The 1998 ACM Computing Classification System

The ACM Computing Classification System (1998)

- A. General Literature
  - A.0 GENERAL
    - *Biographies/autobiographies*
    - *Conference proceedings*
    - *General literary works (e.g., fiction, plays)*
  - 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.1.0 General
    - B.1.1 Control Design Styles
      - *Hardwired control* [**]
      - *Microprogrammed logic arrays* [**]
      - *Writable control store* [**]
    - B.1.2 Control Structure Performance Analysis and Design Aids
      - *Automatic synthesis* [**]
      - *Formal models* [**]
      - *Simulation* [**]
    - B.1.3 Control Structure Reliability, Testing, and Fault-Tolerance [**] (B.8)
      - *Diagnostics* [**]
      - *Error-checking* [**]
      - *Redundant design* [**]
      - *Test generation* [**]
    - B.1.4 Microprogram Design Aids (D.2.2, D.2.4, D.3.2, D.3.4)
      - *Firmware engineering* [**]
      - *Languages and compilers*
      - *Machine-independent microcode generation* [**]
      - *Optimization*
      - *Verification* [**]
    - B.1.5 Microcode Applications
      - *Direct data manipulation* [**]
      - *Firmware support of operating systems/instruction sets* [**]
      - *Instruction set interpretation*
      - *Peripheral control* [**]
      - *Special-purpose* [**]

- B.1.m Miscellaneous
- B.2 ARITHMETIC AND LOGIC STRUCTURES
  - B.2.0 General
  - B.2.1 Design Styles (C.1.1, C.1.2)
    - *Calculator* [**]
    - *Parallel*
    - *Pipeline*
  - B.2.2 Performance Analysis and Design Aids [**] (B.8)
    - *Simulation* [**]
    - *Verification* [**]
    - *Worst-case analysis* [**]
  - B.2.3 Reliability, Testing, and Fault-Tolerance [**] (B.8)
    - *Diagnostics* [**]
    - *Error-checking* [**]
    - *Redundant design* [**]
    - *Test generation* [**]
  - B.2.4 High-Speed Arithmetic NEW!
    - *Algorithms* NEW!
    - *Cost/performance* NEW!
  - B.2.m Miscellaneous
- B.3 MEMORY STRUCTURES
  - B.3.0 General
  - B.3.1 Semiconductor Memories NEW! (B.7.1)
    - *Dynamic memory (DRAM)* NEW!
    - *Read-only memory (ROM)* NEW!
    - *Static memory (SRAM)* NEW!
  - B.3.2 Design Styles (D.4.2)
    - *Associative memories*
    - *Cache memories*
    - *Interleaved memories* [**]
    - *Mass storage (e.g., magnetic, optical, RAID)* Revised
    - *Primary memory*
    - *Sequential-access memory* [**]
    - *Shared memory*
    - *Virtual memory*
  - B.3.3 Performance Analysis and Design Aids [**] (B.8, C.4)
    - *Formal models* [**]
    - *Simulation* [**]
    - *Worst-case analysis* [**]
  - B.3.4 Reliability, Testing, and Fault-Tolerance [**] (B.8)
    - *Diagnostics* [**]
    - *Error-checking* [**]
    - *Redundant design* [**]
    - *Test generation* [**]
  - B.3.m Miscellaneous
- B.4 INPUT/OUTPUT AND DATA COMMUNICATIONS
  - B.4.0 General
  - B.4.1 Data Communications Devices
    - *Processors* [**]
    - *Receivers (e.g., voice, data, image)* [**]
    - *Transmitters* [**]
  - B.4.2 Input/Output Devices
    - *Channels and controllers*
    - *Data terminals and printers*

- *Image display*
- *Voice*
- B.4.3 Interconnections (Subsystems)
  - *Asynchronous/synchronous operation*
  - *Fiber optics*
  - *Interfaces*
  - *Parallel I/O* NEW!
  - *Physical structures (e.g., backplanes, cables, chip carriers)* [**]
  - *Topology (e.g., bus, point-to-point)*
- B.4.4 Performance Analysis and Design Aids [**] (B.8)
  - *Formal models* [**]
  - *Simulation* [**]
  - *Verification* [**]
  - *Worst-case analysis* [**]
- B.4.5 Reliability, Testing, and Fault-Tolerance [**] (B.8)
  - *Built-in tests* [**]
  - *Diagnostics* [**]
  - *Error-checking* [**]
  - *Hardware reliability* [**]
  - *Redundant design* [**]
  - *Test generation* [**]
- B.4.m Miscellaneous

- B.5 REGISTER-TRANSFER-LEVEL IMPLEMENTATION
  - B.5.0 General
  - B.5.1 Design
    - *Arithmetic and logic units*
    - *Control design*
    - *Data-path design*
    - *Memory design*
    - *Styles (e.g., parallel, pipeline, special-purpose)*
  - B.5.2 Design Aids
    - *Automatic synthesis*
    - *Hardware description languages*
    - *Optimization*
    - *Simulation*
    - *Verification*
  - B.5.3 Reliability and Testing [**] (B.8)
    - *Built-in tests* [**]
    - *Error-checking* [**]
    - *Redundant design* [**]
    - *Test generation* [**]
    - *Testability* [**]
  - B.5.m Miscellaneous
- B.6 LOGIC DESIGN
  - B.6.0 General
  - B.6.1 Design Styles
    - *Cellular arrays and automata*
    - *Combinational logic*
    - *Logic arrays*
    - *Memory control and access* [**]
    - *Memory used as logic* [**]
    - *Parallel circuits*
    - *Sequential circuits*
  - B.6.2 Reliability and Testing [**] (B.8)

- *Built-in tests* [**]
- *Error-checking* [**]
- *Redundant design* [**]
- *Test generation* [**]
- *Testability* [**]

- B.6.3 Design Aids
  - *Automatic synthesis*
  - *Hardware description languages*
  - *Optimization*
  - *Simulation*
  - *Switching theory*
  - *Verification*
- B.6.m Miscellaneous

- B.7 INTEGRATED CIRCUITS
  - B.7.0 General
  - B.7.1 Types and Design Styles
    - *Advanced technologies*
    - *Algorithms implemented in hardware*
    - *Gate arrays*
    - *Input/output circuits*
    - *Memory technologies*
    - *Microprocessors and microcomputers*
    - *Standard cells* [**]
    - *VLSI (very large scale integration)*
  - B.7.2 Design Aids
    - *Graphics*
    - *Layout*
    - *Placement and routing*
    - *Simulation*
    - *Verification*
  - B.7.3 Reliability and Testing [**] (B.8)
    - *Built-in tests* [**]
    - *Error-checking* [**]
    - *Redundant design* [**]
    - *Test generation* [**]
    - *Testability* [**]
  - B.7.m Miscellaneous
- B.8 PERFORMANCE AND RELIABILITY NEW! (C.4)
  - B.8.0 General NEW!
  - B.8.1 Reliability, Testing, and Fault-Tolerance NEW!
  - B.8.2 Performance Analysis and Design Aids NEW!
  - B.8.m Miscellaneous NEW!
- B.m MISCELLANEOUS
  - *Design management*

- C. Computer Systems Organization
  - C.0 GENERAL
    - *Hardware/software interfaces*
    - *Instruction set design (e.g., RISC, CISC, VLIW)* Revised
    - *Modeling of computer architecture*
    - *System architectures*
    - *Systems specification methodology*
  - C.1 PROCESSOR ARCHITECTURES
    - C.1.0 General
    - C.1.1 Single Data Stream Architectures

- *Multiple-instruction-stream, single-data-stream processors (MISD)* [**]
- *Pipeline processors* [**]
- *RISC/CISC, VLIW architectures* NEW!
- *Single-instruction-stream, single-data-stream processors (SISD)* [**]
- *Von Neumann architectures* [**]

- C.1.2 Multiple Data Stream Architectures (Multiprocessors)
  - *Array and vector processors*
  - *Associative processors*
  - *Connection machines*
  - *Interconnection architectures (e.g., common bus, multiport memory, crossbar switch)*
  - *Multiple-instruction-stream, multiple-data-stream processors (MIMD)*
  - *Parallel processors* [**]
  - *Pipeline processors* [**]
  - *Single-instruction-stream, multiple-data-stream processors (SIMD)*
- C.1.3 Other Architecture Styles
  - *Adaptable architectures*
  - *Analog computers* NEW!
  - *Capability architectures* [**]
  - *Cellular architecture (e.g., mobile)* Revised
  - *Data-flow architectures*
  - *Heterogeneous (hybrid) systems* NEW!
  - *High-level language architectures* [**]
  - *Neural nets*
  - *Pipeline processors* NEW!
  - *Stack-oriented processors* [**]
- C.1.4 Parallel Architectures NEW!
  - *Distributed architectures* NEW!
  - *Mobile processors* NEW!
- C.1.m Miscellaneous
  - *Analog computers* [**]
  - *Hybrid systems* [**]

- C.2 COMPUTER-COMMUNICATION NETWORKS
  - C.2.0 General
    - *Data communications*
    - *Open Systems Interconnection reference model (OSI)*
    - *Security and protection (e.g., firewalls)* Revised
  - C.2.1 Network Architecture and Design
    - *Asynchronous Transfer Mode (ATM)* NEW!
    - *Centralized networks* [**]
    - *Circuit-switching networks*
    - *Distributed networks*
    - *Frame relay networks* NEW!
    - *ISDN (Integrated Services Digital Network)*
    - *Network communications*
    - *Network topology*
    - *Packet-switching networks* Revised
    - *Store and forward networks*
    - *Wireless communication* NEW!
  - C.2.2 Network Protocols
    - *Applications (SMTP, FTP, etc.)* NEW!

- *Protocol architecture (OSI model)* Revised
- *Protocol verification*
- *Routing protocols* NEW!
- C.2.3 Network Operations
  - *Network management*
  - *Network monitoring*
  - *Public networks*
- C.2.4 Distributed Systems
  - *Client/server* NEW!
  - *Distributed applications*
  - *Distributed databases*
  - *Network operating systems*
- C.2.5 Local and Wide-Area Networks Revised
  - *Access schemes*
  - *Buses*
  - *Ethernet (e.g., CSMA/CD)* NEW!
  - *High-speed (e.g., FDDI, fiber channel, ATM)* NEW!
  - *Internet (e.g., TCP/IP)* NEW!
  - *Token rings* Revised
- C.2.6 Internetworking NEW! (C.2.2)
  - *Routers* NEW!
  - *Standards (e.g., TCP/IP)* NEW!
- C.2.m Miscellaneous

- C.3 SPECIAL-PURPOSE AND APPLICATION-BASED SYSTEMS (J.7)
  - *Microprocessor/microcomputer applications*
  - *Process control systems*
  - *Real-time and embedded systems* Revised
  - *Signal processing systems*
  - *Smartcards* NEW!
- C.4 PERFORMANCE OF SYSTEMS
  - *Design studies*
  - *Fault tolerance* NEW!
  - *Measurement techniques*
  - *Modeling techniques*
  - *Performance attributes*
  - *Reliability, availability, and serviceability*
- C.5 COMPUTER SYSTEM IMPLEMENTATION
  - C.5.0 General
  - C.5.1 Large and Medium (``Mainframe'') Computers
    - *Super (very large) computers*
  - C.5.2 Minicomputers [**]
  - C.5.3 Microcomputers
    - *Microprocessors*
    - *Personal computers*
    - *Portable devices (e.g., laptops, personal digital assistants)* NEW!
    - *Workstations*
  - C.5.4 VLSI Systems
  - C.5.5 Servers NEW!
  - C.5.m Miscellaneous
- C.m MISCELLANEOUS

- D. Software
  - D.0 GENERAL

- D.1 PROGRAMMING TECHNIQUES (E)
  - D.1.0 General
  - D.1.1 Applicative (Functional) Programming
  - D.1.2 Automatic Programming (I.2.2)
  - D.1.3 Concurrent Programming
    - *Distributed programming*
    - *Parallel programming*
  - D.1.4 Sequential Programming
  - D.1.5 Object-oriented Programming
  - D.1.6 Logic Programming
  - D.1.7 Visual Programming
  - D.1.m Miscellaneous
- D.2 SOFTWARE ENGINEERING (K.6.3)
  - D.2.0 General (K.5.1)
    - *Protection mechanisms*
    - *Standards*
  - D.2.1 Requirements/Specifications (D.3.1)
    - *Elicitation methods (e.g., rapid prototyping, interviews, JAD)* NEW!
    - *Languages*
    - *Methodologies (e.g., object-oriented, structured)* Revised
    - *Tools*
  - D.2.2 Design Tools and Techniques Revised
    - *Computer-aided software engineering (CASE)*
    - *Decision tables*
    - *Evolutionary prototyping* NEW!
    - *Flow charts*
    - *Modules and interfaces*
    - *Object-oriented design methods* NEW!
    - *Petri nets*
    - *Programmer workbench* [**]
    - *Software libraries*
    - *State diagrams* NEW!
    - *Structured programming* [**]
    - *Top-down programming* [**]
    - *User interfaces*
  - D.2.3 Coding Tools and Techniques Revised
    - *Object-oriented programming* NEW!
    - *Pretty printers*
    - *Program editors*
    - *Reentrant code* [**]
    - *Standards*
    - *Structured programming* NEW!
    - *Top-down programming* NEW!
  - D.2.4 Software/Program Verification Revised (F.3.1)
    - *Assertion checkers*
    - *Class invariants* NEW!
    - *Correctness proofs*
    - *Formal methods* NEW!
    - *Model checking* NEW!
    - *Programming by contract* NEW!
    - *Reliability*
    - *Statistical methods* NEW!

- *Validation*
- D.2.5 Testing and Debugging
  - *Code inspections and walk-throughs*
  - *Debugging aids*
  - *Diagnostics*
  - *Distributed debugging* NEW!
  - *Dumps* [**]
  - *Error handling and recovery*
  - *Monitors*
  - *Symbolic execution*
  - *Testing tools (e.g., data generators, coverage testing)* Revised
  - *Tracing*
- D.2.6 Programming Environments
  - *Graphical environments* NEW!
  - *Integrated environments* NEW!
  - *Interactive environments* Revised
  - *Programmer workbench* NEW!
- D.2.7 Distribution, Maintenance, and Enhancement Revised
  - *Corrections* [**]
  - *Documentation*
  - *Enhancement* [**]
  - *Extensibility* [**]
  - *Portability*
  - *Restructuring, reverse engineering, and reengineering* Revised
  - *Version control*
- D.2.8 Metrics (D.4.8)
  - *Complexity measures*
  - *Performance measures*
  - *Process metrics* NEW!
  - *Product metrics* NEW!
  - *Software science* [**]
- D.2.9 Management (K.6.3, K.6.4)
  - *Copyrights* [**]
  - *Cost estimation*
  - *Life cycle*
  - *Productivity*
  - *Programming teams*
  - *Software configuration management*
  - *Software process models (e.g., CMM, ISO, PSP)* NEW!
  - *Software quality assurance (SQA)*
  - *Time estimation*
- D.2.10 Design [**] (D.2.2)
  - *Methodologies* [**]
  - *Representation* [**]
- D.2.11 Software Architectures NEW!
  - *Data abstraction* NEW!
  - *Domain-specific architectures* NEW!
  - *Information hiding* NEW!
  - *Languages (e.g., description, interconnection, definition)* NEW!
  - *Patterns (e.g., client/server, pipeline, blackboard)* NEW!
- D.2.12 Interoperability NEW!
  - *Data mapping* NEW!

- *Distributed objects* NEW!
- *Interface definition languages* NEW!
- D.2.13 Reusable Software NEW!
  - *Domain engineering* NEW!
  - *Reusable libraries* NEW!
  - *Reuse models* NEW!
- D.2.m Miscellaneous
  - *Rapid prototyping* [**]
  - *Reusable software* [**]

- D.3 PROGRAMMING LANGUAGES
  - D.3.0 General
    - *Standards*
  - D.3.1 Formal Definitions and Theory (D.2.1, F.3.1, F.3.2, F.4.2, F.4.3)
    - *Semantics*
    - *Syntax*
  - D.3.2 Language Classifications
    - *Applicative (functional) languages* Revised
    - *Concurrent, distributed, and parallel languages*
    - *Constraint and logic languages* NEW!
    - *Data-flow languages*
    - *Design languages*
    - *Extensible languages*
    - *Macro and assembly languages*
    - *Microprogramming languages* [**]
    - *Multiparadigm languages* NEW!
    - *Nondeterministic languages* [**]
    - *Nonprocedural languages* [**]
    - *Object-oriented languages*
    - *Specialized application languages*
    - *Very high-level languages*
  - D.3.3 Language Constructs and Features (E.2)
    - *Abstract data types*
    - *Classes and objects* NEW!
    - *Concurrent programming structures*
    - *Constraints* NEW!
    - *Control structures*
    - *Coroutines*
    - *Data types and structures*
    - *Dynamic storage management*
    - *Frameworks* NEW!
    - *Inheritance* NEW!
    - *Input/output*
    - *Modules, packages*
    - *Patterns* NEW!
    - *Polymorphism* NEW!
    - *Procedures, functions, and subroutines*
    - *Recursion*
  - D.3.4 Processors
    - *Code generation*
    - *Compilers*
    - *Debuggers* NEW!
    - *Incremental compilers* NEW!
    - *Interpreters*
    - *Memory management (garbage collection)* NEW!

- *Optimization*
- *Parsing*
- *Preprocessors*
- *Retargetable compilers* NEW!
- *Run-time environments*
- *Translator writing systems and compiler generators*

- D.3.m Miscellaneous

- D.4 OPERATING SYSTEMS (C)
  - D.4.0 General
  - D.4.1 Process Management
    - *Concurrency*
    - *Deadlocks*
    - *Multiprocessing/multiprogramming/multitasking* Revised
    - *Mutual exclusion*
    - *Scheduling*
    - *Synchronization*
    - *Threads* NEW!
  - D.4.2 Storage Management
    - *Allocation/deallocation strategies*
    - *Distributed memories*
    - *Garbage collection* NEW!
    - *Main memory*
    - *Secondary storage*
    - *Segmentation* [**]
    - *Storage hierarchies*
    - *Swapping* [**]
    - *Virtual memory*
  - D.4.3 File Systems Management (E.5)
    - *Access methods*
    - *Directory structures*
    - *Distributed file systems*
    - *File organization*
    - *Maintenance* [**]
  - D.4.4 Communications Management (C.2)
    - *Buffering*
    - *Input/output*
    - *Message sending*
    - *Network communication*
    - *Terminal management* [**]
  - D.4.5 Reliability
    - *Backup procedures*
    - *Checkpoint/restart*
    - *Fault-tolerance*
    - *Verification*
  - D.4.6 Security and Protection (K.6.5)
    - *Access controls*
    - *Authentication*
    - *Cryptographic controls*
    - *Information flow controls*
    - *Invasive software (e.g., viruses, worms, Trojan horses)*
    - *Security kernels* [**]
    - *Verification* [**]
  - D.4.7 Organization and Design
    - *Batch processing systems* [**]

- *Distributed systems*
- *Hierarchical design* [**]
- *Interactive systems*
- *Real-time systems and embedded systems*

- D.4.8 Performance (C.4, D.2.8, I.6)
  - *Measurements*
  - *Modeling and prediction*
  - *Monitors*
  - *Operational analysis*
  - *Queueing theory*
  - *Simulation*
  - *Stochastic analysis*
- D.4.9 Systems Programs and Utilities
  - *Command and control languages*
  - *Linkers* [**]
  - *Loaders* [**]
  - *Window managers*
- D.4.m Miscellaneous

- D.m MISCELLANEOUS
  - *Software psychology* [**]

- E. Data
  - E.0 GENERAL
  - E.1 DATA STRUCTURES
    - *Arrays*
    - *Distributed data structures* NEW!
    - *Graphs and networks* Revised
    - *Lists, stacks, and queues* Revised
    - *Records* NEW!
    - *Tables* [**]
    - *Trees*
  - E.2 DATA STORAGE REPRESENTATIONS
    - *Composite structures* [**]
    - *Contiguous representations* [**]
    - *Hash-table representations*
    - *Linked representations*
    - *Object representation* NEW!
    - *Primitive data items* [**]
  - E.3 DATA ENCRYPTION
    - *Code breaking* NEW!
    - *Data encryption standard (DES)* [**]
    - *Public key cryptosystems*
    - *Standards (e.g., DES, PGP, RSA)* NEW!
  - E.4 CODING AND INFORMATION THEORY (H.1.1)
    - *Data compaction and compression*
    - *Error control codes*
    - *Formal models of communication*
    - *Nonsecret encoding schemes* [**]
  - E.5 FILES (D.4.3, F.2.2, H.2)
    - *Backup/recovery*
    - *Optimization* [**]
    - *Organization/structure*
    - *Sorting/searching*
  - E.m MISCELLANEOUS

- F. Theory of Computation
  - F.0 GENERAL
  - F.1 COMPUTATION BY ABSTRACT DEVICES
    - F.1.0 General
    - F.1.1 Models of Computation (F.4.1)
      - *Automata (e.g., finite, push-down, resource-bounded)*
      - *Bounded-action devices (e.g., Turing machines, random access machines)*
      - *Computability theory*
      - *Relations between models*
      - *Self-modifying machines (e.g., neural networks)*
      - *Unbounded-action devices (e.g., cellular automata, circuits, networks of machines)*
    - F.1.2 Modes of Computation
      - *Alternation and nondeterminism*
      - *Interactive and reactive computation* Revised
      - *Online computation* NEW!
      - *Parallelism and concurrency*
      - *Probabilistic computation*
      - *Relations among modes* [**]
      - *Relativized computation*
    - F.1.3 Complexity Measures and Classes Revised (F.2)
      - *Complexity hierarchies*
      - *Machine-independent complexity* [**]
      - *Reducibility and completeness*
      - *Relations among complexity classes*
      - *Relations among complexity measures*
    - F.1.m Miscellaneous
  - F.2 ANALYSIS OF ALGORITHMS AND PROBLEM COMPLEXITY (B.6, B.7, F.1.3)
    - F.2.0 General
    - F.2.1 Numerical Algorithms and Problems (G.1, G.4, I.1)
      - *Computation of transforms (e.g., fast Fourier transform)*
      - *Computations in finite fields*
      - *Computations on matrices*
      - *Computations on polynomials*
      - *Number-theoretic computations (e.g., factoring, primality testing)*
    - F.2.2 Nonnumerical Algorithms and Problems (E.2, E.3, E.4, E.5, G.2, H.2, H.3)
      - *Complexity of proof procedures*
      - *Computations on discrete structures*
      - *Geometrical problems and computations*
      - *Pattern matching*
      - *Routing and layout*
      - *Sequencing and scheduling*
      - *Sorting and searching*
    - F.2.3 Tradeoffs between Complexity Measures (F.1.3)
    - F.2.m Miscellaneous
  - F.3 LOGICS AND MEANINGS OF PROGRAMS
    - F.3.0 General
    - F.3.1 Specifying and Verifying and Reasoning about Programs (D.2.1, D.2.4, D.3.1, E.1)
      - *Assertions*

- *Invariants*
- *Logics of programs*
- *Mechanical verification*
- *Pre- and post-conditions*
- *Specification techniques*
- F.3.2 Semantics of Programming Languages (D.3.1)
  - *Algebraic approaches to semantics*
  - *Denotational semantics*
  - *Operational semantics*
  - *Partial evaluation* NEW!
  - *Process models* NEW!
  - *Program analysis* NEW!
- F.3.3 Studies of Program Constructs (D.3.2, D.3.3)
  - *Control primitives*
  - *Functional constructs*
  - *Object-oriented constructs* NEW!
  - *Program and recursion schemes*
  - *Type structure*
- F.3.m Miscellaneous

- F.4 MATHEMATICAL LOGIC AND FORMAL LANGUAGES
  - F.4.0 General
  - F.4.1 Mathematical Logic (F.1.1, I.2.2, I.2.3, I.2.4)
    - *Computability theory*
    - *Computational logic*
    - *Lambda calculus and related systems*
    - *Logic and constraint programming* Revised
    - *Mechanical theorem proving*
    - *Modal logic* NEW!
    - *Model theory*
    - *Proof theory*
    - *Recursive function theory*
    - *Set theory* NEW!
    - *Temporal logic* NEW!
  - F.4.2 Grammars and Other Rewriting Systems (D.3.1)
    - *Decision problems*
    - *Grammar types (e.g., context-free, context-sensitive)*
    - *Parallel rewriting systems (e.g., developmental systems, L-systems)*
    - *Parsing*
    - *Thue systems*
  - F.4.3 Formal Languages (D.3.1)
    - *Algebraic language theory*
    - *Classes defined by grammars or automata (e.g., context-free languages, regular sets, recursive sets)*
    - *Classes defined by resource-bounded automata* [**]
    - *Decision problems*
    - *Operations on languages*
  - F.4.m Miscellaneous
- F.m MISCELLANEOUS

- G. Mathematics of Computing
  - G.0 GENERAL
  - G.1 NUMERICAL ANALYSIS
    - G.1.0 General
      - *Computer arithmetic*

- *Conditioning (and ill-conditioning)* Revised
- *Error analysis*
- *Interval arithmetic* NEW!
- *Multiple precision arithmetic* NEW!
- *Numerical algorithms*
- *Parallel algorithms*
- *Stability (and instability)*

- G.1.1 Interpolation (I.3.5, I.3.7)
  - *Difference formulas* [**]
  - *Extrapolation*
  - *Interpolation formulas*
  - *Smoothing*
  - *Spline and piecewise polynomial interpolation*
- G.1.2 Approximation
  - *Approximation of surfaces and contours* NEW!
  - *Chebyshev approximation and theory*
  - *Elementary function approximation*
  - *Fast Fourier transforms (FFT)* NEW!
  - *Least squares approximation*
  - *Linear approximation*
  - *Minimax approximation and algorithms*
  - *Nonlinear approximation*
  - *Rational approximation*
  - *Special function approximations* NEW!
  - *Spline and piecewise polynomial approximation*
  - *Wavelets and fractals* NEW!
- G.1.3 Numerical Linear Algebra
  - *Conditioning*
  - *Determinants* [**]
  - *Eigenvalues and eigenvectors (direct and iterative methods)* Revised
  - *Error analysis*
  - *Linear systems (direct and iterative methods)*
  - *Matrix inversion*
  - *Pseudoinverses* [**]
  - *Singular value decomposition* NEW!
  - *Sparse, structured, and very large systems (direct and iterative methods)* Revised
- G.1.4 Quadrature and Numerical Differentiation (F.2.1)
  - *Adaptive and iterative quadrature* Revised
  - *Automatic differentiation* NEW!
  - *Equal interval integration* [**]
  - *Error analysis*
  - *Finite difference methods*
  - *Gaussian quadrature*
  - *Iterative methods*
  - *Multidimensional (multiple) quadrature* Revised
- G.1.5 Roots of Nonlinear Equations
  - *Continuation (homotopy) methods* NEW!
  - *Convergence*
  - *Error analysis*
  - *Iterative methods*

- *Polynomials, methods for*
- *Systems of equations*
- G.1.6 Optimization
  - *Constrained optimization*
  - *Convex programming* NEW!
  - *Global optimization* NEW!
  - *Gradient methods*
  - *Integer programming*
  - *Least squares methods*
  - *Linear programming*
  - *Nonlinear programming*
  - *Quadratic programming methods* NEW!
  - *Simulated annealing* NEW!
  - *Stochastic programming* NEW!
  - *Unconstrained optimization* NEW!
- G.1.7 Ordinary Differential Equations
  - *Boundary value problems*
  - *Chaotic systems* NEW!
  - *Convergence and stability*
  - *Differential-algebraic equations* NEW!
  - *Error analysis*
  - *Finite difference methods* NEW!
  - *Initial value problems*
  - *Multistep and multivalue methods* Revised
  - *One-step (single step) methods* Revised
  - *Stiff equations*
- G.1.8 Partial Differential Equations
  - *Domain decomposition methods* NEW!
  - *Elliptic equations*
  - *Finite difference methods* Revised
  - *Finite element methods*
  - *Finite volume methods* NEW!
  - *Hyperbolic equations*
  - *Inverse problems* NEW!
  - *Iterative solution techniques* NEW!
  - *Method of lines*
  - *Multigrid and multilevel methods* NEW!
  - *Parabolic equations*
  - *Spectral methods* NEW!
- G.1.9 Integral Equations
  - *Delay equations* NEW!
  - *Fredholm equations*
  - *Integro-differential equations*
  - *Volterra equations*
- G.1.10 Applications NEW!
- G.1.m Miscellaneous

- G.2 DISCRETE MATHEMATICS
  - G.2.0 General
  - G.2.1 Combinatorics (F.2.2)
    - *Combinatorial algorithms*
    - *Counting problems*
    - *Generating functions*
    - *Permutations and combinations*

- *Recurrences and difference equations*
- G.2.2 Graph Theory (F.2.2)
  - *Graph algorithms*
  - *Graph labeling* NEW!
  - *Hypergraphs* NEW!
  - *Network problems*
  - *Path and circuit problems*
  - *Trees*
- G.2.3 Applications NEW!
- G.2.m Miscellaneous

- G.3 PROBABILITY AND STATISTICS
  - *Contingency table analysis* NEW!
  - *Correlation and regression analysis* NEW!
  - *Distribution functions* NEW!
  - *Experimental design* NEW!
  - *Markov processes* NEW!
  - *Multivariate statistics* NEW!
  - *Nonparametric statistics* NEW!
  - *Probabilistic algorithms (including Monte Carlo)*
  - *Queueing theory* NEW!
  - *Random number generation*
  - *Reliability and life testing* NEW!
  - *Renewal theory* NEW!
  - *Robust regression* NEW!
  - *Statistical computing*
  - *Statistical software*
  - *Stochastic processes* NEW!
  - *Survival analysis* NEW!
  - *Time series analysis* NEW!
- G.4 MATHEMATICAL SOFTWARE
  - *Algorithm design and analysis* Revised
  - *Certification and testing*
  - *Documentation* NEW!
  - *Efficiency*
  - *Parallel and vector implementations* NEW!
  - *Portability* [**]
  - *Reliability and robustness*
  - *User interfaces* NEW!
  - *Verification* [**]
- G.m MISCELLANEOUS
  - *Queueing theory* [**]

- H. Information Systems
  - H.0 GENERAL
  - H.1 MODELS AND PRINCIPLES
    - H.1.0 General
    - H.1.1 Systems and Information Theory (E.4)
      - *General systems theory*
      - *Information theory*
      - *Value of information*
    - H.1.2 User/Machine Systems
      - *Human factors*
      - *Human information processing*
      - *Software psychology* NEW!
    - H.1.m Miscellaneous

- H.2 DATABASE MANAGEMENT (E.5)
  - H.2.0 General
    - *Security, integrity, and protection* [**]
  - H.2.1 Logical Design
    - *Data models*
    - *Normal forms*
    - *Schema and subschema*
  - H.2.2 Physical Design
    - *Access methods*
    - *Deadlock avoidance*
    - *Recovery and restart*
  - H.2.3 Languages (D.3.2)
    - *Data description languages (DDL)*
    - *Data manipulation languages (DML)*
    - *Database (persistent) programming languages*
    - *Query languages*
    - *Report writers*
  - H.2.4 Systems
    - *Concurrency*
    - *Distributed databases* Revised
    - *Multimedia databases* NEW!
    - *Object-oriented databases* NEW!
    - *Parallel databases* NEW!
    - *Query processing*
    - *Relational databases* NEW!
    - *Rule-based databases* NEW!
    - *Textual databases* NEW!
    - *Transaction processing*
  - H.2.5 Heterogeneous Databases
    - *Data translation* [**]
    - *Program translation* [**]
  - H.2.6 Database Machines
  - H.2.7 Database Administration
    - *Data dictionary/directory*
    - *Data warehouse and repository* NEW!
    - *Logging and recovery*
    - *Security, integrity, and protection* NEW!
  - H.2.8 Database Applications
    - *Data mining* NEW!
    - *Image databases* NEW!
    - *Scientific databases* NEW!
    - *Spatial databases and GIS* NEW!
    - *Statistical databases* NEW!
  - H.2.m Miscellaneous
- H.3 INFORMATION STORAGE AND RETRIEVAL
  - H.3.0 General
  - H.3.1 Content Analysis and Indexing
    - *Abstracting methods*
    - *Dictionaries*
    - *Indexing methods*
    - *Linguistic processing*
    - *Thesauruses*
  - H.3.2 Information Storage
    - *File organization*

- *Record classification* [**]
- H.3.3 Information Search and Retrieval
  - *Clustering*
  - *Information filtering* NEW!
  - *Query formulation*
  - *Relevance feedback* NEW!
  - *Retrieval models*
  - *Search process*
  - *Selection process*
- H.3.4 Systems and Software
  - *Current awareness systems (selective dissemination of information--SDI)* [**]
  - *Distributed systems* NEW!
  - *Information networks*
  - *Performance evaluation (efficiency and effectiveness)* NEW!
  - *Question-answering (fact retrieval) systems* [**]
  - *User profiles and alert services* NEW!
- H.3.5 Online Information Services
  - *Commercial services* NEW!
  - *Data sharing* Revised
  - *Web-based services* NEW!
- H.3.6 Library Automation
  - *Large text archives*
- H.3.7 Digital Libraries NEW!
  - *Collection* NEW!
  - *Dissemination* NEW!
  - *Standards* NEW!
  - *Systems issues* NEW!
  - *User issues* NEW!
- H.3.m Miscellaneous

- H.4 INFORMATION SYSTEMS APPLICATIONS
  - H.4.0 General
  - H.4.1 Office Automation (I.7)
    - *Desktop publishing* NEW!
    - *Equipment* [**]
    - *Groupware* NEW!
    - *Spreadsheets*
    - *Time management (e.g., calendars, schedules)*
    - *Word processing*
    - *Workflow management* NEW!
  - H.4.2 Types of Systems
    - *Decision support (e.g., MIS)*
    - *Logistics*
  - H.4.3 Communications Applications
    - *Bulletin boards*
    - *Computer conferencing, teleconferencing, and videoconferencing* Revised
    - *Electronic mail*
    - *Information browsers* NEW!
    - *Videotex*
  - H.4.m Miscellaneous
- H.5 INFORMATION INTERFACES AND PRESENTATION (e.g., HCI) (I.7)
  - H.5.0 General

- H.5.1 Multimedia Information Systems
  - *Animations*
  - *Artificial, augmented, and virtual realities* Revised
  - *Audio input/output*
  - *Evaluation/methodology*
  - *Hypertext navigation and maps* [**]
  - *Video (e.g., tape, disk, DVI)*
- H.5.2 User Interfaces (D.2.2, H.1.2, I.3.6)
  - *Auditory (non-speech) feedback* NEW!
  - *Benchmarking* NEW!
  - *Ergonomics*
  - *Evaluation/methodology*
  - *Graphical user interfaces (GUI)* NEW!
  - *Haptic I/O* NEW!
  - *Input devices and strategies (e.g., mouse, touchscreen)*
  - *Interaction styles (e.g., commands, menus, forms, direct manipulation)*
  - *Natural language* NEW!
  - *Prototyping* NEW!
  - *Screen design (e.g., text, graphics, color)*
  - *Standardization* NEW!
  - *Style guides* NEW!
  - *Theory and methods*
  - *Training, help, and documentation*
  - *User-centered design* NEW!
  - *User interface management systems (UIMS)*
  - *Voice I/O* NEW!
  - *Windowing systems*
- H.5.3 Group and Organization Interfaces
  - *Asynchronous interaction*
  - *Collaborative computing* NEW!
  - *Computer-supported cooperative work* NEW!
  - *Evaluation/methodology*
  - *Organizational design*
  - *Synchronous interaction*
  - *Theory and models*
  - *Web-based interaction*
- H.5.4 Hypertext/Hypermedia NEW! (I.7, J.7)
  - *Architectures* NEW!
  - *Navigation* NEW!
  - *Theory* NEW!
  - *User issues* NEW!
- H.5.5 Sound and Music Computing NEW! (J.5)
  - *Methodologies and techniques* NEW!
  - *Modeling* NEW!
  - *Signal analysis, synthesis, and processing* NEW!
  - *Systems* NEW!
- H.5.m Miscellaneous NEW!

- H.m MISCELLANEOUS

- I. Computing Methodologies
  - I.0 GENERAL
  - I.1 SYMBOLIC AND ALGEBRAIC MANIPULATION Revised
    - I.1.0 General

- I.1.1 Expressions and Their Representation (E.1, E.2)
  - *Representations (general and polynomial)*
  - *Simplification of expressions*
- I.1.2 Algorithms (F.2.1, F.2.2)
  - *Algebraic algorithms*
  - *Analysis of algorithms*
  - *Nonalgebraic algorithms*
- I.1.3 Languages and Systems (D.3.2, D.3.3, F.2.2)
  - *Evaluation strategies*
  - *Nonprocedural languages* [**]
  - *Special-purpose algebraic systems*
  - *Special-purpose hardware* [**]
  - *Substitution mechanisms* [**]
- I.1.4 Applications
- I.1.m Miscellaneous

- I.2 ARTIFICIAL INTELLIGENCE
  - I.2.0 General
    - *Cognitive simulation*
    - *Philosophical foundations*
  - I.2.1 Applications and Expert Systems (H.4, J)
    - *Cartography*
    - *Games*
    - *Industrial automation*
    - *Law*
    - *Medicine and science*
    - *Natural language interfaces*
    - *Office automation*
  - I.2.2 Automatic Programming (D.1.2, F.3.1, F.4.1)
    - *Automatic analysis of algorithms*
    - *Program modification*
    - *Program synthesis*
    - *Program transformation*
    - *Program verification*
  - I.2.3 Deduction and Theorem Proving (F.4.1)
    - *Answer/reason extraction*
    - *Deduction (e.g., natural, rule-based)*
    - *Inference engines* NEW!
    - *Logic programming*
    - *Mathematical induction*
    - *Metatheory* [**]
    - *Nonmonotonic reasoning and belief revision*
    - *Resolution*
    - *Uncertainty, ``fuzzy,'' and probabilistic reasoning*
  - I.2.4 Knowledge Representation Formalisms and Methods (F.4.1)
    - *Frames and scripts*
    - *Modal logic* NEW!
    - *Predicate logic*
    - *Relation systems*
    - *Representation languages*
    - *Representations (procedural and rule-based)*
    - *Semantic networks*
    - *Temporal logic* NEW!
  - I.2.5 Programming Languages and Software (D.3.2)
    - *Expert system tools and techniques*

- I.2.6 Learning (K.3.2)
  - *Analogies*
  - *Concept learning*
  - *Connectionism and neural nets*
  - *Induction*
  - *Knowledge acquisition*
  - *Language acquisition*
  - *Parameter learning*
- I.2.7 Natural Language Processing
  - *Discourse*
  - *Language generation*
  - *Language models*
  - *Language parsing and understanding*
  - *Machine translation*
  - *Speech recognition and synthesis*
  - *Text analysis*
- I.2.8 Problem Solving, Control Methods, and Search (F.2.2)
  - *Backtracking*
  - *Control theory* NEW!
  - *Dynamic programming*
  - *Graph and tree search strategies*
  - *Heuristic methods*
  - *Plan execution, formation, and generation*
  - *Scheduling* NEW!
- I.2.9 Robotics
  - *Autonomous vehicles* NEW!
  - *Commercial robots and applications* NEW!
  - *Kinematics and dynamics* NEW!
  - *Manipulators*
  - *Operator interfaces* NEW!
  - *Propelling mechanisms*
  - *Sensors*
  - *Workcell organization and planning* NEW!
- I.2.10 Vision and Scene Understanding (I.4.8, I.5)
  - *3D/stereo scene analysis* NEW!
  - *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* NEW!
- I.2.11 Distributed Artificial Intelligence
  - *Coherence and coordination*
  - *Intelligent agents* NEW!
  - *Languages and structures*
  - *Multiagent systems* NEW!
- I.2.m Miscellaneous

- I.3 COMPUTER GRAPHICS
  - I.3.0 General
  - I.3.1 Hardware Architecture (B.4.2)
    - *Graphics processors*

- *Hardcopy devices* [**]
- *Input devices*
- *Parallel processing*
- *Raster display devices*
- *Storage devices* [**]
- *Three-dimensional displays* [**]
- *Vector display devices* [**]

- I.3.2 Graphics Systems (C.2.1, C.2.4, C.3)
  - *Distributed/network graphics*
  - *Remote systems* [**]
  - *Stand-alone systems* [**]
- I.3.3 Picture/Image Generation
  - *Antialiasing* [**]
  - *Bitmap and framebuffer operations*
  - *Digitizing and scanning*
  - *Display algorithms*
  - *Line and curve generation*
  - *Viewing algorithms*
- I.3.4 Graphics Utilities
  - *Application packages*
  - *Device drivers* [**]
  - *Graphics editors*
  - *Graphics packages*
  - *Meta files* [**]
  - *Paint systems*
  - *Picture description languages* [**]
  - *Software support*
  - *Virtual device interfaces*
- I.3.5 Computational Geometry and Object Modeling
  - *Boundary representations*
  - *Constructive solid geometry (CSG)* [**]
  - *Curve, surface, solid, and object representations*
  - *Geometric algorithms, languages, and systems*
  - *Hierarchy and geometric transformations*
  - *Modeling packages*
  - *Object hierarchies*
  - *Physically based modeling*
  - *Splines*
- I.3.6 Methodology and Techniques
  - *Device independence* [**]
  - *Ergonomics*
  - *Graphics data structures and data types*
  - *Interaction techniques*
  - *Languages*
  - *Standards*
- I.3.7 Three-Dimensional Graphics and Realism
  - *Animation*
  - *Color, shading, shadowing, and texture*
  - *Fractals*
  - *Hidden line/surface removal*
  - *Radiosity*
  - *Raytracing*
  - *Virtual reality*
  - *Visible line/surface algorithms*

- I.3.8 Applications
- I.3.m Miscellaneous

- I.4 IMAGE PROCESSING AND COMPUTER VISION Revised
  - I.4.0 General
    - *Image displays*
    - *Image processing software*
  - I.4.1 Digitization and Image Capture Revised
    - *Camera calibration* NEW!
    - *Imaging geometry* NEW!
    - *Quantization*
    - *Radiometry* NEW!
    - *Reflectance* NEW!
    - *Sampling*
    - *Scanning*
  - I.4.2 Compression (Coding) (E.4)
    - *Approximate methods*
    - *Exact coding* [**]
  - I.4.3 Enhancement
    - *Filtering*
    - *Geometric correction*
    - *Grayscale manipulation*
    - *Registration*
    - *Sharpening and deblurring* [**]
    - *Smoothing*
  - I.4.4 Restoration
    - *Inverse filtering* [**]
    - *Kalman filtering*
    - *Pseudoinverse restoration* [**]
    - *Wiener filtering* [**]
  - I.4.5 Reconstruction
    - *Series expansion methods*
    - *Summation methods* [**]
    - *Transform methods*
  - I.4.6 Segmentation
    - *Edge and feature detection*
    - *Pixel classification*
    - *Region growing, partitioning*
    - *Relaxation* NEW!
  - I.4.7 Feature Measurement
    - *Feature representation* NEW!
    - *Invariants*
    - *Moments*
    - *Projections*
    - *Size and shape*
    - *Texture*
  - I.4.8 Scene Analysis
    - *Color* NEW!
    - *Depth cues*
    - *Motion* NEW!
    - *Object recognition* NEW!
    - *Photometry*
    - *Range data*
    - *Sensor fusion*

- *Shading* NEW!
- *Shape* NEW!
- *Stereo*
- *Surface fitting* NEW!
- *Time-varying imagery*
- *Tracking* NEW!

- I.4.9 Applications
- I.4.10 Image Representation
  - *Hierarchical*
  - *Morphological*
  - *Multidimensional*
  - *Statistical*
  - *Volumetric*
- I.4.m Miscellaneous

- I.5 PATTERN RECOGNITION
  - I.5.0 General
  - I.5.1 Models
    - *Deterministic* [**]
    - *Fuzzy set*
    - *Geometric*
    - *Neural nets*
    - *Statistical*
    - *Structural*
  - I.5.2 Design Methodology
    - *Classifier design and evaluation*
    - *Feature evaluation and selection*
    - *Pattern analysis*
  - I.5.3 Clustering
    - *Algorithms*
    - *Similarity measures*
  - I.5.4 Applications
    - *Computer vision*
    - *Signal processing*
    - *Text processing*
    - *Waveform analysis*
  - I.5.5 Implementation (C.3)
    - *Interactive systems*
    - *Special architectures*
  - I.5.m Miscellaneous
- I.6 SIMULATION AND MODELING (G.3)
  - I.6.0 General
  - I.6.1 Simulation Theory
    - *Model classification*
    - *Systems theory*
    - *Types of simulation (continuous and discrete)* [*]
  - I.6.2 Simulation Languages
  - I.6.3 Applications
  - I.6.4 Model Validation and Analysis
  - I.6.5 Model Development
    - *Modeling methodologies*
  - I.6.6 Simulation Output Analysis
  - I.6.7 Simulation Support Systems
    - *Environments*
  - I.6.8 Types of Simulation

- *Animation*
- *Combined*
- *Continuous*
- *Discrete event*
- *Distributed*
- *Gaming*
- *Monte Carlo*
- *Parallel*
- *Visual*

- I.6.m Miscellaneous

- I.7 DOCUMENT AND TEXT PROCESSING Revised (H.4, H.5)
  - I.7.0 General
  - I.7.1 Document and Text Editing Revised
    - *Document management* NEW!
    - *Languages* [**]
    - *Spelling* [**]
    - *Version control* NEW!
  - I.7.2 Document Preparation
    - *Desktop publishing*
    - *Format and notation*
    - *Hypertext/hypermedia*
    - *Index generation* NEW!
    - *Languages and systems*
    - *Markup languages* NEW!
    - *Multi/mixed media*
    - *Photocomposition/typesetting*
    - *Scripting languages* NEW!
    - *Standards*
  - I.7.3 Index Generation [**]
  - I.7.4 Electronic Publishing NEW! (H.5.4, J.7)
  - I.7.5 Document Capture NEW!(I.4.1)
    - *Document analysis* NEW!
    - *Graphics recognition and interpretation* NEW!
    - *Optical character recognition (OCR)* NEW!
    - *Scanning* NEW!
  - I.7.m Miscellaneous
- I.m MISCELLANEOUS

- J. Computer Applications
  - J.0 GENERAL
  - J.1 ADMINISTRATIVE DATA PROCESSING
    - *Business*
    - *Education*
    - *Financial (e.g., EFTS)*
    - *Government*
    - *Law*
    - *Manufacturing*
    - *Marketing*
    - *Military*
  - J.2 PHYSICAL SCIENCES AND ENGINEERING
    - *Aerospace*
    - *Archaeology* NEW!
    - *Astronomy*
    - *Chemistry*

- *Earth and atmospheric sciences*
- *Electronics*
- *Engineering*
- *Mathematics and statistics*
- *Physics*

- J.3 LIFE AND MEDICAL SCIENCES
  - *Biology and genetics* Revised
  - *Health*
  - *Medical information systems*
- J.4 SOCIAL AND BEHAVIORAL SCIENCES
  - *Economics*
  - *Psychology*
  - *Sociology*
- J.5 ARTS AND HUMANITIES
  - *Architecture* NEW!
  - *Arts, fine and performing* [**]
  - *Fine arts* NEW!
  - *Language translation*
  - *Linguistics*
  - *Literature*
  - *Music* [**]
  - *Performing arts (e.g., dance, music)* NEW!
- J.6 COMPUTER-AIDED ENGINEERING
  - *Computer-aided design (CAD)*
  - *Computer-aided manufacturing (CAM)*
- J.7 COMPUTERS IN OTHER SYSTEMS (C.3)
  - *Command and control*
  - *Consumer products*
  - *Industrial control*
  - *Military*
  - *Process control*
  - *Publishing*
  - *Real time*
- J.m MISCELLANEOUS

- K. Computing Milieux
  - K.0 GENERAL
  - K.1 THE COMPUTER INDUSTRY
    - *Markets*
    - *Standards*
    - *Statistics*
    - *Suppliers*
  - K.2 HISTORY OF COMPUTING
    - *Hardware*
    - *People*
    - *Software*
    - *Systems*
    - *Theory*
  - K.3 COMPUTERS AND EDUCATION
    - K.3.0 General
    - K.3.1 Computer Uses in Education
      - *Collaborative learning* NEW!
      - *Computer-assisted instruction (CAI)*
      - *Computer-managed instruction (CMI)*
      - *Distance learning* NEW!

- K.3.2 Computer and Information Science Education
  - *Accreditation* NEW!
  - *Computer science education*
  - *Curriculum*
  - *Information systems education*
  - *Literacy* NEW!
  - *Self-assessment*
- K.3.m Miscellaneous
  - *Accreditation* [**]
  - *Computer literacy* [**]

- K.4 COMPUTERS AND SOCIETY
  - K.4.0 General
  - K.4.1 Public Policy Issues
    - *Abuse and crime involving computers* NEW!
    - *Computer-related health issues* NEW!
    - *Ethics* NEW!
    - *Human safety*
    - *Intellectual property rights* NEW!
    - *Privacy*
    - *Regulation*
    - *Transborder data flow*
    - *Use/abuse of power* NEW!
  - K.4.2 Social Issues
    - *Abuse and crime involving computers* [**]
    - *Assistive technologies for persons with disabilities* NEW!
    - *Employment*
    - *Handicapped persons/special needs* [**]
  - K.4.3 Organizational Impacts
    - *Automation* NEW!
    - *Computer-supported collaborative work* NEW!
    - *Employment* NEW!
    - *Reengineering* NEW!
  - K.4.4 Electronic Commerce NEW! (J.1)
    - *Cybercash, digital cash* NEW!
    - *Distributed commercial transactions* NEW!
    - *Electronic data interchange (EDI)* NEW!
    - *Intellectual property* NEW!
    - *Payment schemes* NEW!
    - *Security* NEW!
  - K.4.m Miscellaneous

- K.5 LEGAL ASPECTS OF COMPUTING
  - K.5.0 General
  - K.5.1 Hardware/Software Protection Revised
    - *Copyrights*
    - *Licensing* NEW!
    - *Patents*
    - *Proprietary rights*
    - *Trade secrets* [**]
  - K.5.2 Governmental Issues
    - *Censorship* NEW!
    - *Regulation*
    - *Taxation*
  - K.5.m Miscellaneous
    - *Contracts* [**]

- *Hardware patents* [**]
- K.6 MANAGEMENT OF COMPUTING AND INFORMATION SYSTEMS
  - K.6.0 General
    - *Economics*
  - K.6.1 Project and People Management
    - *Life cycle*
    - *Management techniques (e.g., PERT/CPM)*
    - *Staffing*
    - *Strategic information systems planning* NEW!
    - *Systems analysis and design*
    - *Systems development*
    - *Training*
  - K.6.2 Installation Management
    - *Benchmarks*
    - *Computer selection*
    - *Computing equipment management*
    - *Performance and usage measurement*
    - *Pricing and resource allocation*
  - K.6.3 Software Management (D.2.9)
    - *Software development*
    - *Software maintenance*
    - *Software process* NEW!
    - *Software selection*
  - K.6.4 System Management
    - *Centralization/decentralization*
    - *Management audit*
    - *Quality assurance*
  - K.6.5 Security and Protection (D.4.6, K.4.2)
    - *Authentication*
    - *Insurance* [**]
    - *Invasive software (e.g., viruses, worms, Trojan horses)*
    - *Physical security* [**]
    - *Unauthorized access (e.g., hacking, phreaking)* NEW!
  - K.6.m Miscellaneous
    - *Insurance* [*]
    - *Security* [*]
- K.7 THE COMPUTING PROFESSION
  - K.7.0 General
  - K.7.1 Occupations
  - K.7.2 Organizations
  - K.7.3 Testing, Certification, and Licensing
  - K.7.4 Professional Ethics NEW! (K.4)
    - *Codes of ethics* NEW!
    - *Codes of good practice* NEW!
    - *Ethical dilemmas* NEW!
  - K.7.m Miscellaneous
    - *Codes of good practice* [**]
    - *Ethics* [**]
- K.8 PERSONAL COMPUTING
  - *Games* [*]
  - K.8.0 General
    - *Games*
  - K.8.1 Application Packages
    - *Data communications*

- *Database processing*
- *Freeware/shareware* NEW!
- *Graphics*
- *Spreadsheets*
- *Word processing*

- K.8.2 Hardware
- K.8.3 Management/Maintenance
- K.8.m Miscellaneous NEW!

- K.m MISCELLANEOUS

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* Indicates that the classification is no longer used as of January 1991, but that the item is still searchable for previously classified documents.

** Indicates that the classification is no longer used as of January 1998, but that the item is still searchable for previously classified documents.