

Computing Review Subject Classification System (1964, obsolete)

- 1 General Topics and Education
- 2 Computing Milieu
- 3 Applications
- 4 Programming
- 5 Mathematics of Computation
- 6 Design and Construction
- 7 Analog Computers



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Computing Review Subject Classification System (1964, obsolete)

3 Applications

- 3.1 Natural Sciences
- 3.2 Engineering
- 3.3 Social and Behavioral Sciences
- 3.4 Humanities
- 3.5 Management Data Processing
- 3.6 Artificial Intelligence
- 3.7 Information Retrieval
- 3.8 Miscellaneous

Computing Review Subject Classification System (1964, obsolete)

3.6 Artificial Intelligence

- 3.60 General
- 3.61 Induction and Hypothesis-formation
- 3.62 Learning and Adaptive Systems
- 3.63 Pattern Recognition
- 3.64 Problem-solving
- 3.65 Simulation of Natural Systems
- 3.66 Theory of Heuristic Methods
- 3.69 Miscellaneous

1991 ACM Computing Classification System Tree

Valid in 1997

- [A. General Literature](#)
- [B. Hardware](#)
- [C. Computer Systems Organization](#)
- [D. Software](#)
- [E. Data](#)
- [F. Theory of Computation](#)
- [G. Mathematics of Computing](#)
- [H. Information Systems](#)
- [I. Computing Methodologies](#)
- [J. Computer Applications](#)
- [K. Computing Milieux](#)

The ACM Computing Classification System (1991)

I. Computing Methodologies

- [I.0 GENERAL](#)
- [I.1 ALGEBRAIC MANIPULATION](#)
- [I.2 ARTIFICIAL INTELLIGENCE](#)
- [I.3 COMPUTER GRAPHICS](#)
- [I.4 IMAGE PROCESSING](#)
- [I.5 PATTERN RECOGNITION](#)
- [I.6 SIMULATION AND MODELING \(G.3\)](#)
- [I.7 TEXT PROCESSING \(H.4, H.5\)](#)
- [I.m MISCELLANEOUS](#)

The ACM Computing Classification System (1991)

I.2 ARTIFICIAL INTELLIGENCE

- [I.2.0 General](#)
- [I.2.1 Applications and Expert Systems \(H.4, J\)](#)
- [I.2.2 Automatic Programming \(D.1.2, F.3.1\)](#)
- [I.2.3 Deduction and Theorem Proving](#)
- [I.2.4 Knowledge Representation Formalisms and Methods](#)
- [I.2.5 Programming Languages and Software \(D.3.2\)](#)
- [I.2.6 Learning \(K.3.2\)](#)
- [I.2.7 Natural Language Processing](#)
- [I.2.8 Problem Solving, Control Methods, and Search \(F.2.2\)](#)
- [I.2.9 Robotics](#)
- [I.2.10 Vision and Scene Understanding \(I.4.8, I.5\)](#)
- [I.2.11 Distributed Artificial Intelligence](#)
- [I.2.m Miscellaneous](#)

The ACM Computing Classification System (1991)

I.2.1 Applications and Expert Systems

- *Cartography*
- *Games*
- *Industrial automation*
- *Law*
- *Medicine and science*
- *Natural language interfaces*
- *Office automation*

The ACM Computing Classification System (1991)

I.2.2 Automatic Programming

- *Automatic analysis of algorithms*
- *Program modification*
- *Program synthesis*
- *Program transformation*
- *Program verification*

The ACM Computing Classification System (1991)

I.2.3 Deduction and Theorem Proving

- *Answer/reason extraction*
- *Deduction (e.g., natural, rule-based)*
- *Logic programming*
- *Mathematical induction*
- *Metatheory*
- *Nonmonotonic reasoning and belief revision*
- *Resolution*
- *Uncertainty, "fuzzy," and probabilistic reasoning*

The ACM Computing Classification System (1991)

I.2.4 Knowledge Representation Formalisms and Methods

- *Frames and scripts*
- *Predicate logic*
- *Relation systems*
- *Representation languages*
- *Representations (procedural and rule-based)*
- *Semantic networks*

The ACM Computing Classification System (1991)

I.2.5 Programming Languages and Software

- *Expert system tools and techniques*

The ACM Computing Classification System (1991)

I.2.6 Learning

- *Analogies*
 - *Concept learning*
 - *Connectionism and neural nets*
 - *Induction*
 - *Knowledge acquisition*
 - *Language acquisition*
 - *Parameter learning*
-

The ACM Computing Classification System (1991)

I.2.7 Natural Language Processing

- *Discourse*
- *Language generation*
- *Language models*
- *Language parsing and understanding*
- *Machine translation*
- *Speech recognition and synthesis*
- *Text analysis*

The ACM Computing Classification System (1991)

I.2.9 Robotics

- *Manipulators*
- *Propelling mechanisms*
- *Sensors*

The ACM Computing Classification System (1991)

I.2.10 Vision and Scene Understanding

- *Architecture and control structures*
- *Intensity, color, photometry and thresholding*
- *Modeling and recovery of physical attributes*
- *Motion*
- *Perceptual reasoning*
- *Representations, data structures, and transforms*
- *Shape*
- *Texture*

The ACM Computing Classification System (1991)

I.2.11 Distributed Artificial Intelligence

- *Coherence and coordination*
- *Languages and structures*

Top Two Levels of The ACM Computing Classification System (1998)

A. General Literature

- [A.0 GENERAL](#)
- [A.1 INTRODUCTORY AND SURVEY](#)
- [A.2 REFERENCE \(e.g., dictionaries, encyclopedias, glossaries\)](#)
- [A.m MISCELLANEOUS](#)

B. Hardware

- [B.0 GENERAL](#)
- [B.1 CONTROL STRUCTURES AND MICROPROGRAMMING \(D.3.2\)](#)
- [B.2 ARITHMETIC AND LOGIC STRUCTURES](#)
- [B.3 MEMORY STRUCTURES](#)
- [B.4 INPUT/OUTPUT AND DATA COMMUNICATIONS](#)
- [B.5 REGISTER-TRANSFER-LEVEL IMPLEMENTATION](#)
- [B.6 LOGIC DESIGN](#)
- [B.7 INTEGRATED CIRCUITS](#)
- [B.8 PERFORMANCE AND RELIABILITY \(NEW!\) \(C.4\)](#)
- [B.m MISCELLANEOUS](#)

C. Computer Systems Organization

- [C.0 GENERAL](#)
- [C.1 PROCESSOR ARCHITECTURES](#)
- [C.2 COMPUTER-COMMUNICATION NETWORKS](#)
- [C.3 SPECIAL-PURPOSE AND APPLICATION-BASED SYSTEMS \(J.7\)](#)
- [C.4 PERFORMANCE OF SYSTEMS](#)
- [C.5 COMPUTER SYSTEM IMPLEMENTATION](#)
- [C.m MISCELLANEOUS](#)

D. Software

- [D.0 GENERAL](#)
- [D.1 PROGRAMMING TECHNIQUES \(E\)](#)
- [D.2 SOFTWARE ENGINEERING \(K.6.3\)](#)
- [D.3 PROGRAMMING LANGUAGES](#)
- [D.4 OPERATING SYSTEMS \(C\)](#)
- [D.m MISCELLANEOUS](#)

E. Data

- [E.0 GENERAL](#)
- [E.1 DATA STRUCTURES](#)
- [E.2 DATA STORAGE REPRESENTATIONS](#)
- [E.3 DATA ENCRYPTION](#)
- [E.4 CODING AND INFORMATION THEORY \(H.1.1\)](#)
- [E.5 FILES \(D.4.3, F.2.2, H.2\)](#)
- [E.m MISCELLANEOUS](#)

F. Theory of Computation

- [F.0 GENERAL](#)
- [F.1 COMPUTATION BY ABSTRACT DEVICES](#)
- [F.2 ANALYSIS OF ALGORITHMS AND PROBLEM COMPLEXITY \(B.6, B.7, F.1.3\)](#)
- [F.3 LOGICS AND MEANINGS OF PROGRAMS](#)
- [F.4 MATHEMATICAL LOGIC AND FORMAL LANGUAGES](#)
- [F.m MISCELLANEOUS](#)

G. Mathematics of Computing

- G.0 GENERAL
- G.1 NUMERICAL ANALYSIS
- G.2 DISCRETE MATHEMATICS
- G.3 PROBABILITY AND STATISTICS
- G.4 MATHEMATICAL SOFTWARE
- G.m MISCELLANEOUS

H. Information Systems

- H.0 GENERAL
- H.1 MODELS AND PRINCIPLES
- H.2 DATABASE MANAGEMENT (E.5)
- H.3 INFORMATION STORAGE AND RETRIEVAL
- H.4 INFORMATION SYSTEMS APPLICATIONS
- H.5 INFORMATION INTERFACES AND PRESENTATION (e.g., HCI) (I.7)
- H.m MISCELLANEOUS

I. Computing Methodologies

- I.0 GENERAL
- I.1 SYMBOLIC AND ALGEBRAIC MANIPULATION
- I.2 ARTIFICIAL INTELLIGENCE
- I.3 COMPUTER GRAPHICS
- I.4 IMAGE PROCESSING AND COMPUTER VISION
- I.5 PATTERN RECOGNITION
- I.6 SIMULATION AND MODELING (G.3)
- I.7 DOCUMENT AND TEXT PROCESSING (H.4, H.5)
- I.m MISCELLANEOUS

J. Computer Applications

- J.0 GENERAL
- J.1 ADMINISTRATIVE DATA PROCESSING
- J.2 PHYSICAL SCIENCES AND ENGINEERING
- J.3 LIFE AND MEDICAL SCIENCES
- J.4 SOCIAL AND BEHAVIORAL SCIENCES
- J.5 ARTS AND HUMANITIES
- J.6 COMPUTER-AIDED ENGINEERING
- J.7 COMPUTERS IN OTHER SYSTEMS (C.3)
- J.m MISCELLANEOUS

K. Computing Milieux

- K.0 GENERAL
- K.1 THE COMPUTER INDUSTRY
- K.2 HISTORY OF COMPUTING
- K.3 COMPUTERS AND EDUCATION
- K.4 COMPUTERS AND SOCIETY
- K.5 LEGAL ASPECTS OF COMPUTING
- K.6 MANAGEMENT OF COMPUTING AND INFORMATION SYSTEMS
- K.7 THE COMPUTING PROFESSION
- K.8 PERSONAL COMPUTING

<https://www.acm.org/publications/computing-classification-system/1998>

The ACM Computing Classification System (1998)

I.2 ARTIFICIAL INTELLIGENCE

- I.2.0 General
- I.2.1 Applications and Expert Systems (H.4, J)
- I.2.2 Automatic Programming (D.1.2, F.3.1, F.4.1)
- I.2.3 Deduction and Theorem Proving (F.4.1)
- I.2.4 Knowledge Representation Formalisms and Methods (F.4.1)
- I.2.5 Programming Languages and Software (D.3.2)
- I.2.6 Learning (K.3.2)
- I.2.7 Natural Language Processing
- I.2.8 Problem Solving, Control Methods, and Search (F.2.2)
- I.2.9 Robotics
- I.2.10 Vision and Scene Understanding (I.4.8, I.5)
- I.2.11 Distributed Artificial Intelligence
- I.2.m Miscellaneous

<https://www.acm.org/publications/computing-classification-system/1998/i.2>

The ACM Computing Classification System (1998)

I.2.1 Applications and Expert Systems

- *Cartography*
- *Games*
- *Industrial automation*
- *Law*
- *Medicine and science*
- *Natural language interfaces*
- *Office automation*

The ACM Computing Classification System (1998)

I.2.2 Automatic Programming

- *Automatic analysis of algorithms*
- *Program modification*
- *Program synthesis*
- *Program transformation*
- *Program verification*

The ACM Computing Classification System (1998)

I.2.3 Deduction and Theorem Proving

- *Answer/reason extraction*
- *Deduction (e.g., natural, rule-based)*
- *Inference engines*
- *Logic programming*
- *Mathematical induction*
- *Metatheory [**]*
- *Nonmonotonic reasoning and belief revision*
- *Resolution*
- *Uncertainty, ``fuzzy," and probabilistic reasoning*

The ACM Computing Classification System (1998)

I.2.4 Knowledge Representation Formalisms and Methods

- *Frames and scripts*
- *Modal logic*
- *Predicate logic*
- *Relation systems*
- *Representation languages*
- *Representations (procedural and rule-based)*
- *Semantic networks*
- *Temporal logic*

The ACM Computing Classification System (1998)

I.2.5 Programming Languages and Software

- *Expert system tools and techniques*

The ACM Computing Classification System (1998)

I.2.11 Distributed Artificial Intelligence

- *Coherence and coordination*
 - *Intelligent agents*
 - *Languages and structures*
 - *Multiagent systems*
-

The ACM Computing Classification System (1998)

I.2.6 Learning

- *Analogies*
- *Concept learning*
- *Connectionism and neural nets*
- *Induction*
- *Knowledge acquisition*
- *Language acquisition*
- *Parameter learning*

The ACM Computing Classification System (1998)

I.2.7 Natural Language Processing

- *Discourse*
- *Language generation*
- *Language models*
- *Language parsing and understanding*
- *Machine translation*
- *Speech recognition and synthesis*
- *Text analysis*

The ACM Computing Classification System (1998)

I.2.8 Problem Solving, Control Methods, and Search

- *Backtracking*
- *Control theory*
- *Dynamic programming*
- *Graph and tree search strategies*
- *Heuristic methods*
- *Plan execution, formation, and generation*
- *Scheduling*

The ACM Computing Classification System (1998)

I.2.9 Robotics

- *Autonomous vehicles*
- *Commercial robots and applications*
- *Kinematics and dynamics*
- *Manipulators*
- *Operator interfaces*
- *Propelling mechanisms*
- *Sensors*
- *Workcell organization and planning*

The ACM Computing Classification System (1998)

I.2.10 Vision and Scene Understanding

- *3D/stereo scene analysis*
 - *Architecture and control structures* [******]
 - *Intensity, color, photometry, and thresholding*
 - *Modeling and recovery of physical attributes*
 - *Motion*
 - *Perceptual reasoning*
 - *Representations, data structures, and transforms*
 - *Shape*
 - *Texture*
 - *Video analysis*
-

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■ ACM Computing Classification System

The 2012 ACM Computing Classification System has been developed as a poly-hierarchical ontology that can be utilized in semantic web applications. It replaces the traditional 1998 version of the ACM Computing Classification System (CCS), which has served as the de facto standard classification system for the computing field. It is being integrated into the search capabilities and visual topic displays of the [Digital Library](#). It relies on a semantic vocabulary as the single source of categories and concepts that reflect the state of the art of the computing discipline and is receptive to structural change as it evolves in the future. ACM provides [a tool within the visual display](#) format to facilitate the application of CCS categories to forthcoming papers and a process to ensure that the CCS stays ... [\(More\)](#)

CCS

+ Assign this CCS Concept



General and reference

Hardware

Computer systems
organization

Networks

Software and its engineering

Theory of computation

Mathematics of computing

Information systems

Security and privacy

Human-centered computing

Computing methodologies

Applied computing

Social and professional topics

<https://dl.acm.org/ccs>

The 2012 ACM Computing Classification System - Introduction

GENERAL APPROACH TO THE 2012 CLASSIFICATION REVISION

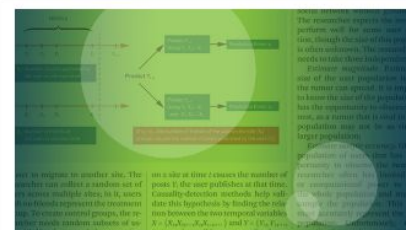
For each top-level branch of the revised CCS, we took the following general approach:

1. The classification maintains an n-level hierarchy. It does not use classification numbers, so there is no distinction between "coded" and "uncoded" levels.
2. The classification is poly-hierarchical. Some terms are parented by multiple concepts, but the narrower children of a particular term are always the same.
3. For top-level, 2nd-level, and 3rd-level terms, each existing "General" and "Miscellaneous" category was rolled up into the term itself. For example, a resource about integrated circuits in general, formerly classified with B.7.0, will now be classified simply with the term Integrated circuits.
4. Acronyms have been removed from each root term but were added as equivalents or synonyms to be incorporated into an evolving thesaurus.
5. Former GENERAL TERMS were incorporated in the CCS General node itself as Cross-cutting Computing Concepts.

NOTES ON INDIVIDUAL BRANCHES

COMPUTING METHODOLOGIES

This branch includes major changes necessitated by the elimination of Image processing and computer vision (I.4). The terms under this former 2nd-level term were relocated to either the new 3rd-level term Computer vision (under Artificial intelligence) or Computer graphics. Computer vision also includes a reworking of Vision and scene understanding (I.2.10). Consideration was given to eliminating Parallel computing as a 2nd-level term in this branch. Perhaps the concept is covered adequately by Parallel architectures, a term within the Computer systems organization branch, and the lower-level terms can be relocated or eliminated. Within this branch, the old classification included many instances of "Applications" (e.g., I.1.4). These terms were eliminated. It is envisioned that content or resources about an application of a computing methodology will be classified with the specific methodology term and an additional term from elsewhere in the classification. However, under Artificial intelligence, Applications and expert systems (I.2.1) was retained and renamed Artificial intelligence applications. Gathered here are major types of applications (e.g., Expert systems); broad 4th-level terms (e.g., Law) are not included but can be found in the Applied computing branch.



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CCS → **Computing methodologies**

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Artificial intelligence

Machine learning

Modeling and simulation

Computer graphics

Distributed computing methodologies

Concurrent computing methodologies

Natural language processing

Knowledge representation and
reasoning

Planning and scheduling

Search methodologies

Control methods

Philosophical/theoretical
foundations of artificial
intelligenceDistributed artificial
intelligence

Computer vision

Learning paradigms

Learning settings

Machine learning approaches

Machine learning algorithms

Cross-validation