

# Sloan Career Cornerstone Center

## Actuarial Science Overview

The Field - Preparation - Day in the Life - Earnings -  
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### The Field

One of the main functions of actuaries is to help businesses assess the risk of certain events occurring and to formulate policies that minimize the cost of that risk. For this reason, actuaries are essential to the insurance industry. Actuaries assemble and analyze data to estimate the probability and likely cost of the occurrence of an event such as death, sickness, injury, disability, or loss of property. Actuaries also address financial questions, including those involving the level of pension contributions required to produce a certain retirement income and the way in which a company should invest resources to maximize its return on investments in light of potential risk. Using their broad knowledge of statistics, finance, and business, actuaries help design insurance policies, pension plans, and other financial strategies in a manner which will help ensure that the plans are maintained on a sound financial basis.



Most actuaries are employed in the insurance industry, specializing in life and health insurance or property and casualty insurance. They produce probability tables which determine the likelihood that a potential future event will generate a claim. From these tables, they estimate the amount a company can expect to pay in claims. For example, property and casualty actuaries calculate the expected amount payable in claims resulting from automobile accidents, an amount that varies with the insured person's age, sex, driving history, type of car, and other factors. Actuaries ensure that the price, or premium, charged for such insurance will enable the company to cover claims and other expenses. The premium must be profitable, yet competitive with other insurance companies. Within the life and health insurance fields, actuaries are helping to develop long-term-care insurance and annuity policies, the latter a growing investment tool for many individuals.



Actuaries in other financial services industries manage credit and price corporate security offerings. They also devise new investment tools to help their firms compete with other financial services companies. Pension actuaries working under the provisions of the Employee Retirement Income Security Act (ERISA) of 1974 evaluate pension plans covered by that Act and report on the plans' financial soundness to participants, sponsors, and Federal regulators. Actuaries working in government help manage social programs such as Social Security and Medicare.

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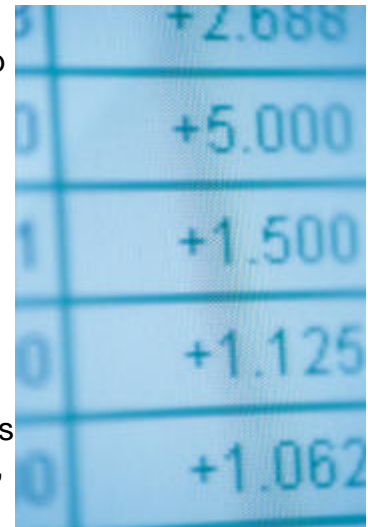
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## Preparation

Actuaries need a strong background in mathematics. Applicants for beginning actuarial jobs usually have a bachelor's degree in mathematics, actuarial science, statistics, or a business-related discipline such as economics, finance, or accounting. Many colleges and universities offer an actuarial science program, and most offer a degree in mathematics, statistics, economics, or finance. Some companies hire applicants without specifying a major, provided that the applicant has a working knowledge of mathematics, including calculus, probability, and statistics, and has demonstrated this knowledge by passing one or two actuarial exams required for professional designation. Courses in economics, accounting, finance, and insurance also are useful. Companies increasingly prefer well-rounded individuals who, in addition to having acquired a strong technical background, have some training in liberal arts and business and possess strong communication skills.



In addition to knowledge of mathematics, computer skills are becoming increasingly important. Actuaries should be able to develop and use spreadsheets and databases, as well as standard statistical analysis software. Knowledge of computer programming languages, such as Visual Basic, also is useful.



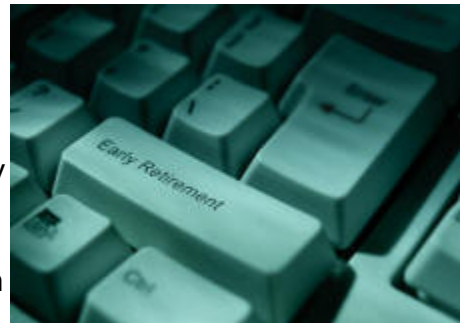
### ► Actuarial Exams

Two professional societies sponsor programs leading to full professional status in their specialty. The Society of Actuaries (SOA) administers a series of actuarial examinations in the life insurance, health benefits systems, retirement systems, and finance and investment fields. The Casualty Actuarial Society (CAS) gives a series of examinations in the property and casualty field, which includes fire, accident, medical malpractice, worker's compensation, and personal injury liability.

Three of the first four exams (exams 1, 2, and 4) in the SOA and CAS examination series are jointly sponsored by the two societies and cover the same material. Because exam 3 is no longer a joint exam, candidates who take the SOA exam 3, which has more testing on life contingencies, will receive a waiver from the CAS, but the SOA does not waive candidates who take the CAS exam 3. These initial examinations test an individual's competence in probability, calculus, statistics, and other branches of mathematics. The first few examinations help students evaluate their potential as actuaries. Many prospective actuaries begin taking the exams in college with the help of self-study guides and courses. Those who pass one or more examinations have better opportunities for employment at higher starting salaries than those who do not.

After graduating from college, most prospective actuaries gain on-the-job experience at an insurance company or consulting firm, while at the same time working to complete the examination process. Actuaries are encouraged to finish the entire series of examinations as soon as possible, advancing first to the Associate level (with an ASA or ACAS designation) and then to the Fellowship level (FSA or FCAS designation). Advanced topics in the casualty field include investment and assets, dynamic financial analysis, and valuation of insurance. Candidates in the SOA examination series must choose a specialty -- group and health benefits, individual life and annuities, pensions, investments, or finance. Examinations are given four times a year. Although many companies allot time to their employees for study, home study is required to pass the examinations, and many actuaries study for months to prepare for each examination. It is likewise common for employers to pay the hundreds of dollars for examination fees and study materials. Most actuaries reach the Associate level within 4 to 6 years and the Fellowship level a few years later.

Specific requirements apply to pension actuaries, who verify the financial status of defined benefit pension plans for the Federal Government. These actuaries must be enrolled by the Joint Board of the U.S. Treasury Department and the U.S. Department of Labor for the Enrollment of Actuaries. To qualify for enrollment, applicants must meet certain experience and examination requirements, as stipulated by the Board. To perform their duties effectively, actuaries must keep up with current economic and social trends and legislation, as well as with health, business, finance, and economic developments that could affect insurance or investment practices. Good communication and interpersonal skills also are important, particularly for prospective consulting actuaries.



Beginning actuaries often rotate among different jobs in an organization to learn various actuarial operations and phases of insurance work, such as marketing, underwriting, and product development. At first, they prepare data for actuarial projects or perform other simple tasks. As they gain experience, actuaries may supervise clerks, prepare correspondence, draft reports, and conduct research. They may move from one company to another early in their careers as they advance to higher positions.



Advancement depends largely on job performance and the number of actuarial examinations passed. Actuaries with a broad knowledge of the insurance, pension, investment, or employee benefits fields can rise to administrative and executive positions in their companies. Actuaries with supervisory ability may advance to management positions in other areas, such as underwriting, accounting, data processing, marketing, and advertising. Some actuaries assume college and university faculty positions.



### "Actuarial Science Overview"

## ► Programs

Programs offering degrees in Actuarial Science are organized by the number of tests each prepares a student to take.

### Undergraduate – Introductory

Curriculum covers all topics on the first CAS/SOA exam, and includes courses in introductory mathematics of finance along with micro and macro economics courses.

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| <ul style="list-style-type: none"><li>• Appalachian State University</li><li>• Arcadia University</li><li>• Arizona State University</li><li>• Auburn University</li><li>• Baldwin–Wallace College</li><li>• Baruch College</li><li>• Baylor University</li><li>• Bellarmine University</li><li>• Beloit College</li><li>• Benedictine University</li><li>• Bentley College</li><li>• Binghamton University</li><li>• Bowling Green State University</li><li>• Brooklyn College</li><li>• California Polytechnic State University</li><li>• Canisius College</li><li>• Case Western Reserve University</li><li>• Central Institute for Actuaries Studies</li><li>• Central Michigan University</li><li>• University of Cincinnati</li><li>• Clemson University</li><li>• Colorado State University</li><li>• Concordia University–Seward, Nebraska</li><li>• University of Delaware</li><li>• Doane College</li><li>• Elizabethtown College</li><li>• Florida State University</li><li>• University of Florida</li><li>• University of Georgia</li><li>• Grand Valley State University</li><li>• Harvey Mudd College</li><li>• Howard University</li><li>• University of Idaho</li><li>• Indiana State University</li><li>• University of Southern Indiana</li><li>• Indiana University–Purdue University at Indianapolis</li><li>• Iowa State University</li><li>• Kansas State University</li><li>• Le Moyne College</li><li>• Long Island University–C.W. Post Campus</li><li>• Louisiana State University–Shreveport</li><li>• Luther College</li><li>• Marist College</li><li>• University of Maryland Baltimore County</li><li>• Miami University</li><li>• Murray State University</li><li>• University of Michigan</li><li>• University of Michigan–Flint</li><li>• University of Nevada–Reno</li><li>• The College of New Jersey</li></ul> | <ul style="list-style-type: none"><li>• Michigan Technological University</li><li>• University of Nebraska–Lincoln</li><li>• Niagara University</li><li>• University of North Carolina at Chapel Hill</li><li>• University of North Carolina at Greensboro</li><li>• Pittsburg State University</li><li>• University of Pittsburgh at Greensburg</li><li>• Portland State University</li><li>• Purdue University</li><li>• Queens College of City University of New York</li><li>• Randolph–Macon College</li><li>• The Richard Stockton College of New Jersey</li><li>• Rochester Institute of Technology</li><li>• Roosevelt University</li><li>• Rose–Hulman Institute of Technology</li><li>• Siena College</li><li>• Siena Heights University</li><li>• Slippery Rock University</li><li>• University of South Carolina</li><li>• South Dakota State University</li><li>• University of Southern Mississippi</li><li>• Southern Utah University</li><li>• St. Cloud State University</li><li>• University of St. Francis</li><li>• St. Lawrence University</li><li>• St. Mary's College</li><li>• St. Norbert College</li><li>• SUNY–Albany</li><li>• SUNY–Binghamton</li><li>• SUNY–Brockport</li><li>• SUNY College at Fredonia</li><li>• SUNY College at Potsdam</li><li>• University of Tennessee at Martin</li><li>• University of Texas at San Antonio</li><li>• Texas Christian University</li><li>• Thiel College</li><li>• University of Toledo</li><li>• Union University</li><li>• Valparaiso University</li><li>• University of Vermont</li><li>• University of Virginia</li><li>• West Chester University of PA</li><li>• Western Kentucky University</li><li>• Western Washington University</li><li>• William Paterson University</li><li>• University of Wisconsin–Madison</li><li>• University of Wisconsin–Platteville</li><li>• University of Wisconsin–Stout</li><li>• University of Wisconsin–Superior</li><li>• University of Wisconsin–Whitewater</li></ul> |
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## Undergraduate – Advanced

Curriculum covers all topics on first two CAS/SOA exams plus 12 semester hours of topics on the third and fourth exams.

<ul style="list-style-type: none"><li>• Abilene Christian University</li><li>• University of Akron</li><li>• Ball State University</li><li>• Boston University</li><li>• Bowling Green State University</li><li>• Bradley University</li><li>• Brigham Young University</li><li>• Bryant University</li><li>• Butler University</li><li>• University of California at Santa Barbara</li><li>• University of Central Florida</li><li>• University of Central Missouri</li><li>• Columbia University</li><li>• University of Connecticut</li><li>• DePaul University</li><li>• Drake University</li><li>• East Tennessee State University</li><li>• University of Evansville</li><li>• Florida State University</li><li>• George Mason University</li><li>• University of Illinois at Urbana–Champaign</li><li>• Illinois State University</li><li>• Indiana University Northwest</li><li>• Indiana University–South Bend</li><li>• University of Iowa</li><li>• Lebanon Valley College</li><li>• University of Louisville</li><li>• Maryville University of St. Louis</li><li>• University of Michigan</li><li>• Michigan State University</li><li>• Middle Tennessee State University</li><li>• University of Minnesota</li><li>• University of Missouri at Rolla</li><li>• University of Nebraska–Lincoln</li><li>• New Jersey Institute</li></ul>	<ul style="list-style-type: none"><li>• New York University Stern School of Business</li><li>• University of North Carolina at Chapel Hill</li><li>• University of North Carolina at Charlotte</li><li>• Northern Illinois University</li><li>• University of Northern Iowa</li><li>• Northwestern College–Iowa</li><li>• The Ohio State University</li><li>• Ohio University</li><li>• Oregon State University</li><li>• Otterbein College</li><li>• Penn State University</li><li>• Purdue University</li><li>• University of Regina</li><li>• Rider University</li><li>• Robert Morris University</li><li>• Roosevelt University</li><li>• Southern Illinois University–Edwardsville</li><li>• Spring Arbor University</li><li>• St. John's University–College of Insurance</li><li>• University of St. Thomas</li><li>• SUNY University at Albany</li><li>• Temple University</li><li>• University of Texas at Austin</li><li>• Towson University</li><li>• Utah State University</li><li>• Washburn University</li><li>• University of Pennsylvania–Wharton School</li><li>• University of Wisconsin–Eau Claire</li><li>• University of Wisconsin–Madison</li><li>• Worcester Polytechnic Institute</li><li>• York University</li></ul>
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## Graduate – Education

Curriculum covers all topics on the first four CAS/SOA exams. These programs lead to a Masters degree.

<ul style="list-style-type: none"><li>• Ball State University</li><li>• Bowling Green State University</li><li>• Central Connecticut State University</li><li>• University of Connecticut</li><li>• Columbia University</li><li>• DePaul University</li><li>• Florida State University</li><li>• George Mason University</li><li>• Maryville University of St. Louis</li><li>• University of Michigan</li><li>• Middle Tennessee State University</li></ul>	<ul style="list-style-type: none"><li>• University of Minnesota</li><li>• University of Nebraska–Lincoln</li><li>• Northern Arizona University</li><li>• Oregon State University</li><li>• Roosevelt University</li><li>• St. John's University (College of Insurance)</li><li>• University of Wisconsin–Madison</li><li>• Youngstown State University</li></ul>
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## Graduate – Education and Research

Curriculum covers all of the topics on the first four CAS/SOA exams and includes at least six semester hours of courses covering advanced actuarial science topics. These programs have a research component and leads to a Masters or Ph.D. degree.

<ul style="list-style-type: none"><li>• Boston University</li><li>• University of Central Florida</li><li>• University of Connecticut</li><li>• Florida State University</li><li>• Georgia State University</li><li>• University of Illinois at Urbana–Champaign</li><li>• Illinois State University</li><li>• University of Iowa</li><li>• Laval University, School of Actuarial Science</li><li>• University of Michigan</li></ul>	<ul style="list-style-type: none"><li>• Penn State University</li><li>• University of Nebraska–Lincoln</li><li>• Simon Fraser University</li><li>• Temple University</li><li>• University of Texas at Austin</li><li>• Wharton School, University of Pennsylvania</li><li>• University of Wisconsin–Milwaukee</li><li>• University of Wisconsin–Madison</li></ul>
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## Day in the Life

Actuaries have desk jobs, and their offices usually are comfortable and pleasant. They often work at least 40 hours a week. Some actuaries -- particularly consulting actuaries -- may travel to meet with clients. Consulting actuaries also may experience more erratic employment and be expected to work more than 40 hours per week.



Actuaries may play a role in determining company policy and may need to explain complex technical matters to company executives, government officials, shareholders, policyholders, or the public in general. They may testify before public agencies on proposed legislation affecting their businesses or explain changes in contract provisions to customers. They also help companies develop plans to enter new lines of business or new geographic markets by forecasting demand in competitive settings.

Both staff actuaries employed by businesses and consulting actuaries provide advice to clients on a contract basis. The duties of most consulting actuaries are similar to those of other actuaries. Some may evaluate company pension plans by calculating the future value of employee and employer contributions and determining whether the amounts are sufficient to meet the future needs of retirees. Others help companies reduce their insurance costs by lowering the level of risk the companies assume. They may provide advice on how to lessen the risk of injury on the job, which will lower worker's compensation costs. Consulting actuaries sometimes testify in court regarding the value of the potential lifetime earnings of a person who is disabled or killed in an accident, the current value of future pension benefits (in divorce cases), or other values arrived at by complex calculations. Many consulting actuaries work in reinsurance, a field in which one insurance company arranges to share a large prospective liability policy with another insurance company in exchange for a percentage of the premium.

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## Earnings

According to the U.S. Bureau of Labor Statistics, median annual earnings of actuaries is \$82,800. The middle 50 percent earned between \$58,710 and \$114,570. The lowest 10 percent had earnings of less than \$46,470 while the top 10 percent earned more than \$145,600. According to the National Association of Colleges and Employers, annual starting salaries for graduates with a bachelor's degree in actuarial science averaged \$53,754 in 2007. Insurance companies and consulting firms give merit increases to actuaries as they gain experience and pass examinations. Some companies also offer cash bonuses for each professional designation achieved. A 2007 survey by Life Office Management Association, Inc. of the largest U.S. insurance and financial services companies indicated that the average base salary for an entry-level actuary was \$53,111. Associate actuaries, who direct and provide leadership in the design, pricing, and implementation of insurance products, received an average salary of \$109,167. Actuaries at the highest technical level without managerial responsibilities reportedly were paid an average of \$125,946.



## Employment

According to the U.S. Bureau of Labor Statistics, actuaries held about 18,000 jobs in the U.S., with over half employed in the insurance industry. A growing number of actuaries work for firms providing a variety of corporate services, especially management and public relations, or for firms offering consulting services. A relatively small number of actuaries are employed by security and commodity brokers or by government agencies. The following are examples of employers of actuaries:



<p><b>Insurance Companies</b></p> <ul style="list-style-type: none"> <li>• <b>Aetna, Inc.</b></li> <li>• <b>AIG</b></li> <li>• <b>Allstate Insurance Company</b></li> <li>• <b>Chubb Group of Insurance Companies</b></li> <li>• <b>General Casualty Companies</b></li> <li>• <b>Munich American Reassurance Company</b></li> <li>• <b>Prudential Insurance Company</b></li> <li>• <b>State Farm Insurance Company</b></li> <li>• <b>Transamerica Reinsurance</b></li> </ul> <p><b>Large corporations and public accounting firms</b></p>	<p><b>U.S. Federal Government</b></p> <ul style="list-style-type: none"> <li>• <b>Centers for Medicare and Medicaid Services</b></li> <li>• <b>U.S. Social Security Administration</b></li> <li>• <b>U.S. Department of Health and Human Services</b></li> </ul> <p><b>State and Local Governments</b></p> <p><b>Consulting firms</b></p> <ul style="list-style-type: none"> <li>• <b>Deloitte Consulting</b></li> <li>• <b>Ernst &amp; Young, LLP</b></li> </ul> <p><b>Banks and investment firms</b></p> <p><b>Educational Institutions</b></p>
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## Career Path Forecast

According to the U.S. Department of Labor, Bureau of Labor Statistics, employment of actuaries is expected to grow rapidly through 2016. Job opportunities should remain good for those who qualify, because the stringent qualifying examination system restricts the number of candidates.



Employment of actuaries is expected to increase by about 24 percent over the 2006-16 period, which is much faster than the average for all other occupations. Employment growth in the insurance industry—the largest employer of actuaries—is expected to continue at a stable pace, while more significant job growth is likely in other industries, such as health care and consulting firms.

Steady demand by the insurance industry should ensure that actuarial jobs in this key industry will remain stable during the projection period. Although relatively few new jobs will be created, actuaries will continue to be needed to develop, price, and evaluate a variety of insurance products and calculate the costs of new risks. The demand for actuaries in life insurance has been growing rapidly as a result of the rise in popularity of annuities, a financial product offered primarily by life insurance companies. In addition, the risk of terrorism and natural disasters has created a large demand for actuaries in property insurance.



Some new employment opportunities for actuaries should also become available in the health-care field as health-care issues and Medicare reform continue to receive attention. Increased regulation of managed health-care companies and the desire to contain health-care costs will continue to provide job opportunities for actuaries, who will also be needed to evaluate the risks associated with new medical issues, such as genetic testing and the impact of new diseases. Others in this field are involved in drafting health-care legislation.

A significant proportion of new actuaries will find employment with consulting firms. Companies that may not find it cost effective to employ their own actuaries are increasingly hiring consulting actuaries to analyze various risks. Other areas with notable growth prospects are information services and accounting services. Also, because actuarial skills are increasingly seen as useful to other industries that deal with risk, such as the airline and the banking industries, additional job openings may be created in these industries.



Despite the increase in employment overall, there has been some decline in the demand for pension actuaries. This is due in large part to the decline of defined benefit plans, which required review by an actuary, in favor of investment based retirement funds, such as 401ks.

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Opportunities for actuaries should be good, particularly for those who have passed at least one or two of the initial exams. In addition, a small number of jobs will open up each year to replace actuaries who leave the occupation to retire or transfer new jobs. Candidates with additional knowledge or experience, such as computer programming skills, will be particularly attractive to employers. Most jobs in this occupation are located in urban areas, but opportunities vary by geographic location.



## Professional Organizations

Professional societies provide an excellent means of keeping current and in touch with other professionals in the field. These groups can play a key role in your development and keep you abreast of what is happening in your field. Associations promote the interests of their members and provide a network of contacts that can help you find jobs and move your career forward. They can offer a variety of services including job referral services, continuing education courses, insurance, travel benefits, periodicals, and meeting and conference opportunities. The following is a partial list of professional associations serving actuaries and employers. A broader list of professional associations is also available at [www.careercornerstone.org](http://www.careercornerstone.org).



### ► **American Academy of Actuaries ([www.actuary.org](http://www.actuary.org))**

The American Academy of Actuaries represents and unites U.S. actuaries from all practice areas.

### ► **American Society of Pension Professionals & Actuaries ([www.aspa.org](http://www.aspa.org))**

The American Society of Pension Professionals & Actuaries is a national organization for career retirement plan professionals.

### ► **Casualty Actuarial Society ([www.casact.org](http://www.casact.org))**

The Casualty Actuarial Society is an organization dedicated to the advancement of the body of knowledge of actuarial science applied to property, casualty and similar risk exposures.

### ► **Society of Actuaries ([www.soa.org](http://www.soa.org))**

The Society of Actuaries is an educational, research and professional organization dedicated to serving the public and Society members.

### ► **The Actuarial Foundation ([www.actuarialfoundation.org](http://www.actuarialfoundation.org))**

The Actuarial Foundation has been established to explore innovative ways to employ actuarial skills in the public interest, educate professionals in the field in how to fulfill these new roles, and bring together broad partnerships of individuals and organizations to address social problems in interdisciplinary ways.