a bite out of the Big Apple when it arrives in New York for a spring meeting on May 16-17 at the Waldorf = Astoria Hotel.

How to inform and educate legislators, regulators, and opinion leaders about the unique skills and insights actuaries can provide is the theme that prevails at this meeting.

Three tracks – product development, financial reporting, and investments – are featured through such topics as actuarial standards, regulatory issues that impact investment strategy, how to influence public policy, and communication skills in the public forum.

Two guest speakers, Dr. William Freund, a nationally known economist, and Professor Meyer Feldberg, Dean of The Graduate School of Business at Columbia University, will complement the continuing education offerings. Freund, the keynote speaker at the May 16 general session, will discuss "Major Issues Facing the Economy, the Insurance Industry, and Actuaries in the Years Ahead." Feldberg, speaker at the May 16 general luncheon, will offer a program on "Strategic Thinking for the 1990s."

Early arrivals can enjoy an evening at the theater on Wednesday, May 15, choosing from three of the hottest shows on Broadway – *Phantom of the Opera*, *Aspects of Love*, and *City of Angels*. Registrants



and guests can mingle at an evening reception on Thursday, May 16, enjoying famous Broadway melodies along with their cocktails and hors d'oeuvres.

For more information, call the SOA Meetings Department, 708-706-3540.

University of Wyoming receives first ASA grant

The first $2,500 grant to an educational institution in recognition of a full-time faculty member attaining ASA status has been awarded to the Mathematics Department of the University of Wyoming in Laramie.

The SOA Career Encouragement and Academic Relations Committee made the grant to the University of Wyoming's mathematics department based on the achievement of Dr. Leonard A. Asimow. A professor in the Mathematics Department, he completed requirements for his ASA designation with the November 1990 SOA examinations.

The university's mathematics department intends to use the funds for promotional materials, including a brochure to be mailed to high schools, and for financial support of students studying actuarial science and taking actuarial examinations.

This grant is part of the ongoing SOA program to strengthen relations between the Society of Actuaries and the academic community. For more information on the academic relations initiatives, call Judy Yore at the SOA office, 708-706-3573.

Mail alert

The First Ballots for the Society's 1991 elections were mailed to all Fellows on March 26. If you are a Fellow and have not received the First Ballot, please call Marilyn Meier at the Society, 708-706-3500. To be valid, ballots must be returned to the Society office by April 26.

Let's target the right group for SOA credits

by Steve Malerich

Until October 1989, the Society of Actuaries' Board of Governors had planned an experimental program for granting credit for college course work. This program was canceled only after a portion of our membership nearly succeeded in amending our by-laws to prohibit such an experiment. I understand the Board now considers this a dead (or at least dormant) issue. That is unfortunate. I believe the experiment simply targeted the wrong group. I suspect that member support for such an experiment would be far greater if the right group of people were targeted.

How colleges grant credit for outside courses

Colleges consider granting credit for courses completed elsewhere in two instances:

- When they have a reciprocal agreement with another college relating to specific courses.
- When students enroll in a college, the school considers granting credits for courses that were taken previously at another school.

The first situation is not relevant, so let's explore the second. Consider a person who began in a different career which also uses mathematics, statistics, operations research, etc. Except for someone who is teaching the subjects that we test, it is unlikely that anyone would have retained enough of the details of these earlier subjects to succeed in passing our exams without studying them again. Forcing these people to go back to ground zero is hardly a way to encourage qualified people to enter our profession.

Why we should consider another route to designations

Should we, who have been through the rigors of the exams, allow anyone else to come in without also going through all of them? Won't this dilute the value of the ASA and FSA designations? If properly targeted and managed, we should be able to maintain, and perhaps even enhance, the value of our professional designations. Let's look at two ways this can happen.

As employers of actuaries, we want to hire the best candidate for a job. Normally, we will consider only those people who have passed at least one of our exams. This criterion excludes individuals who began in a different career, who then considered becoming actuaries, but didn't think it would be worth their time and effort to return to basic mathematics, etc. I believe that some of those people would be at least as good as, and often better than, some of the people we hire. Too bad for them, and for us, as well.

Now, let's look at our Society. Someone recently used the term "inbreeding" in reference to our profession. While high standards must be maintained, we benefit from the influx of ideas that can come from other professions and occupations. A carefully structured program for attracting (not just admitting) people from other fields will enhance the knowledge, and subsequently the value, of our profession.

How the program would work

Initially, the program would be restricted to individuals who have a college degree and perhaps to those with some experience in an applied field of mathematics or statistics. In addition, the individual must never have taken (passed or failed) an actuarial exam, although people may take one or more exams while their applications are being considered.

Upon application, individuals who satisfy the eligibility requirements will be considered for advanced entry into our exam program. The application will specify which subjects the candidate wishes not to repeat.

Only subjects on the Associateship exams will be considered. The Society will consider the candidate's education and experience, then approve all, some, or none of the specified subjects.

If approved for advanced entry, the individual is exempted from taking exams on these subjects. The individual would be allowed to communicate this information to a possible employer, but would not be allowed to claim credit for passing these exams. The initial application and our letter of acceptance would clearly express this restriction. The Society would not grant credits, as such, for advanced entry. But if and when these people apply for Associateship, the Society would treat them as if they had passed the respective exams on the date they applied for advanced entry (or completed the course). This would include the possibility of losing credit for subjects dropped from the syllabus.

Once in the exam program, advanced-entry students would be encouraged to use college courses to help learn SOA subjects but would be required to pass SOA exams before receiving credit for the subjects.

After becoming an Associate, no distinction would be made between individuals who started from the bottom (Course 100) and those who entered at a higher level. An Associate is an Associate.

Hypothetically, it is possible for a person to gain a strong knowledge of all our Associateship materials without taking any of our exams. Practically, we must consider that the ASA designation implies that a person has received a substantial education through the Society of Actuaries. While someone might have sufficient background in most of SOA Associateship subjects, the Society would have to require that a substantial number of credits be obtained through the exams. Included in a minimum would be any subjects that relate primarily to our profession, such as actuarial mathematics.

Unlike the previously planned experiment in credit for college courses, a student would not be inclined to use this program to sidestep our exam process. Someone who deliberately avoided actuarial exams, with the intention of getting advanced placement later, would risk repeating subjects in the future. (Even if advanced placement were approved, the Society might not approve all subjects.) Most students who consider actuarial work as a possible field would likely want to take the exams as they were taking the courses in school.

For the sake of our profession, our companies, and our customers, let's reopen discussion of this issue. Only this time, let's hit the target.

Steve Malerich is Vice President and Treasurer, Early American Life Insurance Company.

FACTUARIES

by Deborah Poppel

This is another in a series of profiles of members of the Society's Board of Governors.

Name: Yuan Chang.

Birthday: July 16, 1934.

Birthplace: Beijing, China.

Current hometown: Manhattan, New York.

Current employer and function: MetLife – Responsible for the pensions business in the non-corporate market (public plans, Taft Hartley, foundations, endowments).

Marital status: Married to Mary H. Han.

Children: Christine Hanway, 29; Timothy, 26; Derek, 22; and Leslie, 20.

My first job was: Selling Oriental gifts at a concession in a farmer's market.

I'd give anything to meet/have met: Winston Churchill.

The number of exams I flunked: Four.

The book I recommend most often: *A Brief History of Time* by Stephen Hawkins.

The movie I'd most like to own the tape of: *Presumed Innocent.*

Nobody would believe it if they saw me: Dancing the jitterbug.

The TV show I stay home to watch: *L.A. Law.*

If I could change one thing about myself, I'd: Spend more time loafing.

When I'm feeling sorry for myself, I: Read – anything.

My fantasy is: To work out an economic theory that works.

The silliest thing I've ever done: Appear in an amateur ice dancing show.

If I could do it over, I'd: Be less anxious about everything and leave more to fate.

My proudest actuarial moment: Greeted by the Society President at two different SOA meetings, once as a new Associate and the other as a new Fellow.

I'm passionate about: Good food.

My favorite way to spend a Sunday: Stay at home with no "must do" and no clock watching.

Book review

Employee benefits change with the times

by William H. Aitken

Canadian Handbook of Flexible Benefits, by Robert J. McKay, Hewitt Associates. Published in 1990 by John Wiley & Sons, 22 Worchester Rd., Rexdale, Ontario M9W 1L1, Canada (416-675-3580). 453 pages. $125 (Canadian).

Traditional employee benefits programs in the 1960s were designed for a family unit typically consisting of a working male, a female homemaker, and two children. But such a traditional family represents only 17% of today's workforce, compared to 65% in the sixties.

Flexible benefits are transforming the delivery of employee compensation and benefits in Canada; 50 flexible benefit programs have been implemented. The financing is under the control of the plan sponsor; the plan members decide how to allocate their allowance. Up to 40% of payroll can be applied to the flexible or benefits area.

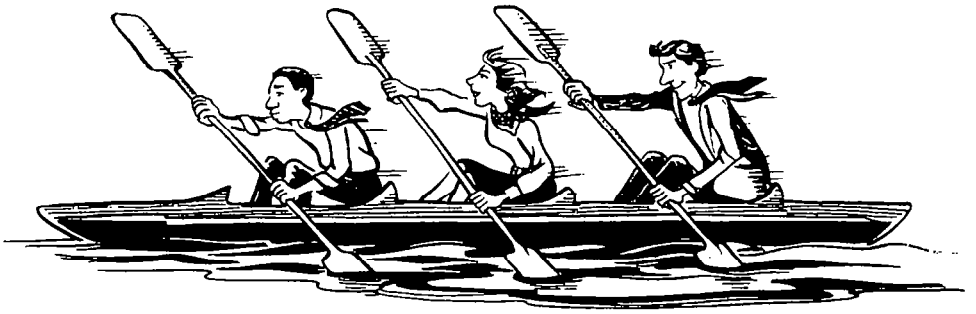
This book of 22 chapters, plus appendix, glossary, and index, gives a thorough account of all aspects of flexible benefits, including generating flexible credits, pricing of benefit options, legal and tax issues, communication and testing, high and low options, visioncare and pharmacare, and reenrollment and areas of choice. Other flexible benefits include time off with pay and retirement choices, four pricing and credit approaches, short-term and long-term benefits, winners and losers analysis, adverse selection and controls, training the trainer, software and hardware, and cost/benefit analysis. Also included are case studies for Cominco, American Express Canada, Prudential Insurance and Potash Corporation.

In addition to information on flexible benefits, this text provides continuing education in a broad area of great value to all Canadian actuaries.

William H. Aitken is with the Department of Statistics and Actuarial Science, University of Waterloo.

Business/university relationship benefits both

by James A. Curtis
and Dr. Edgar Lee Stout



The Society of Actuaries' program initiated last year to strengthen relationships with the academic community affirms the importance of having strong ties with our profession's academic roots. The SOA program is now in place to encourage more interaction with colleges and universities.

Is there more that could be done? Could the personal, one-on-one approach we frequently use to reinforce business relationships also energize professional and academic interaction on a local level? The following example of how one company and one university forged a mutually beneficial relationship through a history of personal contacts might stimulate others to think along the same lines.

Historical perspective

Although the roots were planted 90 years ago, an alliance between Milliman & Robertson, Inc. and the University of Washington's Department of Mathematics only recently came into full flower. In the early 1900s, Loren D. Milliman, father of Wendell Milliman (one of the founders of M&R), was a professor of mathematics and English at the university. Wendell Milliman received his math degree from the university in 1926 and, after his death in 1976, his sister, Grace Pollock, established an endowment fund in his memory to fund visits from the world's leading mathematicians.

Book serves as catalyst

Despite the long-standing connection, it took a book to bring together the individuals who would lead the two entities to their current affiliation. In 1988, James Curtis, Chairman of M&R, sent several complimentary copies of the history of M&R, *Milliman and Robertson: Reflections on the First Forty Years*, to friends of the firm. One copy reached the desk of Lee Stout, Chairman of the Department of Mathematics at the University of Washington. Like many academics, Stout was at the time almost completely unacquainted with the actuarial profession, and Curtis was unaware of the Milliman family connections with the university. Stout contacted Curtis to thank him for the book and they arranged to meet for lunch.

This first contact led to other discussions which pointed out needs both organizations had that the other could meet. Two developments from those discussions are currently yielding tangible results.

Extension courses fulfill professionals' needs

Although many students taking early actuarial exams have had relevant courses during their university careers, they need to refresh their skills when preparing for these exams. The University of Washington's Extension Division has established a program of actuarial coaching classes at its downtown Seattle center. This location is more convenient for working professionals in the actuarial exam process than the main campus. The courses, which cover subjects for 100, 110, 120, 130, 135, 140, and 150 exams, are noncredit, since those who attend have no need of formal academic credit. The courses must be self-sustaining, i.e., tuition for a course must defray the cost of the course.

The program's Advisory Committee includes representatives from the university's mathematics and statistics departments and from several actuarial firms, as well as a representative of the Extension Division.

An important aspect of these courses is that they are taught by professionals from the local community of actuaries. This approach is a conscious decision of the Advisory Committee to ensure that the material is taught by those who are well acquainted with its direct applications. The program appears to meet a genuine need in the community.

M&R pays exam fees for math students

While the University of Washington helps prepare the working professional for actuarial exams, M&R helps by paying exam fees for some undergraduate math students who want to begin the exam process. Although fees are modest and the program is small (fewer than 10 students were supported in the first year), it has proved helpful to students, many of whom are on limited budgets. From the profession's point of view, the program is helpful in drawing students' attention to the possibility of an actuarial career. The fact that the program is sponsored by M&R is not lost on the students, and could serve in a small way to further M&R's recruiting efforts at the University of Washington.

Less tangible results

Goodwill, while an intangible asset, is a very valuable result of university/corporate contacts. The University of Washington's Department of Mathematics has gained a genuine friend in the business community, a supporter who has come to understand and appreciate the work of the department. In return, M&R and the actuarial profession have gained rapport with academia. Some members of the University of Washington faculty have an increased understanding of the actuarial profession.

Although it is not proposed as a model for others, the relationship that has developed between M&R and the Department of Mathematics at the University of Washington is an example of mutually beneficial contacts between a firm of actuaries and an academic department.

James A. Curtis is Chairman and Chief Executive Officer of Milliman and Robertson, Inc. Dr. Edgar Lee Stout, not a member of the Society, is Chairman of the Department of Mathematics at the University of Washington.

A November nightmare

by Michael Reardon

Riding up the elevator I was like a well-conditioned athlete prepared to do battle. I knew everything. Theories, definitions, and facts rolled off my tongue like Mike Tyson's mouthpiece, and I was prepared to walk into the examination room and humiliate the exam writers with the ease in which I fielded their pathetic offerings.

I entered the examination room. I settled confidently into my chair and looked around at the other contestants. In the front row was the man they called "the sage." This was his seventh sitting of this exam. He was the crafty veteran who had been through it all. He had seen this exam split into pieces, put back together, and then split again, and he failed it in every incarnation. He would begin his conversations with comments like, "I remember when I failed this exam in the fall of '87. It was a brutally cold day and they had four questions on derivative instruments. You punks don't know how easy you have it."

The guy at the table in front of me had five pens and seventeen pencils; across from him was a woman with three apples, two cups of coffee, and an egg timer to help pace herself. I had none of these pagan offerings to the exam gods. One man, one pencil, and one calculator, shamelessly sold to students for ten bucks when you could get one free (that actually did something) with a gas fill-up. These were all I would need to dismantle this exam.

We began the pre-exam ritual of filling in 12,000 dots and receiving detailed directions to the restrooms. The guy in front of me was into his third pencil when the starting gun fired. I flipped open the booklet and read the first question. I had to laugh as I spelled out my response. Who did they think they were dealing with?

Then things turned ugly. I didn't recognize the next two questions. I turned back to the first page to make sure I was taking the correct exam. I began to panic and became aware of every sound in the room. Why does the proctor have to slurp his coffee like that? If that woman takes another bite out of that apple I'm going to stuff it down her throat.

I look around the room and everyone is writing furiously. Well, almost everyone. There's one guy who appears to have no concept of the exam at all; he's holding it up in the air and blowing into it.

Why am I not writing? I can't think of anything to write; there's six months of my life down the toilet. I collapse face-first onto the table and reach the end of this examination period. As we're filing out of the room, I put my arm around "the sage" and begin to make plans to be here next time. Do you happen to know where I can pick up an egg timer?

Michael Reardon is Associate at Tillinghast/ Towers Perrin. While not yet a member of the Society of Actuaries, he did pass the exam described above.

Answer to 'Let's Make a Deal'

The March "On the Lighter Side" column asked whether a game show contestant should change his choice of which one of three doors has a prize behind it, after the host opens one of the other two doors he did not select and reveals it contains no prize.

Submitted by James Broffitt, he reasons that if the contestant does not switch his choice of doors, his probability of winning the prize is 1/3, but if he switches, the chance of winning increases to 2/3. Others have argued that if he switches, his chances are 1/2.

Broffitt explains further:

> It is often easiest to understand probability in terms of long-term relative frequency. Suppose this game were repeated 3,000 times. In about 1,000 cases, the initial door selected by the contestant corresponds to the prize, and in about 2,000 cases, the opposite is true. In each of these 3,000 trials, the host opens the door which does not have the prize. It is still true that in 1,000 cases the door selected by the contestant is a winner, but a loser in 2,000 cases. Since in all 3,000 cases the host has eliminated a losing door, the strategy of switching doors will result in 2,000 wins and 1,000 losses. Thus the probability that the initial door chosen wins is 1/3, and the probability of winning using the strategy of switching doors is 2/3.

Broffitt points out that this problem is essentially the same as the well-known Prisoner Problem, found in *Modern Probability Theory and its Applications*, by E. Parzen:

> Three prisoners, whom we will call A, B, and C, are informed by their jailer that one of them has been chosen at random to be executed and the other two are to be freed. Prisoner A, who has studied probability theory, then reasons to himself that he has probability 1/3 of being executed. He then asks the jailer to tell him privately which of his fellow prisoners will be set free, claiming that there would be no harm in divulging this information, since he already knows that at least one will go free. The jailer (being an ethical fellow) refuses to reply, pointing out that if A knew which of his fellows were to be set free, then his probability of being executed would increase to 1/2, since he would then be one of two prisoners, one of whom is to be executed. Is the jailer correct?

Dear Editor:

Insurance industry split over income tax

It is counterproductive for the insurance industry to be divided and belligerent over the Federal Income Tax issue. I propose the following structure by which we might come together:

1. Develop a Base Model upon which we can agree and from which we can draw insight for each added complexity introduced. I suggest this model be a flexible premium universal life policy. Structural variations can be added in the future to duplicate the workings of almost any other product.

   A. Two different companies (one stock and one mutual) sell the same product – same guarantees for expense charges, mortality charges, and interest rates; same current charges/rates – and identical clients pay identical premiums:
   - Premiums booked should be those actually paid.
   - Deductions should include expenses, benefits, and increase in reserves. Focus on the reserve as a function of actual accumulations and deductions as made to date. This is a critical step.

   B. Use the same scenario as in A but one client pays a little more to one company. Any agreements in A should easily extend to this situation.

   C. Use the same scenario as in A except that the current basis charges or credits may be slightly different. Again agreements in A should easily extend.

   D. Use the same scenario as in A except that the guaranteed basis charges are now different. If one were to calculate the guaranteed basis premium for a 100% endowment at age 95, one company would charge 10% to 15% more. Note that while this may simulate differences in whole life premiums between a stock and a mutual company, the mutual company does not have to be the one with the more conservative guarantees. Again agreements in A should easily extend.

2. Identify all issues about traditional type products that need to be resolved and one-by-one find their parallel in 1. If one isn't there, create it and agree on it before proceeding.

The end result regarding the dividend deduction in particular should be a very logical position somewhere between the two extreme positions available today.

I strongly urge all parties involved in the great tax debate to work on such a logical step-by-step program. Perhaps we may find that the simplicity and straightforward structure of universal life can illuminate both actuaries and non-actuaries to find a common logical path. It might even be a path that can be understood by those outside the industry.

Barry Allen

Not all actuaries know APL

In response to Kenneth T. Pawulski and Don Erickson in the January *Actuary*:

Perhaps Robert Clemens has made a few incorrect statements in expressing his concerns about the use of APL in the *Transactions*. However, the fact remains that you cannot expect all actuaries to know APL.

Copying a program directly from the *Transactions* for use by another actuary is certainly not as educational as reading a pseudo-code and converting the author's algorithm to a program in the language of your choice. The *Transactions* should be used for exchange of ideas, not software.

With respect to the readability of APL, anyone who has had to read an APL program by an unknown author who has not inserted the appropriate comments knows that this task can be extremely difficult. If people submitting papers for publication in the *Transactions* considered all potential readers, the above argument would not have been necessary.

Joe Nunes

Double your profit through math

In previous issues of *The Actuary*, several proofs that $1 = 2$ were presented. Of course, all had the usual flaws. The following example may be more intriguing than the usual run-of-the-mill division by zero or infinite series examples to show that $1 = 2$.

Suppose one has a gold bar to be sold for profit. If one could only double this gold bar by some means, then one would double his profits. Suppose this gold bar is cut into pieces (e.g., quartered), forming a simple jigsaw puzzle. By common sense reasoning, one can argue that the puzzle can be put back together to obtain nothing more than the same bar. Of course, we assume that nothing is wasted in the cutting process so that the reconstructed bar is the same as the original. This is what one would expect. It would be nice if one could find a way of cutting up the bar into a finite number of pieces and the pieces were then moved around using rigid motions (e.g., translations and rotations) to form another bar twice as large with no spaces between the pieces.

The mathematical result called the Banach-Tarski paradox states that the above can be done. I looked at the proof in the *Encyclopedia of Mathematics*, Volume 24, by S. Wagon, and did not see any error. This looks like $2 = 1$.

Leonardo C. Aguinaldo

CPA credit now available

The Society of Actuaries is now a registered sponsor of CPA continuing education credit in 49 states. New York approval is expected by April 30, 1991. There are several sessions at the Spring Meetings that have been recommended for CPA continuing education credit. Instructions for obtaining credit will be in the final program of the meetings. For additional information, please call Carol Pandak in Continuing Education at 708-706-3548.

26th Annual Research Conference

The 26th Annual Actuarial Research Conference will be conducted August 8-10, 1991, at the University of Illinois at Champaign/Urbana, Ill. Conference organizers are Esther Portnoy of the University of Illinois and Charles Fuhrer of Washington National Insurance Company. Anyone interested in presenting a paper on any topic of actuarial research should write to Charles Fuhrer, Washington National Insurance Company, 1630 Chicago Ave., Evanston, IL 60201, or call 708-570-4864.

In memoriam

Robert A. Bacon FSA 1960
Henry A. Plimptom ASA 1934
Dennis J. Whimpey FSA 1965

ACTUCROSSWORD

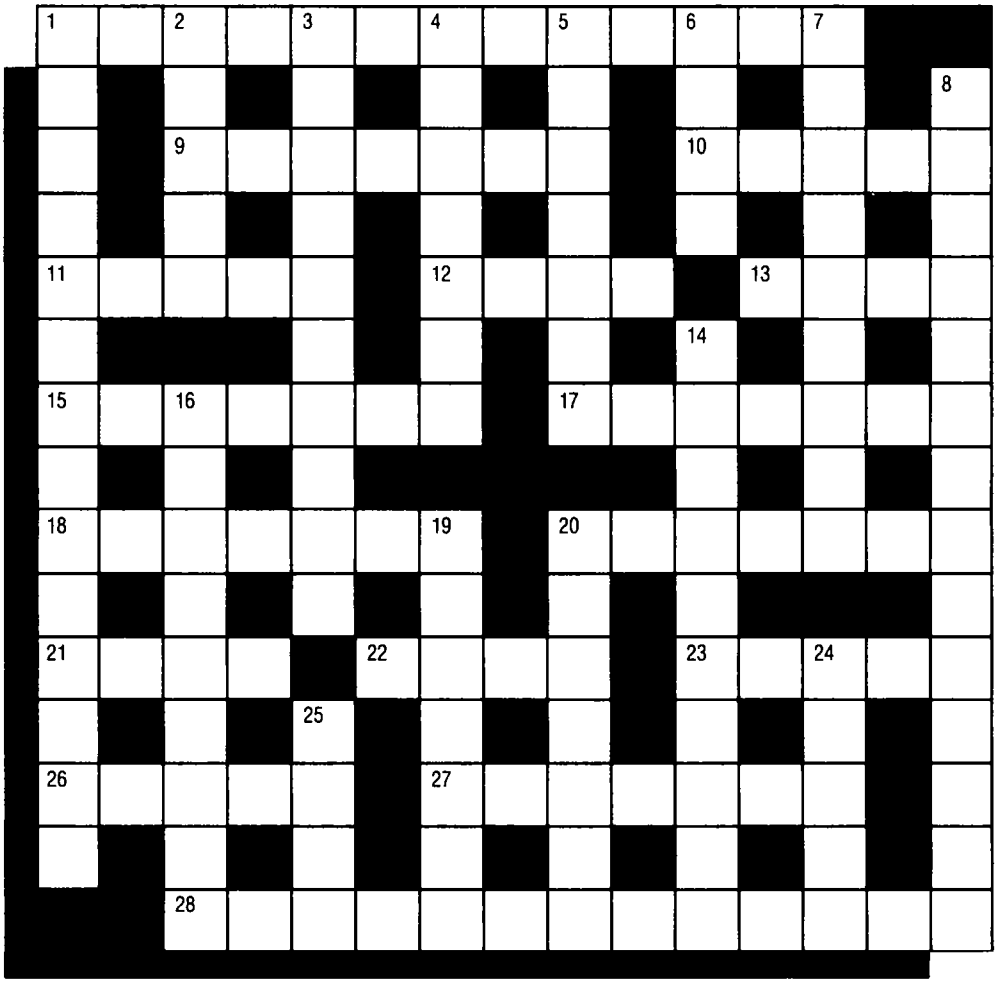
by R. Graham Deas

Across

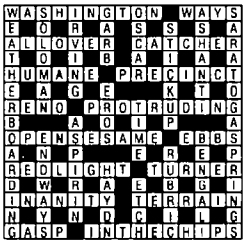
1. Location of penitence of Mr. Darling (2,3,8)
9. English river on a State capital (7)
10. Lavendar displayed in Degas picture (5)
11. Stuff, Royal in Colorado (5)
12. American, not a man, or little by little (4)
13. Moravian city reborn (4)
15. Decapod of Alice's quadrille (7)
17. Data - from sporting places (7)
18. Often at foot of page about currency (7)
20. Ancient city suited to chain reaction (7)
21. Lohengrin bride of asphodel saxifrage (4)
22. Rate revision shows sign of disappointment (4)
23. Small trees to clean (5)
26. Sound of double attrition (5)
27. Praised in a way or gelid in form (7)
28. Pilfering by digital illumination (5,8)

Down

1. They describe doing things in an unorthodox manner (9,5)
2. Mild rebuke or one who provides discipline (5)
3. Childish yet real men may be required to do it (10)
4. Clothing to last longer (7)
5. Suspended state which Afghan gin generally produces (7)
6. Location, not quite en haut but a high one (4)
7. Kind of language using neat prose (9)
8. Put so directors outwitted completely (6,3,5)
14. Short story wound in disputing (10)
16. Attacks to cause underworld center a shock (9)
19. Sounds little but it's tricky (7)
20. Chance of a first one but not afterwards (1,6)
24. Amendment being transported (5)
25. Weapons taken back - not for women (4)



March's Solution



100% SOLVERS — ***January:*** W Allison, F Alpert, A Amodeo, D Apps, B Averbach, D Baillie, J Beaton, D Berger T Mathews S Riddle & N Wilsman, T Boehmer, W Britton, J Braue, M & D Brown, R & M Buck, G Cameron, J Carr, R Carson, F Clarke, S Colpitts, J Damton, F & M David, B Dibben, K & M Diede, M Eckman, Mrs C Edwards, T Etter, F Finkenberg, R Frasca, C & D Friedrich, C Galloway, A Garwood, E Goldstick, P Gollance, W Gooden, J Grantier, O Gupta, P Hepokoski, W Hill, R Hohertz, V Hosler, HTI Hogs, J Hunt, W Jones, O Karsten, R & J Koch, C & P Kroll, L Laderman & D German, D Leapman, W Lumsden, W Luther, M Lykins, R Maguire, J Makin, H Margolit, P Marks, R C Martin, P & J May, G & D Mazaitis, G D McDonald, J Mereu, H Micotti, R A Miller, C Montpetit, B Mowrey, J Nichols, J Palmer (Nov), D Promislow, F Rathgeber, B Rickards, J Ripps, J Schwartz, G Sherritt, M Steinhart, H Tate, Mrs J S Thompson, P Thomson, B & J Uzzell, M Vandesteeg & A White, C Walls, C Wasserman, D Weill, A Weishaus, R Weitzenkamp, D Westrop, M Whitby, A Whiton, H & F Zaret, and two anonymous solvers.

Send solutions to: Competition Editor, 8620 N. Port Washington Rd (312), Milwaukee, WI 53217

ACTUCROSSWORD

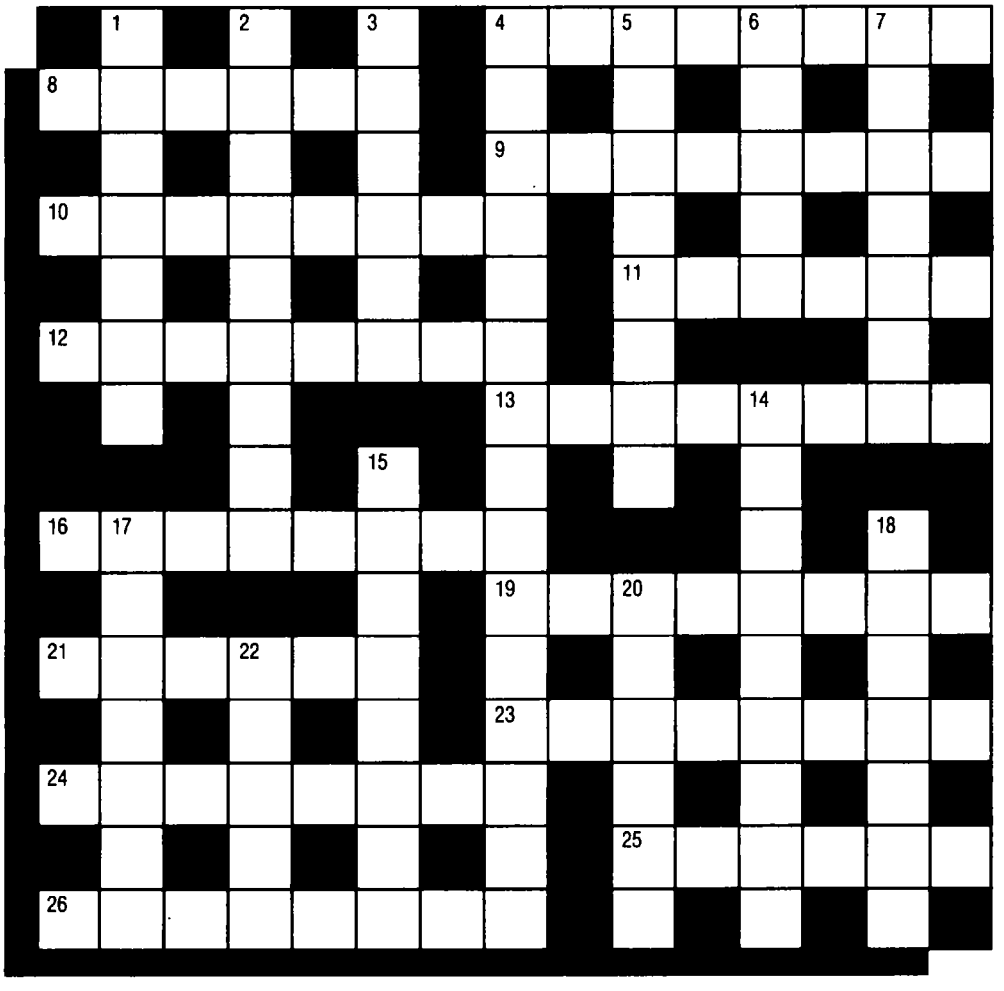
by Bob Hohertz

Across

4. Records principal American composer (8)
8. Fellows, one promises trouble (6)
9. Stout rustic in a complicated test (8)
10. Not to mention a claw, in general (3,5)
11. Spoil the drink limit (6)
12. Led around to enlightened state (8)
13. Paragon unchosen anyway (8)
16. Bloody road! (8)
19. Final station (8)
21. Support ten at the motion picture lot (6)
23. Mixing a dynasty with fish (8)
24. The same old thing: a snare, a vegetable (8)
25. Twisted tangent, tailless solan goose (6)
26. Silence! This'll control the vapors (8)

Down

1. Vireo, the morning after? (3,4)
2. Old buddy, a list of numbers would be very agreeable (9)
3. Opera hat (6)
4. Stake Mrs. Swan the most possible, but she comes in second to last (15)
5. Much pink squash for Alvin... (8)
6. ...is the drink Erwin has inside for a roller (5)
7. The neanderthal's end with the ice age breaking up, and the mood it conveys? (7)
14. Kid, throw around, stumble (9)
15. Power to walk it off (8)
17. Spot a photo and come back together (7)
18. Los Angeles beneath scrub (7)
20. Green, confused egghead to make wrong play (6)
22. In Cassandra, constellation may be observed (5)



Please indicate, on a scale of 1 *(very easy)* to 10 *(very hard)*, how you found this puzzle. Any other comments will be welcome.

MARCH'S ACTUCROSTIC SOLUTION: David Freedman, Maker of Worlds, "Coleman arrived late to a seminar just in time to hear Nobel prize winning physicist Weinberg say to someone in the audience, 'I'm sorry, but I don't know the answer to that question'. 'I do' bellowed Coleman marching off down the aisle. He was told the question and answered it without missing a beat." DISCOVER, July, 1990.

Send solutions to: Competition Editor, 8620 N. Port Washington Rd (312), Milwaukee, WI 53217