

Introduction to Actuarial Science

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Key concepts, typical tasks, required skills, and career pathways

1. What Is Actuarial Science?

Aspect	Description
Definition	The application of mathematics, statistics, and financial theory to assess and manage risk, especially in insurance, pensions, and finance.
Core Goal	Quantify the probability and financial impact of uncertain future events.
Primary Industries	Life & health insurance, property & casualty insurance, pension funds, reinsurance, investment firms, government agencies, consulting.

2. Fundamental Disciplines

Discipline	Relevance to Actuarial Work
Probability & Statistics	Modeling random events, estimating claim frequencies and severities.
Financial Mathematics	Present/future value calculations, interest theory, annuities, bonds, derivatives.
Economics	Understanding macro/economic drivers (inflation, unemployment, mortality trends).
Computer Science / Data Analytics	Large-scale data handling, predictive modeling, simulation (Monte Carlo).
Risk Theory	Modeling aggregate loss, ruin probabilities, capital adequacy.
Regulation & Ethics	Compliance with solvency standards, professional conduct codes.

3. Typical Actuarial Tasks

1. Pricing / Product Development

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- Build tariff structures for insurance policies.
- Use mortality, morbidity, and lapse tables to set premiums.

2. Valuation & Reserving

- Estimate future claim payments (reserves).
- Perform actuarial valuations of pension plans and insurance liabilities.

3. Risk Management

- Conduct scenario analysis and stress testing.
- Determine capital requirements (e.g., Solvency II, Risk-Based Capital).

4. Financial Reporting

- Prepare statements for regulators, auditors, and shareholders.
- Apply IFRS/17 / GAAP actuarial assumptions.

5. Predictive Modeling & Data Science

- Apply machine learning algorithms to underwriting, fraud detection, and customer segmentation.

6. Consulting & Advisory

- Advise corporate clients on employee benefits, mergers & acquisitions, and strategic risk.

4. Core Technical Tools

Tool / Language	Typical Use
Excel / VBA	Quick prototyping, cash flow tables, sensitivity analysis.
R / Python	Statistical modeling, simulation, data cleaning, machine learning.
SQL	Accessing and manipulating large relational data sets.
** actuarial software** (e.g., Prophet, MoSes, GGY, AXIS)	Production-grade pricing, reserving, and projection.

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Tool / Language

Typical Use

SAS / STATA

Advanced analytics and regulatory reporting.

Monte Carlo simulation packages

Modeling complex stochastic processes (e.g., mortality, investment returns).

5. Professional Qualification Pathway

Step	Description
1. Undergraduate Degree	Mathematics, statistics, finance, economics, or actuarial science. • SOA (Society of Actuaries) – U.S. focus • CAS (Casualty Actuarial Society) – property & casualty • IFoA (Institute and Faculty of Actuaries) –
2. Exam Process	UK/International Exams cover probability, financial mathematics, models, actuarial practice, etc.
3. Validation by Educational Experience (VEE)	Coursework or approved self-study