Introduction to Computer Science

Course Description

The goal of this course is to provide an introduction to computer science and its main concepts. It covers basic topics such as information representation and an introduction to algorithms and data structures. Propositional logic and Boolean algebra are also introduced, both of which form an important basis in computer science, e.g., for expressing conditions in programming.Furthermore, the course introduces the three main components of computing infrastructures: hardware, networks, and software. Finally, the course covers the meta level by looking at the role of computer science as a discipline as well as ethics and professional conduct.

Contents

1. Basic concepts of data processing
   1. Data, information and messages
   2. Software, firmware and hardware
   3. Languages, syntax and semantics
   4. Historical overview
2. Information representation
   1. Number representation formats
   2. Representation of non-numerical information
   3. Data types
   4. Redundancy and error tolerance
3. Algorithms and data structures
   1. Algorithms and flow diagrams
   2. Simple data structures
   3. Searching and sorting
   4. Quality of algorithms (correctness, termination, efficiency/complexity)
4. Propositional logic, Boolean algebra and circuit design
   1. Propositions and logical conclusions
   2. Conjunctive and disjunctive normal form
   3. Digital circuit design
5. Hardware and computer architectures
   1. Computer types and their architecture
   2. Processors and memory
   3. Input and output
   4. Interfaces and drivers
   5. High-performance computing
6. Networks and the internet
   1. Wired and wireless networks and their topologies
   2. The TCP/IP and the ISO/OSI model
   3. Internet structure and services
   4. The internet of things
7. Software
   1. BIOS and operating systems
   2. Application software and information systems
   3. Apps
   4. Embedded systems
   5. Software development
8. Computer Science as a discipline
   1. The role and sub-disciplines of computer science
   2. Artificial intelligence, data science and computer science
   3. Ethical aspects of computer science
   4. The ACM Code of Ethics and Professional Conduct