Division of Mathematical Sciences

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The Division of Mathematical Sciences at Haigazian University includes Computer Science and Mathematics. The Bachelor of Science (B.S.) degree is offered in each field. A minor in Computer Science is also offered.

Mission: The Division of Mathematical Sciences serves Haigazian University students, faculty, and staff by offering computer science and mathematics education of the highest quality. The Division also serves the local community through public lectures related to the latest advances in the fields of computing and communication technology. The Division is committed to helping students become leaders in their fields and prepares them to continue their studies and learning at the graduate level.

On completion of either program, Mathematical Sciences students are expected to be able to:

- Demonstrate an understanding of the basic terminology and fundamental concepts that are essential to the Mathematical Sciences.
- Use analytical and problem-solving skills while thinking critically and creatively.
- Apply the concepts and practical skills they have learnt.
- Engage in lifelong learning, a necessity for continuing high performance in their future careers.
- Communicate their ideas clearly and concisely, both orally and in writing.
- Demonstrate a strong commitment to professional and ethical practice within their profession.

Computer Science

The Computer Science program at Haigazian University offers the Bachelor of Science (B.S.) degree.

On completion of their degree, Computer Science students will be able to:

- Design, implement, and evaluate computer programs that solve significant computational problems.
- Use Data Structures and develop algorithms to solve complex computational problems.
- Analyze problem complexity and design new algorithmic solutions when faced with new problems.
- Design and implement different software systems.
- Design and implement different database systems.

- Design and develop E-commerce and web-based systems.
- Understand and analyze modern computer hardware and software systems.
- Understand the specific design decisions regarding computer architecture, operating systems, and memory structures, and evaluate those design decisions.
- Focus on a specific area of interest by selecting from a variety of elective courses on advanced system programming, web and mobile computing, Geographical Information Systems, Artificial Intelligence, network programming, and others.

B.S. degree in Computer Science: In addition to the general education requirements, the Computer Science Department requires a minimum of 55 credits in computer science and 12 credits in mathematics. All computer science students must pass each of CSC 202 and MAT 201 with a minimum grade of 70 in order to register in higher level courses in the major.

The Department also offers a minor. A minor in Computer Science requires 18 credits: CSC 202, CSC 204, CSC 236, MAT 270, and any two CSC courses (excluding CSC 266). Students minoring in Computer Science should complete at least 9 credits of their minor at Haigazian University. Students minoring in Computer Science should score a minimum grade of 70 in CSC 202. For more details regarding minors, kindly refer to the Minors section of the catalog.

General Education (30 cr.)

Core requirements for all HU students are listed on page 58.

Required Courses (43 cr.)

CSC 200	Introduction to Computing	1 cr.
CSC 202	Computer Programming	3 cr.
CSC 204	Advanced Computer Programming & Data Structures	3 cr.
CSC 233	Logic Design of Digital Systems	4 cr.
CSC 236	Design and Analysis of Algorithms	3 cr.
CSC 238	Discrete Structures	3 cr.
CSC 239	Concepts of Programming Languages	3 cr.
CSC 240	Computer Architecture and Assembly Language	3 cr.
CSC 256	Database Systems	3 cr.
CSC 263	Software Engineering	3 cr.
CSC 271	Operating Systems	3 cr.

CSC 274	Data Transmission and Computer Networks	4 cr.
CSC 281	Theory of Computation	3 cr.
CSC 291	Computer Internship	1 cr.
CSC 299	Capstone Project	3 cr.

Elective Courses (12 cr.)

To be chosen in consultation with the student's advisor from the following:

CSC 237	Design and Analysis of Object-Oriented Programming	3 cr.
CSC 251	Numerical Analysis	3 cr.
CSC 279	Mobile Application Development	3 cr.
CSC 280	Advanced Database Management Systems	3 cr.
CSC 282	Introduction to Artificial Intelligence	3 cr.
CSC 283	Computer Graphics	3 cr.
CSC 285	Compiler Design	3 cr.
CSC 286	Systems Programming	3 cr.
CSC 288	Operations Research	3 cr.
CSC 289	GIS for Computer Science	3 cr.
CSC 290	Advanced Computer Networks	3 cr.
CSC 295	Foundations of Parallel and Distributed Systems	3 cr.
CSC 297	Selected Topics in Computer Science	3 cr.
CSC 298	E-Commerce Technology	3 cr.

Mathematics Requirements (12 cr.)

MAT 201	Calculus and Analytic Geometry III	3 cr.
MAT 202	Differential Equations	3 cr.
MAT 219	Linear Algebra	3 cr.
MAT 233	Statistics	3 cr.

Computer Science Courses

CSC 200 Introduction to Computing (1 cr.)

This course introduces the computer science field and its influence on technology. It presents the main operations of computers, the use of computer networks, the World Wide Web, writing simple algorithms and other issues in the field like data/time complexities and computer security issues. Students who have taken CSC 201 or CSC 205 do not receive credit for CSC 200.

CSC 201 Introduction to Computers and Programming (3 cr.)

Introduction to computer hardware, software and basic programming: basics of computer literacy including word processing, spread sheets and Power Point. Introduction to computer hardware, software, and web design using HTML. Fundamental programming constructs using block-structured high-level languages. Not open to Computer Science and Faculty of Business Administration and Economics students.

CSC 202 Computer Programming (3 cr.)

Problem solving and algorithm design. Fundamental programming constructs: decision loops, modules. Fundamental data structures: arrays, records, files. Basic principles of software engineering: stepwise refinement, modular programming, documentation, testing. Lab work will be done in a high-level programming language such as Java.

CSC 204 Advanced Computer Programming & Data Structure (3 cr.)

Advanced programming techniques through dynamic memory allocation. Files and recursion. Introduction to advanced data types: pointers, lists, stacks, queues, trees. Introduction to searching and sorting techniques. Programming projects will be done in a high-level language such as Java. Prerequisite: CSC 202.

CSC 205 Introduction to Computing Concepts for Business (3 cr.)

This course introduces business students to the world of information technology and business computing by exploring introductory concepts in the following areas: general computing, computer hardware, computer software, data resource management, telecommunications & networks, programming, the Internet and the World Wide Web, the use of business spreadsheets such as Excel to perform business functions, and finally the use of business databases such as Access to store and retrieve business information.

CSC 233 Logic Design of Digital Systems (3,1,2; 4 cr)

Fundamental building blocks of digital logic (logic gates, flip-flops, counters, registers); programmable logic devices; logic expressions, minimization, sum of product forms; register transfer notation; finite state machines; physical considerations; date representation; numeric date representation and number bases; representation of nonnumeric date; hierarchical and modular design of digital systems: simple data paths and hardwired control unit realization.

CSC 236 Design and Analysis of Algorithms (3 cr.)

Advanced data structures and related algorithms. Algorithm design techniques, such as divide and conquer, the greedy method, trees and graph traversals, and backtracking. Illustrations through algorithms like searching and sorting, minimum Spanning Trees, single course and all-pairs shortest paths. Asymptotic time and space complexity of algorithms. Introduction to average case analysis and lower bound theory. Prerequisite: CSC 204.

CSC 237 Design and Analysis of Object - Oriented Programming (3 cr.)

The course concentrates on Object-Oriented Programming in C++ and on modeling a visual language such as UML, in the context of a generic object oriented development process. Topics include: function overloading, object identity, development of inheritance, polymorphism, abstract base classes, the object world, analysis/design goals as the driving development force, different system views, use cases, static and dynamic models, diagrams, and modeling with patterns. Prerequisite: CSC 204.

CSC 238 Discrete Structures (3 cr.) (Equivalent to MAT 270)

Sets, relations, functions. Basic counting concepts and techniques. Mathematical induction. Modular arithmetic. Recurrence relations and generating functions. Introduction to graph theory and related algorithms. Prerequisite: CSC 202.

CSC 239 Concepts of Programming Languages (3 cr.)

Classification of programming languages. Emphasizes the principles and programming styles that govern the design and implementation of programming languages and that are based on procedural, object-oriented, functional and rule based paradigms. Data objects, data types, control structures, sub-programs, activation records, binding, scoping, parameter passing, data abstraction. Functional, procedural, object-oriented and logic programming. Prerequisite: CSC 236.

CSC 240 Computer Architecture and Assembly Language (3 cr.)

Basic organization of computer hardware. Representation of data and instructions. Machine operations. Storage and addressing techniques. System interrupts, multi-tasking. Illustration on a specific microprocessor architecture such as Intel or Motorola. Introduction to assembly language. Prerequisite: PHY 233 and CSC 236.

CSC 251 Numerical Analysis (3 cr.)

(Equivalent to MAT 251)

An introduction to scientific computing as illustrated in: number systems and errors, roots of equations, computational linear algebra, curve fitting, numerical integration and differentiation, and numerical differential equations. Programming assignments are required. Prerequisite: MAT 201 and MAT 202.

CSC 256 Database Systems (3 cr.)

Overview of database design concepts. Views of data at different levels; data modeling; the relational, hierarchical, and network data models; relational algebra and calculus; data integrity, security and reliability constraints, normal forms; data definition and data manipulation languages, SQL, transactions, concurrency and recovery; an introduction to logic-based and object-oriented data models.; examples using Oracle DBMS and MSSQL. Prerequisite: CSC 236.

CSC 263 Software Engineering (3 cr.)

The software development life cycle; introduction to software project management: cost estimation and project planning; software specification and requirements analysis; comparison of software architectures; software design techniques; use of static and dynamic analysis tools: data flow concepts, decision tables, decision variables; user interfaces; introduction to software metrics; software quality assurance strategies: software testing strategies; system documentation; system implementation. Prerequisite: CSC 236.

CSC 266 Professional and Social Issues in Computing (3 cr.)

This is a course that focuses on the analysis of the social and professional issues that arise in those professions that deal with Information Technology and Computers.

CSC 271 Operating Systems (3 cr.)

An overview of the structure and the different functions of operating systems. Topics include process management and scheduling, interprocess communication, process synchronization, memory management, disk management, virtual memory, file systems. Introduces deadlock handling, recovery, concurrent programming, protection. Practice will be done using the UNIX operating system. Prerequisite: CSC 240.

CSC 274 Data Transmission & Computer Networks (4 cr.)

Fundamental concepts of data transmission and computer networks; overview of layered protocol hierarchies; the physical, link and network layers of the OSI reference model; TCP/IP reference model. Error control, flow control, routing algorithms; multiple access protocols; packet switching and local area networks. Prerequisite: CSC 240.

CSC 279 Mobile Application Development (3 cr.)

Building mobile applications for various mobile devices including smartphones and tablets. Mobile computing will be discussed from three perspectives: mobile technology, application development, and user interaction. Students will be introduced to mobile application frameworks and development environments including technologies for developing Android/IOS platforms using Eclipse, Android SDK, Xcode and the iOS SDK. Prerequisite: Senior Standing.

CSC 280 Advanced Database Management Systems (3 cr.)

This course emphasizes advanced topics in database management systems. Topics include: advanced query processing and SQL techniques, recover issues and strategies, advanced database models, performance and tuning issues, distributed databases, data warehousing, and database security. Prerequisite: CSC 256.

CSC 281 Theory of Computation (3 cr.)

This course covers finite state machines and pushdown automata, and their relationship to regular and context-free languages. It also covers minimization of automata, Turing machines, and undecidability, computational complexity, propositional calculus and predicate calculus. Prerequisite: CSC 204 and CSC 238.

CSC 282 Introduction to Artificial Intelligence (3 cr.)

Basic concepts and methods of Artificial Intelligence; representation of knowledge; natural language processing; games and search strategies; planning; deduction and reasoning; machine learning; basic notions of expert systems. Prerequisite: CSC 239.

CSC 283 Computer Graphics (3 cr.)

Fundamental concepts of programming for computer graphics; current graphics hardware; Raster algorithms and software; elementary operations in two and three dimensional space; geometric transformations, clipping; interpolation and 3D viewing; curves and splines; ray tracing, shading, illumination and color; graphics data structures; interactive graphics. Prerequisite: MAT 219 and CSC 236.

CSC 285 Compiler Design (3 cr.)

Grammar of programming languages, lexical analysis, parsing theory and parser generation, syntax directed code generation, semantic processing, symbol table organization and management, dynamic storage allocation, code optimization and register allocation; error diagnostics. Prerequisite: CSC 240 and CSC 281.

CSC 286 Systems Programming (3 cr.)

Structure of an operating system; design and implementation of system software; assemblers, linkers, loaders, editors, interpreters, and compilers; task management; system generation and maintenance; system call interface in UNIX. Prerequisite: CSC 240 and CSC 271.

CSC 288 Operations Research (3 cr.)

Introduction to management science and its quantitative tools; models and model building; linear programming and its applications, project scheduling (PERT-cpm), deterministic inventory theory, and waiting line models. Prerequisite: MAT 233 and CSC 202.

CSC 289 GIS for Computer Science (3 cr.)

Introduction to ARC/INFO and its subsystems: ArcEdit, ArcPlot and Tables as tools to analyze and develop GIS Projects. Spatial databases with their data models and the relationships among spatial objects to clarify their role in Spatial Analysis. The student will use the programming language of GIS to develop and customize an independent project. Prerequisite: CSC 256.

CSC 290 Advanced Computer Networks (3 cr.)

Communication services, protocols and software; details of layered protocol hierarchies; the transport, session, presentation and application layers; fundamental concepts of computer network design; computer network and communication protocol architectures; internetworking, network security and internet applications. Prerequisite: CSC 274.

CSC 291 Computer Internship (1 cr.)

This is a required course that involves supervised 6 to 8 weeks work experience in a computer-related training program. Students should submit a summary report to the Department. Grade: Pass or Fail. Prerequisite: Approval of Chairperson.

CSC 292 Selected Topics in Computer Science (3 cr.)

Topic chosen according to the special interests of the faculty and students and related to latest development in the area of computer and information technology. Prerequisite: Permission of Instructor.

CSC 295 Foundations of Parallel and Distributed Systems (3 cr.)

The course introduces students to the basic concepts, architecture, design and development, and particularly the enabling technologies of parallel and distributed computing systems. Specific topics to be covered include the following: characteristics and basic design issues of distributed systems,

inter-process communication (including UNIX sockets and Remote Procedure Calls), distributed operating systems, file service, concurrency control, fault tolerance, security, and case studies. Prerequisite: CSC 271 and CSC 274.

CSC 298 E-Commerce Technology (3 cr.)

The course provides a technical introduction to electronic commerce over the Internet, discussing topics such as electronic data exchange, digital currency, electronic catalogs, telecommunications infrastructure, data warehousing, software agents, web page development using current technologies such a HTML and XML, CGI scripting, Javascript, and Java. Topics may also include cryptographic techniques as applicable to web-site development, management of data in a secure manner, authentication and confidentiality, different levels of security (transaction, network, and protocol), and digital signatures. Prerequisite: Senior Standing or Permission of Instructor.

CSC 299 Capstone Project (3 cr.)

The course integrates skills in analysis, design, and presentation through developing an extensive project. Students select project topic according to their subject of interests and the availability of facilities and the approval of a faculty member who is going to supervise the project. Topics such as professional and ethical responsibilities, team work, intellectual property will be covered and discussed by lectures and seminars. Students are expected to spend some time doing part of their project, based on feasibility, in some companies. Prerequisite: CSC 263 and Senior Standing.