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# COMPUTER SCIENCE

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**No company today operates without computers. In fact, computer science and information technology are key determinants of the competitiveness of all economic sectors. Computers even shape the evolution of our social system, through their role in domains such as health, education, leisure, and the environment. Demand for computer technology is accompanied by demand for well-organized, complex networks and systems. The information technology industry therefore includes both suppliers of technology and modular components (hardware and software), and specialists in integration and organization. The computer science profession is diversified into a multitude of specialized functions involving networks, computerization, computer security, ergonomics, and the graphical representation of information. Researchers in the field of computer science work to reduce their findings to practice in the form of applications.**

**Computer specialists trained in French engineering schools gain superb technical skills. The nation's universities also offer high-quality programs at the licence (bachelor) and master level. Specialized schools confer a wide variety of diplomas in computer engineering, software engineering, network architecture, and management information systems. Some programs that do not enjoy official recognition are nevertheless valued by firms seeking operational specialists. The bottom line is that prospective students have many choices for schools—university, engineering school, or specialized school—and for program content. Generalist programs equip students to adapt to successive waves of a change in a field that changes continuously, whereas specialized programs endow students with skills that are in demand right now**

Fields :
Database, bioinformatics, software engineering, graphics and virtual reality, grid computing, ambiant computing, industrial computing, scientific computing, computer science theory, information systems engineering, Internet, multimedia, networks, systems. Also see the following subject profiles: New technologies 2—Interactive digital arts, Engineering, Mathematics

Sectors of activity :
computer services and consulting, software publishing, sales and distribution, customized hardware construction and system design, telecommunications operations, ICT staffing for organizations (multinationals, public agencies, small and medium enterprises, associations, professional firms), research, and teaching. Representative functions: Design and improve computer and telecommunication systems; develop computer and telecommunication systems and products; manage computer and information projects; consult and advise; manage and operate information systems and networks; train and assist users and customers; sell computer and telecommunication products and services; teach; perform research…

## ORGANIZATION OF STUDIES IN FRANCE

Across the nation, some 5,000 degree programs in computer science and information technology are offered in the universities and other postsecondary institutions. Some programs are long; others are short. Most charge at least some tuition, but some are free or are based on the apprenticeship model. Opportunities for specialization are ample.

### Short programs

Short programs require 2 years of study. Common diplomas include the BTS (brevet de technicien supérieur), IRIS (informatique et réseaux pour l'industrie et les services techniques, computer and network technology for industry and technical services), DUT (diplôme universitaire de technologie, university technology diploma) in general computer science, DUT GEII (génie électrique et informatique industrielle, electrical engineering and industrial computing), and DUT STID (statistiques et traitement informatique des données, statistics and data processing). Students are admitted on the strength of their application; sometimes an interview is required. Curricula include scientific disciplines such as mathematics and physics, technical subjects such as computer architecture and networks, and (often) economics or communication

### Licence (bachelor) programs in computer science

Under the European LMD system, computer science is a major, or option, in licence programs in science and technology. Licence programs give students a solid scientific background, while allowing them to specialize in their third year. Students may go on for a master in computer science or seek admission to a school of engineering. At the master level students choose a concentration in a particular aspect of computer science or information technology, which may correspond to a specific technical domain or application. The array of available concentrations is very wide. Among the most prized by employers are those offered in 3-year MIAGE programs (méthodes informatiques appliquées à la gestion des entreprises, management information systems). Many operate on the apprenticeship model, though apprenticeships are generally open only to students from within the European Union. MIAGE students acquire skills in management as well as computer science.

Professionally oriented licence programs, known as licences professionnelles, also require 3 years of postsecondary study. Licence pro programs are geared toward immediate movement into specialized technical employment. They, too, often operate on the apprenticeship model

### Engineering schools

Students enter France's engineering schools either directly from secondary school or, more commonly, after two years of preparatory study in science. Admission decisions may be made on the basis of the student's score on an entrance examination, or on the strength of the student's application and academic record. Of the 240 schools of engineering recognized by the French national commission on engineering degrees, many allow students to major in computer science or information technology. Examples include INSA (the three national institutes of applied science) in Lyon, Rennes, and Toulouse; Télécom Paris, ENSEEIHT (Ecole nationale supérieure d'Electrotechnique, d'Electronique, d'Informatique, d'Hydraulique et des Télécommunications, national school of electrotechnics, electronics, computer science, hydraulics, and telecommunications) in Toulouse; Télécom Bretagne in Brest, ENSEIRB (Ecole Nationale Supérieure d'Electronique, Informatique et Radiocommunication de Bordeaux, national school of electronics, computer science, and radiocommunication of Borgeaux); ENSIMAG (École Nationale Supérieure d'Informatique et de Mathématiques Appliquées de Grenoble, national school of computer science and applied mathematics of Grenoble); ESIEA (École Supérieure d'Informatique Electronique Automatique, school of computer science, electronics, and control); IFIPS (Institut de Formations d'Ingénieurs, institute for training in engineering) at Université Paris 11 in Orsay; and several schools in the PolyTech network of university-based polytechnics

## RESEARCH THEMES

Centers for research in computer science are found throughout France—many are combined efforts of universities and national research bodies such as CNRS (national center for scientific research) and INRIA (national institute for research in computer science and control). The names of the many labs and centers make up a veritable alphabet soup. IRISA, IMAG, IRIT, LABRI, LIP6, LIX, LORIA, and LRI are among the standouts.

Basic computer science must be distinguished from the numerous related domains that go by the name of computer engineering and that draw on basic research for their innovative power.
Basic computer science has many facets:
– New processor architectures. The great challenge today is to continue increasing processing speed in accordance with Moore's law, which predicts a doubling of computing power every 18 months, holding cost constant. The law has held true for the past 20 years.
– Devising new algorithms and understanding their complexity. Bioinformatics is a particularly rich field in this regard, given the great quantities of data to be processed. The need to process large quantities of heterogeneous and distributed data, such as the ocean of data represented by the Internet, has called forth new research work in logic and algorithmics.
– Programming languages. Programming remains an important activity, with the development of dedicated languages for specific fields of application (protocols, critical real-time systems, parallel computing, synchronous languages, and so on).
– Software engineering. The objective here is to devise the most powerful possible tools for software development. The major challenges at the moment are the verification of critical software and increasing the quality of software through the use of reliable development methods, notably model transformation.
– Interware and support for distributed computer systems, including client-server and peer-to-peer systems developed on the Internet.
– Computer science theory. The mathematical bases of computing and other aspects of theory remain the locus of much research (process algebras, automata, graph theory, modal logics, quantum calculus, and more).
– Methods of symbolic or numeric optimization and simulation; constraint resolution methods.
– Engineering related to the interaction and visualisation of large masses of information.
–Graphic rendering, image processing, virtual and augmented reality.

New fields derived from computer science are rapidly growing in importance. A vivid example is the explosive growth in the use of embedded systems in transportation. The world is becoming digitized, with widespread digitization of texts, sounds (words and music), and images (still and video). The process has produced a multi-media branch of computer science whose key facets include data compression, analysis and synthesis of words and images, encryption issues, communication protocols for multi-media data flows, and so on. Video games and mobile telecommunications are important subdomains in their own right. The spread of mobile communication systems challenges computer scientists to develop ever more complex and dynamic systems for incorporation into mobile devices

## INTERNATIONAL STANDING

France's computer scientists have earned worldwide renown. Engineers André Truong and François Gernelle conceived the world's first microcomputer, the Micral, in 1972. In 1979, Jean Ichbiah invented the ADA compiling language later adopted by the U.S. Department of Defense. Other French pioneers in computer science were Roland Moreno, who patented the smart card in 1974, and Louis Pouzin, inventor of the datagram and designer of the first packet switching network, a necessary precursor of the Internet. In 2007 Joseph Sifakis (CNRS and Université de Grenoble) received the Turing Prize, the equivalent of the Nobel for computer science. Sifakis is known around the world for his innovative theoretical and applied work on the specification and testing of synchronous parallel models

## Websites

•ASTI, association for information sciences and technologies http://www.asti.asso.fr
• AFIG, French computer graphics association http://www.afig.fr
•CNRS (national center for scientific research) http://cnrs.fr
•INRIA (national institute for research in computer science and control) http://www.inria.fr
•Institut TELECOM (educational programs, research, innovation) http://www.institut-telecom.fr
•observatory for the security of information systems and networks http://www.ossir.org
•ONISEP's atlas of educational programs in France http://www.onisep.fr
•ParisTech (Institut des Sciences et Technologies) http://www.paristech.org
•Pasc@line, an association to promote cooperation among educational institutions and professional organizations active in the field of information and communication technology http://www.assopascaline.fr
•Passinformatique, a computer science jobs portal http://www.passinformatique.com/index.php/fre
•Polytech, the national network of university-based polytechnic schools of engineering http://www.polytech-reseau.org/
•n+i network of engineering schools http://www.nplusi.com

## Keywords

Actuarial science – administration – aeronautics – agronomy – algorithms – analogics – analyst – application – archives – arms – audio-visual arts and multimedia – audit –automobile – database – bioinformatics – biology – biostatistics – business – capital – chemistry – code – commercialization – communication – computer – computing – control – consultant, consulting – creation – cryptography – culture – cyberspace – data – design – developer – documentation – digital – e-business and e-commerce – economics – econometrics – electrical engineering – electronics – energy – engineering – enterprise – entrepreneurship – equipment – exploitation – fibers – finance – graphic – imaging – industry – infography – information systems and technology – insurance – Internet – law – logistics – management – manager – marketing – mathematics – microbiology – multimedia – nanotechnologies – networks – optimization – physics – polytechnic – process control – programming – reliability – research – robotics – sales – sciences – security – signal – simulation – software and software engineering – statistics – strategy – systems – technology – telecommunications – video games – virtual – webmaster.

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