

Introduction to Actuarial Science

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Key concepts, roles, and tools for aspiring actuaries

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 Objective	Quantify the probability and financial impact of future uncertain events.
Typical Industries	Life & health insurance, property & casualty insurance, pension funds, investment firms, government agencies, consulting firms, reinsurance, and emerging areas such as fintech and climate risk.

2. Fundamental Disciplines

Discipline	Relevance to Actuarial Work
Probability Theory	Models random events (e.g., death, accident, natural disaster).
Statistics & Data Analysis	Estimates parameters, fits distributions, validates models, and conducts hypothesis testing.
Financial Mathematics	Time value of money, interest theory, annuities, loans, and derivatives pricing.
Life Contingencies	Survival models, life tables, mortality rates, and life insurance calculations.
Risk Theory	Aggregate loss modeling, ruin probabilities, and capital allocation.
Economics & Finance	Asset-liability management, investment risk, and macro-economic assumptions.
Computer Science / Programming	Data manipulation, simulation, and implementation of actuarial models (R, Python, SAS, VBA, SQL).

3. Typical Actuarial Tasks

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1. Pricing & Product Development

- Determine premiums for life, health, property, and casualty policies.
- Conduct profitability analysis and competitive benchmarking.

2. Valuation & Reserving

- Calculate reserves (case reserves, IBNR, IBNER).
- Perform actuarial valuations of pension plans and insurance liabilities.

3. Risk Management

- Model frequency and severity of claims.
- Apply capital models (e.g., Solvency II, ORSA, RBC).
- Conduct scenario and stress testing.

4. Financial Reporting & Compliance

- Prepare statements for regulators and auditors (e.g., GAAP, IFRS 17).
- Ensure adherence to actuarial standards of practice.

5. Consulting & Advisory

- Advise on product design, mergers & acquisitions, and strategic planning.
- Provide expert testimony in litigation or regulatory hearings.

4. The Actuarial Qualification Path

Stage	Typical Exams / Requirements	Main Focus
Pre-Actuarial (Foundations)	Probability (P), Financial Mathematics (FM), Modeling (M), Statistics (ST)	Core mathematical knowledge.
Core Technical (CT)	CT1–CT8 (or equivalents)	Life contingencies, risk models, financial economics, actuarial modelling.
Core Application (CA)	CA1–CA3	Business awareness, professionalism, and communication.

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Stage	Typical Exams / Requirements	Main Focus
Specialist Modules	e.g., Life Insurance, General Insurance, Pensions, Investments	Deep dive into a chosen practice area.
Professional Development	Work?based experience, continuing professional development (CPD)	Practical skills, ethics, and lifelong learning.

Note: The exact exam structure varies by professional body (e.g., Society of Actuaries (SOA), Casualty Actuarial Society (CAS), Institute and Faculty of Actuaries (IFoA)).

5. Core Mathematical Tools

Tool Typical Use

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