

SETL NEWSLETTER 84
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J. SCHWARTZ
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P L A N F O R A L I B R A R Y O F A L G O R I T H M S

THE SETLB SYSTEM IS FAST ENOUGH TO ALLOW SMALL-SCALE COMPUTATIONAL EXPERIMENTS AND A MEDIUM-SCALE DEBUGGING EFFORT. PART OF OUR WORK CAN THEREFORE BE DEVOTED TO THE ACCUMULATION OF A LIBRARY OF INTERESTING DEBUGGED SETLB ALGORITHMS. THESE WILL BE USEFUL BOTH AS PROTOTYPES FOR THE DEVELOPMENT OF EFFICIENT VERSIONS, AND IN TEACHING. CERTAIN ALGORITHMS, WHICH OF COURSE DESERVE PRIORITY, WILL SERVE AS PROTOTYPES FOR PARTS OF FUTURE VERSIONS OF THE SETL SYSTEM.

IT IS NOT TO BE ANTICIPATED THAT THE FIRST DEVELOPED VERSION OF AN ALGORITHM WILL OFTEN BE ITS PERMANENT \sphericalangle BEST FORM \sphericalangle . THE BEST VERSION OF AN ALGORITHM IS THAT IN WHICH ITS ESSENTIAL STRUCTURE IS PORTRAYED MOST SIMPLY, AND IN WHICH POSSIBLE DIRECTIONS OF IMPORTANT GENERALISATION APPEAR MOST PLAINLY. TO ACHIEVE SUCH VERSIONS WILL REQUIRE A CONTINUING MANY-PERSON EFFORT OF RESTATEMENT, LIKE THE SOCIAL PROCESS OF \sphericalangle POLISHING \sphericalangle WHICH YIELDS REFINED VERSIONS OF MATHEMATICAL PROOFS.

THE PRESENT NEWSLETTER ATTEMPTS TO SET THE STAGE FOR THE DEVELOPMENT OF A LIBRARY OF ALGORITHMS BY GIVING, IN A FIRST VERSION, AN INDEX OF THE ALGORITHMIC AREAS LIKELY TO BE OF IMPORTANCE TO US.

AREA I. ALGEBRAIC AND ARITHMETIC ALGORITHMS.

MULTIPRECISION ARITHMETIC

RATIONAL ARITHMETIC, ARITHMETIC IN ARBITRARY NUMBER FIELDS

POLYNOMIALS OVER ARBITRARY NUMBER FIELDS

SYMBOLIC MANIPULATION OF ELEMENTARY FUNCTIONS

SYMBOLIC DIFFERENTIATION

SYMBOLIC INTEGRATION

CALCULATING REIMANN SURFACES OF ELEMENTARY FUNCTIONS

CALCULATING INVARIANTS OF ALGEBRAIC NUMBER FIELDS

CALCULATION OF GALOIS GROUPS

POLYNOMIAL MANIPULATION

POLYNOMIAL FACTORISATION

POLYNOMIALS IN SEVERAL VARIABLES, SYSTEMS OF POLYNOMIAL EQUATIONS

RESOLVENTS

GROUP OPERATIONS

VARIOUS GROUP-THEORETICAL CONSTRUCTIONS

FACTOR GROUPS, EXTENSION, ETC.

GROUP REPRESENTATIONS

ISOMORPHISMS

COMBINATORIAL CONSTRUCTIONS FOR GROUPS

MANIPULATION OF GROUPS DESCRIBED BY GENERATORS AND RELATIONS

AREA II. COMBINATORIAL ALGORITHMS.

GRAPHS

ISOMORPHISM, INVARIANTS OF GRAPHS AND SUBGRAPHS, CHROMATIC NUMBER, PLANARITY OF GRAPHS

DETECTION AND GENERATION OF SUBGRAPHS WITH GIVEN PROPERTIES

MINIMUM SPANNING TREE, SHORTEST PATHS, MINIMUM CUT, CYCLE-BREAKING, CLIQUES

HAMILTONIAN CIRCUITS, MAXIMUM CUT

MATCHING IN GRAPHS, NETWORK FLOWS

COVERING BY SUBGRAPHS - ARC COVER, NODE COVER, CLIQUE COVER

DECOMPOSITIONS OF PARTIALLY ORDERED SETS

GENERATION OF RANDOM GRAPHS, TREES, AND OTHER COMBINATORIAL OBJECTS

3 - DIMENSIONAL MATCHING

TABLE COMPRESSION

ADVANTAGEOUS REPRESENTATIONS FOR BINARY AND MULTI-PARAMETER RELATIONSHIPS

ARRANGEMENTS OF OBJECTS FOR ADVANTAGEOUS ADJACENCIES

DECOMPOSITION INTO ADVANTAGEOUSLY ARRANGABLE SUBSETS

INTERACTIVE TABLE-COMPRESSION SCHEMES

GENERATION OF MAGIC SQUARES, LATIN SQUARES, AND SIMILAR COMBINATORIAL OBJECTS

GENERATION OF FINITE GEOMETRIES

KNOTS AND LINKAGES

CALCULATION OF KNOT AND LINKAGE INVARIANTS
ISOMORPHISM OF KNOTS AND LINKAGES
GENERATION OF CLASSES OF KNOTS AND LINKAGES

COMBINATORIAL TOPOLOGY

REPRESENTATION AND MANIPULATION OF MULTIDIMENSIONAL
COMBINATORIAL OBJECTS
CALCULATION OF TOPOLOGICAL AND OTHER INVARIANTS
CALCULATING ISOMORPHISM/NON-ISOMORPHISM OF COMBINATORIAL
OBJECTS
SYSTEMATIC GENERATION OF MULTIDIMENSIONAL COMBINATORIAL
OBJECTS

LINEAR PROGRAMMING ALGORITHMS WITH COMBINATORIAL IMPLICATIONS

INTEGER PROGRAMMING ALGORITHMS

SORTING AND SEARCHING

STATISTICALLY ADVANTAGEOUS SORTS
SORTS OPTIMAL FROM VARIOUS POINTS OF VIEW
SORTING AND SEARCHING USING HIERARCHICALLY ORGANISED MEMORIES
TAPE SORTING
SPECIAL DATA STRUCTURES USEFUL FOR SORTING
BALANCED TREES
HASH TABLE ALGORITHMS
SEARCHING FOR SIMILAR RATHER THAN EXACTLY MATCHING
OBJECTS

BRANCH AND BOUND ALGORITHMS, BACKTRACKING ALGORITHMS

AREA III. LANGUAGES - SYNTAX AND FRONT-END PROCESSING GENERALLY.

PARSING

GRAMMAR TRANSFORMATION AND GRAMMAR ANALYSIS

ANALYSIS OF FINITE-STATE AUTOMATA

INTERACTIVE GRAMMAR-ANALYSIS SCHEMES

METALANGUAGE AND COMPILER WRITING SYSTEMS

OPTIMISATION OF PARSE-RELATED PROCESSES

PARSE-TABLE COMPRESSION

DIAGNOSTIC GENERATION TECHNIQUES - ERROR RECOVERY AND CORRECTION

PARSING TECHNIQUES FOR COMPLEX AND NATURAL LANGUAGE GRAMMARS

PARSING TECHNIQUES FOR MULTIDIMENSIONAL OBJECTS

LEXICAL-SCAN METACOMPILERS

SCAN-RELATED UTILITIES

CROSS REFERENCE GENERATION

DETECTION OF SUSPICIOUS AND MISSPELLED VARIABLES

MACROPROCESSOR ALGORITHMS

CONDITIONAL EXPANSION ALGORITHMS

SYNTAX MACRO SCHEMES

NAMESCOPING ALGORITHMS

DECLARATION ANALYSIS

DECLARATION CONSISTENCY CHECKING

ALGORITHMS FOR THE DIAGNOSIS OF SYNTAX ERRORS

PROGRAM ERROR-CORRECTION ALGORITHMS

AREA IV. LANGUAGES - SEMANTIC DEFINITION.

LANGUAGE INTERPRETER ALGORITHMS

INTERPRETERS REALISING UNUSUAL CONTROL STRUCTURES

SIMULATION LANGUAGE INTERPRETERS

INTERPRETERS FOR PARALLEL LANGUAGES

DATA STRUCTURES FOR DIFFERENTIAL REALISATIONS OF
NONDETERMINISTIC LANGUAGES

LANGUAGES PROVIDING PROTECTION AND ALLOCATION FEATURES

INTERPRETERS FOR COMPLETELY PARALLEL MODELS OF COMPUTATION

AREA V. LANGUAGES - OPTIMISATION.

PREFLOW ANALYSIS - DETECTION OF POINTER AND SUBROUTINE VALUE RANGES

CALL-PATTERN ANALYSIS

FLOW ANALYSIS

VARIABLE-USE ANALYSIS, USE-DEFINITION CHAINING

CODE MOTION, OPERATOR STRENGTH REDUCTION, COMPRESSION OF
OPTIMISATION-RELATED DATA

OTHER OPTIMISATIONS OF CODE-MOTION, CODE-DUPLICATION,
AND CODE SIMPLIFICATION TYPE

ALGORITHMS FOR THE DISCOVERY OF IMPLICIT PARALLELISM

RECURSION REMOVAL

ANALYSIS OF VARIABLE TYPES AND VALUE RANGES

ANALYSIS OF OPERATION-TO-VALUE APPLICATION PATTERNS

OPTIMAL CODE GENERATION USING GLOBAL-ANALYSIS DERIVED INFORMATION

ORGANISATION OF SPECIAL CASING

MACHINE-RELATED SPECIAL CASES

ALGORITHMS RELATED TO THE SETL DATA STRATEGY ELABORATION LANGUAGE

DATA-REPRESENTATION TRACING

DATA-STRUCTURE AND CODE SEQUENCE CHOICE ALGORITHMS

DETECTION OF OPERATION PATTERNS FOR LOCAL OPTIMISATION

AREA VI. LANGUAGES - SPECIAL APPLICATIONS.

STRUCTURE OF COMPLEX GRAPHICS PACKAGES

REPRESENTATION AND MANIPULATION OF GRAPHIC OBJECTS

GRAPHIC OPERATIONS

THREE-DIMENSIONAL GRAPHIC OBJECTS

PERSPECTIVE VIEW GENERATORS

HIDDEN-LINE ELIMINATION ALGORITHMS

DATA-BASE SYSTEM ALGORITHMS

SEARCH OPTIMISATION

INDEX GENERATION AND CONTROL

MAPPING STRUCTURES FOR DATA INDEPENDENCE

REFERENCE-DETERMINATION ALGORITHMS

USEFUL OPERATION SUBLIBRARIES FOR:

STRING MANIPULATION

VECTOR MANIPULATION

OTHER SIGNIFICANT FAMILIES OF TRANSFORMATIONS
(COMBINATORIAL CALCULI, ETC.)

AREA VII. OPERATING SYSTEMS.

JOB SCHEDULING AND CONTROL

JOB CONTROL LANGUAGE ANALYSER

JOB-STEP CONTROLLER, REACTION TO JOB-STEP ERRORS

JOB TERMINATION, CLEANUP

BATCH SCHEDULING

PRIORITY SCHEDULING, OTHER SCHEDULING SCHEMES

SWAPPING AND RESIDENCE LEVEL CONTROL

SPACE ALLOCATION ALGORITHMS

REACTION TO RESIDENCE-LEVEL REQUESTS

PROCESS INITIATION RULES AND PROCEDURES

INTER-PROCESS COMMUNICATION MECHANISMS

PROCESS SUSPEND, WAKEUP, AND ABORT

INTERRUPT TRANSMISSION AND MANAGEMENT

PROCESS-CONDITION GENERATED INTERRUPTS

PROCESS COORDINATION

SYSTEM SELF-PROTECTION SCHEMES

RATIONING OF CRITICAL SYSTEM RESOURCES

ADMINISTRATION OF PRIVILEGE LEVELS AND PROCESS CAPABILITIES

ADMINISTRATION OF TRAPS ON PRIVILEGE OR ACCESS REQUESTS

PRIVILEGED TERMINAL ADMINISTRATION

SUBALLOCATION RULES AND PROCEDURES

PROCESS ABORT CLEANUP PROCEDURES

AUTOMATIC AND PERIODIC MESSAGE POSTING

PROCESS BATCHING

TABLE-CONSISTENCY CHECKING

TABLE RECOVERY AFTER CRASH

DEVICE CONTROL

DEVICE-ERROR RECOVERY PROCEDURES

DEVICE ACCESS-PATH CHOICE

REACTION TO DEVICE-DOWN, DEVICE-UP, AND DEVICE-ADDED CONDITIONS

LIGHT-PEN TRACKING

CHARACTER RECOGNITION FOR OPTICAL READERS

I/O CONTROL AND BUFFERING

PHYSICAL DATA CONTROL AND ERROR HANDLING

BUFFER CONTROL PROCEDURES, BUFFER-AHEAD MECHANISMS

AUTOMATIC DATA-STAGING PROCEDURES

FILE AND RECORD POSITIONING FOR ADVANTAGEOUS ACCESS AND SHARABILITY

FILE RECOVERY AFTER STORAGE-DEVICE DOWN

BAD-SPOT-LIST TREATMENT

DISMOUNTABLE FILES

VERIFICATION OF ACCEPTABILITY

REMOTE COMMUNICATION

COMMUNICATIONS ERROR RECOVERY

POLLING SCHEMES

OUTPUT ROUTING TO REMOTE SITES

COMMUNICATIONS PATH CHOICE - COMMUNICATIONS ROUTING

FILE LIBRARIAN SERVICES

FILE OPENING AND CLOSING

SUBLIBRARY ADMINISTRATION: FILE NAME QUALIFICATION SCHEMES

LIBRARY UPDATE PROCEDURES

CATALOG MAINTAINANCE, CATALOG SEARCH PROCEDURES

TEXT FILE MAINTAINANCE, HISTORY KEEPING, CORRECTION

BATCH AND INTERACTIVE TEXT EDITING

TEXT GROUPING, TEXT-ORIENTED MACROPROCESSING

MULTIPLE CYCLE (MULTIPLE GENERATION) FILE SCHEMES

FILE REORGANISATION

LINK-EDITOR SERVICES

SUBROUTINE LIBRARY SEARCH PROCEDURES

ACCOUNTING ALGORITHMS

POSTING TO ACCOUNT-TABLES

FILE MAINTAINANCE CHARGES

FILE ACCESS BOOKKEEPING

DAYLOG MAINTAINANCE, DAYLOG SUMMARY AND DUMPING

RESOURCES-EXHAUSTED PROCEDURES

 ADDITION OF RESOURCES TO ACCOUNTS

ACCOUNTING SUMMARY PREPARATION

INPUT AND TRANSACTION JOURNALING PROCEDURES

 ERROR-LOGGING

SYSTEM STATUS REPORTING

 STATUS-INFORMATION COLLECTION

AREA VIII. ARTIFICIAL INTELLIGENCE.

HEURISTIC SEARCH

GOAL GENERATION, GOAL-TREE PRUNING

MAZE SEARCHING IN PARALLEL

GAME-PLAYING

REPRESENTATION OF BOARD SITUATIONS

DIFFERENTIAL UPDATE

GENERATION OF MOVES POSSESSING HIGH LIKEIHOOD OF ADVANTAGE

STORAGE AND ACCESS OF ◁BOOK KNOWLEDGE▷ IN ADVANTAGEDUS LAYOUT

HEURISTIC SEARCH FOR SPECIAL OR OPTIMAL COMBINATORIAL
STRUCTURES

PRECONDITIONING OF STRUCTURES FOR REPEATED SEARCH

QUESTION-ANSWERING AND THEOREM PROVING

RESOLUTION-ORIENTED THEOREM PROVING

MODEL-GUIDED THEOREM PROVING

INTERACTIVE THEOREM PROVERS

PROVERS AND PROOF-CHECKERS FOR PROGRAM CORRECTNESS

USE OF THEOREM PROVERS AS OBJECT-BUILDERS AND
QUESTION-ANSWERERS

FACT-BASE REPRESENTATION, SEMANTIC INFORMATION STRUCTURES

EFFICIENT DEDUCTION IN PRESENCE OF A LARGE FACT-BASE

REPRESENTATION OF RELATIONSHIPS IN MODELS OF SUBJECT
DOMAINS

MAINTAINANCE AND INTERACTIVE IMPROVEMENT OF A FACT-BASE

GENERATION OF REQUESTS FOR HINTS

GENERATION OF NATURAL-LANGUAGE REQUESTS, NATURAL LANGUAGE
RESPONSES

NATURAL LANGUAGE ANALYSIS

NATURAL LANGUAGE PARSERS

SEMANTIC RESOLUTION OF AMBIGUITIES

NATURAL LANGUAGE TRANSLATION PROCEDURES

LEARNING

SAMPLE DISCRIMINATION

DEFINITION OF COMPOUND DISCRIMINATORS AND SIGNIFICANT PATTERNS

MULTIPLE-LEVEL LEARNING

LEARNING OF PROGRAMS AND PROCEDURES

PATTERN RECOGNITION

REPRESENTATION AND DETECTION OF LOGICAL PATTERNS

GESTALT ASSEMBLY FROM LOCAL ELEMENTS

FEATURE EXTRACTION FROM TWO-DIMENSIONAL PATTERNS

TOPOLOGICAL FEATURES

RECONSTRUCTION OF THREE-DIMENSIONAL OBJECTS
FROM TWO-DIMENSIONAL GRAPHIC REPRESENTATIONS

FEATURES OF AUDIO PATTERNS

SIMILARITY MEASUREMENT

FORMAL ANALOGIES BETWEEN LOGICAL PATTERNS

AUDIO INPUT DECODING

USE OF CONTEXT TO ELIMINATE AMBIGUITY

STATISTICAL PROPERTIES OF NATURAL AND SPOKEN LANGUAGE

AREA IX. ALGORITHMS RELATED TO NUMERICAL CALCULATIONS.

NUMERICAL ALGORITHMS OF INTERESTING COMBINATORIAL STRUCTURE

FAST MATRIX PROCEDURES

FAST FOURIER TRANSFORM

MATRIX DECOMPOSITION AND PRECONDITIONING

SPARSE MATRICES

LINEAR PROGRAMMING

INTEGER PROGRAMMING

REDUCTION OF OTHER PROBLEMS TO LINEAR AND INTEGER PROGRAMMING
PROBLEMS

ERROR CORRECTION

COMBINATORIAL STRUCTURES USEFUL FOR ERROR CORRECTION

SEQUENTIAL DECODING

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