

Employment of school social workers is expected to grow due to expanded efforts to respond to rising student enrollments. Moreover, continued emphasis on integrating disabled children into the general school population will lead to more jobs. However, availability of State and local funding will dictate the actual job growth in schools.

Opportunities for social workers in private practice will expand, but this growth will be inhibited to a certain degree by funding cutbacks and by restrictions that managed care organizations place on services. The growing popularity of employee assistance programs also is expected to spur some demand for private practitioners, some of whom provide social work services to corporations on a contractual basis.

### Earnings

Median annual earnings of child, family, and school social workers were \$31,470 in 2000. The middle 50 percent earned between \$24,910 and \$40,170. The lowest 10 percent earned less than \$20,120, and the top 10 percent earned more than \$50,280. Median annual earnings in the industries employing the largest numbers of child, family, and school social workers in 2000 were:

Elementary and secondary schools .....	\$41,700
Local government, except education and hospitals .....	35,780
State government, except education and hospitals .....	32,860
Individual and family services .....	27,170
Residential care .....	26,780

Median annual earnings of medical and public health social workers were \$34,790 in 2000. The middle 50 percent earned between \$27,800 and \$43,450. The lowest 10 percent earned less than \$22,490, and the top 10 percent earned more than \$53,160. Median annual earnings in the industries employing the largest numbers of medical and public health social workers in 2000 were:

Hospitals .....	\$40,020
Health and allied services, not elsewhere classified .....	36,230
Local government, except education and hospitals .....	35,300
Nursing and personal care facilities .....	31,580
Individual and family services .....	29,730

Median annual earnings of mental health and substance abuse social workers were \$30,170 in 2000. The middle 50 percent earned between \$23,840 and \$39,190. The lowest 10 percent earned less than \$19,300, and the top 10 percent earned more than \$48,750. Median annual earnings in the industries employing the largest numbers of mental health and substance abuse social workers in 2000 were:

Local government, except education and hospitals .....	\$33,950
Hospitals .....	33,150
Health and allied services, not elsewhere classified .....	28,270
Individual and family services .....	28,160
Residential care .....	26,620

### Related Occupations

Through direct counseling or referral to other services, social workers help people solve a range of personal problems. Workers in occupations with similar duties include the clergy, counselors, psychologists, and social and human service assistants.

### Sources of Additional Information

For information about career opportunities in social work and voluntary credentials for social workers, contact:

► National Association of Social Workers, 750 First St. NE., Suite 700, Washington, DC 20002-4241. Internet: <http://www.naswdc.org>

For a listing of accredited social work programs or to order a *Directory of Colleges and Universities with Accredited Social Work Degree Programs* for a nominal charge, contact:

► Council on Social Work Education, 1725 Duke St., Suite 500, Alexandria, VA 22314-3457. Internet: <http://www.cswe.org>

Information on licensing requirements and testing procedures for each State may be obtained from State licensing authorities, or from:

► Association of Social Work Boards, 400 South Ridge Pkwy., Suite B, Culpeper, VA 22701. Internet: <http://www.aswb.org>

## Computer and Mathematical Occupations

### Actuaries

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#### Significant Points

- A strong background in mathematics is essential.
- About 7 out of 10 actuaries are employed in the insurance industry.
- This small occupation generates relatively few job openings; the fastest employment growth is expected in the computer and data processing services, health services, and management and actuarial consulting industries.

#### Nature of the Work

Actuaries are essential employees because they determine future risk, make price decisions, and formulate investment strategies. Some actuaries also design insurance, financial, and pension plans

and ensure that these plans are maintained on a sound financial basis. Most actuaries specialize in life and health or property and casualty insurance; others work primarily in finance or employee benefits. Some use a broad knowledge of business and mathematics in investment, risk classification, or pension planning.

Regardless of specialty, actuaries assemble and analyze data to estimate probabilities of an event taking place, such as death, sickness, injury, disability, or property loss. They also address financial questions, including those involving the level of pension contributions required to produce a certain retirement income level or how a company should invest resources to maximize return on investment in light of potential risk. Moreover, actuaries may help determine company policy and sometimes 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 may help companies develop plans to enter new lines of business or new geographic markets with existing lines of business by forecasting demand in competitive settings.

Most actuaries are employed in the insurance industry, in which they estimate the amount a company will pay in claims. For example, property/casualty actuaries calculate the expected amount of claims resulting from automobile accidents, which varies depending on 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. This premium must be profitable and yet competitive with other insurance companies.

Actuaries employed in other industries perform several different functions. The small but growing group of actuaries in the financial services industry, for example, manages credit and helps price corporate security offerings. Because banks now offer their customers investment products such as annuities and asset management services, actuaries increasingly help financial institutions manage the substantial risks associated with these products. Actuaries employed as pension actuaries enrolled under the provisions of the Employee Retirement Income Security Act (ERISA) of 1974 evaluate pension plans covered by that act and report on their financial soundness to plan members, sponsors, and Federal regulators. Actuaries working in government help manage social programs such as Social Security and Medicare.

In addition to salaried actuaries, numerous consulting actuaries provide advice to clients on a contract basis. Their clients include insurance companies, corporations, health maintenance organizations, healthcare providers, government agencies, and attorneys. The

duties of most consulting actuaries are similar to those of other actuaries. For example, some design pension plans through calculating the future value of current deductions from earnings and by determining the amount of employer contributions. Others provide advice to healthcare plans or financial services firms. Consultants sometimes testify in court regarding the value of 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 complex calculations. Many consulting actuaries work in reinsurance, 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.

### Working Conditions

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.

### Employment

Actuaries held about 14,000 jobs in 2000. Over seven-tenths of the actuaries who were wage and salary workers were employed in the insurance industry. Some had jobs in life and health insurance companies, while property and casualty insurance companies, pension funds, or insurance agents and brokers employed others. Most of the remaining actuaries worked for firms providing a variety of corporate services, especially management and public relations, or for actuarial consulting services. A relatively small number of actuaries was employed by security and commodity brokers or by government agencies. Some developed computer software for actuarial calculations.

### Training, Other Qualifications, and Advancement

As with many business positions, actuaries need a strong background in mathematics and general business. 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. About 100 colleges and universities offer an actuarial science program, and most colleges and universities offer a degree in mathematics or statistics. 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 ability 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 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.

Two professional societies sponsor programs leading to full professional status in their specialty. The first, the Society of Actuaries (SOA), administers a series of actuarial examinations for the life and health insurance, pension, and finance and investment fields. The Casualty Actuarial Society (CAS), on the other hand, gives a series of examinations for the property and casualty field, which includes fire, accident, medical malpractice; workers compensation; and personal injury liability.



*Actuaries perform complex mathematical analysis that assists organizations in making important operational decisions.*

The first four exams of the SOA and CAS examination series are jointly sponsored by the two societies and cover the same material. For this reason, students do not need to commit themselves to a specialty until they have taken the initial examinations. These 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.

Actuaries are encouraged to complete the entire series of examinations as soon as possible, advancing first to the associate level, and then to the fellowship level. Advanced casualty topics include investment and assets, dynamic financial analysis, and valuation of insurance topics. 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 twice a year, in the spring and the fall. Although many companies allot time to their employees for study, extensive 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 fees and study materials. Most reach the associate level within 4 to 6 years and the fellowship level a few years later.

Specific requirements apply for pension actuaries, who verify the financial status of defined benefit pension plans to the Federal Government. These actuaries must be enrolled by the Joint Board for the Enrollment of Actuaries. To qualify for enrollment, applicants must meet certain experience and examination requirements, as stipulated by the Joint Board.

To perform their duties effectively, actuaries must keep up with current economic and social trends and legislation, as well as with developments in health, business, finance, and economics 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 move up 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 advance 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, or advertising. Some actuaries assume college and university faculty positions. (See the statement on teachers—postsecondary elsewhere in the *Handbook*.)

### Job Outlook

This small occupation generates relatively few job openings from employment growth and the need to replace those who leave the occupation each year. The fastest employment growth is expected in the computer and data processing services, health services, and management and actuarial consulting industries. Employment of actuaries is expected to grow more slowly than the average for all occupations through 2010, as projected job growth in these industries is offset by a slowdown in actuarial employment growth in

insurance industries, which traditionally employ the majority of actuaries.

New employment opportunities should become available in health services, in medical and health insurance industries, and in government—in healthcare and Social Security. Changes in managed healthcare and the desire to contain healthcare costs will continue to provide opportunities for actuaries. Some actuaries also are evaluating the risks associated with controversial medical issues, such as genetic testing or the impact of diseases such as AIDS. Others in this field are involved in drafting healthcare legislation. As healthcare issues and Social Security reform continue to receive growing attention, opportunities for actuaries should increase.

Actuaries will continue to be needed to evaluate risks associated with catastrophes, such as earthquakes, tornadoes, hurricanes, floods, and other natural disasters. Growing areas in property and casualty insurance are environmental and international risk management. Actuaries evaluate risks such as the likelihood of a toxic waste spill, or the costs and benefits of implementing pollution control equipment in a factory. As economic globalization continues and companies expand their operations abroad, they increasingly rely on actuaries to evaluate the risk of setting up a new factory or acquiring a foreign subsidiary.

The banking and securities and commodities industries also should provide additional jobs for actuaries. As financial services continue to consolidate and insurance firms, banks, and securities firms enter one another's markets, new opportunities will emerge. Actuaries will be needed to analyze the risks associated with entering a new market, such as launching a new service or merging with an already established company.

At the same time, changes in consumer preferences for retirement investment plans will adversely affect employment in the life insurance and pension funds industries. The overall decline in the life insurance industry, reflecting fewer life insurance policies sold in favor of investments earning higher returns, will continue to affect the need for actuaries. Similarly, more people are choosing to invest in defined contribution plans, which are less complicated to analyze and, therefore, require fewer actuaries than defined pension systems. Actuaries in the pension funds industry are more likely to be involved in financial planning—helping people manage their retirement money.

Layoffs in the insurance and financial industries due to downsizing and mergers also affect employment. Many of the actuaries released from insurance firms are choosing to establish consulting practices. Jobs should be available for actuaries working in consulting as firms who do not employ their own actuarial staff continue to hire consulting actuaries to analyze various risks.

### Earnings

Median annual earnings of actuaries were \$66,590 in 2000. The middle 50 percent earned between \$47,260 and \$93,140. The lowest 10 percent had earnings of less than \$37,130, while the top 10 percent earned over \$127,360. The average salary for actuaries employed by the Federal Government was \$78,120 in 2001.

According to the National Association of Colleges and Employers, annual starting salaries for bachelor's degree graduates in actuarial science averaged \$45,753 in 2001.

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 2001 salary survey of insurance and financial services companies, conducted by the Life Office Management Association, Inc., indicated that the average base salary for an entry-level actuary with the largest U.S. companies was \$44,546. Associate actuaries with the largest U.S. companies, who direct and

provide leadership in the design, pricing, and implementation of insurance products, received an average salary of \$91,544. Actuaries at the highest technical level without managerial responsibilities in the same size companies earned an average of \$108,777.

### Related Occupations

Actuaries need a strong background in mathematics, statistics, and related fields. Other workers whose jobs involve related skills include accountants and auditors, budget analysts, economists and market and survey researchers, financial analysts and personal financial advisors, insurance underwriters, mathematicians, and statisticians.

### Sources of Additional Information

Career information on actuaries specializing in pensions is available from:

► American Society of Pension Actuaries, 4245 N. Fairfax Dr., Suite 750, Arlington, VA 22203. Internet: <http://www.aspa.org>

For information about actuarial careers in life and health insurance, employee benefits and pensions, and finance and investments, contact:

► Society of Actuaries (SOA), 475 N. Martingale Rd., Suite 800, Schaumburg, IL 60173-2226. Internet: <http://www.soa.org>

For information about actuarial careers in property and casualty insurance, contact:

► Casualty Actuarial Society (CAS), 1100 N. Glebe Rd., Suite 600, Arlington, VA 22201. Internet: <http://www.casact.org>

The SOA and CAS jointly sponsor a Web site for those interested in pursuing an actuarial career. Internet:

<http://www.BeAnActuary.org>

For general facts about actuarial careers, contact:

► American Academy of Actuaries, 1100 17th St. NW., 7th Floor, Washington, DC 20036. Internet: <http://www.actuary.org/index.htm>

## Computer Programmers

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### Significant Points

- Employment growth will be considerably slower than that of other computer specialists, due to the spread of pre-packaged software solutions.
- Three out of 5 computer programmers held at least a bachelor's degree in 2000.
- Prospects should be best for college graduates with knowledge of a variety of programming languages and tools; those with less formal education or its equivalent in work experience should face strong competition for programming jobs.

### Nature of the Work

Computer programmers write, test, and maintain the detailed instructions, called programs, that computers must follow to perform their functions. They also conceive, design, and test logical structures for solving problems by computer. Many technical innovations in programming—advanced computing technologies and sophisticated new languages and programming tools—have redefined the role of a programmer and elevated much of the programming work done today. Job titles and descriptions may vary, depending on the organization. In this occupational statement,

*computer programmer* refers to individuals whose main job function is programming; this group has a wide range of responsibilities and educational backgrounds.

Computer programs tell the computer what to do, such as which information to identify and access, how to process it, and what equipment to use. Programs vary widely depending upon the type of information to be accessed or generated. For example, the instructions involved in updating financial records are very different from those required to duplicate conditions on board an aircraft for pilots training in a flight simulator. Although simple programs can be written in a few hours, programs that use complex mathematical formulas, whose solutions can only be approximated, or that draw data from many existing systems, may require more than a year of work. In most cases, several programmers work together as a team under a senior programmer's supervision.

Programmers write programs according to the specifications determined primarily by computer software engineers and system analysts. (Separate statements on computer software engineers and systems analysts, computer scientists, and database administrators appear elsewhere in the *Handbook*.) After the design process is complete, it is the job of the programmer to convert that design into a logical series of instructions that the computer can follow. They then code these instructions in a conventional programming language, such as COBOL; an artificial intelligence language, such as Prolog; or one of the most advanced object-oriented languages such as Java, C++, or Smalltalk. Different programming languages are used depending on the purpose of the program. COBOL, for example, is commonly used for business applications, whereas Fortran (short for "formula translation") is used in science and engineering. C++ is widely used for both scientific and business applications. Programmers generally know more than one programming language; and since many languages are similar, they often can learn new languages relatively easily. In practice, programmers often are referred to by the language they know, such as Java programmers, or the type of function they perform or environment in which they work, such as database programmers, mainframe programmers, or Internet programmers.

Many programmers update, repair, modify, and expand existing programs. When making changes to a section of code, called a *routine*, programmers need to make other users aware of the task the routine is to perform. They do this by inserting comments in the coded instructions, so others can understand the program. Many programmers use computer-assisted software engineering (CASE) tools to automate much of the coding process. These tools enable a programmer to concentrate on writing the unique parts of the program, because the tools automate various pieces of the program being built. CASE tools generate whole sections of code automatically, rather than line by line. This also yields more reliable and consistent programs and increases programmers' productivity by eliminating some routine steps.

Programmers test a program by running it, to ensure the instructions are correct and it produces the desired information. If errors do occur, the programmer must make the appropriate change and recheck the program until it produces the correct results. This process is called debugging. Programmers may continue to fix these problems throughout the life of a program. Programmers working in a mainframe environment may prepare instructions for a computer operator who will run the program. (A separate statement on computer operators appears elsewhere in the *Handbook*.) They also may contribute to a manual for users.

Programmers often are grouped into two broad types—applications programmers and systems programmers. *Applications programmers* write programs to handle a specific job, such as a program to track inventory, within an organization. They may also revise