

Booklist for Computer Science Amateurs

A reasoned and compact book list for computer science amateurs and beginners, aiming to provide a direct pathway to study on a specific subfield of Computer Science. Generally outdated or substitutable book would be removed dynamically in this book list, and only best choices are listed here.

Amount: 144 books; update: 2018-11-13.

Class

EX: Classic books which are comprehensive and well-organized.

A: Great and in-depth books in some specific fields.

B: Worth-reading.

C: Plain books or abstruse books which may be useful for some experts.

D: Partly useful.

E: General and substitutable.

"+" or "++" stands for the potential helpfulness in some particular area.

TODO:

1. **authors**
2. **properties**: One or more Words from: primer, advanced, handbook, theoretical, practical,
3. **keywords**: describe topics and the exact subfield.
4. **review**: 100-500 words.

Algorithms and data structures

Algorithms denotes Sequential and parallel computational procedures for solving a wide range of problems. A data structure is the organization and manipulation of data.

Generic Algorithms

Algorithms, 4th Edition, Class: A, primer

Concrete Mathematics, 2nd Edition, Class: A+, primer

Introduction to Algorithms, Class: B, primer

The Art of Computer Programming, Class: A++, handbook, advanced

Specialized Algorithms

Data Structures and Network Algorithms, by Robert Endre Tarjan, Class: A

Combinatorial Optimization: Algorithms And Complexity, Class: B

Combinatorial Optimization: Networks and Matroids, by Eugene Lawler, Class: B, advanced

Artificial intelligence

Generic Artificial intelligence

The implementation and study of systems that exhibit an autonomous intelligence or behavior of their own.

Artificial Intelligence - A Modern Approach, 3rd Edition, Class: A, primer

Paradigms of Artificial Intelligence Programming - Case Studies in Common LISP, Class: B+, primer

Decision Procedures: an Algorithmic Point of View, by Daniel Kroening, Ofer Strichman, Class: B+

Knowledge representation, reasoning and declarative problem solving with Answer sets, by Chitta Baral, Class: TBD

Automated reasoning

Solving engines, such as used in Prolog, which produce steps to a result given a query on a fact and rule database, and automated theorem provers that aim to prove mathematical theorems with some assistance from a programmer.

Automated Theorem Proving, Class: TBD

Certified Programming with Dependent Types, Class: A

Interactive Theorem Proving and Program Development Coq'Art: The Calculus of Inductive Constructions, Class: A++, primer

Little Engines of Proof, Class: TBD

Mathematical Components, Class: A

Proof Trick Small Inversions, Class: TBD

Software Foundations, Class: EX, primer

- Volume 1 Logical Foundations
- Volume 2 Programming Language Foundations
- Volume 3 Verified Functional Algorithms
- Volume 4 QuickChick

Computer vision

Algorithms for identifying three-dimensional objects from a two-dimensional picture.

Computer Vision: Algorithms and Applications, by Richard Szeliski, Class: B, advanced

Computer Vision: Models, Learning, and Inference, by Dr Simon J. D. Prince, Class: A,

Soft computing

the use of inexact solutions for otherwise extremely difficult problems:

Foundations of Data Science, Class: A, primer

Machine learning

Automated creation of a set of rules and axioms based on input.

Machine Learning A Probabilistic Perspective, Class: B+

Neural Networks and Deep Learning, by Michael Nielsen, Class: A

Optimal Learning by Warren B. Powell, Class: B

Pattern Recognition and Machine Learning, Class: A

The Elements of Statistical Learning, Class: B+

Reinforcement Learning, An Introduction, Class: B+, primer

Evolutionary computing

Biologically inspired algorithms.

Artificial Intelligence - Neural Networks Algorithms, Applications, And Programming Techniques, Class: C

Fuzzy Sets And Systems Theory And Applications, by Didier Dubois, Henri Prade, Class: B

Natural language processing

Building systems and algorithms that analyze, understand, and generate natural (human) languages.

Speech and Language Processing, by Dan Jurafsky, Class: TBD

Neural Network Methods for Natural Language Processing, by Yoav Goldberg, Class: A, primer

Robotics

Algorithms for controlling the behaviour of robots.

Introduction to Robotics: Mechanics, Planning, and Control, Class: A

Expert Systems

Intelligent Systems for Engineers and Scientists, 2nd Edition, Adrian A. Hopgood, Class: C

Introduction to Expert Systems, 3rd edition, by Jackson P. , Addison Wesley, Class: TBD, primer

Expert Systems, Principles and Programming, by Giarratano J. , Riley G. , Class: C, primer

Introduction to Knowledge Systems, by Stefik M., Morgan Kaufmann, Class: A, advanced

The Handbook of Applied Expert Systems, Jay Liebowitz, Class: C, handbook

Communication and security

Networking

Algorithms and protocols for reliably communicating data across different shared or dedicated media, often including error correction.

Computer Networking: A Top-Down Approach, Class: A, primer

Computer security

Practical aspects of securing computer systems and computer networks.

Security Engineering: A Guide to Building Dependable Distributed Systems, by Ross J. Anderson, Class: A

Cryptography

Applies results from complexity, probability, algebra and number theory to invent and break codes, and analyze the security of cryptographic protocols.

Applied Cryptography: Protocols, Algorithms, and Source Code in C, by Bruce Schneier, Class: A

Computer architecture

Computer architecture

The design, organization, optimization and verification of a computer system, mostly about CPUs and Memory subsystem (and the bus connecting them).

Computer Organization and Design, Class: EX, primer

Principles of Computer System Design: An Introduction, Class: A+

Operating systems

Systems for managing computer programs and providing the basis of a usable system.

Computer Systems A Programmers Perspective, 3rd Global Edition, Class: A, primer

Modern Operating Systems, 4th Edition, Class: B+, primer

Operating System Concepts, 7th Edition, Class: B, primer

Operating Systems: Three Easy Pieces, Class: B

Understanding The Linux Kernel, Class: TBD

Concurrent, parallel, and distributed systems

Parallel computing

The theory and practice of simultaneous computation; data safety in any multitasking or multithreaded environment.

Parallel Programming in C with MPI and OpenMP, by Quinn, Class: B, practical

CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, by Shane Cook, Class: B, practical

Concurrency (computer science)

Computing using multiple concurrent threads of execution, devising algorithms for solving problems on multiple processors to achieve maximal speed-up compared to sequential execution.

Communicating Sequential Processes, by Hoare, Class: TBD, theoretical

The Theory and Practice of Concurrency, by Roscoe, Class: TBD, theoretical

Distributed computing

Computing using multiple computing devices over a network to accomplish a common objective or task and thereby reducing the latency involved in single processor contributions for any tasks. *Operating Systems: Concurrent and Distributed Software Design*, by Jean Bacon, Class: C

Distributed Systems, 3rd Edition, by Maarten van Steen, Class: A, primer

Mathematical foundations

Introduction to Linear Algebra, Class: C+, primer

Mathematics for Computer Science 2013, Class: EX, primer

Probability theory and examples, 4th Edition, Class: C, primer

Foundations of Computer Science, C Edition, Class: EX, primer

Coding theory

Useful in networking and other areas where computers communicate with each other.

Information Theory, Inference, and Learning Algorithms, by David MacKay, Class: A

Combinatorial Mathematics

Combinatorics concerned with counting, both as a means and an end in obtaining results, and certain properties of finite structures.

Introduction to Combinatorial Mathematics (Computer Science Series), by Chung L. Liu, Class: B+

Graph theory

Foundations for data structures and searching algorithms.

General Topology, John L. Kelley, Class: C, primer

Mathematical logic

Boolean logic and other ways of modeling logical queries; the uses and limitations of formal proof methods

A First Course in Logic: An Introduction to Model Theory, Proof Theory, Computability, and Complexity, by Shawn Hedman, Class: A+

Discrete Mathematics and Its Applications, Class: B+, primer

Logic in Computer Science, Modelling and Reasoning about Systems, Class: EX, primer

Logic for Applications 2nd Ed, Class: A, primer

Mathematical Logic, Ebbinghaus, Class: C, primer

Algebraic Logic

Boolean Functions Theory, Algorithms, and Applications, Class: C+

Category Theory

**Category Theory A Gentle Introduction*, Class: A+, primer

Categories for the Working Mathematician, Saunders Mac Lane, Class: A++

Basic Category Theory for Computer Scientists, Class: C, primer

Formal Systems

Theory of Formal Systems, Class: C

Lattice Theory

Introduction to Lattices and Order, Class: TBD, primer

Lambda-calculus

Lambda-Calculus and Combinators, an Introduction, Class: A

Programming Languages and Lambda Calculus, Class: C+

The Lambda Calculus, It's syntax and Semantics, Class: A+

Modal Theory

Pi-calculus

An Introduction to the pi-Calculus, Class: C, primer

Handbook of Process Algebra, Class: TBD

Introduction to Process Algebra, Class: B++, primer

The Pi-Calculus A Theory of Mobile Processes, Class: B+

Proof Theory

Proof Theory, Gaisi Takeuti, 2nd Ed, Class: B

Structural Proof Theory, Class: B+

Recursion Theory

Recursion Theory for Metamathematics, by Raymond M. Smullyan, Class: B

COMPUTABILITY An introduction to recursive function theory, Class: TBD, primer

Set Theory

Introduction to Axiomatic set theory, by Takeuti G. Zaring W., Class: B, primer

Number theory

Theory of the integers. Used in cryptography as well as a test domain in artificial intelligence.

An Introduction To The Theory Of Numbers, by Ivan Niven, Hugh L. Montgomery, Herbert S. Zuckerman, Class: B, primer

Programming languages and compilers

Lectures on the Curry-Howard isomorphism-Elsevier Science, Class: A, primer

Compiler theory

Theory of compiler design, based on Automata theory.

Advanced Compiler Design and Implementation, Class: B, advanced

Compilers, Principles, Techniques, and Tools, 2nd Edition, Class: B, advanced, handbook

Compiling With Continuations, Class: TBD+

Language Implementation Patterns, Class: B++, primer

Modern Compiler Implementation In Java, Class: A, primer

Programming language pragmatics

Taxonomy of programming languages, their strength and weaknesses. Various programming paradigms, such as object-oriented programming.

Programming Language Pragmatics, Third Edition, by Michael L. Scott, Class: A+

Programming language theory

A branch of computer science that deals with the design, implementation, analysis, characterization, and classification of programming languages and their individual features.

Concepts of Programming Languages, 11th Ed, Class: A, primer

Concepts, Techniques and Models of Computer Programming, Class: A++

Essentials of Programming Languages, Class: B+, primer

Foundations for Programming Languages, by John.C..Mitchell, Class: A+, primer

Let Over Lambda, Class: A+

Practical Foundations for Programming Languages, 2nd Edition, Class: c

Programming Languages Application and Interpretation, Class: TBD

Structure and Interpretation of Computer Programs, Class: B, primer

The Art of the Metaobject Protocol, Class: TBD

Formal semantics

Rigorous mathematical study of the meaning of programs.

Concrete Semantics, Class: A

Type theory

Formal analysis of the types of data, and the use of these types to understand properties of programs — especially program safety.

Homotopy Type Theory, Class: A

Type Theory and Functional Programming, Class: A+

Types and Programming Languages, Class: A++

Software engineering

Algorithm Design

Using ideas from algorithm theory to creatively design solutions to real tasks.

Algorithm Design, Class: A, primer

The Algorithm Design Manual, Class: A, primer

Computer programming

The practice of using a programming language to implement algorithms.

A Little Java, A Few Patterns, Class: C

Automate the Boring Stuff with Python, Class: TBD, primer

Introduction to Computation and Programming Using Python, Class

Hacker's Delight, 2nd Edition, Class: A

How To Design Programs, Class: A+, primer

Programming Pearls, Class: A

Formal methods

Mathematical approaches for describing and reasoning about software design.

Formal Reasoning About Programs, Class: B+

Program Analysis and Verification

Principle of Model Checking, Class: A

Principles of Program Analysis, Class: A, primer

Theory of computation

Introduction to Languages and The Theory of Computation, 4th Edition, Class: C

The Calculus of Computation: Decision Procedures with Applications to Verification, by Aaron R. Bradley, Class: B

Automata theory

Different logical structures for solving problems.

An Introduction to Formal Languages and Automata, 3rd Edition, Class: B+

Introduction To Automata Theory Languages, and Computation, Class: TBD, primer

Computability theory

What is calculable with the current models of computers. Proofs developed by Alan Turing and others provide insight into the possibilities of what may be computed and what may not.

Introduction to the Theory of Computation, Class: A++, primer

Computational complexity theory

Fundamental bounds (especially time and storage space) on classes of computations.

Computers and Intractability: A Guide to the Theory of NP-Completeness, by Michael R. Garey, David S. Johnson, Class: C

The Nature of Computation, Class: A, primer

Computational Complexity, Class: A, primer

Quantum computing theory

Explores computational models involving quantum superposition of bits.

Quantum Computation and Quantum Information, Class: TBD, primer

Appendix. Programming Language Tutorial

Textbooks to learn a particular Programming Language efficiently.

An Introduction To Programming In Emacs Lisp, 2nd Edition, Class: TBD

Core Java, 9th Edition, by Cay S. Horstmann, Gary Cornell, Class: TBD

Fundamental Kotlin, by Miloš Vasić, Class: TBD

JavaScript Programmer's Reference, by Alexei White, Class: TBD

MATLAB Primer, Class: TBD

ML for the Working Programmer, by Lawrence C. Paulson, Class: TBD

On Lisp, Class: TBD, advanced

Practical Common Lisp, Class: TBD,

Programming Elixir 1.3, Class: TBD

Programming in IDRIS, A Tutorial, Class: TBD

Programming in Scala: A comprehensive Step-by-Step Scala Programming Guide, by Martin Odersky, Lex Spoon, Bill Venners, Class: TBD

R for Data Science, by Hadley Wickham, Class: TBD

Real World OCaml, Class: TBD

Real World Haskell, Class: TBD

Rust Essentials, Class: TBD

The Art of Prolog, 2nd Edition, Class: TBD

The C Programming Language, by Brian W. Kernighan, Class: TBD

The Little Schemer, 4th Edition, Class: TBD

The Scheme Programming Language, 4th Edition, Class: TBD

The Seasoned Schemer, Class: TBD

Verified Functional Programming in Agda, by Aaron Stump, Class: TBD