Pension Mathematics for Single Employer Defined Benefit (DB) Plans

Why Pension Mathematics: Defined benefit plans are pensions plans where an employer promises a group of its employees to pay post-retirement annuity benefits that are specified by a mathematical formula. As these promised payments may be made way into the future, actuarial science specialists (called pension actuaries) are required to periodically perform a valuation of the defined benefit pension plan to verify that the employer is taking the correct steps to pay the promised benefits when they come due.

This Pension Seminar: This series of pension lectures is devoted to introducing students to the some of the mathematics used by pension actuaries to determine whether employers have enough funds to cover future pension annuity benefits to their current employees. Usually pension actuaries are required to file reports to a country's pension plan regulators. Although we will focus on post-retirement annuities, I must emphasize that pension actuaries are involved in almost all aspects of pension plans including designing the plan itself, managing pension risks, and valuing pension plans in cases of mergers and acquisitions.

What Do We Cover: Because of the long term nature of commitment given by defined benefit pension (DB) plans, the have a "reserve" (called the accrued liability) and require "premiums" (called normal costs). There are several methods, called pension cost methods, for determining accrued liabilities and normal costs. We will focus on the following actuarial cost methods: (i) unit credit, (ii) projected unit credit, (iii) entry age normal, (iv) individual level premium, (v) attained age normal, (vi) frozen initial liability, (vii) aggregate, and (viii) individual aggregate. We will also cover the mathematics of employee contributions and early and late retirement. We will explore the effect on valuation results of various patterns of experience, including experience with respect to investment earnings, mortality, disability, employee turnover, changes in compensation, and retirement: this is called analysis of experience gains and losses.