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Stat 470. Actuarial Mathematics, Spring '04

INSTRUCTOR: Eric Slud, Math. Dept., Rm. 2314, ×5-5469, **evs@math.umd.edu**

OBJECTIVE OF THE COURSE: This course introduces several of the major mathematical ideas involved in calculating life-insurance premiums, including: compound interest and present valuation of future income streams; probability distributions and expected values derived from life tables; the interpolation of probability distributions from values estimated at one-year multiples; the 'Law of Large Numbers' describing the regular probabilistic behavior of large populations of independent individuals; and the detailed calculation of expected present values arising in Insurance problems.

Course Prerequisite: Calculus through Math 240-241. Some Probability at the level of Stat 400 would be helpful. Ideas from probability and statistics will be developed from scratch, as needed, through course notes and reference to the Stat 400 text, *Introduction to Probability and Statistics*, 6th ed. (2004) by R. Devore.

MAIN TEXT: Notes available at (reproduction) cost from the Student Union bookstore.
RECOMMENDED TEXTS: (1) *Life Insurance Mathematics*, 3rd ed. (1997), by H. Gerber, Springer-Verlag.
(2) *Theory of Interest and Life Contingencies With Pension Applications: A Problem Solving Approach*, 3rd ed. (1999) by Michael M. Parmenter, ACTEX Publications.

Course format: Graded homeworks (one every $1\frac{1}{2}$ weeks), one in-class midterm in March, and a take-home final or project in lieu of a final exam. Homework counts 40%, and midterm and final/project each count 30%, toward the course grade. Project and/or take-home topics will be distributed and discussed after the mid-term.

COURSE OUTLINE

I. Overview of actuarial mathematical problems.
   A. Theory of interest and actuarial notation.

II. Introduction to Life Tables & Mortality Measurements.
   A. Probability densities, random variables, expectation, law of large numbers.
   B. Relative frequencies and empirical death rates. Connections with probabilities.
   C. Survival curves. Force of mortality (hazard rates).
   D. Theoretical survival models. Estimation from life-table data.
   D. Actuarial approximations for survival probabilities.
   E. Probability in demography: stationary populations and age-distributions.

III. Calculation of Insurance Premiums. Valuation of insurance contracts. Reserves.

SEE OVER FOR BACKGROUND MATERIAL ON ACTUARIAL SCIENCE.

BACKGROUND: Actuarial Science is the subject at the interface of mathematics and business relating to the valuation of risks and Insurance. Actuaries find employment in the Insurance industry, as professionals and consultants employed to certify the financial soundness of pension and insurance plans, and in government agencies such as the Social Security Administration, Pension Benefit Guaranty Corporation, and department of Housing and Urban Development.

The training of Actuaries involves heavily mathematical undergraduate coursework, as well as a solid grounding in business and economics. Actuarial certification, by the Society of Actuaries or the Casualty Actuarial Society, is accomplished through a battery of ETS-type examinations with a prescribed syllabus, which for the first several examinations is primarily mathematical and statistical.

The Mathematics Department has established an undergraduate Actuarial Track of the Mathematics major, and a Certificate in Actuarial Mathematics available to non-Math majors. Both the Track and the Certificate enable students to earn a degree documenting that they have taken a package of courses covering parts of the actuarial examination syllabi, and have prepared themselves to take several of the actuarial exams. For further details, visit

http://www.math.umd.edu/undergrad/actuary.html