value of guaranteed liabilities (i.e. including bonuses declared to date, but not future bonuses). This amount can be expressed as a percentage of the market value of assets.

Next, the present value of future reversionary bonuses at present rates on the in-force business is established, and the free reserves less this amount are compared with the market value of assets.

Finally, the free reserves, less the value of future reversionary bonuses on the in-force business, are compared with the support required to allow the latest year's new business to pay current rates of reversionary bonus.

Other relevant factors are discussed, including shareholders' participation (if any), new business trends, expense ratios, underwriting standards, investment strategy, financial guarantees, and transfers from investment reserves.

The methodology is based on the mutualization price techniques first developed in the late 1960's for evaluating proprietary life companies. The basis for calculations is Schedule 5 of the DTI returns, updated as necessary to take into account subsequent movements. Together with other schedules, it allows a reasonably full picture of the life company's products and portfolios to be formed. However, other sources of information are necessary as well, such as trade journals. The valuation itself is a gross premium one, with realistic mortality, interest and other assumptions. Various problems arise: timing of the DTI returns, deficiencies in the information provided, and treatment of subsidiaries.

Finally, an example is given of the results of the calculations for three life offices.

COMMERCIAL FIRE INSURANCE

BY N. R. GILLOT *et al.*

(Synopsis of a paper presented to the Society on 5 January 1988)

IN 1847 W. E. Hillman, Actuary to the Star Assurance Office, stated that "the time is approaching when . . . the present loose and almost undefined method of estimating (fire insurance) premiums for different kinds of risks will give place to one of a more scientific and definite nature". However, since that time, the actuary's role in fire insurance has been negligible and it could be argued that the setting of commercial fire insurance premiums is still not undertaken in a scientific way. The authors believe that actuarial techniques are very relevant to this problem. The paper aims to introduce the subject of fire insurance and to indicate areas in which actuaries might be usefully involved. The timing of the paper is opportune as many offices are having to produce their own premium

structures following the demise of the market tariff which had been in force for many years.

Having set out what is generally covered by a commercial fire insurance policy, the perspective of the underwriter is discussed. A typical rating structure of one office is described and areas in which other offices use different approaches are noted. The paper then indicates methods by which rating revisions can be carried out.

A section giving the actuarial perspective shows that underwriters and actuaries view the same problem in different ways. The interdependency between rating factors and the extent to which each factor contributes to the true differentiation between risk is often not well understood. Use of experience rating within commercial fire insurance is another area where it might be thought the actuary could usefully contribute. Other issues such as rating excesses, credibility theory and the impact of investment income are also discussed. The paper argues for a joint approach between underwriters and actuaries to the statistical problems of fire insurance.

The use of computerized fire underwriting systems for the setting of rates is briefly described. Experimentation with the use of expert systems for the same purpose is also discussed.

The last three sections of the paper leave the subject of premium rating to concentrate on reinsurance, claims and statistics. Reinsurance is a complex issue for fire insurance; the different aspects of the subject covered are the type of reinsurance used, the level of retentions, catastrophe protection, security and coinsurance. There is a brief consideration of the settlement, reserving and distribution by size of claims, before the final section of the paper which considers statistics. Perhaps the first thing that any actuary will have to do before becoming usefully involved in the subject of fire insurance is to collect some appropriate statistics in an area where good statistics are often not easily available. The availability, collection and analysis of statistics is a prerequisite to applying some of the techniques described earlier in the paper.

DETERMINATION OF THE CONTRIBUTION RATE TO MONEY PURCHASE ARRANGEMENTS

By David Carr with help from Gary Simmons

(Synopsis of a paper presented to the Society on 15 March 1988)

The paper explored money purchase scheme design, in particular the effect on design of money purchase contracting out.

Simple scheme designs were explored and were found to result in some very