THE COMPUTER CENTER CDC LIBRARIES (CLIB) MANUAL IS A CROSS REFERENCE VOLUME FOR MANY SUBPROGRAMS, PROGRAMS, UTILITIES AND PROCEDURES AVAILABLE ON THE CDC CYBER 170 COMPUTERS AT DTNSRDC. CLIB LISTS THE ROUTINES BY FUNCTIONAL CATEGORY AND ALPHABETICALLY, BY LIBRARY, WITH DESCRIPTIVE TITLES.
RE: Proprietary Information, Pages 3-10, 3-37
These pages do not contain proprietary information. It means users cannot get source from DTNSRDG.
Per Ms. Sharon Good, DTNSRDG

COMPUTATION, MATHEMATICS AND LOGISTICS DEPARTMENT
DEPARTMENTAL REPORT

JUNE 1984
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***** INTRODUCTION *****

THE COMPUTER CENTER MAKES AVAILABLE ON THE CDC COMPUTERS, IN ADDITION TO THE NOS/BE OPERATING SYSTEM, A WIDE VARIETY OF BOTH SCIENTIFIC AND UTILITY PROGRAMS, SUBPROGRAMS AND CATALOGUED PROCEDURES. MOST OF THE ROUTINES ARE MAINTAINED IN LIBRARIES ON PERMANENT FILES AND MAY BE INVOKED BY THE APPROPRIATE (LOADER) CONTROL CARDS. A FEW PROGRAMS ARE AVAILABLE AS INDEPENDENT PERMANENT FILES.

THE CLIB-SERIES OF MANUALS CONSISTS OF THE FOLLOWING, WHICH DESCRIBE THE CONTENTS OF THE VARIOUS CDC 6000 LIBRARIES MAINTAINED BY THE COMPUTER CENTER:

CLIB - COMPUTER CENTER CDC LIBRARIES
CLIB/N - COMPUTER CENTER CDC LIBRARIES/NSRDC AND NSRDC5 (SUBPROGRAMS)
CLIB/P - COMPUTER CENTER CDC LIBRARIES/PROCFL (PROCEDURES)
CLIB/U - COMPUTER CENTER CDC LIBRARIES/UTILITY (PROGRAMS)
CLIB/M - COMPUTER CENTER CDC LIBRARIES/MNSRDC (PROGRAMS)

THIS MANUAL, CLIB, IS A CROSS-REFERENCE MANUAL WHICH DESCRIBES ALL THE LIBRARIES AND INDICATES A SOURCE FOR MORE COMPLETE DOCUMENTATION ON HOW TO USE THE ROUTINES IN THE LIBRARIES. REFERENCES MAY BE TO OTHER PUBLISHED BOOKS, MACHINE-READABLE DOCUMENTATION OR MASTER COPIES ON FILE IN USER SERVICES. THE OTHER MANUALS IN THIS SERIES CONTAIN MACHINE-READABLE DOCUMENTS.

ALL REFERENCE MATERIAL IS AVAILABLE FOR PERUSAL IN USER SERVICES (CARDEROCK: BLDG 17, ROOM 100, (202) 227-1907; ANNAPOLIS: BLDG 100, ROOM 2-J, (301) 267-3343). COPIES OF THE CLIB-SERIES MAY BE OBTAINED FROM USER SERVICES.

*** HOW TO USE THIS MANUAL ***

THE ROUTINES ARE CLASSIFIED IN ONE OR MORE FUNCTIONAL CATEGORIES (SEE PAGE 1-3 FOR A LIST OF CATEGORIES). THEY ARE LISTED, BEGINNING ON PAGE 1-6, UNDER THE VARIOUS CATEGORIES. EACH ENTRY IN THIS LIST INDICATES THE TYPE OF ROUTINE, THE LIBRARY (IF ANY) WHERE IT MAY BE FOUND, AND THE LOCATION OF THE DETAILED DOCUMENT WHICH DESCRIBES ITS USE.

THE ROUTINES LISTED IN THIS MANUAL ARE DIVIDED BY TYPE (PROGRAM, SUBPROGRAM OR CATALOGUED PROCEDURE), IN CHAPTERS 2, 3 AND 4, RESPECTIVELY. THESE CHAPTERS DESCRIBE THE VARIOUS LIBRARIES AVAILABLE AND LIST THE ROUTINES IN EACH LIBRARY (WITH A DESCRIPTIVE TITLE) ALPHABETICALLY.
*** HOW TO PRINT INDIVIDUAL DOCUMENTS ***

ALL DOCUMENT FILES RESIDE ON THE MASS STORAGE SYSTEM (MSS). YOUR MSACCES PASSWORD MUST BE SUBMITTED TO THE SYSTEM BEFORE DOCUMENTS CAN BE OBTAINED. THIS MAY BE DONE WITH A SEPARATE 'MSACCES' COMMAND OR BY USING THE MSACCES PARAMETER IN THE BEGIN STATEMENT.

TO PRINT A DOCUMENT:

BEGIN, DOCGET,,<LIBRARY>,,<ROUTINE>,OUTPUT,MSACCES=<PASSWORD>.

WHERE <LIBRARY> IS THE LIBRARY CONTAINING THE ROUTINE
<ROUTINE> IS THE NAME OF THE ROUTINE WHOSE DOCUMENTATION IS DESIRED.

TO PRINT THE DOCUMENT(S) ON THE XEROX 8700, EITHER:

A) ADD 'FID=<FID>' TO THE 'BEGIN,DOCGET,...'
WHERE <FID> IS THE FILE ID FOR THE BANNER

B) USE
BEGIN, XEROX,,OUTPUT,FID,,DOCPRT.
### FUNCTIONAL CATEGORIES

The following functional categories are used at DTNSRDC. Those preceded by an asterisk (*) are local DTNSRDC categories. All others are from the VIM (the CDC Users Group) list.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>Arithmetic routines</td>
</tr>
<tr>
<td>A1</td>
<td>Real numbers</td>
</tr>
<tr>
<td>A2</td>
<td>Complex numbers</td>
</tr>
<tr>
<td>A3</td>
<td>Decimal</td>
</tr>
<tr>
<td>A4</td>
<td>I/O routines</td>
</tr>
<tr>
<td>B0</td>
<td>Elementary functions</td>
</tr>
<tr>
<td>B1</td>
<td>Trigonometric</td>
</tr>
<tr>
<td>B2</td>
<td>Hyperbolic</td>
</tr>
<tr>
<td>B3</td>
<td>Exponential and logarithmic</td>
</tr>
<tr>
<td>B4</td>
<td>Roots and powers</td>
</tr>
<tr>
<td>C0</td>
<td>Polynomials and special functions</td>
</tr>
<tr>
<td>C1</td>
<td>Evaluation of polynomials</td>
</tr>
<tr>
<td>C2</td>
<td>Roots of polynomials</td>
</tr>
<tr>
<td>C3</td>
<td>Evaluation of special functions (non-statistical)</td>
</tr>
<tr>
<td>C4</td>
<td>Simultaneous non-linear algebraic equations</td>
</tr>
<tr>
<td>C5</td>
<td>Simultaneous transcendental equations</td>
</tr>
<tr>
<td>C6</td>
<td>Roots of functions</td>
</tr>
<tr>
<td>D0</td>
<td>Operations on functions and solutions of differential equations</td>
</tr>
<tr>
<td>D1</td>
<td>Numerical integration</td>
</tr>
<tr>
<td>D2</td>
<td>Numerical solutions of ordinary differential equations</td>
</tr>
<tr>
<td>D3</td>
<td>Numerical solutions of partial differential equations</td>
</tr>
<tr>
<td>D4</td>
<td>Numerical differentiation</td>
</tr>
<tr>
<td>E0</td>
<td>Interpolation and approximations</td>
</tr>
<tr>
<td>E1</td>
<td>Table look-up and interpolation</td>
</tr>
<tr>
<td>E2</td>
<td>Curve fitting</td>
</tr>
<tr>
<td>E3</td>
<td>Smoothing</td>
</tr>
<tr>
<td>E4</td>
<td>Minimizing or maximizing a function</td>
</tr>
<tr>
<td>F0</td>
<td>Operations on matrices, vectors &amp; simultaneous linear equations</td>
</tr>
<tr>
<td>F1</td>
<td>Vector and matrix operations</td>
</tr>
<tr>
<td>F2</td>
<td>Eigenvalues and eigenvectors</td>
</tr>
<tr>
<td>F3</td>
<td>Determinants</td>
</tr>
<tr>
<td>F4</td>
<td>Simultaneous linear equations</td>
</tr>
<tr>
<td>G0</td>
<td>Statistical analysis and probability</td>
</tr>
<tr>
<td>G1</td>
<td>Data reduction (common statistical parameters)</td>
</tr>
<tr>
<td>G2</td>
<td>Correlation and regression analysis</td>
</tr>
<tr>
<td>G3</td>
<td>Sequential analysis</td>
</tr>
<tr>
<td>G4</td>
<td>Analysis of variance</td>
</tr>
<tr>
<td>G5</td>
<td>Time series</td>
</tr>
<tr>
<td>G6</td>
<td>Special functions (includes random numbers and PDF's)</td>
</tr>
<tr>
<td>G7</td>
<td>Multivariate analysis and scale statistics</td>
</tr>
<tr>
<td>G8</td>
<td>Non-parametric methods and statistical tests</td>
</tr>
<tr>
<td>G9</td>
<td>Statistical inference</td>
</tr>
</tbody>
</table>
H0 OPERATIONS RESEARCH TECHNIQUES, SIMULATION & MANAGEMENT SCIENCE
H1 LINEAR PROGRAMMING
H2 NON-LINEAR PROGRAMMING
H3 TRANSPORTATION AND NETWORK CODES
H4 SIMULATION MODELING
H5 SIMULATION MODELS
H6 CRITICAL PATH PROGRAMS
H8 AUXILIARY PROGRAMS
H9 COMBINED

I0 INPUT
I1 BINARY
I2 OCTAL
I3 DECIMAL
I4 BCD (HOLLERITH)
I9 COMPOSITE

J0 OUTPUT
J1 BINARY
J2 OCTAL
J3 DECIMAL
J4 BCD (HOLLERITH)
J5 PLOTTING
J7 ANALOG
J9 COMPOSITE

K0 INTERNAL INFORMATION TRANSFER
K1 EXTERNAL-TO-EXTERNAL
K2 INTERNAL-TO-INTERNAL (RELOCATION)
K3 DISK
K4 TAPE
K5 DIRECT DATA DEVICES

L0 EXECUTIVE ROUTINES
L1 ASSEMBLY
L2 COMPILING
L3 MONITORING
L4 PREPROCESSING
L5 DISASSEMBLY AND DERELATIVIZING
L6 RELATIVIZING
L7 COMPUTER LANGUAGE TRANSLATORS

M0 DATA HANDLING
M1 SORTING
M2 CONVERSION AND/OR SCALING
M3 MERGING
M4 CHARACTER MANIPULATION
M5 SEARCHING, SEEKING, LOCATING
M6 REPORT GENERATORS
M9 COMPOSITE

N0 DEBUGGING
N1 TRACING AND TRAPPING
N2 DUMPING
N3 MEMORY VERIFICATION AND SEARCHING
N4 BREAKPOINT PRINTING
00 SIMULATION OF COMPUTERS AND DATA PROCESSORS (INTERPRETERS)
01 OFF-LINE EQUIPMENT (LISTERS, REPRODUCERS, ETC.)
03 COMPUTERS
04 PSEUDO-COMPUTERS
05 SOFTWARE SIMULATION OF PERIPHERALS
09 COMPOSITE

P0 DIAGNOSTICS (HARDWARE MALFUNCTION)
Q0 SERVICE OR HOUSEKEEPING, PROGRAMMING AIDS
Q1 CLEAR/RESET
Q2 CHECKSUM ACCUMULATION AND CORRECTION
Q3 FILE MANIPULATION
Q4 INTERNAL HOUSEKEEPING, SAVE, RESTORE, ETC.
Q5 REPORT GENERATOR SUBROUTINES
Q6 PROGRAM DOCUMENTATION: FLOW CHARTS, DOCUMENT STANDARDIZATION
Q7 PROGRAM LIBRARY UTILITIES

R0 LOGIC AND SYMBOLIC
R1 FORMAL LOGIC
R2 SYMBOL MANIPULATION
R3 LIST AND STRING PROCESSING
R4 TEXT EDITING

S0 INFORMATION RETRIEVAL
T0 APPLICATIONS AND APPLICATION-ORIENTED PROGRAMS
T1 PHYSICS (INCLUDING NUCLEAR)
T2 CHEMISTRY
T3 OTHER PHYSICAL SCIENCES (GEOLOGY, ASTRONOMY, ETC.)
T4 ENGINEERING
T5 BUSINESS DATA PROCESSING
T6 MANUFACTURING (NON-DATA) PROCESSING AND PROCESS CONTROL
T7 MATHEMATICS AND APPLIED MATHEMATICS
T8 SOCIAL AND BEHAVIORAL SCIENCES AND PSYCHOLOGY
T9 BIOLOGICAL SCIENCES
T10 REGIONAL SCIENCES (GEOGRAPHY, URBAN PLANNING)
T11 COMPUTER ASSISTED INSTRUCTION

U0 LINGUISTICS AND LANGUAGES
V0 GENERAL PURPOSE UTILITY SUBROUTINES
V1 RANDOM NUMBER GENERATORS
V2 COMBINATORIAL GENERATORS: PERMUTATIONS, COMBINATIONS & SUBSETS
**V3 STANDARD AND SPECIAL PROBLEMS

X0 DATA REDUCTION
X1 RE-FORMATTING, DECOMMUTATION, ERROR DIAGNOSIS
X2 EDITING
X3 CALIBRATION
X4 EVALUATION
X5 ANALYSIS (TIME-SERIES ANALYSIS)
X6 SIMULATION (GENERATE TEST DATA FOR DATA REDUCTION SYSTEM)

Y0 INSTALLATION MODIFICATION
Y1 INSTALLATION MODIFICATION LIBRARY
Y2 NEWPL TAPE OF INSTALLATION MODIFICATIONS

Z0 ALL OTHERS
*** LIST OF ROUTINES BY FUNCTIONAL CATEGORY ***

THE FOLLOWING IS A LIST OF ROUTINES DISCUSSED IN THE CLIB SERIES OF MANUALS. EACH ROUTINE APPEARS UNDER THE CATEGORY(IES) TO WHICH IT HAS BEEN ASSIGNED.

EACH ENTRY HAS THE FOLLOWING FORM:

NAME/TYPExLIB/DOC/

WHERE NAME IS THE NAME OF THE ROUTINE (MAY BE ABBREVIATED TO FIT INTO 7 CHARACTERS (SPSS))

TYPE IS THE KIND OF ROUTINE  
D - MAIN PROGRAM ACTIVATED BY A DATA CARD (SPSS)  
M - MAIN PROGRAM  
P - PROCEDURE  
S - SUBPROGRAM

LIB IS THE LIBRARY CONTAINING THE ROUTINE (THE NUMBER IN PARENTHESES FOLLOWING EACH LIBRARY NAME BELOW IS THE PAGE IN THIS MANUAL WHERE THE LIBRARY IS DISCUSSED)

A - ARLNALG (3-2)  
B - BIMEDP (2-1)  
D - SANDIA (3-71)  
E - EISPACK (3-4)  
F - FUNPACK (3-8)  
I - IMSL (3-10)  
K - MINPACK (3-36)  
L - LINPACK (3-33)  
M - MSL (3-37)  
N - NSRDC (3-57)  
P - PROCFIL (4-1)  
R - MNSRDC (2-4)  
S - SPSS (2-5)  
T - PASCAL (2-13)  
U - UTILITY (2-8)  
S - NSRDC5 (3-68)  
BLANK - NOT IN A LIBRARY

DOC INDICATES THE MANUAL WHERE THE ROUTINE IS DOCUMENTED  
M - CLIB/MNSRDC (PROGRAMS)  
N - CLIB/NSRDC AND NSRDC5 (SUBPROGRAMS)  
P - CLIB/PROCFIL (PROCEDURES)  
R - CCRM (COMPUTER CENTER REFERENCE MANUAL) (MAY CONTAIN ENOUGH INFORMATION TO USE THE ROUTINE OR A FURTHER REFERENCE.)  
U - CLIB/UTILITY (PROGRAMS)  
* - USER SERVICES MAY HAVE THE DOCUMENT  
BLANK - FOR DOCUMENTATION LOCATION, SEE THE DISCUSSION OF THAT LIBRARY IN THIS MANUAL
## AO ARITHMETIC ROUTINES

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAFRAC /S/M /</td>
<td>HCF /S/M /</td>
</tr>
<tr>
<td>FFRAC /S/M /</td>
<td>ICOMN /S/N/</td>
</tr>
<tr>
<td>FMFRAC /S/M /</td>
<td>LCM /S/M /</td>
</tr>
</tbody>
</table>

## A1 REAL NUMBERS

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMCON /S/M /</td>
<td>ISUMIT /S/N/N/</td>
</tr>
<tr>
<td>DASUM /S/I /</td>
<td>NFIIL /S/N/N/</td>
</tr>
</tbody>
</table>

## A2 COMPLEX NUMBERS

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CADR /S/M /</td>
<td>COMBES /S/M /</td>
</tr>
<tr>
<td>CBAREX /S/M /</td>
<td>CPOLRT /S/M /</td>
</tr>
<tr>
<td>CCOMPE /S/M /</td>
<td>CPSUM /S/M /</td>
</tr>
<tr>
<td>CCOMGR /S/M /</td>
<td>CREV /S/M /</td>
</tr>
<tr>
<td>CDERIV /S/M /</td>
<td>CSBR /S/M /</td>
</tr>
<tr>
<td>CFBSUM /S/M /</td>
<td>CSHRNK /S/M /</td>
</tr>
<tr>
<td>CGITRF /S/M /</td>
<td>ELRH1C /S/I /</td>
</tr>
<tr>
<td>CINTRF /S/M /</td>
<td>ELRH2C /S/I /</td>
</tr>
<tr>
<td>CYTRF /S/M /</td>
<td>ELZHC /S/I /</td>
</tr>
<tr>
<td>CDIV /S/M /</td>
<td>ELZVC /S/I /</td>
</tr>
<tr>
<td>CMPINV /S/N/N/</td>
<td>HARM /S/M /</td>
</tr>
<tr>
<td>CMPYR /S/M /</td>
<td>HELP /S/M /</td>
</tr>
<tr>
<td>CNSLVL /S/M /</td>
<td>HELP /S/N/N/</td>
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## A4 I/O ROUTINES

<table>
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<tr>
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<tbody>
<tr>
<td>XEROX /P/P/P/P/</td>
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## B0 ELEMENTARY FUNCTIONS

<table>
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<tr>
<th>Function</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>DNRM2 /S/I /</td>
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## B1 TRIGONOMETRIC

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COTAN /S/N/*/</td>
<td>SICI /S/M/</td>
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</table>

## B3 EXPONENTIAL AND LOGARITHMIC

<table>
<thead>
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<th>Function</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CBAREX /S/M /</td>
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</table>

## B4 ROOTS AND POWERS

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPROOT /S/N/N/</td>
<td>PROOT /S/N/N/</td>
</tr>
<tr>
<td>DPROOT /S/N/N/</td>
<td>PROOT /S/N/N/</td>
</tr>
<tr>
<td>SUMPS /S/M/</td>
<td></td>
</tr>
</tbody>
</table>

## C1 EVALUATION OF POLYNOMIALS

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADR /S/M/</td>
<td>CQDIV /S/M/</td>
</tr>
<tr>
<td>APOWR /S/N/*/</td>
<td>CREV /S/M/</td>
</tr>
<tr>
<td>BPOWR /S/N/*/</td>
<td>CSBR /S/M/</td>
</tr>
<tr>
<td>CADR /S/M/</td>
<td>CSHRNK /S/M/</td>
</tr>
<tr>
<td>CCOMPE /S/M/</td>
<td>DERIV /S/M/</td>
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<tr>
<td>CDERIV /S/M/</td>
<td>EVREAL /S/M/</td>
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<td>CLDIV /S/M/</td>
<td>FMULT1 /S/M/</td>
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<td>CMPYR /S/M/</td>
<td>HIFAC /S/N/*/</td>
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<tr>
<td>CNSLVL /S/M/</td>
<td>IBCQVU /S/I/</td>
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<td>COMPEV /S/M/</td>
<td>ICQVU /S/I/</td>
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<td>COSEVL /S/M/</td>
<td>LDIV /S/M/</td>
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<tr>
<td>CPDIV /S/M/</td>
<td>MPYR /S/M/</td>
</tr>
<tr>
<td>CPTRAN /S/M/</td>
<td>NSLVL /S/M/</td>
</tr>
</tbody>
</table>
C2 ROOTS OF POLYNOMIALS

CINT /S/M/  MULLP /S/M/  ZCPOLY /S/I/  
CPOLRT /S/M/  NROOTS /S/N/*  ZPOLR /S/I/  
DROOT /S/N/N/  POLYUL/M/R/M/  ZQADC /S/I/  
HELP /S/M/  PROOT /S/M/  ZQADR /S/I/  
HELP /S/N/N/  PROOT /S/N/N/  ZRPOLY /S/I/  
INT /S/M/  QUART /S/N/*  

C3 EVALUATION OF SPECIAL FUNCTIONS (NON-STATISTICAL)

AI /S/N/*  COMBES /S/M/  GAMMA /S/N/N/  
ALGAMA /S/I/  COMBES /S/N/*  HANKEL /S/M/  
BEJYO /S/N/*  DAW /S/F/  LOGGAM /S/M/  
BEJY1 /S/N/*  EI /S/F/  LOGGAM /S/N/*  
BESE0 /S/F/  ELF /S/M/  MERFCI /S/I/  
BESEE1 /S/F/  ELIEM /S/F/  MERFI /S/I/  
BESEK0 /S/F/  ELIE1 /S/F/  MMBS10 /S/I/  
BESEK1 /S/F/  ELIKM /S/F/  MMBS11 /S/I/  
BES10 /S/F/  ELIKI /S/F/  MMBSJ0 /S/I/  
BES11 /S/F/  ELIPE /S/F/  MMBSJ1 /S/I/  
BESJ0 /S/F/  ELIPK /S/F/  MMBSKO /S/I/  
BESJ1 /S/F/  ELK /S/M/  MMBS1K /S/I/  
BESK0 /S/F/  ELLI /S/N/N/  MMBSYN /S/I/  
BESK1 /S/F/  ELLIP /S/N/*  MMDAS /S/I/  
BESNIS /S/M/  EL3 /S/M/  MMDE1 /S/I/  
BESNKS /S/M/  EONE /S/F/  MMDEI /S/I/  
BESSI /S/N/N/  ERF /S/I/  MMDEIK /S/I/  
BESSJ /S/N/N/  ERF /S/M/  MKELE /S/I/  
BESSK /S/N/N/  ERF /S/N/*  MKELO /S/I/  
BESSY /S/N/N/  ERFC /S/I/  MMKEL0 /S/I/  
BESY /S/F/  ERFINV /S/M/  MPS /S/I/  
BSJ /S/M/  ERROR /S/N/*  NBESJ /S/M/  
BSJ /S/N/N/  EXPEI /S/F/  PSI /S/F/  
CBSF /S/N/*  EXPINT /S/N/*  PSI /S/N/*  
CEI3 /S/N/*  FRESNEL /S/N/N/  RBESY /S/M/  
CELLI /S/N/N/  GAMAIN /S/M/  SNCNDN /S/N/N/  
CEL3 /S/M/  GAMCARS /S/N/N/  VCONVO /S/I/  
CHEBEV /S/M/  GAMMA /S/I/  YNU /S/F/  
CHTOL /S/M/  GAMMA /S/M/  

C4 SIMULTANEOUS NON-LINEAR ALGEBRAIC EQUATIONS

HYBRD /S/K/  NEWT /S/M/  RQNWT /S/M/  
HYBRD1 /S/K/  NONLIQ /S/M/  ZSYSTM /S/I/  
HYBRJ /S/K/  NRSNG /S/M/  
HYBRJ1 /S/K/  QNWT /S/M/  

C5 SIMULTANEOUS TRANSCENDENTAL EQUATIONS

QNWT /S/M/  RQNWT /S/M/  

C6 ROOTS OF FUNCTIONS

ROOTER /S/N/*  ZANLYT /S/I/  ZREAL1 /S/I/  
ZAFUJ /S/M/  ZBRENT /S/I/  ZREAL2 /S/I/  
ZAFUM /S/M/  ZCOUNT /S/M/  
ZAFUR /S/M/  ZFALSE /S/I/  

D0 OPERATIONS ON FUNCTIONS AND SOLUTIONS OF DIFFERENTIAL EQUATIONS

PADE /S/M/  RATL /S/M/  

### D1 NUMERICAL INTEGRATION

- **DBCEVU** /S/1 / HERMIT /S/M / SICI /S/M / 
- **DBCDQ** /S/1 / LAGRAN /S/M / SIMP /S/N/*/
- **DBLINT** /S/1 / LAGUER /S/M / SIMPRC /S/M / 
- **DCADRE** /S/1 / LEGEND /S/M / SIMPUN /S/N/N/ 
- **DCSQDU** /S/1 / PARBL /S/M / TRGINT /S/M / 
- **FG1** /S/N/*/ QUAD /S/M / UNSPL /S/M / 
- **FNOL3** /S/N/*/ QUADG /S/N/N/ XFIL /S/N/*/ 
- **GM1** /S/M / ROMBG /S/M / 

### D2 NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

- **DE** /S/D/ / DTPTB /S/1 / MIMIC /M/ /R/ 
- **DEROOT** /S/D/ / DVERK /S/1 / STEP /S/D/ / 
- **DGEAR** /S/1 / FNOL3 /S/N/*/ 
- **DREBS** /S/1 / KUTMER /S/N/N/ 

### D3 NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

- **BLCKDQ** /S/M / LINBVP /S/M / RKINIT /S/M / 
- **BVP** /S/M / NRKV5 /S/M/ 
- **DRATEX** /S/M / NRKVSH /S/M/ 

### D4 NUMERICAL DIFFERENTIATION

- **CDERIV** /S/M / DERIV /S/M / LAGDIF /S/M / 
- **DCSEVU** /S/1 / DIFTAB /S/M / TRGDIF /S/M / 

### E0 INTERPOLATION AND APPROXIMATIONS

- **COSEVL** /S/M / SINEVL /S/M / 
- **OMNITAB/H*/R/ ZSRCH /S/I/ 

### E1 TABLE LOOK-UP AND INTERPOLATION

- **ACFI** /S/M / ICSCCU /S/I / RICH /S/M / 
- **AITKEN** /S/M / ICSCICU /S/I / SEARCH /S/M / 
- **ATSM** /S/M / ICSPPLN /S/I / SINSER /S/M / 
- **CRDTAB** /S/N/*/ IGHSCU /S/I / TBLU1 /S/M/ 
- **DISCOT** /S/N/N/ IGHSCV /S/I / TBLU2 /S/M/ 
- **FRMRA2** /S/N/*/ IRATCU /S/I / TBLU3 /S/M/ 
- **HRMT1** /S/M / NRICH /S/M / TERP1 /S/M/ 
- **HRMT2** /S/M / ORTHON /S/M / TERP2 /S/M/ 
- **IBCIEU** /S/I / PRICH /S/M/ 

### E2 CURVE FITTING

- **BSUBHT** /S/M / FFT3D /S/I / LSQHTS /S/M/ 
- **CCONGR** /S/M / FFT5 /S/N/N/ LSQST /S/M/ 
- **CDECOM** /S/M / FHRNEW /S/M / LSQSUB /S/N/*/ 
- **CFQME** /S/M / FITLIN /S/M / OPLSA /S/N/N/ 
- **CHEBAP** /S/M / FLGNEW /S/M / ORTHFT /S/M/ 
- **CHEBEV** /S/M / FLINV /S/I / PLAGR /S/M/ 
- **COMCUB** /S/M / FLSQFY /S/M / PLRG /M/R/M/ 
- **CTLLF** /S/I / FOURAP /S/M / POLYN /S/N/N/ 
- **CUBIC2** /S/M / FOURI /S/M / PRONY /S/M/ 
- **CURV** /S/M / GMHAS /S/N/*/ RFFT /S/N/N/ 
- **DIFTAB** /S/M / GM1 /S/M / RFSN /S/N/N/ 
- **FCGM2** /S/M / IBCICU /S/I / SPLFIT /S/N/*/ 

**Notes:**
- *JUNE 1984* CDC CYBER D1-E2 PAGE 1-9
### E2 Curve Fitting (continued)

- FCLSQ /S/M/ / ICSFKU /S/I/ / SPLINE /S/M/ /
- FDLSQ /S/M/ / ICSVKU /S/I/ / SQFIT /S/N/*/ 
- FFT /S/N/N/ / IFLSSQ /S/I/ / QRSL /S/L/ 
- FFTCC /S/I/ / ITRLSQ /S/M/ / SURFS /S/M/ 
- FFTRC /S/I/ / LINWOOD/H/ /R/ / UNCPSL /S/M/ 
- FFT2C /S/I/ / LSQHTM /S/M/ 

### E3 Smoothing

- ICSCOU /S/I/ / MILN2 /S/M/ / SMOOTH /S/M/ 
- ICSSCU /S/I/ / SIGSMT /S/M/ / SMOOTH /S/N/*/ 
- ICSSV /S/I/ / SMOUCB /S/M/ 

### E4 Minimizing or Maximizing a Function

- CHKDER /S/K/ / LMSTR1 /S/K/ / ZXGSN /S/I/ 
- LMDER /S/K/ / MIGEN /S/M/ / ZXGSP /S/I/ 
- LMDER1 /S/K/ / MINMAX /S/N/*/ / ZXMIN /S/I/ 
- LMDIF /S/K/ / MINRAT /S/M/ / ZXSSQ /S/I/ 
- LMDIF1 /S/K/ / ZSCNT /S/I/ 
- LMSTR /S/K/ / ZXGCR /S/I/ 

### F0 Operations on Matrices, Vectors & Simultaneous Linear Equations

- OMNITABM/ /R/ / SGECO /S/L/ 

### F1 Vector and Matrix Operations

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**F1  VECTOR AND MATRIX OPERATIONS (CONTINUED)**

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**F2  EIGENVALUES AND EIGENVECTORS**

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F4 SIMULTANEOUS LINEAR EQUATIONS

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LESWNE

LESWNP

LINSYS

LinV3F

LinV3P

BPDSOM

BPSUM

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CGAUS

CGITRF

CGLESM
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*Note: The above table contains the names of programs and functions associated with each category (Correlation and Regression Analysis, Sequential Analysis, Analysis of Variance, Time Series). Each entry is a combination of a program name and a function, followed by notes indicating the specific function and any additional information.*
G6 SPECIAL FUNCTIONS (INCLUDES RANDOM NUMBERS AND PDF'S)

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G7 MULTIVARIATE ANALYSIS AND SCALE STATISTICS

AFACT /S/1/ / CANCORR/D/S/ / OFHARR /S/1/ / 
BMDPKM /M/B/ / DISCRIM/D/S/ / OFIMAG /S/1/ / 
BMDP1M /M/B/ / FACTOR /D/S/ / OFPRI /S/1/ / 
BMDP2M /M/B/ / GUTTMAN/D/S/ / OFPROT /S/1/ / 
BMDP3M /M/B/ / JFACTOR/D/S/ / OFROTA /S/1/ / 
BMDP4M /M/B/ / ODIS /S/1/ / OFSCHN /S/1/ / 
BMDP6M /M/B/ / OCLINK /S/1/ / OFSCOR /S/1/ / 
BMDP7M /M/B/ / ODFISH /S/1/ / OPRINC /S/1/ / 
BMDP8M /M/B/ / ODNORM /S/1/ / OTMLNR /S/1/ / 
BMDP9M /M/B/ / OFCOEF /S/1/ / RELIAB/D/S/ / 
BMDQ3M /M/B/ / OFCOMM /S/1/ / 

G8 NON-PARAMETRIC METHODS AND STATISTICAL TESTS

BMDP1F /M/B/ / NBQT /S/1/ / NMKSF /S/1/ / 
BMDP2F /M/B/ / NBSDL /S/1/ / NMKTS /S/1/ / 
BMDP3F /M/B/ / NBSIGN /S/1/ / NMRANK /S/1/ / 
BMDP3S /M/B/ / NDKER /S/1/ / NMTIE /S/1/ / 
BMDP4F /M/B/ / NDMPLE /S/1/ / NONPAR /D/S/ / 
CROSSTA/D/S/ / NHEXT /S/1/ / NPAR /D/S/ / 
NAKI /S/1/ / NHINC /S/1/ / NRBHA /S/1/ / 
NAWNR /S/1/ / NKS1 /S/1/ / NRWMD /S/1/ / 
NAWRPE /S/1/ / NKS2 /S/1/ / NRWRST /S/1/ / 
NAWRPU /S/1/ / NMCC /S/1/ / RSO /S/N*/ 
NBCYC /S/1/ / NMKEN /S/1/ / SUMMARY/D/S/ / 

G9 STATISTICAL INFERENCE

AGVACL /S/1/ / BENSON /S/1/ / CTRBYC /S/1/ / 
ASMKMC /S/1/ / BEPAT /S/1/ / GTCN /S/1/ / 
BEHMON /S/1/ / BEPET /S/1/ / OIND /S/1/ / 
BEHSON /S/1/ / CTPR /S/1/ / 

H1 LINEAR PROGRAMMING

ARRIBA /M/ /R/ ZX3LP /S/1/ / 
ZXOLP /S/1/ / ZX4LP /S/1/ / 

H4 SIMULATION MODELING

GPSS /M/ /R/ MIMIC /M/ /R/ SIMI5 /M/ /R/ 

I0 INPUT

FASTIN /S/N*/ 

I2 OCTAL

OFMTDE /S/N/N/ OFMTV /S/N/N/ 

I3 DECIMAL

CRDTAB /S/N*/ USRDM /S/1/ / 
USCRDM /S/1/ / USRDV /S/1/ / 

I4 BCD (HOLLERITH)

ICOM /S/N*/ ICOMN /S/N*/ IFMTV /S/N/N/ 

I9 COMPOSITE

START /S/M/ /
### J1 BINARY
- CV029 /M/U/U/
- CV029 /P/P/P/

### J2 OCTAL
- PRTFL /S/N/N/

### J3 DECIMAL
- USLEAP /S/1/
- USWB /S/1/
- USWBF /S/1/
- USWFV /S/1/
- USNRM /S/1/

### J4 BCD (HOLLERITH)
- BANNER /M/U/U/
- BANNER /M/U/U/
- BANNER /M/U/U/
- BANNER /M/U/U/
- BANR /S/N/N/
- BANR /S/N/N/
- BANR /S/N/N/
- BANR /S/N/N/

### J5 PLOTTING
- BMDP5D /M/B/
- BMDP6D /M/B/
- BMDP7D /M/B/
- CALCFL /S/R/
- CALCFLP /S/N/N/
- CALCT /P/P/P/
- CALC936 /S/R/
- DISSPLA /S/R/
- HSTO /S/M/

### J9 COMPOSITE
- PRUDMP /M/U/U/
- TAPDMP9 /M/U/U/

### K1 EXTERNAL-TO-EXTERNAL
- COPY /M/R/
- COPY /M/R/
- COPY /M/R/
- COPY /M/R/
- COPY /M/R/
- COPY /M/R/
- COPY /M/R/
- COPY /M/R/
- CVT360 /M/R/
- C2M /P/P/P/
- C2MALL /P/P/P/
- CCOPY /S/1/
- CMMOVEF /S/5/N/
- CSWAP /S/1/
- DCOPY /S/1/
- DSWAP /S/1/
- GETDABA /S/N/N/
- GETRA /S/N/N/
- MFETCH /S/N/N/
- MOVEIT /S/N/N/
- NSETP /S/N/N/

### K2 INTERNAL-TO-INTERNAL (RELOCATION)
- GETDABA /S/N/N/
- SAIHY /S/1/
- SAXPY /S/1/
- SCOPY /S/1/
- SSWAP /S/1/
- SCMP /S/N/N/
- RCPA /S/N/N/
- SAXPY /S/1/
- SCOPY /S/1/
- SSWAP /S/1/
- SCMP /S/N/N/
- RCPA /S/N/N/

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**Notes:**
- BINARY, OCTAL, DECIMAL, BCD (HOLLERITH), PLOTTING, COMPOSITE, EXTERNAL-TO-EXTERNAL, and INTERNAL-TO-INTERNAL sections list various commands and their parameters.
- The commands include binary conversion, octal, decimal, BCD (Hollerith), plotting, composite operations, and external/internal relocation.
### K3 DISK
- **COPYL** /M/ /R/ Pros2R /P/P/P/ Updget /P/P/P/
- **COPYLIB/M/U/U/** Prudmp /M/U/U/ Updgets/P/P/P/
- **COPYLIB/P/P/P/** Seldump /P/P/P/ Updgetf/P/P/P/
- **COPYN /M/ /R/** Tranpk /P/P/P/ Updrepr/P/P/P/
- **GETOBJ /M/U/U/** Updadd /P/P/P/ Upddele/P/P/P/

### K4 TAPE
- **AUDPFT /M/U/U/** Copyblk/P/P/P/
- **COPYBFR/M/ /R/** Selload/P/P/P/

### L0 EXECUTIVE ROUTINES
- **ANYLIB /P/P/P/** Libpro /P/P/P/ Nogo /P/P/P/
- **ANYPRO /P/P/P/** Libproa/P/P/P/ Program/P/P/P/
- **ANYPROS /P/P/P/** Libseti/P/P/P/ Seclud /P/P/P/
- **BIGLOAD/P/P/P/** Libset2/P/P/P/ S2k260 /P/P/P/
- **CCL /M/ /R/** Mnsrdc /P/P/P/ S2k280 /P/P/P/
- **DISPOST/P/P/P/** Mypro /P/P/P/ Ttymsg /S/S/N/
- **IDDS /P/P/P/** Mypros /P/P/P/ Utility/P/P/P/

### L2 COMPILING
- **APL /M/ /R/** Mnfn /M/ /%/ Runmnf /P/P/P/
- **BASIC /M/ /R/** Pascbl /M/T/R/ Runpas /P/P/P/
- **COBOL /M/ /R/** Pli /M/ /R/ Runseq /P/P/P/
- **COMPASS/M/ /R/** Runbas /P/P/P/ Runts /P/P/P/
- **FTN4 /M/ /R/** Runftn /P/P/P/ Snobol /M/ /R/
- **FTN5 /M/ /R/** Runftn5/P/P/P/

### L4 PREPROCESSING
- **RATFOR /M/ /%/** Tidy /M/U/U/

### L7 COMPUTER LANGUAGE TRANSLATORS
- **F45 /M/ /R/** F451t /P/P/P/ Lcs /M/ /R/

### M0 DATA HANDLING
- **COMPAR /M/U/U/** C2d /M/U/U/ Equ60 /S/N/N/
- **COMPSTR/S/N/N/** D2c /M/U/U/ Maskit /S/N/N/

### M1 SORTING
- **ASORT /S/N/N/** Issort /S/N/N/ Ssortl /S/N/N/
- **ASORTMV /S/N/N/** Msaudit /P/P/P/ Ssort3 /S/N/N/
- **AUDIT /P/P/P/** Qsort /S/N/N/ Vaord /S/M/ /
- **AUDSORT/M/U/U/** Qsort1 /S/N/N/ Vecord /S/M/ /
- **CSHUF1 /S/5/N/** Sort /P/P/P/ Vsrta /S/1/ /
- **CSORT /S/5/N/** Sortcz /P/P/P/ Vsrth /S/1/ /
- **CSORID /S/5/N/** Sortmr /M/ /R/ Vsrtp /S/1/ /
- **CSORTN /S/5/N/** Sort5 /M/ /R/ Vstr /S/1/ /
- **CSORT2 /S/5/N/** Ssort /S/N/N/ Vsrts /S/1/ /
- **DEKSORT/M/U/U/** Ssortf /S/N/N/ Vsrut /S/1/ /
- **HSTGRM /S/M/ /** Ssortl /S/N/N/
M2 CONVERSION AND/OR SCALING

CHIN /S/5/N/ DATFMT /S/N/N/ MONTH /S/N/N/
CVCHIN /S/5/N/ D2A /P/P/P/ NEWDAT /S/N/N/
CVCHOL /S/5/N/ GETHOUR /S/N/N/ NEWDAT /S/5/N/
CVHOCH /S/5/N/ HEX3 /S/N/N/ S2HMS /S/5/N/
CVINCH /S/5/N/ HMS2S /S/5/N/ UNHEX3 /S/N/N/
CVT360 /M/ /R/ IHMS /S/N/N/ WEEKDAY /S/N/N/
CV029 /M/U/U/ IROMAN /S/N/N/ WRITE /M/ /R/
CV029 /P/P/P/ JGDATEN /S/N/N/
DATCNV /S/N/N/ JULIAN /S/N/N/

M3 MERGING

MERGE /M/ /R/ SORTR/T/M/ /R/

M4 CHARACTER MANIPULATION

ADJL /S/N/N/ D6301 /S/N/N/ PUTCRT /S/N/N/
ADJR /S/N/N/ EXPAND /S/N/N/ REPLAC /S/N/N/
ASCADD /S/N/N/ EXPRM /S/N/N/ REPLACM /S/N/N/
ASCDM /S/N/N/ EXBIT /S/N/N/ REPHI /S/N/N/
ASCBSX /S/N/N/ EXTPRM /S/N/N/ REPLLO /S/N/N/
ASCDC /M/U/U/ FBINRD /S/N/N/ REPLNE /S/N/N/
ASCGET /S/N/N/ GETCHA /S/N/N/ RIGHT /S/N/
ASCII /S/N/N/ GETCHR /S/N/N/ SBYT /S/N/N/
ASCII1 /S/N/N/ GETPRM /S/N/N/ SEMICO /S/N/N/
ASCII10 /P/P/P/ GETSTR /S/5/N/ SETREW /S/N/N/
ASCLEN /S/N/N/ IBUNP /S/N/N/ SHIFTA /S/N/N/
ASCPUT /S/N/N/ IPAKLFT/S/N/N/ SKWEZL /S/N/N/
ASHIFT /S/N/N/ ISTANCE /S/N/N/ SKWEZR /S/N/N/
CENTER /S/N/N/ IRTRAN/S/5/N/ TEKTRI /S/N/N/
CENTER /S/5/N/ LBYT /S/N/N/ TRAILBZ /S/N/N/
CHFILL /S/N/N/ LEFT /S/5/N/ TRANS /S/5/N/
CHIN /S/5/N/ LEFTADJ /S/N/N/ VALDAT /S/N/N/
CHNGSEQ /S/N/N/ MOVCHAR /S/N/N/ VFFILL /S/N/N/
CONTRACT /S/N/N/ MOVECM /S/N/N/ VT100/ /S/N/N/
COPYEXT /M/U/U/ MOVSTR /S/N/N/ ZBLANK /S/N/N/
CVCHIN /S/5/N/ MXGET /S/N/N/ ZEROFI /S/N/N/
CVCHOL /S/5/N/ OMROMI /S/N/N/ ZEROS /S/N/N/
CVHOCH /S/5/N/ PARGET /S/N/N/
CVINCH /S/5/N/ PUTCRA /S/N/N/

M5 SEARCHING, SEEKING, LOCATING

AMAXE /S/N/N/ GETCHR /S/N/N/ LASTCH /S/5/N/
AMINE /S/N/N/ GETSTR /S/5/N/ LASTCHH /S/5/N/
CFIND /S/5/N/ ICAMAX /S/1/ / LASTMARD /S/N/N/
FINDC /S/N/N/ IDAMAX /S/1/ / LASTCH /S/5/N/
FINDW /S/N/N/ IDIGIT /S/N/N/ MAXE /S/N/N/
FINDWRD /S/N/N/ IxFINDCH /S/N/N/ MINE /S/N/N/
FIRSTCH /S/5/N/ ISAMAX /S/1/ / NFFILLT /S/N/N/
FRSTCH /S/5/N/ LASTC /S/N/N/ NUMER /S/5/N/
GETCHA /S/N/N/ LASTCH /S/N/N/ VALIDT /S/N/N/

M6 REPORT GENERATORS

PR2UP /M/U/U/ QU /M/ /R/
NO DEBUGGING
ALTIME /S/N/N/ CMMPGOS/S/5/N/ MONERR /S/F/ /
ALTYM /S/5/N/ CMMFGSS/S/5/N/ PRTIME /S/N/N/
CMMPGFS/S/5/N/ GETCCL /S/N/N/ SM5PRNT/S/5/N/

N2 DUMPING
CMMDUMP/S/5/N/ DUMPA /S/N/N/ PRUDMP /M/U/U/
DMPA /S/N/N/ DUMPFL /S/N/N/ RECOVRD/S/N/N/
DMPCPA /S/N/N/ DUMPOBJ/M/U/U/ TAPDMP9/M/U/U/
DMPCPA /S/5/N/ DUMPXPK/S/5/N/ PRTIME /S/N/N/
DMPFIL /M/U/U/ FDMP /M/U/U/ CMMPGSS/S/5/N/

O1 OFF-LINE EQUIPMENT (LISTERS, REPRODUCERS, ETC.)
BRAILLE/M/U/U/ LISTCMP/M/U/U/ PROALL /P/P/P/
CARDs /M/U/U/ LISTEO1/M/U/U/ PRODOC /P/P/P/
CARDs2 /M/U/U/ LISTER /M/U/U/ PROLIST/P/P/P/
COPYEXT/M/U/U/ LISTM /M/U/U/ PR2UP /M/U/U/
COPYRE /M/U/U/ LISTN /M/U/U/ PURPOSE/P/P/P/
COPYSEL/M/U/U/ LIST2 /M/U/U/ "ECDC/ P/P/P/
CV029 /M/U/U/ LIST1 /M/U/U/ TIBITS/P/P/P/
CV029 /P/P/P/ LIST2 /M/U/U/ UPDDOC /P/P/P/
DOCDATE/P/P/P/ LIST3 /M/U/U/ UPDLISI/P/P/P/
DOCDOC /P/P/P/ LIST4 /M/U/U/ WARNING/S/N/N/
FRAME /M/U/U/ LMNPFR/M/U/U/ WRITE /M/U/
GETREV /M/U/U/ MANUAL /M/U/U/ XDOC /M/U/U/
LINERL /M/U/U/ MANUAL /P/P/P/
LIST /P/P/P/ PAGEPRT/M/U/U/

P0 DIAGNOSTICS (HARDWARE MALFUNCTION)
UERTST /S/1/ /

Q0 SERVICE OR HOUSEKEEPING, PROGRAMMING AIDS
AC /S/N/N/ GETLGO /S/N/N/ NORERUN/P/P/P/
AC /S/5/N/ GETMFNS/P/P/P/ NUMEXEC/S/N/N/
ALTIME /S/N/N/ GETMS /P/P/P/ NUMVAR /S/N/N/
ALTYM /S/5/N/ GETPROD/P/P/P/ OFLREQ /P/P/P/
AUDIT /P/P/P/ GODROP /S/N/N/ OVLNAME/S/N/N/
AUDPFT /M/U/U/ GRIPE /P/P/P/ PAKPAS /P/P/
BANNER /M/U/U/ HERE /S/N/N/ PARMGET/P/P/P/
BANNERS/M/U/U/ IBL /S/N/N/ PFNEWAC/M/U/U/
BANNERS/P/P/P/ IDID /S/N/N/ PFRC /S/N/N/
BANNER3/M/U/U/ ISEC /S/N/N/ PFRC /S/5/N/
BANNER6/M/U/U/ JOBCM /S/N/N/ PM /S/5/N/
BAR /S/N/N/ JOBNAM/S/N/N/ PRTFL /S/N/N/
BAN6 /S/N/N/ JOBORG /S/N/N/ PTIM /M/U/U/
BDF /P/P/P/ JOBTIME/M/U/U/ PUTMS /P/P/P/
BUFISZ/S/N/N/ LPFPERR/S/N/N/ REDUCE /S/N/N/
CALCIBM/M/U/U/ LIBBAM /S/N/N/ ROUTERC/S/N/N/
CBLFMT /M/U/U/ LIBSYM /S/N/N/ ROUTERC/S/5/N/
CMMERC/S/5/N/ LINER /M/U/U/ SEND /P/P/P/
CMMERC/S/5/N/ LINERL /M/U/U/ SKPSTAT/S/N/N/
COMQ /P/P/P/ LONGEST/M/U/U/ SZKRM /M/U/U/
COUNTLR/M/U/U/ LPL /M/U/U/ TIMLEFT/S/N/N/
CZM /P/P/P/ LPLM /M/U/U/ TPAUDT/P/P/P/
Q0 SERVICE OR HOUSEKEEPING, PROGRAMMING AIDS (CONTINUED)

C2MALL /P/P/P/ MACHINE/S/N/N/ TPGET /P/P/P/
DFDATIM/N/U/U/ MAKSUB /M/U/U/ TPRLS /P/P/P/
DSDAUDIT/P/P/P/ MEMUSED/S/N/N/ UHELP /S/1/ /
DSDLRS /P/P/P/ MFNS /M/U/U/ UHELP1 /S/1/ /
EDIT /M/ /R/ MFRAIE /S/N/N/ UHELP2 /S/1/ /
ELTIME /S/N/N/ MFRAIE /S/S/N/ UHELP3 /S/1/ /
ELTYM /S/S/N/ MFX /P/P/P/ UHELP4 /S/1/ /
EOFAD /M/U/U/ MSAUD /M/U/U/ WHATLIB/M/U/U/
FETCHC /P/P/P/ MSAUDIT/P/P/P/ WHATLIB/P/P/P/
FETCHM /P/P/P/ MSAUFP1/M/U/U/ WHICHMF/M/U/U/
FRAME /M/U/U/ MSAUFP2/M/U/U/ WHICHOS/M/U/U/
FTNRFL /S/N/N/ MSSALL /P/P/P/ XEROX /P/P/P/
GETCCL /S/N/N/ MSTABLE/P/P/P/ XFRC2M /M/U/U/
GETDABA/S/N/N/ MSTBL /M/U/U/ XFRC2MA/M/U/U/
GETFIT /S/N/N/ M2C /P/P/P/ XFRM2C /M/U/U/
GETLFSN/S/N/N/ M2CALL /P/P/P/ XFRM2CA/M/U/U/}

Q1 CLEAR/RESET

UERSET /S/1/ / UGETIO /S/1/ /

Q3 FILE MANIPULATION

ANYLIB /P/P/P/ LIBSET1/P/P/P/ SKPFI1 /S/N/N/
ANYPRO /P/P/P/ LIBSET2/P/P/P/ S2K260 /P/P/P/
ANYPROS/P/P/P/ MNSRDC /P/P/P/ S2K280 /P/P/P/
BIGLOAD/P/P/P/ MPRO /P/P/P/ TTYOPN /S/5/N/
CLUNLD /S/N/N/ MYPROS /P/P/P/ UNLOAD /S/N/N/
DISPST/P/P/P/ NOGO /P/P/P/ UPDLIST/P/P/P/
EOI /M/U/U/ PF /S/N/N/ UTILITY/P/P/P/
LIBPRO /P/P/P/ PROGRAM/P/P/P/ ZSYSEQ /S/N/N/
LIBPROA/P/P/P/ SEGLD /P/P/P/

Q4 INTERNAL HOUSEKEEPING, SAVE, RESTORE, ETC.

ADDEXT /P/P/P/ PFRSTOR/P/P/P/ PURGEN /P/P/P/
DBUTIL /M/ /R/ PHC /P/P/P/ RENAMAC/P/P/P/
MSNEWAC/M/U/U/ PLC /P/P/P/ RENAMID/P/P/P/
NEWID /P/P/P/ PROMNT /M/U/U/ RENMID /M/U/U/
PAC /P/P/P/ PRTIME /S/N/N/ RSTORPF/M/U/U/
PAHC /P/P/P/ PRTYM /S/S/N/ SELDUMP/P/P/P/
PAC /P/P/P/ PURGALL/P/P/P/ SELLOAD/P/P/P/

Q5 REPORT GENERATOR SUBROUTINES

REPORT /D/S/ /

Q6 PROGRAM DOCUMENTATION: FLOW CHARTS, DOCUMENT STANDARDIZATION

ADDECK /M/U/U/ DOCLIST/P/P/P/ PGMTAPE/P/P/P/
DOCADD /P/P/P/ DOCREPL/P/P/P/ PURPOS /M/U/U/
DOCADT /M/U/U/ DOCS /M/U/U/ PURPOSE/M/U/U/
DOCDELETE/P/P/P/ DOCUMENT/M/U/U/ TAPLIST/M/U/U/
DOCFILE/P/P/P/ EXECARD/M/U/U/ UNDOCIT/M/U/U/
DOCGET /P/P/P/ GEDOC /M/U/U/ UNDOCIT/M/U/U/
DOCIT /M/U/U/ LGOTREE/P/P/P/
## Q7 PROGRAM LIBRARY UTILITIES

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<tr>
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<td>ADD PROED</td>
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<td>REDECK</td>
<td>DECK REDECK</td>
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<td>SUPORT</td>
<td>SUPPORT</td>
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</tbody>
</table>

## R1 FORMAL LOGIC

- COUPLE

## R3 LIST AND STRING PROCESSING

- PROSE
- SNOBOL

## R4 TEXT EDITING

- EDITOR
- NETED
- RNF

## S0 INFORMATION RETRIEVAL

- ACCRTPT
- ADPCOST
- AUDIT
- AUDPFT
- AUDSORT
- CCNOTE
- DBUTIL
- DDL
- DMS170
- DODAT
- DOCUMNT
- EXECDIR
- EXECDIR
- GETDOC
- GETREV
- IDID
- JOBORG
- MANUAL
- MSAUDIT
- PAGEPR
- PRMNT
- PURPOS
- RANNUM
- XIRAND

## T4 ENGINEERING

- ABAQUS
- ARDCFT
- CIVCO
- ECAP
- ELBOW
- ELBOW
- ECAP
- STRESS

## T6 MANUFACTURING (NON-DATA) PROCESSING AND PROCESS CONTROL

- APT

## V1 RANDOM NUMBER GENERATORS

- EXRAND
- IRAND
- NRND
- NRML
- NRMNO
- RN2
- RN2
- RAND
- RAND
- RNGU
- RNGU
- RN1

## V3 STANDARD AND SPECIAL PROBLEMS

- BRAILLE

## X5 ANALYSIS (TIME-SERIES ANALYSIS)

- BMDP1L
- BMDP2L
- SPECTRA
- SURVIVA
- BOXJENK
- SURVIVA
- SPECTRA
- SURVIVA
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<th>ALL OTHERS</th>
<th>MF2CPU /S/5/N/</th>
<th>SSP /S/ /R/</th>
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<td>MF2CPU</td>
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**PROGRAMS**

THE COMPUTER CENTER CURRENTLY MAINTAINS THREE LIBRARIES OF MAIN PROGRAMS IN ABSOLUTE FORM:

1) **BIMEDP** - SOME OF THE BIO-MEDICAL STATISTICAL PROGRAMS (P-SERIES)
2) **MNSRDC** - LOCALLY WRITTEN AND/OR SUPPORTED SCIENTIFIC PROGRAMS
3) **UTILITY** - LOCALLY WRITTEN AND/OR SUPPORTED UTILITIES

THERE ARE ALSO SOME MAIN PROGRAMS, INCLUDING SPSS AND CVT360, WHICH ARE MAINTAINED IN SEPARATE FILES.

*** BIMEDP *** (PROPRIETARY)

THE BIMEDP-82 BIO-MEDICAL STATISTICAL PROGRAMS P-SERIES FROM UCLA ACCEPT DATA WITH PARAMETER LANGUAGE CONTROL SIMILAR TO SPSS. IT REPLACES ALL PREVIOUS VERSIONS OF BIMED. MOST PROGRAMS WILL RUN IN CM120000. THIS IS THE CDC FTN5 VERSION, WHICH IS MAINTAINED BY NORTHWESTERN UNIVERSITY.

REFERENCE: "BMDP STATISTICAL SOFTWARE 1983 (OR 1981)", W. J. DIXON, EDITOR, UNIVERSITY OF CALIFORNIA PRESS, BERKELEY.

BEGIN,DOCGET,,BMDP,,BMDP82,OUTPUT,MSACCES=<PW>.
(20 PAGES REQUIRED READING)

BIMEDP ROUTINES ARE AVAILABLE ON THE MASS STORAGE SYSTEM AND CURRENTLY INCLUDE:

- **BMDP1D** SIMPLE DATA DESCRIPTION
- **BMDP2D** FREQUENCY COUNT ROUTINE
- **BMDP3D** T TEST AND T-SQUARED ROUTINE
- **BMDP4D** ALPHANUMERIC FREQUENCY COUNT ROUTINE
- **BMDP5D** UNIVARIATE PLOTTING
- **BMDP6D** BIVARIATE PLOTTING
- **BMDP7D** DESCRIPTION OF STRATA WITH HISTOGRAMS AND ANALYSIS OF VARIANCE
- **BMDP8D** MISSING VALUE CORRELATION
- **BMDP9D** MULTIDIMENSIONAL DATA DESCRIPTION
- **BMDPAM** DESCRIPTION AND ESTIMATION OF MISSING DATA
BMDP1F  TWO-WAY FREQUENCY TABLES - MEASURES OF ASSOCIATION
BMDP2F  TWO-WAY FREQUENCY TABLES - EMPTY CELLS AND DEPARTURES FROM INDEPENDENCE
BMDP3F  MULTIWAY FREQUENCY TABLES - LOG-LINEAR MODEL
BMDP4F  FREQUENCY TABLES - REPLACES BMDP1F, BMDP2F, BMDP3F
BMDP1L  LIFE TABLES AND SURVIVAL FUNCTION
BMDP2L  REGRESSION WITH INCOMPLETE SURVIVAL DATA
BMDP1M  CLUSTER ANALYSIS ON VARIABLES
BMDP2M  CLUSTER ANALYSIS ON CASES
BMDP3M  BLOCK CLUSTERING (SEE BMDP3M)
BMDP4M  FACTOR ANALYSIS
BMDP6M  CANONICAL CORRELATION ANALYSIS
BMDP7M  STEPWISE DISCRIMINANT ANALYSIS
BMDP8M  BOOLEAN FACTOR ANALYSIS
BMDP9M  SCORING BASED ON PREFERENCE PAIRS
BMDPKM  K-MEANS CLUSTERING OF CASES
BMDP3M  BLOCK CLUSTERING BY IMPROVED METHOD
BMDP1R  MULTIPLE LINEAR REGRESSION
BMDP2R  STEPWISE REGRESSION
BMDP3R  NONLINEAR REGRESSION
BMDP4R  REGRESSION ON PRINCIPAL COMPONENTS
BMDP5R  POLYNOMIAL REGRESSION
BMDP6R  PARTIAL CORRELATION AND MULTIVARIATE REGRESSION
BMDP9R  ALL POSSIBLE SUBSETS REGRESSION
BMDP4R  DERIVATIVE-FREE NONLINEAR REGRESSION
BMDP3R  STEPWISE LOGISTIC REGRESSION
BMDP1S  MULTIPASS TRANSFORMATION
BMDP3S  NONPARAMETRIC STATISTICS
BMDP1T  UNIVARIATE AND BIVARIATE SPECTRAL ANALYSIS
BMDP2T  BOX-JENKENS TIME SERIES ANALYSIS
BMDP1V  ONE-WAY ANALYSIS OF VARIANCE AND COVARIANCE
BMDP2V  ANALYSIS OF VARIANCE AND COVARIANCE, INCLUDING REPEATED MEASURES
BMDP3V  GENERAL MIXED MODEL ANALYSIS OF VARIANCE
BMDP4V  GENERAL UNIVARIATE AND MULTIVARIATE WEIGHTED ANOVA
             (UNIVERSITY OF ROCHESTER)
BMDP8V  GENERAL MIXED MODEL ANALYSIS OF VARIANCE EQUAL CELL SIZES

TO USE:  MSACCES, PASSWORD.
          MSFETCH, BMDPXX, UN=CSYS.
          BMDPXX,...
THE COMPUTER CENTER MAINTAINS SOME LOCALLY WRITTEN AND/OR SUPPORTED SCIENTIFIC PROGRAMS IN THE PUBLIC ACCESS LIBRARY CALLED 'MNSRDC'. PROGRAMS IN THE LIBRARY MAY BE EXECUTED IN ONE OF THE FOLLOWING WAYS:

A) ATTACH,MNSRDC.
   LIBRARY,MNSRDC. OR LDSET,LIB=MNSRDC.
   PROG,<PARAMETERS>. WHERE PROG IS THE DESIRED PROGRAM

B) BEGIN,MNSRDC,,PROG,<PARAMETERS>.

REFERENCE: CLIB/M. BECAUSE THERE ONLY TWO ROUTINES IN MNSRDC, ONLY A COMPUTER COPY OF THE MANUAL IS AVAILABLE. WHEN THERE IS A SUFFICIENT NUMBER OF ROUTINES IN MNSRDC, CLIB/M WILL BE PUBLISHED FORMALLY. ADDITIONS TO THE LIBRARY ARE WELCOME.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

LIBRARY 'MNSRDC' CONTAINS THE FOLLOWING PROGRAMS:

PLRG POLYNOMIAL REGRESSION (IBM SSP SAMPLE PROGRAM MODIFIED)

POLYMUL ROOTS OF A POLYNOMIAL WITH COMPLEX COEFFICIENTS BY MULLER'S METHOD
SPSS

STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES (SPSS) IS AN OPEN-ENDED INTEGRATED SYSTEM OF STATISTICAL PROGRAMS EMBEDDED IN A SINGLE CONTROL PROGRAM. THE CDC CYBER VERSION WAS OBTAINED FROM NORTHWESTERN UNIVERSITY.

SPSS IS A BATCH SYSTEM WRITTEN MOSTLY IN FORTRAN. THIS PACKAGE (VERSION 9) IS MORE VERSATILE THAN THE BIMEDP ROUTINES (PAGE 2-1), SINCE MANY DIFFERENT STATISTICS CAN BE PERFORMED ON THE SAME DATA IN ONE RUN.

NOTE: THE XSPSS BOOKS DO NOT DESCRIBE OUR SYSTEM.

THE FOLLOWING DOCUMENTS MAY BE PRINTED:
BEGIN,DOCGET,,SPSS,,<DOC>,OUTPUT,MSACCES=<PASSWORD>.

WHERE <DOC> IS SPSSGEN - DOCUMENT 187 (15 PAGES) GENERAL DISCRIPTION
SPSSV90 - DOCUMENT 457B (93 PAGES) CDC UPDATE
VER90 - DOCUMENT 86 (4-PAGE SUMMARY)
XREF90 - DOCUMENT 508 (6 PAGES) (CROSS REFERENCE TO OTHER SPSS DOCUMENTATION)
ERRPT90 - SUMMARY OF REPORTED PROBLEMS (48 PAGES)
JFACTOR - DOCUMENT 412
MANOVA - DOCUMENT 588 (91 PAGES)
SUMTABLE - DOCUMENT 411

'SPSS' CONTAINS THE FOLLOWING DATA-CARD-CALLABLE PROCEDURES:

AGGREGATE DESCRIPTIVE GROUP STATISTICS FOR SPECIFIED VARIABLES WRITTEN TO RAW OUTPUT FILE

ANOVA ONE- TO FIVE-WAY ANALYSIS OF VARIANCE AND COVARIANCE FOR FACTORIAL DESIGNS

BOX-JENKINS ANALYSIS OF UNIVARIATE TIME SERIES; CAN IDENTIFY, FIT, AND FORECAST TIME SERIES DATA.

BREAKDOWN DESCRIPTIVE STATISTICS ON SUBGROUPS

CANCORR CANONICAL CORRELATION ANALYSIS AND TESTS OF STATISTICAL SIGNIFICANCE

CONDESCRIPITIVE DESCRIPTIVE STATISTICS FOR CONTINUOUS (UNGROUPED) VARIABLES

CROSSTABS 2-WAY TO N-WAY JOINT FREQUENCY DISTRIBUTION, CONTINGENCY TABLES AND RELATED MEASURES OF ASSOCIATION

DISCRIMINANT MULTIPLE DISCRIMINANT ANALYSIS IN STEPWISE OR DIRECT MODE

FACTOR FACTOR ANALYSIS BY ONE OF FIVE DIFFERENT METHODS
FREQUENCIES
ONE-WAY FREQUENCY DISTRIBUTIONS WITH DESCRIPTIVE STATISTICS

GUTTMAN
UP TO 50 SEPARATE GUTTMAN SCALES BY VARIANT OF GOOD ENOUGH TECHNIQUE

G3SLS
GENERALIZED AND 3-STAGE LEAST SQUARES ESTIMATES OF THE PARAMETERS OF A SYSTEM OF SIMULTANEOUS STOCHASTIC EQUATIONS

JFACTOR
JORESKOG FACTOR ANALYSIS FOR GENERALIZED LEAST SQUARES, MAXIMUM LIKELIHOOD, AND UNWEIGHTED LEAST SQUARES

MANOVA
MULTIVARIATE ANALYSIS OF VARIANCE AND COVARIANCE WITH UNEQUAL CELL FREQUENCIES

MULT RESPONSE
FREQUENCY AND CROSSTABULATION TABLES FOR MULTIPLE RESPONSE VARIABLES

NONLINEAR
NONLINEAR REGRESSION BY MINIMIZING SUMS OF SQUARES

NONPAR CORR
SPEARMAN AND/OR KENDALL RANK-ORDER CORRELATION COEFFICIENTS AND LEVEL OF SIGNIFICANCE

NPAR TESTS
13 NONPARAMETRIC STATISTICAL TESTS

ONEWAY
ONE-WAY ANALYSIS OF VARIANCE WITH RANGE TESTS

PARTIAL CORR
UP TO 25 SETS OF PARTIAL CORRELATIONS OF ANY ORDER OR COMBINATION - LEAST SQUARES REGRESSION IN MULTIPLE OR STEPWISE MODE

PEARSON CORR
PEARSON PRODUCT-MOMENT (ZERO-LEVEL) CORRELATION COEFFICIENTS AND LEVEL OF SIGNIFICANCE

PLOT
BIVARIATE PLOTS FOR CALCOMP

REGRESSION
MULTIPLE REGRESSION ANALYSIS BY FORWARD INCLUSION, BACKWARD ELIMINATION OR STEPWISE SOLUTION METHOD

RELIABILITY
COEFFICIENTS OF RELIABILITY AND OTHER SUMMARY STATISTICS FOR EVALUATING MULTIPLE ITEM SCALES

REPORT
FLEXIBLE REPORT GENERATOR WITH SUMMARY AND COMPOSITE STATISTICS

SCATTERGRAM
SCATTER DIAGRAM OF DATA POINTS AND SIMPLE REGRESSION

SPECTRAL
SPECTRAL ANALYSIS USING FOURIER METHODS TO REPRESENT A TIME SERIES

SUMMARY TABLES
TABLES (PERCENTAGES AND OPTIONAL CELL COUNTS) WHICH SUMMARIZE RELATIONSHIPS BETWEEN INDEPENDENT VARIABLE AND A NUMBER OF DICHOTOMOUS DEPENDENT VARIABLES
SURVIVAL
SURVIVAL ANALYSIS AND LIFE EXPECTANCIES - EVALUATE TIME INTERVAL BETWEEN STARTING AND TERMINAL EVENTS

TETRACHORIC
TETRACHORIC CORRELATION COEFFICIENTS BETWEEN DICHOTOMOUS VARIABLES

T-TEST
STUDENT'S T AND PROBABILITY LEVELS TESTS ON SAMPLE MEANS
THE COMPUTER CENTER MAINTAINS SOME LOCALLY WRITTEN AND/OR SUPPORTED UTILITIES IN THE PUBLIC ACCESS LIBRARY CALLED 'UTILITY'. PROGRAMS IN THIS LIBRARY MAY BE EXECUTED IN ONE OF THE FOLLOWING WAYS:

A) ATTACH,UTILITY.
   LIBRARY,UTILITY. OR LDSET,LIB=UTILITY.
   PROG,<PARAMETERS>. WHERE PROG IS THE DESIRED PROGRAM

B) BEGIN,UTILITY,,PROG,<PARAMETERS>.

REFERENCES: ALL OF THESE PROGRAMS ARE DOCUMENTED IN CLIB/U, WHICH MAY BE OBTAINED FROM USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

LIBRARY 'UTILITY' CONTAINS THE FOLLOWING PROGRAMS:

ADDECK ADD "DECK RECORDS IN FRONT OF EACH DOCUMENT IN A DOCUMENT FILE

ALARM SOUND BELL 20 TIMES AT INTERACTIVE TERMINAL

ASCDC CONVERT 7-BIT ASCII FILE TO 6-BIT CDC AND VICE VERSA

AUDPFT PRODUCE MINI-AUDIT OF USER PF DUMP TAPES CREATED BY SELDUMP OR PRIVATE PACK PF DUMP

AUDSORT SORT OUTPUT FROM USER AUDIT

BANNER PRINT A BANNER (PAGE)

BANNERS PRINT 1 TO 8 BANNERS ON ONE PAGE

BANNER3 PRINT 3 BANNERS ON ONE PAGE

BANNER6 PRINT 3-6 BANNERS ON ONE PAGE

BINDEX GIVE LIST AND SORTED LIST OF OUTPUT OF EDITLIB 'LISTLIB' AND 'CONTENT' DIRECTIVES

BRAILLE BRAILLE PRINTER

CALCIBL CALCULATE BEST BLOCK LENGTHS (I.E. MIN TIME REQUIRED FOR RANDOM ACCESS AND MINIMUM BUFFER SIZE) FOR INDEX SEQUENTIAL FILE

CARDS REPRODUCE A BCD DECK WITH MODIFICATIONS. (FIELDS MAY BE MOVED, DELETED, INTERCHANGED, GANG PUNCHED AND/OR SEQUENCED)

CARDS2 REPRODUCE A BCD DECK WITH MODIFICATIONS. (FIELDS MAY BE COPIED, MOVED, DELETED, INTERCHANGED, GANG PUNCHED AND/OR SEQUENCED.)
CBLFMT  REFORMAT A COBOL SOURCE PROGRAM TO ENHANCE ITS READABILITY, THEREBY MAKING IT EASIER TO UNDERSTAND AND MODIFY

COMPAR  COMPARE TWO TEXT FILES AND REPORT ANY DIFFERENCES

COPYEXT  COPY UNIT RECORDS (ZERO BYTE TERMINATED) EXTRACTING SPECIFIED COLUMNS AND OPTIONALLY MOVING THEM AND OPTIONALLY ADD EDITOR SEQUENCING

COPYLIB  FROM AN EDITLIB LISTLIB LISTING, CREATE SORTED (OR UNSORTED) DIRECTIVES TO COPY AN EDITLIB USER LIBRARY

COPYRE  COPY AND REARRANGE FILE OF ZERO BYTE TERMINATED RECORDS (150 CHARACTERS MAXIMUM PER RECORD)

COPYS  A GENERAL PURPOSE UTILITY FROM NORTHWESTERN UNIVERSITY WHICH PROVIDES A LARGE VARIETY OF COPY OPERATIONS FOR SEQUENTIAL OR RANDOM FILES (4)

COPYSEL  COPY AND REARRANGE FILE OF ZERO BYTE TERMINATED RECORDS (150 CHARACTERS MAXIMUM PER RECORD; FILE PROCESSED DIRECTLY)

COUNTLR  COUNT LOGICAL RECORDS IN A FILE

CVO29  CONVERT TO 029 PUNCH CODE

C2D  CONVERT COMMENTS INTO DOCUMENTATION

DECKS  LIST UPDATE 'SOURCE' FILE DECK/COMDECK NAMES, SEQUENCE NUMBER AND NUMBER OF CARDS AND, OPTIONALLY (FOR DOCUMENT FILES), NUMBER OF LINES AND NUMBER OF PAGES

DEKSORT  SORT IDENT AND DECK LISTINGS FROM UPDATE OUTPUT FILE

DFDATIM  PUT DATE/TIME INTO DAYFILE

DMPFIL  DUMP FIRST N WORDS OF EACH LOGICAL RECORD IN M FILES

DOCDAT  LIST DOCUMENT NAMES, DATES AND PAGE NUMBERS

DOCIT  ADD PAGING TO ONE OR MORE DOCUMENTS

DOCS  CREATE DOCUMENTATION FOR (SUB)PROGRAMS, PROCEDURES, LIBRARIES, MAGNETIC TAPES, AND PERMANENT FILES

DOCUMNT  MAINTAIN A FILE OF DOCUMENTS

DUMP_OBJ  DUMP A BINARY FILE (ABSOLUTE OR RELOCATABLE), EXPANDING ALL LOADER TABLES

D2C  CONVERT DOCUMENT TO FORTRAN, COBOL, OR COMPASS COMMENTS

EOfAD  ADD OR DELETE EOF'S TO/FROM A FILE (THRU EOI)
EOI: POSITION A FILE AT END-OF-INFORMATION (EOI)

EXECARD: EXTRACT EXECUTE CARD PARAMETER/SUBPROGRAM USAGE/PROCEDURE USAGE INFORMATION FROM DOCUMENTATION FILES (WHICH WERE PREPARED IN THE FORMAT GENERATED BY PROGRAM 'DOC')

FDMP: INTERPRETTED MEMORY DUMP

FRAME: PRINT A FRAME FOR LINING UP PRINTOUTS

GETDOC: EXTRACT (PRINT) ONE OR MORE COPIES OF ONE OR MORE DOCUMENTS FROM A DOCUMENT FILE

GETOBJ: EXTRACT ONE OBJECT MODULE FROM A SEQUENTIAL OBJECT FILE OR AN EDITLIB USER LIBRARY

GETREV: EXTRACT ALL PAGES FROM A MANUAL WHICH WERE MODIFIED AFTER USER-SPECIFIED DATE

HEXDMP: SEE TAPDMP9

JOBTIME: PUT JOB CP EXECUTION TIME TO THIS POINT INTO DAYFILE

LINER: COUNT LINES AND PAGES OF A FILE HAVING FIRST CHARACTER CARRIAGE CONTROL

LINERL: LIST A DOCUMENT (CARRIAGE CONTROL IN COLUMN 1, ZERO BYTE TERMINATED RECORDS) WITH RECORD COUNT AND COUNT OF LINES ON EACH PAGE. LIST THRU END-OF-INFORMATION.

LISTBIN: LIST BINARY MODULES AND PROCEDURES IN ONE OR MORE FILES

LISTCMP: LIST AN UPDATE COMPIL FILE, EACH DECK BEGINNING ON A NEW PAGE WITH A BANNER PAGE PRECEDING IT

LISTEROI: LIST A FILE INSERTING *EOR, *EOF, *EOI WHERE APPROPRIATE

LISTM: MULTI-OPTION LISTING PROGRAM

LISTM: LIST IN MULTIPLE COLUMN

LISTN: NUMBERED LIST OF ONE FILE OF ZERO-BYTE TERMINATED RECORDS

LISTZ: LIST ZERO-BYTE TERMINATED RECORDS WITH RECORD NUMBER AND LENGTHS (USER MAY SPECIFY MAXIMUM NUMBER OF CHARACTERS TO READ (DEFAULT: 140) AND PRINT (DEFAULT: 110)

LIST1: LIST (CENTERED) ONE COPY OF A FORM (UP TO 90 CHARACTERS PER LINE AND HAVING CARRIAGE CONTROL IN COLUMN 1). OPTIONALLY PRINT RECORD-IN-FILE, PAGE AND LINE-ON-PAGE COUNTS AND LINE LENGTHS.
LIST2  SINGLE/DOUBLE SPACE LISTING, 6 OR 8 LINES PER INCH, WITH OPTIONAL SKIP OVER PERFORATION AT BOTTOM OF PAGE (FIRST 120 CHARACTERS)

LIST3  LIST FIRST (UP TO 90-CHARACTER, ZERO BYTE TERMINATED) RECORD IN EACH LOGICAL RECORD THROUGH EOI

LIST4  LIST UNIT RECORDS, THRU EOI, WHICH HAVE '1' IN COLUMN 1

LMFNPFN LIST EXECUTING USER'S TABLE/MFNPFN WITH LINE COUNTS

LONGEST  FIND THE LENGTH OF THE LONGEST LINE IN A FILE

LPL  LIST PAGE LENGTHS IN A DOCUMENT (LONG PAGES AND LONG LINES CAN BE FLAGGED)

LPLM  LIST PAGE LENGTHS IN A MANUAL (LONG PAGES AND LONG LINES CAN BE FLAGGED)

MAKSUB  GENERATE A SKELETON SUBPROGRAM

MANUAL  EXTRACT REVISION PAGES FROM A MANUAL (CCRM OR CCBRM)

MFNS  EXTRACT USER INITIALS AND MSS FILE NAMES FROM MSAUDIT

MF2MFA  USING PARTIAL AUDIT OUTPUT, GENERATE PROCEDURES TO MOVE ALL FILES FROM ONE MAINFRAME TO ANOTHER V/S THE MSS

MSAUD  SORT LO=F OUTPUT FROM MSAUDIT

MSAUFP1  FROM MSAUDIT,LO=F OUTPUT, GENERATE A PROCEDURE TO DO AN MSAUDIT,LO=FP FOR EACH SEMI-PRIVATE MSS FILE AND A SEPARATE FILE OF THE SEMI-PRIVATE FILENAMES FOR PROGRAM MSAUFPP2

MSAUFP2  FROM MSAUDIT,LO=FP OUTPUT OF PROCEDURE GENERATED BY PROGRAM MSAUFP1 AND OUTPUT OF PROGRAM MSAUFPP1, MAKE LIST OF ACCESS TO MSS SEMI-PRIVATE FILES

MSNEWAC  BASED ON MSAUDIT,LO=F, GENERATE A PROCEDURE TO RENAME THE AC PARAMETER FOR MASS STORAGE SYSTEM FILES

MSTBL  GENERATE TABLE/MFNPFN INTERACTIVELY FOR MSS

NEWNAME  RENAME A SIMPLE ABSOLUTE MODULE

PFNEWAC  RENAME CATALOGED ACCOUNT NUMBER. USE WHEN ALL FILES CATALOGED UNDER A GIVEN JOB ORDER NUMBER ARE TO BE CHANGED TO ANOTHER JOB ORDER NUMBER.

PROMNT  MAINTAIN AN ALPHABETICAL, SEQUENTIAL PROCEDURE FILE, EACH PROCEDURE BEING ONE NOS/BE LOGICAL RECORD. BOTH CCL AND B/R PROCEDURES ARE SUPPORTED.

PRUDMP  OCTAL AND CHARACTER DUMP OF DISK FILE BY RELATIVE PRU NUMBER
PR2UP  This program is intended to reformat a single-column text file composed of 60-character lines into a 2-up (double-column) format having maximum total line length of 132 printable characters (plus 1 pos for carriage control). The output will be suitable for printing either on a line printer or on Xerox-1200 8-1/2 x 11 paper.

PTIM  Print CPA, CPB, CPA+CPB, IO and PP times since start of job or intercom session

PURPOS  Extract purpose information from document files (which were prepared in the format generated by program 'DOCS')

PURPOSE  Extract purpose information from documentation files (which were prepared in the format generated by program 'DOCS')

REDECK  Change an update compile file back into a source file

RENMID  Convert AI=S Audit into a procedure to rename the ID on each file in the audit by copying the file

RSTORPF  Create a file of directives to be used to restore permanent files

SORTUP  Generate update directives to sort oldpl

SZKRMN  Rename account number on cataloged S2000 data base files

TAPDMP9  Dump 9-track tape in hexadecimal (and character, if ASCII or EBCDIC) or octal-and-character (if BCD or display code)

TAPLIST  Prepare two lists from magtapedocumentation file: 1) list of tape number, label, density, remarks and description for each tape documented in file 2) list of tape numbers and labels

TIDY  Renumber and edit FORTRAN source programs

UNDICIT  Remove the paging which was added to document(s) by program 'DOCIT'

VAXER  Copy VAX continuous data to 5040 character blocks for Xerox

WHATLIB  List libraries specified on last library card

WHICHMF  Tell interactive user or batch job which mainframe is being used

WHICHOS  Tell interactive user or batch job which operating system is being used

XDOC  Extract all documents from a document file (having *DECK'S) preparing the output for the XEROX 8700 to start each document on a new page
XFRC2M CREATE PROCEDURE TO TRANSFER ONE CDC PERMANENT FILE TO MASS STORAGE FOR THE EXECUTING USER (CDC PFN OBTAINED FROM USER'S FILE TABLE/MFNPFFN)

XFRC2MA CREATE PROCEDURE TO TRANSFER ALL CDC PERMANENT FILES OF EXECUTING USER TO MASS STORAGE (BASED ON USER'S CDC FILE TABLE/MFNPFFN)

XFRM2C CREATE PROCEDURE TO TRANSFER ONE MSS FILE TO A CDC PERMANENT FILE (BASED ON EXECUTING USER'S FILE TABLE/MFNPFFN)

XFRM2CA CREATE PROCEDURE TO TRANSFER ALL MSS FILES OF EXECUTING USER TO A CDC PERMANENT FILE (BASED ON EXECUTING USER'S FILE TABLE/MFNPFFN)
*** PROGRAMS NOT IN LIBRARIES ***

Several programs which are not in libraries are listed below. (See their individual documents for attach and execute information.)

If the length of a document is given in parentheses following the description, the individual document may be printed by:

```
BEGIN,DOCGET,,OTHER,,<PROG>,OUTPUT,MSACCE=<PASSWORD>.
```

Where <PROG> is the name of the program whose documentation is desired.

ABAQUS  A family of modeling capabilities based on the finite element method for non-linear structural problems

ACCTRPT  Provide job order manager with computer accounting status information (3)

ADPCOST  Provide job order manager with computer accounting status information (2)

APL   A programming language

APT   Automatically programmed tools - prepare punched paper tapes for numerically controlled machine tools

CCL  CYBER control language reference guide (39)

COPYBF R  Re-create a CDC 'random' file from data copied earlier to a sequential file, or copy a random file (2)

COPYE  Copy a file to end-of-information (2)

COPYF  Copy binary or coded files (2)

COPYR  Copy binary or coded records (2)

COPYRM  Copy and convert records on sequential (SQ) files from one record type and block structure to another (3)

COPYSF  Copy files or records with optional shift to right (3)

CVT360  Convert double precision S/360 FORTRAN programs to single precision CDC FORTRAN (1)

EZGR  TEKTRONIX PLOT10 easy graphing software package for 4027 color graphics terminals

IDDS  Prepare/examine graphically numerical data input to or output from a FORTRAN program (see page 4-3)

GPSS  GENERAL PURPOSE SIMULATION SYSTEM V
MIMIC  A DIGITAL/ANALOG SIMULATION LANGUAGE OF SOLVING SYSTEMS OF
ORDINARY DIFFERENTIAL EQUATIONS

MNF  MINNESOTA FORTRAN (MNF) IS AN ALTERNATIVE COMPILER WHICH
HAS VERY GOOD DIAGNOSTICS

NASTRAN  A GENERAL PURPOSE FINITE ELEMENT STRUCTURAL ANALYSIS PROGRAM

NETED  TEXT EDITOR (MODELLED AFTER THE STANDARD ARPANET EDITOR)
(25)

OMNITAB  ENABLES THE NON-PROGRAMMER TO PERFORM DATA, STATISTICAL AND
NUMERICAL ANALYSIS

PLI  A SUBSET OF ANSI PL/I

PROSE  A TEXT PROCESSOR (31)

PURGALL  PURGE (ALL OF) THE FILES OF SPECIFIED AC AND ID (2)

RATFOR  CONVERT RATIONAL FORTRAN TEXT INTO CDC FTN TEXT (12)

RNF  TEXT PROCESSOR (45)

SHARP  SHIP ANALYSIS AND RETRIEVAL PROGRAM - A GENERALIZED DATA
BASE MANAGEMENT SYSTEM

SIMSCRIPT II.5  A GENERAL PURPOSE SIMULATION LANGUAGE AND A DISCRETE EVENT
SIMULATOR

SNOBOL  SNOBOL4 - VERSION 3.10 - USER'S GUIDE (37)

SYSTEM 2000  A DATA BASE MANAGEMENT SYSTEM

WRITE  CHARACTER CONVERSION FOR DOCUMENTS CREATED BY PROSE (10)
DOCUMENTS DESCRIBING THE PASCAL 6000 VERSION 3 SYSTEM MAY BE PRINTED BY:

BEGIN,DOCGET,,PASCAL,,<DOC>,OUTPUT,MSACCES=<PASSWORD>.

WHERE <DOC> IS:

PASCAL  PASCAL 6000 COMPILER RELEASE 3  (92)
PASCLIB  PASCAL LIBRARIES (COMPILE-TIME: PSRCLIB; RUN-TIME: PASCLIB)  (77)
PTOOLS  SEVEN DOCUMENTS DESCRIBING EIGHT TOOLS FOR PASCAL PROGRAMS  (34)
***** SUBPROGRAMS *****

THE COMPUTER CENTER MAINTAINS SEVERAL LIBRARIES OF SUBPROGRAMS IN RELOCATABLE OBJECT FORM. THIS CHAPTER DESCRIBES THE FOLLOWING LIBRARIES AND LISTS THE CONTENTS OF EACH WITH DESCRIPTIVE TITLES (REFERENCES ARE GIVEN FOR THE WRITE-UPS):

ARLNALG - AEROSPACE RESEARCH LABORATORIES LINEAR ALGEBRA LIBRARY
EISPACK - SOLVE EIGENVALUE AND EIGENVECTOR PROBLEMS
FUNPACK - SPECIAL FUNCTIONAL SUBROUTINE PACKAGE FROM ARGONNE NATIONAL LABORATORY
IMSL - INTERNATIONAL MATHEMATICAL AND STATISTICAL LIBRARIES PACKAGE
LINPACK - SOLVE SYSTEMS OF SIMULTANEOUS LINEAR EQUATIONS
MINPACK - SOLVE NON-LINEAR EQUATIONS AND NON-LINEAR LEAST SQUARES PROBLEMS
MSL - CDC MATH SCIENCE LIBRARY
NSRDC - DTNSRDC WRITTEN AND/OR SUPPORTED SCIENTIFIC AND UTILITY SUBROUTINES
NSRDC5 - DTNSRDC WRITTEN AND/OR SUPPORTED SCIENTIFIC AND UTILITY SUBROUTINES WHICH USE UNIQUE FEATURES OF FORTRAN 77
SANDIA - ORDINARY DIFFERENTIAL EQUATION SOLVERS FROM SANDIA LABORATORIES

THESE ROUTINES ARE USED PRIMARILY WITH FTN5, FTN4, MNF OR RATFOR PROGRAMS AND MOST ARE CODED IN FORTRAN.

TO ACCESS ANY LIBRARY:

ATTACH,<LIB>.  
LDSET,LIB=<LIB>.  OR LIBRARY,<LIB>.  
LGO.  OR OTHER LOAD AND EXECUTE CARD(S)

FOR EXAMPLE,

JOBNAME.  
CHARGE,....  
FTN5.  
ATTACH,NSRDC5.  
ATTACH,NSRDC.  
LDSET,LIB=NSRDC5/NSRDC.  
LGO.  
' 7/8/9 EOR  
PROGRAM TEST (INPUT=128, OUTPUT=128)  
...  
CALL ANOVA1 (...)  
...  
END  
' 7/8/9 EOR  
(DATA CARDS)  
" 6/7/8/9 E01

INDIVIDUAL MACHINE-READABLE DOCUMENTS, WHEN AVAILABLE, MAY BE PRINTED (SEE PAGE 1-2).
THE AEROSPACE RESEARCH LABORATORIES (ARL) LINEAR ALGEBRA LIBRARY IS A COLLECTION OF 34 SUBROUTINES FOR SOLUTIONS TO LINEAR SYSTEMS AND DETERMINATION OF EIGENVALUES AND EIGENVECTORS OF REAL SYMMETRIC MATRICES. SOME OF THESE ROUTINES ARE SPECIFICALLY OPTIMIZED FOR THE CDC 6000 SERIES COMPUTERS.


MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'ARLNALG' INCLUDE:

- **BAC1** EIGENVECTORS OF A SYMMETRIC MATRIX FROM THOSE OF ITS TRIDIAGONAL FORM
- **BAC2** EIGENVECTORS OF A SYMMETRIC MATRIX FROM THOSE OF ITS TRIDIAGONAL FORM
- **BISEC** EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX BY THE BISECTION METHOD
- **FIP** FAST INNER PRODUCT EVALUATION OPTIMIZED FOR THE CDC 6000
- **IMPR1** ITERATIVE IMPROVEMENT TO MACHINE ACCURACY OF THE SOLUTION X OF AX = B OBTAINED USING SUBROUTINE LEQS1
- **IMPR2** ITERATIVE IMPROVEMENT TO MACHINE ACCURACY OF THE SOLUTION X OF AX = B OBTAINED USING SUBROUTINE LEQS2
- **IMQL1** EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC MATRIX
- **INIT** EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX BY INVERSE ITERATION
- **LEQS1** SOLUTION OF A LINEAR SYSTEM GIVEN A TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY LU1
- **LEQS2** SOLUTION OF A LINEAR SYSTEM GIVEN A TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY LU2
- **LEQS3** SOLUTION OF A LINEAR SYSTEM GIVEN A TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY LU3
- **LEQS4** SOLUTION OF A LINEAR SYSTEM GIVEN A TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY LU4
- **LEQS5** SOLUTION OF A LINEAR SYSTEM GIVEN A TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY LU5
- **LEQS6** SOLUTION OF A LINEAR SYSTEM GIVEN A TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY LU6
LU1  LU FACTORIZATION OF A REAL SQUARE MATRIX

LU2  LU FACTORIZATION OF A REAL SQUARE MATRIX BY THE CROUT METHOD WITH ACCUMULATING INNER PRODUCTS

LU3  LU FACTORIZATION OF A REAL SQUARE MATRIX

LU4  LU FACTORIZATION OF A REAL BAND MATRIX A TOGETHER WITH THE NUMBER OF POSITIVE EIGENVALUES IF A IS SYMMETRIC

LU5  CHOLESKY FACTORIZATION OF A POSITIVE DEFINITE REAL SYMMETRIC MATRIX

LU6  CHOLESKY FACTORIZATION OF A POSITIVE DEFINITE REAL SYMMETRIC BAND MATRIX

ORIMP  ITERATIVE IMPROVEMENT OF THE SOLUTION X OF AX = B OBTAINED USING SUBROUTINE ORSOL

ORSOL  LEAST SQUARES SOLUTION OF A LINEAR SYSTEM GIVEN AN ORTHOGONAL-TRIANGULAR FACTORIZATION OF THE COEFFICIENT MATRIX PRODUCED BY SUBROUTINE ORTHO

ORTHO  ORTHOGONAL TRANSFORMATION OF A GIVEN GENERAL M BY N MATRIX A TO UPPER TRIANGULAR FORM

ORTH02  ORTHOGONAL TRANSFORMATION OF A GENERAL M BY N MATRIX A TO UPPER TRIANGULAR FORM AND THE SOLUTION OF THE ASSOCIATED LINEAR LEAST SQUARES PROBLEM

QZABX  SOLUTION OF THE GENERALIZED MATRIX EIGENVALUE PROBLEM USING THE QZ ALGORITHM

REBAKA  RECOVERY OF EIGENVECTORS OF GENERALIZED SYMMETRIC EIGENVALUE PROBLEM FROM THOSE OF STANDARD FORM PRODUCED BY REDUC1

REDUC1  REDUCTION OF THE GENERALIZED SYMMETRIC EIGENVALUE PROBLEM TO STANDARD FORM

RITZIT  ITERATIVE COMPUTATION OF EIGENVALUES LARGEST IN MAGNITUDE AND CORRESPONDING EIGENVECTORS OF A REAL SYMMETRIC MATRIX

RNQL1  EIGENVALUES OF A REAL SYMMETRIC TRIDIAGONAL MATRIX

SVD  SINGULAR VALUE DECOMPOSITION OF A REAL RECTANGULAR MATRIX

TRI1  FAST HOUSEHOLDER TRIDIAGONAL FORM OF A REAL SYMMETRIC MATRIX

TRI2  COMPACT HOUSEHOLDER TRIDIAGONAL FORM OF A REAL SYMMETRIC MATRIX

TRI3  FAST HOUSEHOLDER TRIDIAGONAL FORM OF A REAL SYMMETRIC MATRIX FOR THE QL ALGORITHM

TRI4  HOUSEHOLDER TRIDIAGONAL FORM OF A REAL SYMMETRIC MATRIX FOR THE QL ALGORITHM
**THE EIGENSYSTEM PACKAGE FROM ARGONNE NATIONAL LABORATORY IS A COLLECTION OF 70 SUBROUTINES TO SOLVE EIGENVECTOR AND EIGENVALUE PROBLEMS. ROUTINES IN THIS PACKAGE ARE OFTEN SUPERIOR IN SPEED AND ACCURACY TO SIMILAR ROUTINES IN OTHER PACKAGES.**

**REFERENCES:** LECTURE NOTES IN COMPUTER SCIENCE, VOLUME 6, "MATRIX EIGENSYSTEM ROUTINES - EISPACK GUIDE", SMITH, ET AL, SPRINGER-VERLAG, BERLIN-HEIDELBERG-NEW YORK, 1974.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

**ROUTINES IN LIBRARY 'EISPACK' INCLUDE:**

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAKVEC</td>
<td>BACK TRANSFORM THE EIGENVECTORS OF THAT SYMMETRIC TRIDIAGONAL MATRIX DETERMINED BY FIGI</td>
</tr>
<tr>
<td>BALANC</td>
<td>BALANCE A REAL GENERAL MATRIX</td>
</tr>
<tr>
<td>BALBAK</td>
<td>BACK TRANSFORM THE EIGENVECTORS OF THAT REAL MATRIX TRANSFORMED BY BALANC</td>
</tr>
<tr>
<td>BANDR</td>
<td>REDUCE A REAL SYMMETRIC BAND MATRIX TO A SYMMETRIC TRIDIAGONAL MATRIX USING AND OPTIONALLY ACCUMULATING ORTHOGONAL TRANSFORMATIONS</td>
</tr>
<tr>
<td>BANDV</td>
<td>DETERMINE SOME EIGENVECTORS OF A REAL SYMMETRIC BAND MATRIX OR SOLVE BAND EQUATIONS</td>
</tr>
<tr>
<td>BISECT</td>
<td>DETERMINE SOME EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX</td>
</tr>
<tr>
<td>BQR</td>
<td>DETERMINE SOME EIGENVALUES OF A REAL SYMMETRIC BAND MATRIX</td>
</tr>
<tr>
<td>CBABK2</td>
<td>BACK TRANSFORM THE EIGENVECTORS OF THAT COMPLEX MATRIX TRANSFORMED BY CBAL</td>
</tr>
<tr>
<td>CBAL</td>
<td>BALANCE A COMPLEX GENERAL MATRIX</td>
</tr>
<tr>
<td>CG</td>
<td>DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX GENERAL MATRIX</td>
</tr>
<tr>
<td>CH</td>
<td>DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX HERMITIAN MATRIX</td>
</tr>
<tr>
<td>CINVIT</td>
<td>DETERMINE THOSE EIGENVECTORS OF A COMPLEX UPPER HESSENBERG MATRIX CORRESPONDING TO SPECIFIED EIGENVALUES</td>
</tr>
<tr>
<td>COMBAK</td>
<td>BACK TRANSFORM THE EIGENVECTORS OF THAT UPPER HESSENBERG MATRIX DETERMINED BY COMHES</td>
</tr>
<tr>
<td>COMHES</td>
<td>REDUCE A COMPLEX GENERAL MATRIX TO COMPLEX UPPER HESSENBERG FORM USING ELEMENTARY TRANSFORMATIONS</td>
</tr>
<tr>
<td>COMLR</td>
<td>DETERMINE THE EIGENVALUES OF A COMPLEX UPPER HESSENBERG MATRIX</td>
</tr>
</tbody>
</table>
COMLR2 DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX UPPER HESSENBERG MATRIX

COMQR DETERMINE THE EIGENVALUES OF A COMPLEX UPPER HESSENBERG MATRIX

COMQR2 DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX HESSENBERG MATRIX

CORTB BACK TRANSFORM THE EIGENVECTORS OF THAT UPPER HESSENBERG MATRIX DETERMINED BY CORTH

CORTH REDUCE A COMPLEX GENERAL MATRIX TO UPPER HESSENBERG FORM USING UNITARY TRANSFORMATIONS

ELMBAK BACK TRANSFORM THE EIGENVECTORS OF THAT UPPER HESSENBERG MATRIX DETERMINED BY ELMHES

ELMHES REDUCE A REAL GENERAL MATRIX TO UPPER HESSENBERG FORM USING ELEMENTARY TRANSFORMATIONS

ELTRAN ACCUMULATE THE TRANSFORMATIONS IN THE REDUCTION OF A REAL GENERAL MATRIX BY ELMHES

FIGI TRANSFORM A CERTAIN REAL NON-SYMMETRIC TRIDIAGONAL MATRIX TO A SYMMETRIC TRIDIAGONAL MATRIX

FIGI2 TRANSFORM A CERTAIN REAL NON-SYMMETRIC TRIDIAGONAL MATRIX TO A SYMMETRIC TRIDIAGONAL MATRIX ACCUMULATING THE DIAGONAL TRANSFORMATIONS

HQR DETERMINE THE EIGENVALUES OF A REAL UPPER HESSENBERG MATRIX

HQR2 DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A REAL UPPER HESSENBERG MATRIX

HTRIBK BACK TRANSFORM THE EIGENVECTORS OF THAT SYMMETRIC TRIDIAGONAL MATRIX DETERMINED BY HTRIDI

HTRIB3 BACK TRANSFORM THE EIGENVECTORS OF THAT SYMMETRIC TRIDIAGONAL MATRIX DETERMINED BY HTRID3

HTRIDI REDUCE A COMPLEX HERMETIAN MATRIX TO A REAL SYMMETRIC TRIDIAGONAL MATRIX USING UNITARY TRANSFORMATIONS

HTRID3 REDUCE A COMPLEX HERMETIAN MATRIX, STORED AS A SINGLE SQUARE ARRAY, TO A REAL SYMMETRIC TRIDIAGONAL MATRIX USING UNITARY TRANSFORMATIONS

IMTQLV DETERMINE THE EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

IMTQL1 DETERMINE THE EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

IMTQL2 DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX

INVIT DETERMINE THOSE EIGENVECTORS OF A REAL UPPER HESSENBERG MATRIX CORRESPONDING TO SPECIFIED EIGENVALUES
MINFIT  COMPUTE THE SINGULAR VALUE DECOMPOSITION OF AN ARBITRARY REAL
RECTANGULAR MATRIX AND THE SOLUTION OF A RELATED LINEAR LEAST
SQUARES PROBLEM

ORTBAK  BACK TRANSFORM THE EIGENVECTORS OF THAT UPPER HESSENBerg
MATRIX DETERMINED BY ORTHES

ORTHES  REDUCE A REAL GENERAL MATRIX TO UPPER HESSENBerg FORM USING
ORTHOGONAL TRANSFORMATIONS

ORTRAN  ACCUMULATE THE TRANSFORMATIONS IN THE REDUCTION OF A REAL
GENERAL MATRIX BY ORTHES

QZHAS  SIMULTANEOUSLY REDUCE ONE OF A PAIR OF REAL GENERAL MATRICES
TO UPPER HESSENBerg FORM AND THE OTHER TO UPPER TRIANGULAR
FORM USING AND OPTIONALLY ACCUMULATING ORTHOGONAL
TRANSFORMATIONS

QZIT  REDUCE ONE OF A PAIR OF REAL MATRICES FROM UPPER HESSENBerg
TO QUASI-UPPER TRIANGULAR FORM WHILE MAINTAINING THE UPPER
TRIANGULAR FORM OF THE OTHER USING AND OPTIONALLY
ACCUMULATING ORTHOGONAL TRANSFORMATIONS

QZVAL  EXTRACT THE GENERALIZED EIGENVALUES OF A REAL MATRIX SYSTEM
WITH ONE MATRIX IN QUASI-UPPER TRIANGULAR FORM AND THE OTHER
IN UPPER TRIANGULAR FORM USING AND OPTIONALLY ACCUMULATING
ORTHOGONAL TRANSFORMATIONS

QZVEC  DETERMINE THE GENERALIZED EIGENVECTORS OF A REAL MATRIX
SYSTEM WITH ONE IN QUASI-UPPER TRIANGULAR FORM AND THE OTHER
IN UPPER TRIANGULAR FORM USING BACK SUBSTITUTION

RATQR  DETERMINE SOME EXTREME EIGENVALUES OF A SYMMETRIC TRIDIOAGONAL
MATRIX

REBAKB  BACK TRANSFORM THE EIGENVECTORS OF THAT DERIVED SYMMETRIC
MATRIX DETERMINED BY REDUC2

REBAK  BACK TRANSFORM THE EIGENVECTORS OF THAT DERIVED SYMMETRIC
MATRIX DETERMINED BY REDUC OR REDUC2

REDC  REDUCE A CERTAIN GENERALIZED SYMMETRIC EIGENPROBLEM TO THE
STANDARD SYMMETRIC EIGENPROBLEM USING CHOLSKY DECOMPOSITION

REDUC2  REDUCE CERTAIN GENERALIZED SYMMETRIC EIGENPROBLEMS TO
STANDARD SYMMETRIC EIGENPROBLEMS USING CHOLSKY DECOMPOSITION

RG  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND
EIGENVECTORS OF A REAL GENERAL MATRIX

RGG  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND
EIGENVECTORS FOR THE REAL GENERAL GENERALIZED EIGENPROBLEM
A"X = (LAMBDA)"B"X

RS  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND
EIGENVECTORS OF A REAL SYMMETRIC MATRIX
RSB  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC BAND MATRIX

RSG  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS FOR THE REAL SYMMETRIC GENERALIZED EIGENPROBLEM

\[ A^\times x = (\lambda) B^\times x \]

RSGAB DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS FOR THE REAL SYMMETRIC GENERALIZED EIGENPROBLEM

\[ A^\times B^\times x = (\lambda) x \]

RSGBA DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS FOR THE REAL SYMMETRIC GENERALIZED EIGENPROBLEM

\[ B^\times A^\times x = (\lambda) x \]

RSP  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC PACKED MATRIX

RST  DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC TRIDIAGONAL MATRIX

RT   DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A CERTAIN REAL TRIDIAGONAL MATRIX

SVD   COMPUTE THE SINGULAR VALUE DECOMPOSITION OF AN ARBITRARY REAL RECTANGULAR MATRIX

TINVIT DETERMINE SOME EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX

TQLRAT DETERMINE THE EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

TQL1  DETERMINE THE EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

TQL2  DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX

TRBAK1 BACK TRANSFORM THE EIGENVECTORS OF THAT SYMMETRIC TRIDIAGONAL MATRIX DETERMINED BY TRED1

TRBAK3 BACK TRANSFORM THE EIGENVECTORS OF THAT SYMMETRIC TRIDIAGONAL MATRIX DETERMINED BY TRED3

TRED1 REDUCE A REAL SYMMETRIC MATRIX TO A SYMMETRIC TRIDIAGONAL MATRIX USING ORTHOGONAL TRANSFORMATIONS

TRED2 RETURN A REAL SYMMETRIC MATRIX TO A SYMMETRIC TRIDIAGONAL MATRIX ACCUMULATING THE ORTHOGONAL TRANSFORMATIONS

TRED3 REDUCE A REAL SYMMETRIC MATRIX, STORED AS A ONE-DIMENSIONAL ARRAY, TO A SYMMETRIC TRIDIAGONAL MATRIX USING ORTHOGONAL TRIDIAGONAL MATRIX USING ORTHOGONAL TRANSFORMATIONS

TRIDIB DETERMINE SOME EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

TSTURM DETERMINE SOME EIGENVALUES AND EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX
SPECIAL FUNCTIONAL SUBROUTINE PACKAGE FROM ARGONNE NATIONAL LABORATORY CONTAINING 24 USER-CALLABLE ROUTINES FOR BESSEL FUNCTIONS, DAWSON'S INTEGRAL, ELLIPTIC INTEGRALS OF THE FIRST AND SECOND KIND AND EXPONENTIAL INTEGRAL.

REFERENCES: MASTER DOCUMENTS ON FILE IN USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'FUNPACK' INCLUDE:

<table>
<thead>
<tr>
<th>Routine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSEI0</td>
<td>Function to calculate modified Bessel functions of the first kind of order zero, ( \exp(-\text{ABS}(x)) \times i0(x) )</td>
</tr>
<tr>
<td>BSEI1</td>
<td>Function to calculate modified Bessel functions of the first kind of order one, ( \exp(-\text{ABS}(x)) \times i1(x) )</td>
</tr>
<tr>
<td>BSEK0</td>
<td>Compute modified Bessel functions of the second kind of order zero, ( \exp(x) \times k0(x) ), for real, positive ( x )</td>
</tr>
<tr>
<td>BSEK1</td>
<td>Compute modified Bessel functions of the second kind of order one, ( \exp(x) \times k1(x) ), for real, positive ( x )</td>
</tr>
<tr>
<td>BESI0</td>
<td>Function to calculate modified Bessel functions of the first kind of order zero, ( i0(x) )</td>
</tr>
<tr>
<td>BESI1</td>
<td>Function to calculate modified Bessel functions of the first kind of order one, ( i1(x) )</td>
</tr>
<tr>
<td>BESJ0</td>
<td>Function to calculate Bessel functions of the first kind of order zero, ( j0(x) )</td>
</tr>
<tr>
<td>BESJ1</td>
<td>Function to calculate Bessel functions of the first kind of order one, ( j1(x) )</td>
</tr>
<tr>
<td>BESK0</td>
<td>Compute modified Bessel functions of the second kind of order zero, ( k0(x) ), for real, positive ( x )</td>
</tr>
<tr>
<td>BESK1</td>
<td>Compute modified Bessel functions of the second kind of order one, ( k1(x) ), for real, positive ( x )</td>
</tr>
<tr>
<td>BESY</td>
<td>Subroutine to compute Bessel functions of the second kind of non-negative order, ( y-\text{SUB}-\text{NU}(x) ), for real, positive ( x ) (see YNU)</td>
</tr>
<tr>
<td>DAW</td>
<td>Function to compute Dawson's integral for all real arguments</td>
</tr>
</tbody>
</table>
EI  COMPUTE EXPONENTIAL INTEGRAL, EI(X)

ELIEI  COMPUTE COMPLETE ELLIPTIC INTEGRALS OF THE SECOND KIND, E(CAY**2)

ELIEM  COMPUTE COMPLETE ELLIPTIC INTEGRALS OF THE SECOND KIND, E(1-ETA)

ELIKI  COMPUTE COMPLETE ELLIPTIC INTEGRALS OF THE FIRST KIND, K(CAY**2)

ELIKM  COMPUTE COMPLETE ELLIPTIC INTEGRALS OF THE FIRST KIND, K(1-ETA)

ELIPE  COMPUTE COMPLETE COMPLETE ELLIPTIC INTEGRALS OF THE SECOND KIND, E(CAYSQ)

ELIPK  COMPUTE COMPLETE ELLIPTIC INTEGRALS OF THE FIRST KIND, K(CAYSQ)

EONE  COMPUTE EXPONENTIAL INTEGRAL, E-SUB-1(X)

EXPEI  COMPUTE EXPONENTIAL INTEGRAL, EXP(-X)*EI(X)

MONERR  ERROR HANDLING FACILITIES, INCLUDING USER INTERACTION, FOR FUNPACK

PSI  FUNCTION TO COMPUTE LOGARITHMIC DERIVATIVE OF THE GAMMA FUNCTION FOR REAL ARGUMENTS.

YNU  FUNCTION TO COMPUTE BESSEL FUNCTIONS OF THE SECOND KIND OF NON-NEGATIVE REAL ORDER, Y-SUB-NU(X), FOR REAL, POSITIVE X (SEE BESY)
THE INTERNATIONAL MATHEMATICAL AND STATISTICAL LIBRARIES PACKAGE
(EDITION 9) CONTAINS OVER 517 SUBROUTINES IN THE FOLLOWING AREAS:

A - ANALYSIS OF EXPERIMENTAL DESIGN DATA
B - BASIC STATISTICS
C - CATEGORIZED DATA ANALYSIS
D - DIFFERENTIAL EQUATIONS, QUADRATURE, DIFFERENTIATION
E - EIGENANALYSIS
F - FORECASTING, ECONOMETRICS, TIME SERIES
G - GENERATION AND TESTING OF RANDOM NUMBERS, GOODNESS OF FIT
I - INTERPOLATION, APPROXIMATION AND SMOOTHING
L - LINEAR ALGEBRAIC EQUATIONS
M - MATHEMATICAL AND STATISTICAL SPECIAL FUNCTIONS
N - NONPARAMETRIC STATISTICS
O - OBSERVATION STRUCTURE
R - REGRESSION ANALYSIS
S - SAMPLING
U - UTILITY FUNCTIONS
V - VECTOR-MATRIX ARITHMETIC
Z - ZEROS AND EXTREMA, LINEAR PROGRAMMING

REFERENCES: THE IMSL LIBRARY, VOLUMES 1 THRU 4.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING
PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'IMSL' INCLUDE:

AAHELP DETAILED INFORMATION ON IMSL CONVENTIONS FOR DOCUMENTATION
AND NOTATION, INPUT/OUTPUT, ERROR DETECTING, MATRIX/VECTOR
STORAGE MODES

ABIBN ANALYSIS OF BALANCED INCOMPLETE BLOCK AND BALANCED LATTICE
DESIGNS

ACRDAN ANALYSIS OF ONE-WAY CLASSIFICATION DESIGN DATA

ACTRST CONTRAST ESTIMATES AND SUMS OF SQUARES

AFACN FULL FACTORIAL PLAN ANALYSIS

AFACT SUMS OF SQUARES, MEAN SQUARES, DEGREES OF FREEDOM, AND MEANS
FOR ALL EFFECTS IN A FULL FACTORIAL PLAN, ALLOWING
REPLICATION ON OPTION

AGBACP ANALYSIS OF BALANCED COMPLETE EXPERIMENTAL DESIGN STRUCTURE
DATA

AGLMOD GENERAL LINEAR MODEL ANALYSIS

AGVACL ONE OR TWO-SIDED INTERVAL ESTIMATE OF A VARIANCE COMPONENT

AGXPM EXPECTED MEAN SQUARES FOR BALANCED COMPLETE DESIGN MODELS
ALGAMA  EVALUATE THE LOG (BASE E) OF THE ABSOLUTE VALUE OF THE GAMMA FUNCTION (GLGAMA=ALGAMA)

ALSQAN  ANALYSIS OF LATIN SQUARE DESIGN DATA

AMEANS  PREPARATION OF A SET OF UNBALANCED DATA FOR ANALYSIS BY THE METHOD OF UNWEIGHTED MEANS

ANCOV1  COVARIANCE ANALYSIS FOR ONE-WAY CLASSIFICATION DESIGN DATA

ANESTE  ANALYSIS OF COMPLETELY NESTED DESIGN DATA WITH EQUAL NUMBERS IN THE SUBCLASSES

ANESTU  ANALYSIS OF COMPLETELY NESTED DESIGN DATA WITH UNEQUAL NUMBERS IN THE SUBCLASSES

AORDR  REORDERING OF THE DATA OBTAINED FROM ANY BALANCED COMPLETE EXPERIMENTAL DESIGN

ARCBAN  ANALYSIS OF TWO-WAY CLASSIFICATION DESIGN DATA

ASNKMC  STUDENT-NEWMAN-KEULS MULTIPLE COMPARISON TEST

BDCOU1  TALLY OF OBSERVATIONS INTO A ONE-WAY FREQUENCY TABLE

BDCOU2  TALLY OF OBSERVATIONS INTO A TWO-WAY FREQUENCY TABLE

BDLTV  PRODUCE LETTER-VALUE SUMMARY

BDTRGI  TRANSGENERATION OF THE COLUMNS OF A MATRIX (IN-CORE VERSION)

BDTRGO  TRANSGENERATION OF THE COLUMNS OF A MATRIX (OUT-OF-CORE VERSION)

BECOR  ESTIMATES OF MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENTS (OUT-OF-CORE VERSION)

BECORI  ESTIMATES OF MEANS, STANDARD DEVIATIONS, AND CORRELATION COEFFICIENTS (IN-CORE VERSION)

BECOVM  MEANS AND VARIANCE-COVARIANCE MATRIX

BECTR  TETRACHORIC CORRELATION COEFFICIENT ESTIMATION

BECVL  VARIANCES AND COVARIANCES OF LINEAR FUNCTIONS (OUT-OF-CORE VERSION)

BECVLI  VARIANCES AND COVARIANCES OF LINEAR FUNCTIONS (IN-CORE VERSION)

BEGRPS  MOMENTS ESTIMATION FOR GROUPED DATA WITH AND WITHOUT SHEPPARDS CORRECTIONS

BEIGRP  ESTIMATION OF BASIC STATISTICAL PARAMETERS USING GROUPED DATA

BEIUGR  ESTIMATION OF BASIC STATISTICAL PARAMETERS USING UNGROUPED DATA
BELBIN  INTERVAL ESTIMATE OF THE PARAMETER P OF THE BINOMIAL DISTRIBUTION
BELPOS  INTERVAL ESTIMATE OF THE PARAMETER LAMBDA OF THE POISSON DISTRIBUTION
BEMDP  MEDIAN POLISH OF A TWO-WAY TABLE
BEMIRI  ESTIMATES OF MEANS, SIMPLE REGRESSION COEFFICIENTS, THEIR INTERCEPTS, STANDARD ERRORS OF THE REGRESSION COEFFICIENTS, AND STANDARD DEVIATIONS FOR ARRAYS WHICH CONTAIN MISSING VALUES (IN-CORE VERSION)
BEMIRO  ESTIMATES OF MEANS, SIMPLE REGRESSION COEFFICIENTS, THEIR INTERCEPTS, STANDARD ERRORS OF THE REGRESSION COEFFICIENTS, AND STANDARD DEVIATIONS FOR ARRAYS WHICH CONTAIN MISSING VALUES (OUT-OF-CORE VERSION)
BEMMI  ESTIMATES OF MEANS, STANDARD DEVIATIONS, CORRELATION COEFFICIENTS, SKEWNESS AND KURTOSIS FROM A DATA MATRIX CONTAINING MISSING OBSERVATIONS (IN-CORE VERSION)
BEMMO  ESTIMATES OF MEANS, STANDARD DEVIATIONS, CORRELATION COEFFICIENTS, SKEWNESS AND KURTOSIS FROM A DATA MATRIX CONTAINING MISSING OBSERVATIONS (OUT OF CORE VERSION)
BEMNON  LOCATION (MEAN) INFERENCE USING A SAMPLE FROM A NORMAL POPULATION WITH KNOWN VARIANCE
BEMSON  MEAN AND VARIANCE INFERENCE USING A SAMPLE FROM A NORMAL POPULATION
BENSON  VARIANCE INFERENCE USING A SAMPLE FROM A NORMAL POPULATION WITH KNOWN MEAN
BEPAT  MEAN AND VARIANCE INFERENCE USING SAMPLES FROM EACH OF TWO NORMAL POPULATIONS WITH UNEQUAL VARIANCES
BEPET  MEAN AND VARIANCE INFERENCE USING SAMPLES FROM EACH OF TWO NORMAL POPULATIONS WITH EQUAL VARIANCES
BESRB  BISERIAL AND POINT-BISERIAL CORRELATION COEFFICIENTS FOR A QUALITATIVELY DICHOTOMIZED VARIABLE AND A NUMERICALLY MEASURABLE AND CLASSIFIED VARIABLE
BESRN  BISERIAL CORRELATION COEFFICIENT FOR A QUALITATIVELY DICHOTOMIZED VARIABLE AND A NUMERICALLY OR QUALITATIVELY CLASSIFIED VARIABLE
CAXPY  COMPUTE A CONSTANT TIMES A VECTOR PLUS A VECTOR, ALL COMPLEX (VBLA=CAXPY)
CBNRHO  ESTIMATION OF THE BIVARIATE NORMAL CORRELATION COEFFICIENT USING A CONTINGENCY TABLE
CCOPY  COPY A VECTOR X TO A VECTOR Y, BOTH COMPLEX (VBLA=CCOPY)
CDOTC  COMPUTE COMPLEX DOT PRODUCT USING CONJUGATED VECTOR COMPONENTS (VBLA=CDOTC)

CDOTU  COMPUTE COMPLEX DOT PRODUCT USING UNCONJUGATED VECTOR COMPONENTS (VBLA=CDOTU)

CSCAL  COMPUTE A COMPLEX CONSTANT TIMES A COMPLEX VECTOR (VBLA=CSCAL)

CSSCAL COMPUTE A REAL CONSTANT TIMES A COMPLEX VECTOR (VBLA=CSSCAL)

CSWAP  INTERCHANGE VECTORS X AND Y, BOTH COMPLEX (VBLA=CSWAP)

CTLLF  LOG-LINEAR FIT OF CONTINGENCY TABLE

CTPR   COMPUTE EXACT PROBABILITIES FOR CONTINGENCY TABLES

CTRBYC ANALYSIS OF A CONTINGENCY TABLE

CZDOTC COMPUTE COMPLEX DOT PRODUCT USING CONJUGATED VECTOR COMPONENTS (AND DOUBLE PRECISION ACCUMULATION) (VBLA=CZDOTC)

CZDOTU COMPUTE COMPLEX DOT PRODUCT USING UNCONJUGATED VECTOR COMPONENTS (AND DOUBLE PRECISION ACCUMULATION) (VBLA=CZDOTU)

DASUM  COMPUTE DOUBLE PRECISION SUM OF ABSOLUTE VALUES (VBLA=DASUM)

DAXPY  COMPUTE A CONSTANT TIMES A VECTOR PLUS A VECTOR, ALL DOUBLE PRECISION (VBLA=DAXPY)

DBCEVU BICUBIC SPLINE MIXED PARTIAL DERIVATIVE EVALUATOR

DBCQDU BICUBIC SPLINE QUADRATURE

DBLINT NUMERICAL INTEGRATION BY ADAPTIVE ROMBERG METHOD (OVER A RECTANGLE)

DCADRE NUMERICAL INTEGRATION OF A FUNCTION USING CAUTIOUS ADAPTIVE ROMBERG EXTRAPOLATION

DCOPY  COPY A VECTOR X TO A VECTOR Y, BOTH DOUBLE PRECISION (VBLA=DCOPY)

DCSEVU CUBIC SPLINE FIRST AND SECOND DERIVATIVE EVALUATOR

DCSQDU CUBIC SPLINE QUADRATURE

DDOT   COMPUTE DOUBLE PRECISION DOT PRODUCT (VBLA-DDOT)

DGEAR  DIFFERENTIAL EQUATION SOLVER - VARIABLE ORDER ADAMS PREDICTOR CORRECTOR METHOD OR GEARS METHOD

DNRM2  COMPUTE THE EUCLIDEAN LENGTH OR L2 NORM OF A DOUBLE PRECISION VECTOR (VBLA=DNRM2)

DREBS  DIFFERENTIAL EQUATION SOLVER - BURLISCH-STOER EXTRAPOLATION METHOD
DROT APPLY GIVENS PLANE ROTATION (DOUBLE PRECISION) (VBLA=DROT)

DROTG CONSTRUCT GIVENS PLANE ROTATION (DOUBLE PRECISION) (VBLA=DROTG)

DROTM APPLY A MODIFIED GIVENS PLANE ROTATION (DOUBLE PRECISION) (VBLA=DROTM)

DROTMG CONSTRUCT A MODIFIED GIVENS PLANE ROTATION (DOUBLE PRECISION) (VBLA=DROTMG)

DSCAL COMPUTE A DOUBLE PRECISION CONSTANT TIMES A DOUBLE PRECISION VECTOR (VBLA=DSCAL)

DSDOT COMPUTE SINGLE PRECISION DOT PRODUCT USING DOUBLE PRECISION ACCUMULATION (VBLA=DSDOT)

DSWAP INTERCHANGE VECTORS X AND Y, BOTH DOUBLE PRECISION (VBLA=DSWAP)

DTPTB MULTIPLE SHOOTING METHOD (BOUNDARY VALUE)

DVERK DIFFERENTIAL EQUATION SOLVER - RUNGE KUTTA-VERNER FIFTH AND SIXTH ORDER METHOD

EBALAC BALANCE A COMPLEX GENERAL MATRIX AND ISOLATE EIGENVALUES WHENEVER POSSIBLE

EBALAF BALANCE A REAL MATRIX IN THE EUCLIDEAN NORM

EBBCKC BACK TRANSFORMATION OF THE EIGENVECTORS OF A BALANCED COMPLEX MATRIX TO FORM THE EIGENVECTORS OF THE ORIGINAL MATRIX

EBBCKF BACK TRANSFORMATION OF THE EIGENVECTORS OF A BALANCED REAL MATRIX TO FORM THE EIGENVECTORS OF THE ORIGINAL MATRIX

EHBCKF BACK TRANSFORMATION OF THE EIGENVECTORS OF A REAL UPPER HESSENBERG MATRIX TO FORM THE EIGENVECTORS OF THE ORIGINAL MATRIX

EHBCKH BACK TRANSFORMATION OF THE EIGENVECTORS OF A REAL SYMMETRIC TRIDIAGONAL MATRIX OBTAINED FROM THE HOUSEHOLDER REDUCTION OF A HERMITIAN MATRIX

EHESSC REDUCTION OF A GENERAL COMPLEX MATRIX TO COMPLEX UPPER HESSENBERG FORM

EHESSF REDUCTION OF A NONSymmetric MATRIX TO UPPER HESSENBERG FORM BY ORTHOGONAL TRANSFORMATIONS

EHOBKS BACK TRANSFORMATION TO FORM THE EIGENVECTORS OF THE ORIGINAL SYMMETRIC MATRIX FROM THE EIGENVECTORS OF THE TRIDIAGONAL MATRIX

EHOUCH REDUCTION OF A COMPLEX HERMITIAN MATRIX TO REAL SYMMETRIC TRIDIAGONAL FORM
EHOUSS  REDUCTION OF A SYMMETRIC MATRIX TO SYMMETRIC TRIDIAGONAL FORM USING A HOUSEHOLDER REDUCTION

EIGBS  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A BAND SYMMETRIC MATRIX

EIGCC  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A COMPLEX GENERAL MATRIX

EIGCH  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A COMPLEX HERMITIAN MATRIX

EIGRF  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A REAL GENERAL MATRIX IN FULL STORAGE MODE

EIGRS  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A REAL SYMMETRIC MATRIX IN SYMMETRIC STORAGE MODE

EIGZC  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF THE SYSTEM A^2X=\LAMBDA^2B^2X WHERE A AND B ARE COMPLEX MATRICES

EIGZF  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF THE SYSTEM A^2X=\LAMBDA^2B^2X WHERE A AND B ARE REAL MATRICES

ELRH1C  EIGENVALUES OF A COMPLEX UPPER HESSENBERG MATRIX

ELRH2C  EIGENVALUES AND EIGENVECTORS OF A COMPLEX UPPER HESSENBERG MATRIX AND BACKTRANSFORMATION OF THE EIGENVECTORS

ELZHC  REDUCE TWO COMPLEX MATRICES, A AND B, SIMULTANEOUSLY, A TO UPPER HESSENBERG AND B TO UPPER TRIANGULAR FORM

ELZVC  CALCULATE THE EIGENVALUES AND, OPTIONALLY, EIGENVECTORS OF THE SYSTEM A^2Z=\LAMBDA^2B^2Z WHERE COMPLEX MATRIX A IS UPPER HESSENBERG AND COMPLEX MATRIX B IS UPPER TRIANGULAR

EQRH1F  EIGENVECTORS OF A REAL UPPER HESSENBERG MATRIX CORRESPONDING TO SPECIFIED EIGENVALUES

EQRH3F  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A REAL UPPER HESSENBERG MATRIX

EQT1S  SMALLEST OR LARGEST M EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

EQT2S  EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX USING THE QL METHOD

EQT3S  THE SMALLEST (OR LARGEST) EIGENVALUES OF A TRIDIAGONAL MATRIX IN ALGEBRAIC VALUE WHOSE SUM EXCEEDS A GIVEN VALUE

EQZQF  HESSENBERG REDUCTION FOR THE GENERALIZED EIGENVALUE PROBLEM A^2X=\LAMBDA^2B^2X. REDUCTION OF A TO UPPER HESSENBERG FORM AND B TO UPPER TRIANGULAR FORM
EQZTF

EXPLICIT QZ ITERATION FOR THE GENERALIZED EIGENVALUE PROBLEM
\[ A^x = \lambda B^x \]
WHERE A IS IN UPPER HESSENBERG FORM AND B IS
UPPER TRIANGULAR. A IS REDUCED TO QUASI-UPPER TRIANGULAR
FORM WHILE KEEPING MATRIX B UPPER TRIANGULAR.

EQZVF

EIGENVALUES AND OPTIONALLY, EIGENVECTORS OF THE GENERALIZED
EIGENVALUE PROBLEM \[ A^z = \lambda B^z \] WHERE B IS UPPER TRIANGULAR
AND A IS QUASI-UPPER TRIANGULAR.

ERF

EVALUATE THE ERROR FUNCTION (MERF=ERF)

ERFC

EVALUATE THE COMPLEMENTED ERROR FUNCTION (MERRC=ERFC)

FFTCC

FAST FOURIER TRANSFORM OF A COMPLEX VALUED SEQUENCE

FFTRC

FAST FOURIER TRANSFORM OF A REAL VALUED SEQUENCE

FFTSC

SINE AND COSINE TRANSFORMS OF A REAL VALUED SEQUENCE

FFT2C

FAST FOURIER TRANSFORM OF A COMPLEX VALUED SEQUENCE OF LENGTH
EQUAL TO A POWER TWO

FFI3D

FAST FOURIER TRANSFORM OF A COMPLEX VALUED ARRAY

FLINV

INVERSE LAPLACE TRANSFORM OF A COMPLEX FUNCTION

FTARPS

PRELIMINARY ESTIMATION OF THE AUTOREGRESSIVE PARAMETERS IN AN
ARIMA STOCHASTIC MODEL

FTAUTO

MEAN, VARIANCE, AUTOCOVARIANCES, AUTOCORRELATIONS, AND
PARTIAL AUTOCORRELATIONS FOR A STATIONARY TIME SERIES

FTCAST

TIME SERIES FORECASTS AND PROBABILITY LIMITS USING AN ARIMA
(BOX-JENKINS) MODEL

FTCMP

NON-SEASONAL ARIMA (BOX-JENKINS) STOCHASTIC MODEL ANALYSIS
FOR A SINGLE TIME SERIES WITH FULL PARAMETER ITERATION AND
MAXIMUM LIKELIHOOD ESTIMATION

FTCROS

MEANS, VARIANCES, CROSS-COVARIANCES, AND CROSS-CORRELATIONS
FOR TWO MUTUALLY STATIONARY N CHANNEL TIME SERIES

FTCRXY

CROSS-COVARIANCE OF TWO MUTUALLY STATIONARY TIME SERIES

FTFPS

FAST FOURIER TRANSFORM ESTIMATES OF POWER SPECTRA AND CROSS
SPECTRA OF TIME SERIES

FTFREQ

SINGLE OR MULTICHANNEL TIME SERIES ANALYSIS IN THE TIME AND
FREQUENCY DOMAINS

FTGEN

GENERATION OF A TIME SERIES FROM A GIVEN ARIMA (BOX-JENKINS)
STOCHASTIC MODEL

FTKALM

KALMAN FILTERING

FTMPS

PRELIMINARY ESTIMATION OF THE MOVING AVERAGE PARAMETERS IN AN
ARIMA STOCHASTIC MODEL
FTMXL  MAXIMUM LIKELIHOOD ESTIMATION OF AUTOREGRESSIVE AND MOVING AVERAGE PARAMETERS IN AN ARIMA (BOX-JENKINS) STOCHASTIC MODEL

FTRDIF  TRANSFORMATIONS, DIFFERENCES AND SEASONAL DIFFERENCES OF A TIME SERIES FOR MODEL IDENTIFICATION

FTTRN  PRELIMINARY PARAMETER ESTIMATES FOR A UNIVARIATE TRANSFER FUNCTION MODEL

FTWEIN  WIENER FORECAST FOR A STATIONARY STOCHASTIC PROCESS

FTWENM  MULTICHANNEL WIENER FORECAST

FTWENX  MAXIMUM LIKELIHOOD PARAMETER ESTIMATES FOR A MULTICHANNEL, SINGLE OUTPUT TIME SERIES MODEL

GAMMA  EVALUATE THE GAMMA FUNCTION

GFIT  CHI-SQUARED GOODNESS OF FIT TEST

GGAMR  ONE PARAMETER GAMMA RANDOM DEVIATE GENERATOR, AND USABLE AS THE BASIS FOR TWO PARAMETER GAMMA, EXPONENTIAL, CHI-SQUARED, CHI, BETA, T, AND F DEVIATE GENERATION

GGBN  BINOMIAL RANDOM DEVIATE GENERATOR

GGBNR  NEGATIVE BINOMIAL RANDOM DEVIATE GENERATOR

GBBTR  BETA RANDOM DEVIATE GENERATOR

GGCAY  CAUCHY RANDOM DEVIATE GENERATOR

GGCHS  CHI-SQUARED RANDOM DEVIATE GENERATOR

GGDA  GENERAL DISCRETE DISTRIBUTION RANDOM DEVIATE GENERATOR USING ALIAS METHOD

GGDT  GENERAL DISCRETE DISTRIBUTION RANDOM DEVIATE GENERATOR USING TABLE LOOKUP

GGEOT  GEOMETRIC RANDOM DEVIATE GENERATOR

GGEXN  EXPONENTIAL RANDOM DEVIATE GENERATOR

GGEXT  RANDOM DEVIATE GENERATOR FOR MIXTURE OF TWO EXPONENTIALS

GGHPR  HYPERGEOMETRIC RANDOM DEVIATE GENERATOR

GGMAR  ONE PARAMETER GAMMA RANDOM DEVIATE GENERATOR WITH EXTENSIONS

GGMTN  MULTINOMIAL RANDOM DEVIATE GENERATOR

GGNLG  LOG-NORMAL RANDOM DEVIATE GENERATOR

GGNML  NORMAL OR GAUSSIAN RANDOM DEVIATE GENERATOR

GGNPM  NORMAL RANDOM DEVIATE GENERATOR VIA THE POLAR METHOD
GGNQF  NORMAL RANDOM DEVIATE GENERATOR - FUNCTION FORM OF GGML

GGNSM  MULTIVARIATE NORMAL RANDOM DEVIATE GENERATOR WITH GIVEN
        COVARIANCE MATRIX

GGPON  POISSON RANDOM DEVIATE GENERATOR WHERE THE POISSON PARAMETER
        CHANGES FREQUENTLY

GGPOS  POISSON RANDOM DEVIATE GENERATOR WHERE THE POISSON PARAMETER
        DOES NOT CHANGE OFTEN

GGSPH  GENERATION OF UNIFORM RANDOM DEVIATES FROM THE SURFACE OF THE
        UNIT SPHERE IN 3 OR 4 SPACE

GGSTA  STABLE DISTRIBUTION RANDOM DEVIATE GENERATOR

GGTRA  TRIANGULAR DISTRIBUTION RANDOM DEVIATE GENERATOR

GGUBFS  BASIC UNIFORM (0,1) RANDOM NUMBER GENERATOR - FUNCTION FORM
        OF GGUBS

GGUBS  BASIC UNIFORM (0,1) PSEUDO-RANDOM NUMBER GENERATOR

GGUBT  UNIFORM (0,1) PSEUDO-RANDOM NUMBER GENERATOR USING ALTERNATE
        MULTIPLIER

GGUD  DISCRETE UNIFORM RANDOM NUMBER GENERATOR

GGUW  UNIFORM (0,1) RANDOM NUMBER GENERATOR WITH SHUFFLING

GGVCR  GENERAL CONTINUOUS DISTRIBUTION RANDOM DEVIATE GENERATOR

GGWIB  WEIBULL RANDOM DEVIATE GENERATOR

GTCN  SAMPLE SIZE OR NUMBER OF CLASS INTERVALS DETERMINATION FOR
        CHI-SQUARED TEST APPLICATIONS

GTDDU  D-SQUARE TALLY

GTD2T  THE D-SQUARE TEST

GTMNT  MOMENTS AND STANDARDIZED MOMENTS OF UNIFORM RANDOM NUMBERS

GTNOR  TEST FOR NORMALITY OF RANDOM DEVIATES

GTPBC  COUNT OF THE NUMBER OF ZERO BITS IN A GIVEN SUBSET OF A REAL
        WORD

GTPKP  PROBABILITY DISTRIBUTION OF N ELEMENTS INTO TWO EQUI-PROBABLE
        STATES

GTPL  POKER TEST TALLY OF HAND TYPES AND STATISTICS

GTPOK  PERFORM THE POKER TEST

GTPR  TALLY OF COORDINATES OF PAIRS (OR LAGGED PAIRS) OF RANDOM
        NUMBERS
GTPST  PAIRS TEST OR GOODS SERIAL TEST
GTRN   RUNS TEST
GTRTN  TALLY OF NUMBER OF RUNS UP AND DOWN
GTTRT  TALLY FOR TRIPLETS TEST
GTTRT  TRIPLETS TEST
IBCEVU BICUBIC SPLINE EVALUATOR
IBCICU BICUBIC SPLINE TWO-DIMENSIONAL COEFFICIENT CALCULATOR
IBCIEU BICUBIC SPLINE TWO-DIMENSIONAL INTERPOLATOR
ICAMAX FIND THE SMALLEST INDEX OF THE MAXIMUM MAGNITUDE OF A COMPLEX VECTOR (VBLA-ICAMAX)
ICSCCU INTERPOLATION BY CUBIC SPLINES (EASY TO USE)
ICSEVU EVALUATION OF A CUBIC SPLINE
ICSFKU LEAST SQUARES APPROXIMATION BY CUBIC SPLINES - FIXED KNOTS
ICSICU INTERPOLATORY APPROXIMATION BY CUBIC SPLINES WITH ARBITRARY SECOND DERIVATIVE END CONDITIONS
ICSMOU ONE-DIMENSIONAL DATA SMOOTHING BY ERROR DETECTION
ICSPLN INTERPOLATION BY CUBIC SPLINES WITH PERIODIC END CONDITIONS
ICSSSCU CUBIC SPLINE DATA SMOOTHER WITH USER SUPPLIED PARAMETER
ICSSCV CUBIC SPLINE DATA SMOOTHER (EASY TO USE)
ICSVKU LEAST SQUARES APPROXIMATION BY CUBIC SPLINES - VARIABLE KNOTS
IDAMAX FIND THE SMALLEST INDEX OF THE MAXIMUM MAGNITUDE OF A DOUBLE PRECISION VECTOR (VBLA-IDAMAX)
IFLSQ LEAST SQUARES APPROXIMATION WITH USER SUPPLIED BASIS FUNCTIONS
IQHSCU ONE-DIMENSIONAL QUASI-CUBIC HERMITE INTERPOLATION
IQHSCV SMOOTH SURFACE FITTING WITH IRREGULARLY DISTRIBUTED DATA POINTS (INTERPOLATION)
IRATCU RATIONAL WEIGHTED CHEBYCHEV APPROXIMATION OF A CONTINUOUS FUNCTION
ISAMAX FIND THE SMALLEST INDEX OF THE MAXIMUM MAGNITUDE OF A SINGLE PRECISION VECTOR (VBLA-ISAMAX)
LEQTIB LINEAR EQUATION SOLUTION - BAND STORAGE MODE - SPACE ECONOMIZER SOLUTION
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<td>LINV3F</td>
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<td>LIN1PB</td>
<td>Inversion of a Matrix</td>
<td>Positive Definite Band Symmetric Matrix</td>
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LIN2PB  INVERSION OF MATRIX - POSITIVE DEFINITE BAND SYMMETRIC MATRIX - BAND SYMMETRIC STORAGE MODE - HIGH ACCURACY SOLUTION

LLBQF  SOLUTION OF LINEAR LEAST SQUARES - HIGH ACCURACY

LLSQF  SOLUTION OF A LINEAR LEAST SQUARES PROBLEM

LSVDB  SINGULAR VALUE DECOMPOSITION OF A BIDIAGONAL MATRIX

LSVDF  SINGULAR VALUE DECOMPOSITION OF A REAL MATRIX

LUDAPB DECOMPOSITION OF A POSITIVE DEFINITE BAND SYMMETRIC MATRIX - BAND SYMMETRIC STORAGE MODE

LUDATF  L-U DECOMPOSITION BY THE CROUT ALGORITHM WITH OPTIONAL ACCURACY TEST

LUDECP  DECOMPOSITION OF A POSITIVE DEFINITE MATRIX - SYMMETRIC STORAGE MODE

LUELMF ELIMINATION PART OF SOLUTION OF AX=B (FULL STORAGE MODE)

LUELMP ELIMINATION PART OF THE SOLUTION OF AX=B - POSITIVE DEFINITE MATRIX - SYMMETRIC STORAGE MODE

LUELPB ELIMINATION PART OF SOLUTION OF AX=B - POSITIVE DEFINITE BAND SYMMETRIC MATRIX - BAND SYMMETRIC STORAGE MODE

LUREFF  REFINEMENT OF SOLUTION TO LINEAR EQUATIONS - FULL STORAGE MODE

LUREFP  REFINEMENT OF SOLUTION TO LINEAR EQUATIONS - POSITIVE DEFINITE MATRIX - SYMMETRIC STORAGE MODE

LUREPB  REFINEMENT OF SOLUTION TO LINEAR EQUATIONS - POSITIVE DEFINITE BAND SYMMETRIC MATRIX - BAND SYMMETRIC STORAGE MODE

MDBETA BETA PROBABILITY DISTRIBUTION FUNCTION

MDBETI INVERSE BETA PROBABILITY DISTRIBUTION FUNCTION

MDBIN BINOMIAL PROBABILITY DISTRIBUTION FUNCTION

MDBNOR BIVARIATE NORMAL PROBABILITY DISTRIBUTION FUNCTION

MDCH  CHI-SQUARED PROBABILITY DISTRIBUTION FUNCTION

MDCHI INVERSE CHI-SQUARED PROBABILITY DISTRIBUTION FUNCTION

MDCHN NON-CENTRAL CHI-SQUARED PROBABILITY DISTRIBUTION FUNCTION

MDFD  F PROBABILITY DISTRIBUTION FUNCTION

MDFDRE  F PROBABILITY DISTRIBUTION FUNCTION (INTEGER OR FRACTIONAL DEGREES OF FREEDOM)

MDFI  INVERSE F PROBABILITY DISTRIBUTION FUNCTION
MDGAM  GAMMA PROBABILITY DISTRIBUTION FUNCTION
MDGC  GENERAL CONTINUOUS PROBABILITY DISTRIBUTION FUNCTION
MDGCI  INVERSE OF GENERAL CONTINUOUS PROBABILITY DISTRIBUTION FUNCTION
MDHYP  HYPERGEOMETRIC PROBABILITY DISTRIBUTION FUNCTION
MDNOR  NORMAL OR GAUSSIAN PROBABILITY DISTRIBUTION FUNCTION
MDNRIS  INVERSE STANDARD NORMAL (GAUSSIAN) PROBABILITY DISTRIBUTION FUNCTION
MDSMR  KOLMOGOROV-SMIRNOV STATISTICS ASYMPTOTIC PROBABILITY DISTRIBUTION FUNCTION
MDSTI  INVERSE OF A MODIFICATION OF STUDENT'S T PROBABILITY DISTRIBUTION FUNCTION
MDTD  STUDENT'S T PROBABILITY DISTRIBUTION FUNCTION
MDTN  NON-CENTRAL T PROBABILITY DISTRIBUTION FUNCTION
MDTNF  INTEGRAL RELATED TO CALCULATION OF NON-CENTRAL T AND BIVARIATE NORMAL PROBABILITY DISTRIBUTION FUNCTIONS
MDTPS  CUMULATIVE PROBABILITY AND, OPTIONALLY, INDIVIDUAL TERMS OF THE POISSON PROBABILITY DISTRIBUTION FUNCTION
MERFCI  INVERSE COMPLEMENTED ERROR FUNCTION
MERFI  INVERSE ERROR FUNCTION
MMBSI  MODIFIED BESSEL FUNCTION OF THE FIRST KIND OF ORDER ZERO
MMBSI1  MODIFIED BESSEL FUNCTION OF THE FIRST KIND OF ORDER ONE
MMBSJ  BESSEL FUNCTION OF THE FIRST KIND OF ORDER ZERO
MMBSJ1  BESSEL FUNCTION OF THE FIRST KIND OF ORDER ONE
MMBSK  MODIFIED BESSEL FUNCTION OF THE SECOND KIND OF ORDER ZERO
MMBSK1  MODIFIED BESSEL FUNCTION OF THE SECOND KIND OF ORDER ONE
MMBSYN  BESSEL FUNCTION OF THE SECOND KIND OF NON-NEGATIVE REAL FRACTIONAL ORDER FOR REAL POSITIVE ARGUMENTS
MMDAS  DAWSON INTEGRAL
MMDE1  EXPONENTIAL INTEGRALS
MMDELE  COMPLETE ELLIPTIC INTEGRAL OF THE SECOND KIND
MMDELK  COMPLETE ELLIPTIC INTEGRAL OF THE FIRST KIND
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMKELD</td>
<td>Derivatives of the Kelvin functions (Ber, Bei, Ker, and Kei) of order zero</td>
</tr>
<tr>
<td>MMKEL</td>
<td>Kelvin functions of the first kind, (Ber, Bei), and of the second kind, (Ker, Kei), of order zero</td>
</tr>
<tr>
<td>MMKEL1</td>
<td>Kelvin functions of the first kind, (Ber, Bei), and of the second kind, (Ker, Kei), of order one</td>
</tr>
<tr>
<td>MMPSI</td>
<td>Logarithmic derivative of the Gamma function</td>
</tr>
<tr>
<td>MSMRAT</td>
<td>Ratio of the ordinate to the upper tail area of the standardized normal (Gaussian) distribution</td>
</tr>
<tr>
<td>NAKI1</td>
<td>Kruskal-Wallis test for identical populations</td>
</tr>
<tr>
<td>NAWNRP</td>
<td>Wilsons ANOVA (2 or 3 way designs) without replicates</td>
</tr>
<tr>
<td>NAWRPE</td>
<td>Wilsons ANOVA (1, 2, or 3 way designs) with equal replication</td>
</tr>
<tr>
<td>NAWRPU</td>
<td>Wilsons ANOVA (1, 2, or 3 way designs) with unequal replication</td>
</tr>
<tr>
<td>NBCYC</td>
<td>Noether's test for cyclical trend</td>
</tr>
<tr>
<td>NBQT</td>
<td>Cochran Q test</td>
</tr>
<tr>
<td>NBSDL</td>
<td>Cox and Stuart sign test for trends in dispersion and location</td>
</tr>
<tr>
<td>NBSIGN</td>
<td>Sign test (for percentiles)</td>
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<tr>
<td>NDEST</td>
<td>Evaluate probability density function at specified points</td>
</tr>
<tr>
<td>NDKER</td>
<td>Nonparametric probability density function (one-dimensional) estimation by kernel method</td>
</tr>
<tr>
<td>NDMPLE</td>
<td>Nonparametric probability density function (one-dimensional) estimation by penalized likelihood method</td>
</tr>
<tr>
<td>NHEXT</td>
<td>Fisher's exact method for 2 by 2 tables</td>
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<tr>
<td>NHINC</td>
<td>Inclusionance test</td>
</tr>
<tr>
<td>NKS1</td>
<td>Kolmogorov-Shirnov one-sample test</td>
</tr>
<tr>
<td>NKS2</td>
<td>Kolmogorov-Shirnov two-sample test</td>
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<tr>
<td>NMCC</td>
<td>Calculate and test the significance of the Kendall coefficient of concordance</td>
</tr>
<tr>
<td>NMKEN</td>
<td>Kendall's test for correlation (rank correlation coefficient)</td>
</tr>
<tr>
<td>NMKSF</td>
<td>Frequency distribution of K and the probability of equalling or exceeding K, where K, the total score from the Kendall rank correlation coefficient calculations, and N, the sample size, are given</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>NMKTS</td>
<td>K-Sample Trends Test Against Ordered Alternatives</td>
</tr>
<tr>
<td>NMRANK</td>
<td>Numerical Ranking</td>
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<tr>
<td>NMTIE</td>
<td>Tie Statistics, Given a Sample of Observations</td>
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<td>NRBHA</td>
<td>Bhapkar V Test</td>
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<tr>
<td>NRWMD</td>
<td>Wilcoxon Signed Rank Test</td>
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<td>NRWRST</td>
<td>Wilcoxon Rank-Sum Test</td>
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<tr>
<td>OCDIS</td>
<td>Pairwise Euclidean Distance Between Columns of a Matrix</td>
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<tr>
<td>OCLINK</td>
<td>Perform a Single-Linkage or Complete-Linkage Hierarchical Cluster Analysis Given a Similarity Matrix</td>
</tr>
<tr>
<td>ODFISH</td>
<td>Linear Discriminant Analysis Method of Fisher for Reducing the Number of Variables</td>
</tr>
<tr>
<td>ODNORM</td>
<td>Multivariate Normal Linear Discriminant Analysis Among Several Known Groups</td>
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<tr>
<td>OFCOEF</td>
<td>Compute a Matrix of Factor Score Coefficients for Input to IMSL Routine OFSCORE</td>
</tr>
<tr>
<td>OFCOMM</td>
<td>Compute an Unrotated Factor Loading Matrix According to a Common Factor Model by Unweighted or Generalized Least Squares, or by Maximum Likelihood Procedures</td>
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<tr>
<td>OFHARR</td>
<td>Transformation of Unrotated Factor Loading Matrix to Oblique Axes by Harris-Kaiser Method</td>
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<td>OFIMAG</td>
<td>Compute an Unrotated Factor Loading Matrix According to an Image Model</td>
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<td>OFIMA3</td>
<td>Least Squares Solution to the Matrix Equation AT = B</td>
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<td>OFPRI</td>
<td>Compute an Unrotated Factor Loading Matrix According to a Principal Component Model</td>
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<td>OFPROT</td>
<td>Oblique Transformation of the Factor Loading Matrix Using a Target Matrix, Including Pivot and Power Vector Options</td>
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<td>OFRESI</td>
<td>Communalities and Normalized Factor Residual Correlation Matrix Calculation</td>
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<tr>
<td>OFROTA</td>
<td>Orthogonal Rotation of a Factor Loading Matrix Using a Generalized Orthomax Criterion, Including Quartimax, Varimax, and Equamax</td>
</tr>
<tr>
<td>OFSCHN</td>
<td>Orthogonal Transformation of the Factor Loading Matrix Using a Target Matrix</td>
</tr>
<tr>
<td>OFSCORE</td>
<td>Compute a Set of Factor Scores Given the Factor Score Coefficient Matrix</td>
</tr>
</tbody>
</table>
OIND WILKS TEST FOR THE INDEPENDENCE OF K SETS OF MULTI-NORMAL VARIATES

OPRINC PRINCIPAL COMPONENTS OF A MULTIVARIATE SAMPLE OF OBSERVATIONS

OTMLNR MAXIMUM LIKELIHOOD ESTIMATION FROM GROUPED AND/OR CENSORED NORMAL DATA

RLCOMP GENERATION OF AN ORTHOGONAL CENTRAL COMPOSITE DESIGN

RLDCQM DECODING OF A QUADRATIC REGRESSION MODEL

RLDCVA VARIANCE ESTIMATES FOR DECODED ORTHOGONAL POLYNOMIAL REGRESSION COEFFICIENTS

RLDCW VARIANCES OF CODED ORTHOGONAL POLYNOMIAL REGRESSION COEFFICIENTS. FOR USAGE IN CONJUNCTION WITH IMSL ROUTINES RLFOTH AND RLFOTW, AND PROVIDED TO PREPARE INPUT FOR IMSL ROUTINE RLDCVA.

RLDOPM COEFFICIENT DECODER FOR AN ORTHOGONAL POLYNOMIAL REGRESSION MODEL

RLEAP LEAPS AND BOUNDS ALGORITHM FOR DETERMINING A NUMBER OF BEST REGRESSION SUBSETS FROM A FULL REGRESSION MODEL

RLFITI PURE REPLICATION ERROR DEGREES OF FREEDOM AND SUM OF SQUARES (IN-CORE VERSION)

RLFITO PURE REPLICATION ERROR DEGREES OF FREEDOM AND SUM OF SQUARES (OUT-OF-CORE VERSION)

RLFOR FIT A UNIVARIATE CURVILINEAR REGRESSION MODEL USING ORTHOGONAL POLYNOMIALS WITH OPTIONAL WEIGHTING (EASY TO USE VERSION)

RLFOTH FIT A UNIVARIATE CURVILINEAR REGRESSION MODEL USING ORTHOGONAL POLYNOMIALS

RLFOTW FIT A UNIVARIATE CURVILINEAR REGRESSION MODEL USING ORTHOGONAL POLYNOMIALS WITH WEIGHTING

RLGQMI CENTERING OF INDEPENDENT VARIABLE SETTINGS AND GENERATION OF CENTERED SQUARE AND CROSS PRODUCT TERMS (IN-CORE VERSION)

RLGQMO CENTERING OF INDEPENDENT VARIABLE SETTINGS AND GENERATION OF UNCENTERED SQUARE AND CROSS PRODUCT TERMS (OUT-OF-CORE VERSION)

RLINCF RESPONSE CONTROL USING A FITTED SIMPLE LINEAR REGRESSION MODEL

RLINPF INVERSE PREDICTION USING A FITTED SIMPLE LINEAR REGRESSION MODEL

RLLAV LINEAR REGRESSION USING LEAST ABSOLUTE VALUES CRITERION
RRLMV  LINEAR REGRESSION USING LEAST MINIMAX
RLMUL  MULTIPLE LINEAR REGRESSION ANALYSIS
RLONE  ANALYSIS OF A SIMPLE LINEAR REGRESSION MODEL
RLOPDC RESPONSE PREDICTION USING AN ORTHOGONAL POLYNOMIAL REGRESSION MODEL
RLPOL  GENERATE ORTHOGONAL POLYNOMIALS WITH THE ASSOCIATED CONSTANTS AA AND BB
RLPRDI CONFIDENCE INTERVALS FOR THE TRUE RESPONSE AND FOR THE AVERAGE OF A SET OF FUTURE OBSERVATIONS ON THE RESPONSE (IN-CORE VERSION)
RLPRDO CONFIDENCE INTERVALS FOR THE TRUE RESPONSE AND FOR THE AVERAGE OF A SET OF FUTURE OBSERVATIONS ON THE RESPONSE (OUT-OF-CORE VERSION)
RLRES  PERFORM A RESIDUAL ANALYSIS FOR A FITTED REGRESSION MODEL
RLSEP  SELECTION OF A REGRESSION MODEL USING A FORWARD STEPWISE ALGORITHM, AND COMPUTATION OF THE USUAL ANALYSIS OF VARIANCE TABLE ENTRIES - EASY TO USE VERSION
RLSTP  REGRESSION MODEL SELECTION USING A FORWARD STEPWISE ALGORITHM WITH RESULTS AVAILABLE AFTER EACH STEP
RLSUBM RETRIEVAL OF A SYMMETRIC SUBMATRIX FROM A MATRIX STORED IN SYMMETRIC STORAGE MODE BY RLSTP
RLSUM  REORDERING OF THE ROWS AND CORRESPONDING COLUMNS OF A SYMMETRIC MATRIX STORED IN SYMMETRIC STORAGE MODE
RSMITZ LEAST SQUARES FIT OF THE NON-LINEAR REGRESSION MODEL Y(I) = ALPHA+BETA*GAMMA**X(I)+E(I)
SASUM  COMPUTE SINGLE PRECISION SUM OF ABSOLUTE VALUES (VBLA=SASUM)
SAXPY  COMPUTE A CONSTANT TIMES A VECTOR PLUS A VECTOR, ALL SINGLE PRECISION (VBLA=SAXPY)
SCASUM  COMPUTE COMPLEX SUM OF ABSOLUTE VALUES (VBLA=SCASUM)
SCNRM2  COMPUTE THE EUCLIDEAN LENGTH OR L2 NORM OF A COMPLEX VECTOR (VBLA=SCNRM2)
SCOPY  COPY A VECTOR X TO A VECTOR Y, BOTH SINGLE PRECISION (VBLA=SCOPY)
SDOT  COMPUTE SINGLE PRECISION DOT PRODUCT (VBLA=SDOT)
SDSDOT COMPUTE SINGLE PRECISION DOT PRODUCT AND ADD A CONSTANT USING DOUBLE PRECISION ACCUMULATION (VBLA=SDSDOT)
SNRM2 COMPUTE THE EUCLIDEAN LENGTH OR L2 NORM OF A SINGLE PRECISION VECTOR (VBLA=SNRM2)

SROT APPLY GIVENS PLANE ROTATION (SINGLE PRECISION) (VBLA=SROT)

SROTG CONSTRUCT GIVENS PLANE ROTATION (SINGLE PRECISION) (VBLA=SROTG)

SROTM APPLY A MODIFIED GIVENS PLANE ROTATION (SINGLE PRECISION) (VBLA=SROTM)

SROTMG CONSTRUCT A MODIFIED GIVENS PLANE ROTATION (SINGLE PRECISION) (VBLA=SROTMG)

SSCAL COMPUTE A SINGLE PRECISION CONSTANT TIMES A SINGLE PRECISION VECTOR (VBLA=SSCAL)

SSPAND SIMPLE RANDOM SAMPLING WITH PROPORTION DATA - INFERENCES REGARDING THE POPULATION PROPORTION AND TOTAL

SSPBLK STRATIFIED RANDOM SAMPLING WITH PROPORTION DATA - INFERENCES REGARDING THE POPULATION PROPORTION AND TOTAL

SSRAND SIMPLE RANDOM SAMPLING WITH CONTINUOUS DATA - INFERENCES REGARDING THE POPULATION MEAN AND TOTAL USING RATIO OR REGRESSION ESTIMATION

SSRBLK STRATIFIED RANDOM SAMPLING WITH CONTINUOUS DATA - INFERENCES REGARDING THE POPULATION MEAN AND TOTAL USING RATIO OR REGRESSION ESTIMATION

SSSAND SIMPLE RANDOM SAMPLING WITH CONTINUOUS DATA - INFERENCES REGARDING THE POPULATION MEAN AND TOTAL

SSSBLK STRATIFIED RANDOM SAMPLING WITH CONTINUOUS DATA - INFERENCES REGARDING THE POPULATION MEAN AND TOTAL

SSSCAN SINGLE STAGE CLUSTER SAMPLING WITH CONTINUOUS DATA - INFERENCES REGARDING THE POPULATION MEAN AND TOTAL

SSSEST TWO-STAGE SAMPLING WITH CONTINUOUS DATA AND EQUISIZED PRIMARY UNITS - INFERENCES REGARDING THE POPULATION MEAN AND TOTAL

SSSWAP INTERCHANGE VECTORS X AND Y, BOTH SINGLE PRECISION (VBLA=SSSWAP)

UERSET SET MESSAGE LEVEL FOR IMSL ROUTINE UERTST

UERTST PRINT A MESSAGE REFLECTING AN ERROR CONDITION

UGETIO TO RETRIEVE CURRENT VALUES AND TO SET NEW VALUES FOR INPUT AND OUTPUT UNIT IDENTIFIERS

UHELP DISPLAY METHODS OF OBTAINING INFORMATION ON IMSL CONVENTIONS REGARDING VARIOUS SUBJECTS AND PROVIDE A MEANS FOR INDIVIDUAL SITES TO SUPPLY USERS WITH SITE SPECIFIC INFORMATION
UHELP1 WRITE INFORMATION REGARDING IMSL CONVENTIONS AND NOTATION TO AN OUTPUT FILE

UHELP2 WRITE INFORMATION REGARDING IMSL INPUT AND OUTPUT CONVENTIONS

UHELP3 WRITE INFORMATION REGARDING IMSL ERROR DETECTING FACILITIES

UHELP4 WRITE INFORMATION REGARDING MATRIX/VECTOR STORAGE MODES USED IN IMSL SUBROUTINES

USBOX PRINT BOXPLOT

USCRDM READ A MATRIX (OPTIONAL SEQUENCE CHECK)

USHIST PRINT A HISTOGRAM (VERTICAL)

USHIUT PRINT A HISTOGRAM, PLOTTING TWO FREQUENCIES WITH ONE BAR OF THE HISTOGRAM (VERTICAL)

USHVI PRINT A HISTOGRAM (HORIZONTAL)

USLEAP PRINT RESULTS OF THE BEST-REGRESSIONS ANALYSIS PERFORMED BY IMSL ROUTINE RLEAP

USMNX DETERMINATION OF THE MINIMUM AND MAXIMUM VALUES OF A VECTOR

USPC PRINT A SAMPLE PDF, A THEORETICAL PDF AND CONFIDENCE BAND INFORMATION WITH OPTIONAL PLOT

USPDF PLOT OF TWO SAMPLE PROBABILITY DISTRIBUTION FUNCTIONS AGAINST THEIR SPECTRA

USPLT PRINTER PLOT OF UP TO TEN FUNCTIONS

USRDM READ A MATRIX

USRDV READ A VECTOR

USSLF PRINT STEM AND LEAF DISPLAY

USTREE PRINT A BINARY TREE (WHICH MAY REPRESENT THE OUTPUT OF A CLUSTERING ALGORITHM IN CHAPTER 0)

USWBM PRINT A MATRIX STORED IN BAND STORAGE MODE

USWBS PRINT A MATRIX STORED IN BAND SYMMETRIC STORAGE MODE

USWFM PRINT A MATRIX STORED IN FULL STORAGE MODE

USWVF PRINT A VECTOR

USWSM PRINT A MATRIX STORED IN SYMMETRIC STORAGE MODE

VABMXF MAXIMUM ABSOLUTE VALUE OF THE ELEMENTS OF A VECTOR OR A SUBSET OF THE ELEMENTS OF A VECTOR (FULL STORAGE MODE)
VABMXS  MAXIMUM ABSOLUTE VALUE OF THE ELEMENTS OF A ROW OR COLUMN OF A MATRIX STORED (SYMMETRIC STORAGE MODE)

VABSMF  SUM OF THE ABSOLUTE VALUES OF THE ELEMENTS OF A VECTOR OR A SUBSET OF A VECTOR (FULL STORAGE MODE)

VABSMS  SUM OF THE ABSOLUTE VALUES OF THE ELEMENTS OF A ROW (OR COLUMN) OF A MATRIX STORED (SYMMETRIC STORAGE MODE)

VBLA    PACKAGE OF 38 LINEAR ALGEBRA ROUTINES

VCONVO  VECTOR CONVOLUTION

VCVTBF  STORAGE MODE CONVERSION OF MATRICES (BAND TO FULL STORAGE MODE)

VCVTCH  STORAGE MODE CONVERSION OF MATRICES (FULL COMPLEX TO HERMITIAN)

VCVTFB  STORAGE MODE CONVERSION OF MATRICES (FULL TO BAND STORAGE MODE)

VCVTFQ  STORAGE MODE CONVERSION (FULL TO BAND SYMMETRIC STORAGE MODE)

VCVTFS  STORAGE MODE CONVERSION OF MATRICES (FULL TO SYMMETRIC)

VCVTHC  STORAGE MODE CONVERSION OF MATRICES (HERMITIAN TO FULL COMPLEX)

VCVTQF  STORAGE MODE CONVERSION (BAND SYMMETRIC TO FULL STORAGE MODE)

VCVTQS  STORAGE MODE CONVERSION (BAND SYMMETRIC TO SYMMETRIC STORAGE MODE)

VCVTSF  STORAGE MODE CONVERSION OF MATRICES (SYMMETRIC TO FULL)

VCVTSQ  STORAGE MODE CONVERSION (SYMMETRIC TO BAND SYMMETRIC STORAGE MODE)

VDCPS   DECOMPOSE AN INTEGER INTO ITS PRIME FACTORS

VHSH2C  COMPLEX HOUSEHOLDER TRANSFORMATION TO ZERO A SINGLE ELEMENT OF A MATRIX

VHSH2R  REAL HOUSEHOLDER TRANSFORMATION TO ZERO A SINGLE ELEMENT OF A MATRIX

VHSH3R  REAL HOUSEHOLDER TRANSFORMATION TO ZERO TWO ELEMENTS OF A MATRIX

VHS12   REAL HOUSEHOLDER TRANSFORMATION - COMPUTATION AND APPLICATIONS

VIPRFF  VECTOR INNER PRODUCT OF TWO VECTORS OR SUBSETS OF TWO VECTORS

VIPRSS  VECTOR INNER PRODUCT OF TWO VECTORS EACH OF WHICH IS PART OF SOME MATRIX STORED IN SYMMETRIC MODE
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
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<tbody>
<tr>
<td>VMULBB</td>
<td>MATRIX MULTIPLICATION (BAND STORAGE MODE)</td>
</tr>
<tr>
<td>VMULBF</td>
<td>MATRIX MULTIPLICATION (BAND BY FULL MATRICES)</td>
</tr>
<tr>
<td>VMULBS</td>
<td>MATRIX MULTIPLICATION (BAND BY SYMMETRIC)</td>
</tr>
<tr>
<td>VMULFB</td>
<td>MATRIX MULTIPLICATION (FULL BY BAND MATRICES)</td>
</tr>
<tr>
<td>VMULFF</td>
<td>MATRIX MULTIPLICATION (FULL STORAGE MODE)</td>
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<td>VMULFM</td>
<td>MATRIX MULTIPLICATION OF THE TRANSPOSE OF MATRIX A BY MATRIX B (FULL STORAGE MODE)</td>
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<td>VMULFP</td>
<td>MATRIX MULTIPLICATION OF MATRIX A BY THE TRANSPOSE OF MATRIX B (FULL STORAGE MODE)</td>
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<td>VMULFQ</td>
<td>MATRIX MULTIPLICATION (FULL BY BAND SYMMETRIC MATRICES)</td>
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<tr>
<td>VMULFS</td>
<td>MATRIX MULTIPLICATION (FULL BY SYMMETRIC MATRICES)</td>
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<tr>
<td>VMULQB</td>
<td>MATRIX MULTIPLICATION (BAND SYMMETRIC BY BAND MATRICES)</td>
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<tr>
<td>VMULQF</td>
<td>MATRIX MULTIPLICATION (BAND SYMMETRIC BY FULL MATRICES)</td>
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<td>VMULQQ</td>
<td>MATRIX MULTIPLICATION (BAND SYMMETRIC STORAGE MODE)</td>
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<tr>
<td>VMULQS</td>
<td>MATRIX MULTIPLICATION (BAND SYMMETRIC BY SYMMETRIC MATRICES)</td>
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<tr>
<td>VMULSB</td>
<td>MATRIX MULTIPLICATION (SYMMETRIC BY BAND MATRICES)</td>
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<tr>
<td>VMULSF</td>
<td>MATRIX MULTIPLICATION (SYMMETRIC BY FULL MATRICES)</td>
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<tr>
<td>VMULSQ</td>
<td>MATRIX MULTIPLICATION (SYMMETRIC BY BAND SYMMETRIC MATRICES)</td>
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<tr>
<td>VMULSS</td>
<td>MATRIX MULTIPLICATION (SYMMETRIC STORAGE MODE)</td>
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<td>VNRMF1</td>
<td>INFINITY-NORM MATRICES (FULL STORAGE MODE)</td>
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<td>VNRMF2</td>
<td>EUCLIDEAN-NORM OF MATRICES (FULL STORAGE MODE)</td>
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<td>VNRMS1</td>
<td>1-NORM OF MATRICES (SYMMETRIC STORAGE MODE)</td>
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<tr>
<td>VNRMS2</td>
<td>EUCLIDEAN-NORM OF MATRICES (SYMMETRIC STORAGE MODE)</td>
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<tr>
<td>VPOLYF</td>
<td>MATRIX POLYNOMIAL (FULL STORAGE MODE)</td>
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<tr>
<td>VSRTA</td>
<td>SORTING OF ARRAYS BY ALGEBRAIC VALUE</td>
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<td>VSRM</td>
<td>SORTING OF ARRAYS BY ABSOLUTE VALUE</td>
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<tr>
<td>VSRTP</td>
<td>SORTING OF ARRAYS BY ABSOLUTE VALUE - PERMUTATIONS RETURNED</td>
</tr>
<tr>
<td>VSRTR</td>
<td>SORTING OF ARRAYS BY ALGEBRAIC VALUE - PERMUTATIONS RETURNED</td>
</tr>
</tbody>
</table>
VSRTU  INTERCHANGE THE ROWS OR COLUMNS OF A MATRIX USING A
       PERMUTATION VECTOR SUCH AS THE ONE OBTAINED FROM IMSL
       ROUTINES VSRTP OR VSRTR

VTPROF  TRANSPOSE PRODUCT OF MATRIX (FULL STORAGE MODE)

VTPROS  TRANSPOSE PRODUCT OF A MATRIX (SYMmetric STORAGE MODE)

VTRAN  TRANSPOSE A RECTANGULAR MATRIX

VUABQ  MATRIX ADDITION (BAND + BAND SYMMETRIC MATRICES)

VUAFB  MATRIX ADDITION (FULL + BAND MATRICES)

VUAFQ  MATRIX ADDITION (FULL + BAND SYMMETRIC MATRICES)

VUAFS  MATRIX ADDITION (FULL + SYMMETRIC MATRICES)

VUASB  MATRIX ADDITION (SYMMETRIC + BAND MATRICES)

VUASQ  MATRIX ADDITION (SYMMETRIC + BAND SYMMETRIC MATRICES)

ZANLYT  ZEROS OF AN ANALYTIC COMPLEX FUNCTION USING THE MULLER METHOD
       WITH DEFLATION

ZBRENT  ZERO OF A FUNCTION WHICH CHANGES SIGN IN A GIVEN INTERVAL
       (BRENT ALGORITHM)

ZCPOLY  ZEROS OF A POLYNOMIAL WITH COMPLEX COEFFICIENTS
       (JENKINS-TRAUB)

ZFALSE  ZERO OF A FUNCTION GIVEN AN INTERVAL CONTAINING THE ZERO

ZPOLR  ZEROS OF A POLYNOMIAL WITH REAL COEFFICIENTS (LAGUERRE)

ZQADC  ZEROS OF A QUADRATIC WITH COMPLEX COEFFICIENTS

ZQADR  ZEROS OF A QUADRATIC WITH REAL COEFFICIENTS

ZREAL1  THE REAL ZEROS OF A REAL FUNCTION - TO BE USED WHEN INITIAL
        GUESSES ARE POOR

ZREAL2  THE REAL ZEROS OF A REAL FUNCTION - TO BE USED WHEN INITIAL
        GUESSES ARE GOOD

ZRPOLY  ZEROS OF A POLYNOMIAL WITH REAL COEFFICIENTS (JENKINS-TRAUB)

ZSCNT  SOLVE SYSTEM OF NONLINEAR EQUATIONS BY SECANT METHOD

ZSRCH  GENERATE POINTS IN AN N DIMENSIONAL SPACE

ZSYSTM  DETERMINATION OF A ROOT OF A SYSTEM OF N SIMULTANEOUS
       NONLINEAR EQUATIONS IN N UNKNOWNS

ZXCGR  A CONJUGATE GRADIENT ALGORITHM FOR FINDING THE MINIMUM OF A
       FUNCTION OF N VARIABLES
ZXGSN ONE-DIMENSIONAL UNIMODAL FUNCTION MINIMIZATION USING THE GOLDEN SECTION SEARCH METHOD

ZXGSP. ONE-DIMENSIONAL UNIMODAL FUNCTION MINIMIZATION USING THE GOLDEN SECTION SEARCH METHOD - DATA PARAMETERS SPECIFIED

ZXMIN MINIMUM OF A FUNCTION OF N VARIABLES USING A QUASI-NEWTON METHOD

ZXSSQ MINIMUM OF THE SUM OF SQUARES OF M FUNCTIONS IN N VARIABLES USING A FINITE DIFFERENCE LEVENBERG-MARQUARDT ALGORITHM

ZXOLP SOLVE THE LINEAR PROGRAMMING PROBLEM (PHASE ONE OR PHASE TWO) VIA THE REVISED SIMPLEX ALGORITHM

ZX3LP SOLVE THE LINEAR PROGRAMMING PROBLEM VIA THE REVISED SIMPLEX ALGORITHM (EASY TO USE VERSION)

ZX4LP SOLVE THE LINEAR PROGRAMMING PROBLEM VIA THE REVISED SIMPLEX ALGORITHM USING ORTHOGONAL DECOMPOSITION (EASY TO USE VERSION)
LINPACK IS A PACKAGE OF 40 SUBROUTINES TO ANALYZE AND SOLVE VARIOUS CLASSES OF SYSTEMS OF SIMULTANEOUS LINEAR ALGEBRAIC EQUATIONS WHICH WAS OBTAINED FROM ARGONNE NATIONAL LABORATORY. BESIDE THE SINGLE PRECISION PACKAGE VERSIONS FOR COMPLEX OR DOUBLE PRECISION EXIST. ROUTINES ARE INCLUDED FOR GENERAL, BANDED, SYMMETRIC INDEFINITE, SYMMETRIC POSITIVE DEFINITE, TRIANGULAR, AND TRIDIAGONAL SQUARE MATRICES PLUS LEAST SQUARE PROBLEMS AND OR AND SINGLE VALUE DECOMPOSITIONS OF RECTANGULAR MATRICES. THE PACKAGE ALSO INCLUDES 11 BASIC LINEAR ALGEBRA SUBPROGRAMS.


MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'LINPACK' INCLUDE:

SCHDC COMPUTES THE CHOLESKY DECOMPOSITION OF A POSITIVE DEFINITE MATRIX. A PIVOTING OPTION ALLOWS THE USER TO ESTIMATE THE CONDITION OF A POSITIVE DEFINITE MATRIX OR DETERMINE THE RANK OF A POSITIVE SEMIDEFINITE MATRIX.

SCHDD DOWNDATES AN AUGMENTED CHOLESKY DECOMPOSITION OR THE TRIANGULAR FACTOR OF AN AUGMENTED QR DECOMPOSITION.

SCHEX UPDATES THE CHOLESKY FACTORIZATION A = TRANS(R)*R OF A POSITIVE DEFINITE MATRIX A OF ORDER P UNDER DIAGONAL PERMUTATIONS OF THE FORM TRANS(E)*A*E WHERE E IS A PERMUTATION MATRIX.

SCHUD UPDATES AN AUGMENTED CHOLESKY DECOMPOSITION OF THE TRIANGULAR PART OF AN AUGMENTED QR DECOMPOSITION.

SGBCO FACTORS A REAL BAND MATRIX BY GAUSSIAN ELIMINATION AND ESTIMATES THE CONDITION OF THE MATRIX.

SGBDI COMPUTES THE DETERMINANT OF A BAND MATRIX USING THE FACTORS COMPUTED BY SGBCO OR SGBFA.

SGBFA FACTORS A REAL BAND MATRIX BY ELIMINATION.

SGBSL SOLVES THE REAL BAND SYSTEM A * X = B OR TRANS(A) * X = B USING THE FACTORS COMPUTED BY SGBCO OR SGBFA.

SGECO FACTORS A REAL MATRIX BY GAUSSIAN ELIMINATION AND ESTIMATES THE CONDITION OF THE MATRIX.

SGEDI COMPUTES THE DETERMINANT AND INVERSE OF A MATRIX USING THE FACTORS COMPUTED BY SGECO OR SGEFA.

SGEFA FACTORS A REAL MATRIX BY GAUSSIAN ELIMINATION.
SGESL SOLVES THE REAL SYSTEM $A^* X = B$ OR $\text{TRANS}(A)^* X = B$ USING THE FACTORS COMPUTED BY SGECO OR SGEFA.

SGTLS GIVEN A GENERAL TRIDIAGONAL MATRIX AND A RIGHT HAND SIDE WILL FIND THE SOLUTION.

SPBCO FACTORS A REAL SYMMETRIC POSITIVE DEFINITE MATRIX STORED IN

SPBDI COMPUTES THE DETERMINANT OF A REAL SYMMETRIC POSITIVE DEFINITE BAND MATRIX USING THE FACTORS COMPUTED BY SPBCO OR SPBFA.

SPBFA FACTORS A REAL SYMMETRIC POSITIVE DEFINITE MATRIX STORED IN BAND FORM.

SPBSL SOLVES THE REAL SYMMETRIC POSITIVE DEFINITE BAND SYSTEM $A^T X = B$ USING THE FACTORS COMPUTED BY SPBCO OR SPBFA.

SPOCO FACTORS A REAL SYMMETRIC POSITIVE DEFINITE MATRIX AND ESTIMATES THE CONDITION OF THE MATRIX.

SPODI COMPUTES THE DETERMINANT AND INVERSE OF A CERTAIN REAL SYMMETRIC POSITIVE DEFINITE MATRIX (SEE BELOW) USING THE FACTORS COMPUTED BY SPOCO, SPOFA OR SQRDC.

SPOFA FACTORS A REAL SYMMETRIC POSITIVE DEFINITE MATRIX.

SPOS L SOLVES THE REAL SYMMETRIC POSITIVE DEFINITE SYSTEM $A^T X = B$ USING THE FACTORS COMPUTED BY SPOCO OR SPOFA.

SPPCO FACTORS A REAL SYMMETRIC POSITIVE DEFINITE MATRIX STORED IN PACKED FORM AND ESTIMATES THE CONDITION OF THE MATRIX.

SPPDI COMPUTES THE DETERMINANT AND INVERSE OF A REAL SYMMETRIC POSITIVE DEFINITE MATRIX USING THE FACTORS COMPUTED BY SPPCO OR SPPFA.

SPPFA FACTORS A REAL SYMMETRIC POSITIVE DEFINITE MATRIX STORED IN PACKED FORM.

SPPSL SOLVES THE REAL SYMMETRIC POSITIVE DEFINITE SYSTEM $A^T X = B$ USING THE FACTORS COMPUTED BY SPPCO OR SPPFA.

SPTSL GIVEN A POSITIVE DEFINITE TRIDIAGONAL MATRIX AND A RIGHT HAND SIDE WILL FIND THE SOLUTION.

SQRDC USES HOUSEHOLDER TRANSFORMATIONS TO COMPUTE THE QR FACTORIZATION OF AN $N$ BY $P$ MATRIX $X$. COLUMN PIVOTING BASED ON THE 2-NORMS OF THE REDUCED COLUMNS MAY BE PERFORMED AT THE USERS OPTION.

SQRSL APPLIES THE OUTPUT OF SQRDC TO COMPUTE COORDINATE TRANSFORMATIONS, PROJECTIONS, AND LEAST SQUARES SOLUTIONS.
SSICO FACTORS A REAL SYMMETRIC MATRIX BY ELIMINATION WITH SYMMETRIC PIVOTING AND ESTIMATES THE CONDITION OF THE MATRIX.

SSIDI COMPUTES THE DETERMINANT, INERTIA AND INVERSE OF A REAL SYMMETRIC MATRIX USING THE FACTORS FROM SSIFA.

SSIFA FACTORS A REAL SYMMETRIC MATRIX BY ELIMINATION WITH SYMMETRIC PIVOTING.

SSISL SOLVES THE REAL SYMMETRIC SYSTEM $A * X = B$ USING THE FACTORS COMPUTED BY SSIFA.

SSPCO FACTORS A REAL SYMMETRIC MATRIX STORED IN PACKED FORM BY ELIMINATION WITH SYMMETRIC PIVOTING AND ESTIMATES THE CONDITION OF THE MATRIX.

SSPDI COMPUTES THE DETERMINANT, INERTIA AND INVERSE OF A REAL SYMMETRIC MATRIX USING THE FACTORS FROM SSPFA, WHERE THE MATRIX IS STORED IN PACKED FORM.

SSPFA FACTORS A REAL SYMMETRIC MATRIX STORED IN PACKED FORM BY ELIMINATION WITH SYMMETRIC PIVOTING.

SSISL SOLVES THE REAL SYMMETRIC SYSTEM $A * X = B$ USING THE FACTORS COMPUTED BY SSPFA.

SSVDC REDUCES A REAL NXP MATRIX $X$ BY ORTHOGONAL TRANSFORMATIONS $U$ AND $V$ TO DIAGONAL FORM.

STRCO ESTIMATES THE CONDITION OF A REAL TRIANGULAR MATRIX.

STRDI COMPUTES THE DETERMINANT AND INVERSE OF A REAL TRIANGULAR MATRIX.

STRSL SOLVES SYSTEMS OF THE FORM $T * X = B$ OR TRANS$(T) * X = B$ WHERE $T$ IS A TRIANGULAR MATRIX OF ORDER $N$. 
MINPACK IS A PACKAGE OF 23 FORTRAN SUBPROGRAMS (11 ARE USER-CALLABLE) TO SOLVE NON-LINEAR EQUATIONS AND NON-LINEAR LEAST SQUARES PROBLEMS. IT WAS OBTAINED FROM ARGONNE NATIONAL LABORATORY.

REFERENCES: ANL-80-74

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

USER-CALLABLE ROUTINES IN LIBRARY 'MINPACK' INCLUDE:

- **CHKDER**: CHECK THE GRADIENTS OF M NONLINEAR FUNCTIONS IN N VARIABLES, EVALUATED AT A POINT X, FOR CONSISTENCY WITH THE FUNCTIONS THEMSELVES
- **HYBRD**: FIND A ZERO OF A SYSTEM OF N NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE POWELL HYBRID METHOD
- **HYBRD1**: FIND A ZERO OF A SYSTEM OF N NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE POWELL HYBRID METHOD
- **HYBRJ**: FIND A ZERO OF A SYSTEM OF N NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE POWELL HYBRID METHOD
- **HYBRJ1**: FIND A ZERO OF A SYSTEM OF N NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE POWELL HYBRID METHOD
- **LMDER**: MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVENBERG-MARQUARDT ALGORITHM
- **LMDER1**: MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVENBERG-MARQUARDT ALGORITHM
- **LMSTR**: MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVENBERG-MARQUARDT ALGORITHM WHICH USES MINIMAL STORAGE
- **LMSTR1**: MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVENBERG-MARQUARDT ALGORITHM WHICH USES MINIMAL STORAGE
- **LMDIF**: MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVENBERG-MARQUARDT ALGORITHM
- **LMDIF1**: MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVENBERG-MARQUARDT ALGORITHM
THE CDC MATH SCIENCE LIBRARY CONTAINS OVER 300 NUMERICAL
MATHEMATICAL ROUTINES COVERING THE FOLLOWING EIGHT AREAS:

- PROGRAMMED ARITHMETIC
- ELEMENTARY FUNCTIONS
- POLYNOMIALS AND SPECIAL FUNCTIONS
- ORDINARY DIFFERENTIAL EQUATIONS
- INTERPOLATION, APPROXIMATION AND QUADRATURE
- LINEAR ALGEBRA
- PROBABILITY, STATISTICS AND TIME SERIES
- NONLINEAR EQUATION SOLVERS

REFERENCE: MATH SCIENCE LIBRARY, VOLUMES 1-8, CDC PUBLICATION NUMBER
60327500.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING
PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'MSL' INCLUDE:

- **ACFI** SINGLE CONTINUED FRACTION INTERPOLATION ON TABULAR DATA WITH
  ARBITRARY SPACING
- **ADR** ADD COEFFICIENTS OF LIKE POWERS OF TWO REAL POLYNOMIALS
- **AICEN** AITKEN'S INTERPOLATION OF ORDER N-1 (ORDER RANGE FROM 1-9)
- **AMCON** PROVIDE CERTAIN MACHINE AND MATHEMATICAL CONSTANTS AS SINGLE
  PRECISION NUMBERS OF MAXIMUM ACCURACY
- **ATSM** SELECT A SUBTABLE ORDERED, ACCORDING TO PROXIMITY, OF THOSE
  POINTS THAT HAVE ABCISSAE CLOSEST TO A GIVEN VALUE, FROM A
  MONOTONE ORDERED TABLE
- **BALANC** BALANCE A COMPLEX MATRIX BY THE USE OF DIAGONAL SIMILARITY
  TRANSFORMATIONS
- **BANEIG** DETERMINE A SPECIFIED NUMBER OF THE SMALLEST EIGENVALUES AND
  ASSOCIATED EIGENVECTORS OF THE ALGEBRAIC EIGENVALUE PROBLEM
  \[ A^{*}V = \lambda B V \]
  WHERE A IS A SYMMETRIC, NONNEGATIVE
  DEFINITE, NARROW BAND MATRIX AND B IS A POSITIVE DEFINITE
  DIAGONAL MATRIX
- **BCHSDC** DECOMPOSE A REAL, SYMMETRIC POSITIVE BAND MATRIX INTO
  (BANDED) UPPER AND LOWER TRIANGULAR FACTORS
- **BDCWNP** DECOMPOSE A BANDED MATRIX INTO BANDED LOWER AND UPPER
  TRIANGULAR FACTORS WITH NO PIVOTING
- **BDECOM** DECOMPOSE A BANDED MATRIX B INTO BANDED LOWER AND UPPER
  TRIANGULAR FACTORS L AND U, WITH IMPLICIT EQUILIBRATION AND
  PARTIAL PIVOTING
- **BESNIS** EVALUATE A TABLE FOR THE BESSEL FUNCTION I(X) FOR
  \[ N=0,1,2,3,\ldots,J-1 \]
BESNKS  EVALUATE A TABLE OF VALUES OF THE BESSEL FUNCTION K(X)

BETAR  COMPUTE INCOMPLETE BETA RATIO (OF THE INCOMPLETE BETA
FUNCTION AT X,P,Q TO THE COMPLETE BETA FUNCTION AT P,Q)

BFBNP  SOLVE LY=B AND UX=Y BY BACK SUBSTITUTIONS - WHERE B IS A
 MATRIX CONSISTING OF M COLUMN VECTORS AND, L AND U ARE LOWER
 AND UPPER TRIANGULAR FACTORS, POSSIBLY OBTAINED FROM BDCWNP

BFBSUM  SOLVE 'LY=B AND UX=Y BY BACK SUBSTITUTIONS - WHERE B IS A
MATRIX CONSISTING OF M COLUMN VECTORS AND, L AND U ARE LOWER
AND UPPER TRIANGULAR MATRICES OBTAINED FROM BDECOM

BITERM  SOLVE A SYSTEM OF LINEAR EQUATIONS WITH ITERATIVE REFinement
 FOR SYSTEMS HAVING A BAND COEFFICIENT MATRIX

BITRFM  SOLVE, WITH ITERATIVE REFINEMENT, A SYSTEM OF LINEAR
 EQUATIONS HAVING A BAND COEFFICIENT MATRIX

BITRNP  SOLVE, WITH ITERATIVE REFINEMENT, A SYSTEM OF LINEAR
 EQUATIONS HAVING A BAND COEFFICIENT MATRIX

BITRPD  SOLVE A SYSTEM OF LINEAR EQUATIONS WITH ITERATIVE REFinement,
 GIVEN THE TRIANGULAR DECOMPOSITION

BITWNP  SOLVE, WITH ITERATIVE REFINEMENT, A SYSTEM OF LINEAR
 EQUATIONS HAVING A BAND COEFFICIENT MATRIX

BLCKDQ  SOLVE A SYSTEM OF FIRST ORDER DIFFERENTIAL EQUATIONS AT A
 POINT B, GIVEN THE (INITIAL) VALUES AT A POINT A

BLESOM  SOLVE A SYSTEM OF N LINEAR EQUATIONS (WITH M RIGHT-HAND
 SIDES), HAVING A BAND COEFFICIENT MATRIX

BLSWNP  SOLVE A SYSTEM OF LINEAR EQUATIONS (WITH SEVERAL RIGHT-HAND
 SIDES), HAVING A BAND COEFFICIENT MATRIX, USING NO PIVOTING

BPDITM  SOLVE A SYSTEM OF LINEAR EQUATIONS WITH ITERATIVE REFinement
 - A BANDED, SYMMETRIC SYSTEM WITH POSITIVE DEFINITENESS

BPDSFB  SOLVE LY=B AND LTX=Y BY BACK SUBSTITUTIONS - WHERE B IS A
 MATRIX CONSISTING OF M COLUMN VECTORS AND L AND LT ARE THE
 LOWER TRIANGULAR FACTOR AND ITS TRANSPOSE POSSIBLY OBTAINED
 FROM BCHSDC

BPDSOM  SOLVE A POSITIVE DEFINITE SYMMETRIC BAND SYSTEM OF EQUATIONS
 HAVING M RIGHT-HAND SIDES

BRTLTT  COMPUTE THE TEST STATISTIC FOR BARTLETT'S TEST OF HOMOGENEITY
 OF A GROUP OF VARIANCE ESTIMATES AND DETERMINE THE
 PROBABILITY OF OBTAINING A VALUE FOR THE TEST STATISTIC LESS
 THAN THAT OBSERVED

BSJ  EVALUATE THE SPHERICAL BESSEL FUNCTION J(X) FOR N=-1,0,.....1

BSUBHT  FIND A LEAST SQUARES SOLUTION TO AN OVERDETERMINED SYSTEM
 THAT HAS BEEN DECOMPOSED USING HOUSEHOLDER TRANSFORMATIONS
BVP
SOLVE NONLINEAR P-POINT BOUNDARY VALUE PROBLEM IN ORDINARY DIFFERENTIAL EQUATIONS

CADR
ADD COEFFICIENTS OF LIKE POWERS OF TWO COMPLEX POLYNOMIALS

CBAREX
EVALUATE \( C^R \) FOR \( C \) A COMPLEX NUMBER AND \( R \) A REAL NUMBER

CCOMPE
EVALUATE A POLYNOMIAL HAVING COMPLEX COEFFICIENTS AT A COMPLEX POINT

CCONGR
SOLVE THE RECTANGULAR SYSTEM \( AX = B, X = B \) IN THE LEAST SQUARES SENSE, IF NO EXACT SOLUTION EXISTS - \( A, B, X \) ARE COMPLEX

CDECOM
DECOMPOSE A COMPLEX SQUARE MATRIX INTO POWER AND UPPER TRIANGULAR MATRICES WITH PARTIAL PIVOTING AND ROW EQUILIBRATION

CDERIV
GIVEN THE COMPLEX COEFFICIENTS OF A POLYNOMIAL, COMPUTE THE COMPLEX COEFFICIENTS OF THE DERIVATIVE POLYNOMIAL

CEL3
COMPUTE THE COMPLETE ELLIPTIC INTEGRAL OF THE THIRD KIND

CFBSUM
SOLVE \( LY = B \) AND \( UX = Y \) BY FORWARD AND BACKWARD SUBSTITUTIONS, WHERE \( B \) IS A MATRIX CONSISTING OF \( M \) COLUMN VECTORS WITH COMPLEX ELEMENTS, AND \( L \) AND \( U \) ARE LOWER AND UPPER TRIANGULAR MATRICES OBTAINED FROM CDECOM

CFQME
CONSTRUCT THE MINIMAX POLYNOMIAL THROUGH A DISCRETE, WEIGHTED, SET OF POINTS

CGITRF
SOLVE A COMPLEX SYSTEM OF LINEAR EQUATIONS HAVING \( M \) RIGHT-HAND SIDE COMPLEX COLUMN VECTORS WITH ITERATIVE REFINEMENT

CGLESM
SOLVE A COMPLEX SYSTEM OF LINEAR EQUATIONS HAVING \( M \) RIGHT-HAND SIDES

CHEBAP
FIND A CLOSE APPROXIMATION TO A MINIMAX FIT OF A GIVEN FUNCTION OVER A GIVEN INTERVAL

CHEBEV
EVALUATE A CHEBYCHEV POLYNOMIAL AT A GIVEN POINT

CHIDST
PERFORM THE CHI-SQUARE DISTRIBUTION TEST

CHIPRB
COMPUTE THE PROBABILITY OF OBTAINING A VALUE OF CHI-SQUARE WHICH IS LESS THAN OR EQUAL TO THE GIVEN VALUE CHI-SQUARE

CHIRAB
PERFORM A CHI-SQUARE TEST FOR RUNS ABOVE AND BELOW ZERO - TESTS HYPOTHESIS THAT A SAMPLE OF RANDOM VARIABLES IS OBTAINED FROM A POPULATION WHICH IS SYMMETRICALLY DISTRIBUTED ABOUT ZERO

CHIRUD
PERFORM THE CHI-SQUARE TEST FOR RUNS UP AND DOWN

CHSDEC
DECOMPONE A POSITIVE DEFINITE SYMMETRIC MATRIX INTO A LOWER TRIANGULAR MATRIX AND ITS TRANSPOSE
CHSQO  FUNCTION TO COMPUTE THE VALUE OF CHI-SQUARE WHEN GIVEN THE EXPECTED AND OBSERVED FREQUENCIES

CHTOL  EVALUATE THE DISTANCE OF A POINT TO A LINE

CINPRD  COMPUTE THE INNER PRODUCT OF TWO VECTORS HAVING COMPLEX COEFFICIENTS IN DOUBLE PRECISION

CINT  GIVEN THE COMPLEX COEFFICIENTS OF A POLYNOMIAL, COMPUTE THE COEFFICIENTS OF THE INTEGRAL POLYNOMIAL

CITERF  SOLVE LY=B AND UX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS WITH ITERATIVE REFINEMENT, WHERE B IS A MATRIX CONSISTING OF M COLUMN VECTORS HAVING COMPLEX ELEMENTS, AND L AND U ARE LOWER AND UPPER TRIANGULAR MATRICES OBTAINED FROM CDECOM - PROVIDE THE DATA FOR ESTIMATING THE CONDITION NUMBER OF THE COEFFICIENT MATRIX AND THE NUMBER OF CORRECT DIGITS IN THE FIRST COMPUTED SOLUTION

CLDIV  DIVIDE A POLYNOMIAL WITH COMPLEX COEFFICIENTS BY THE LINEAR EXPRESSION (X+B) WHERE B IS COMPLEX

CMPYR  FIND THE PRODUCT OF TWO POLYNOMIALS WHEN ANY OF THE COEFFICIENTS ARE COMPLEX

CNSLVL  ESTIMATE THE ERROR PERFORMED IN THE EVALUATION OF A COMPLEX POLYNOMIAL IN THE NEIGHBORHOOD OF ONE OF ITS ROOTS

COMBES  COMPUTE A TABLE OF BESSEL FUNCTIONS OF THE FIRST AND SECOND KINDS FOR COMPLEX ARGUMENT AND ORDERS

COMCUB  FIND THE SLOPES AT A GIVEN SET OF POINTS OF THE CUBIC SPLINE PASSING THROUGH THE POINTS

COMPEV  EVALUATE A REAL POLYNOMIAL AT A COMPLEX POINT

CONRAY  PERFORM ARITHMETIC OPERATIONS ON THE OBSERVATIONS OF ONE VARIABLE IN A MULTIPLEXED DATA ARRAY AND A SPECIFIED CONSTANT

CORCOV  COMPUTE EITHER THE AUTOCORRELATION COEFFICIENTS OR THE AUTOCOVARIANCE COEFFICIENTS FOR ONE OF THE VARIABLES IN A MULTIPLEXED DATA ARRAY

COSEVL  EVALUATE A COSINE POLYNOMIAL AT A GIVEN POINT

CPDIV  PROVIDE THE QUOTIENT AND REMAINDER OBTAINED BY DIVIDING ONE POLYNOMIAL BY ANOTHER - COEFFICIENTS MAY BE COMPLEX

CPOLRT  FIND ALL ROOTS OF AN NTH DEGREE POLYNOMIAL HAVING COMPLEX COEFFICIENTS

CPTRAN  COORDINATE TRANSLATION SUCH THAT THE POLYNOMIAL P(X) BECOMES P(X+T) - P(X) MAY HAVE COMPLEX COEFFICIENTS.
CQDIV  DIVIDE THE COMPLEX POLYNOMIAL BY THE QUADRATIC EXPRESSION
     \((x^2 + b\cdot x + c)\), \(b\) AND \(c\) COMPLEX

CREV   REVERSE THE ORDER OF POLYNOMIAL COEFFICIENTS IN AN ARRAY -
     COEFFICIENTS MAY BE COMPLEX

CSBR   SUBTRACT COEFFICIENTS OF LIKE POWERS OF TWO POLYNOMIALS -
     COEFFICIENTS MAY BE COMPLEX

CSHRNK COMPUTE THE COEFFICIENTS OF THE POLYNOMIAL \(p(ax)\) FROM THE
     COEFFICIENTS OF THE POLYNOMIAL \(p(x)\) - COMPLEX COEFFICIENTS

CUBIC2 FIT A CUBIC TO TWO POINTS, GIVEN THE SLOPE AT EACH

CURV   EVALUATE THE MERIT FUNCTION FOR A GIVEN DATA SET

DCBHT  REDUCE A GIVEN MATRIX TO UPPER TRIANGULAR FORM BY HOUSEHOLDER
     TRANSFORMATIONS

DCWNE  DECOMPOSE A SQUARE MATRIX INTO LOWER AND UPPER TRIANGULAR
     MATRICES WITH PARTIAL PIVOTING BUT WITHOUT ROW EQUILIBRATION

DCWNP  DECOMPOSE A SQUARE MATRIX INTO LOWER AND UPPER TRIANGULAR
     MATRICES WITHOUT PIVOTING

DECOM  DECOMPOSE A SQUARE MATRIX INTO LOWER AND UPPER TRIANGULAR
     MATRICES WITH PARTIAL PIVOTING AND ROW EQUILIBRATION

DEIG   SOLVE FOR THE EIGENVALUES AND RIGHT EIGENVECTORS OF THE
     DYNAMICAL SYSTEM \( Ax + Bx - Cx = 0 \) WHERE \( A, B, C \) ARE REAL, BUT
     OTHERWISE GENERAL, MATRICES

DERIV  GIVEN THE REAL COEFFICIENTS OF A POLYNOMIAL, COMPUTE THE REAL
     COEFFICIENTS OF THE DERIVATIVE POLYNOMIAL

DETERM CALCULATE THE DETERMINANT OF A SQUARE MATRIX IN THE FORM
     \( D_1 \cdot (2^{n-2} \cdot D_2) \) USING THE INFORMATION FROM THE SUBROUTINE DECOM

DIFTAB DIFFERENTIATE NUMERICALLY A FUNCTION GIVEN AS A TABLE WITH
     EQUISpaced ARGUMENTS

DLETE  REMOVE SPECIFIED OBSERVATIONS FROM A DATA ARRAY

DRATEX SOLVE NUMERICALLY INITIAL VALUE PROBLEMS IN ORDINARY
     DIFFERENTIAL EQUATIONS

DSCRP2 DETERMINE THE MEDIAN, MINIMUM, MAXIMUM AND RANGE FOR EITHER A
     SINGLE VARIABLE IN A MULTIPLEXED DATA ARRAY OR ALL THE
     VARIABLES IN A MULTIPLEXED DATA ARRAY

DTSHFT FURNISH A GUESS OF AN EIGENVALUE TO A COMPLEX HESSENBERG
     MATRIX
EIGCHK  GIVEN AN APPROXIMATE EIGENVALUE/EIGENVECTOR PAIR OF A REAL SYMMETRIC MATRIX A, AND THE MATRIX, AND ESTIMATES OF THE CLOSEST EIGENVALUES TO THE GIVEN EIGENVALUE, PROVIDE ERROR BOUNDS AND POSSIBLY REFINEMENT OF THE EIGENVALUE.

EIGC01  GIVEN AN APPROXIMATION TO AN EIGENVALUE OF A REAL MATRIX HAVING REAL AND DISTINCT ROOTS, CONVERGE TO THE EIGENVALUE-EIGENVECTOR PAIR WHOSE EIGENVALUE IS NEAREST TO THIS APPROXIMATION.

EIGIMP  REFINE THE EIGENVECTORS OBTAINED FROM SUBROUTINE EIGVCH (WIELANOT INVERSE ITERATION).

EIGSYM  FIND ALL EIGENVECTORS OF A REAL, SYMMETRIC MATRIX - SUBSET OF EIGENVECTORS MAY ALSO BE FOUND.

EIGVCH  COMPUTE THE EIGENVECTORS CORRESPONDING TO A REAL EIGENVALUE OF A REAL UPPER HESSENBERG MATRIX.

EIG5    FIND ALL, OR OPTIONALLY A SUBSET OF THE EIGENVALUES OF A GENERAL, REAL-ELEMENTED MATRIX.

ELF     EVALUATE THE INCOMPLETE ELLIPTIC INTEGRALS OF THE FIRST AND SECOND KIND.

ELK     EVALUATE THE COMPLETE ELLIPTIC INTEGRALS OF THE FIRST AND SECOND KIND.

EL3     COMPUTE THE ELLIPTIC INTEGRAL OF THE THIRD KIND.

ERF     COMPUTE THE ERROR FUNCTION.

ERFINV  FIND THE INVERSE ERROR FUNCTION - COMPUTE THE UPPER LIMIT OF THE INTEGRAL IN THE ERROR FUNCTION.

EVREAL  EVALUATE A POLYNOMIAL HAVING REAL COEFFICIENTS AT A REAL VALUE OF THE INDEPENDENT VARIABLE.

EXRAND  GENERATE RANDOM NUMBERS HAVING A NEGATIVE EXPONENTIAL DISTRIBUTION.

FABSV   COMPUTE THE VALUE OF THE MODULUS OF A VECTOR.

FAFRAC  ADD TWO FRACTIONS AND EXPRESS THE RESULT AS A FRACTION IN ITS LOWEST FORM.

FBSUBM  SOLVE LY=B AND UX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS, WHERE B IS A MATRIX CONSISTING OF M COLUMN VECTORS, AND U AND L ARE LOWER AND UPPER TRIANGULAR MATRICES OBTAINED FROM DECOM.

FBSUBS  SOLVE LY=B AND UX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS, WHERE B IS A COLUMN VECTOR, AND U AND L ARE LOWER AND UPPER TRIANGULAR MATRICES OBTAINED FROM DECOM.

FCGM2   SOLVE THE RECTANGULAR EQUATION SYSTEM AX-BAR=B-BAR IN THE LEAST SQUARES SENSE, IF NO EXACT SOLUTION EXISTS - A, X-BAR, B-BAR ARE COMPLEX.
FCLSQ  CONSTRUCT A LEAST SQUARE POLYNOMIAL OF A SPECIFIED DEGREE WHOSE GRAPH APPROXIMATES A SET OF DATA POINTS

FDLSQ  CONSTRUCT A LEAST SQUARE POLYNOMIAL APPROXIMATION OF SOME PRE-ASSIGNED DEGREE TO A SET OF DATA POINTS WITH GIVEN WEIGHT WHERE THE POLYNOMIAL IS CONSTRAINED AT N POINTS AND THE DERIVATIVE IS ALSO CONSTRAINED AT THE FIRST M OF THE N POINTS WHERE M <= N

FFRAC  CHANGE A VECTOR WITH FRACTIONAL COMPONENTS INTO ONE WITH INTEGER COMPONENTS TIMES A SCALAR FRACTION

FHRNEW  CONSTRUCT THE HERMETIAN POLYNOMIAL OF DEGREE N+M+1 THROUGH N+1 COORDINATES WITH DERIVATIVES AT THE FIRST M+1 POINTS

FILTER  COMPUTE THE OUTPUTS FROM A MOVING AVERAGE -- AUTOREGRESSIVE FILTER -- BOTH INPUT AND OUTPUT ARRAYS MAY BE MULTIPLEXED ARRAYS

FITLIN  FIND THE BEST FIT LINE -- MINIMIZE THE SUM OF THE SQUARES OF THE PERPENDICULAR DISTANCES FROM THE POINTS TO THE LINE

FLGNEW  CONSTRUCT THE NTH DEGREE LAGRANGIAN THROUGH N+I COORDINATES X(I), AF(I)

FLSQFY  FIND A LEAST SQUARES POLYNOMIAL OF SPECIFIED DEGREE WHOSE GRAPH APPROXIMATES A SET OF DATA POINTS

FMFRAC  MULTIPLY TWO FRACTIONS AND EXPRESS THE RESULT AS A FRACTION IN ITS LOWEST TERMS

FMMX  MATRIX-MATRIX MULTIPLICATION

FMTMX  MULTIPLY THE TRANSPOSE OF A MATRIX BY A MATRIX ON THE RIGHT

FMTR  TRANSPOSE AN M BY N MATRIX

FMTVCX  MULTIPLY THE TRANSPOSE OF A COMPLEX MATRIX ON THE RIGHT BY A COMPLEX VECTOR

FMTVX  MULTIPLY THE TRANSPOSE OF A MATRIX BY A VECTOR

FMULT1  MULTIPLY A GIVEN NTH DEGREE POLYNOMIAL BY A GIVEN LINEAR FACTOR TO GIVE AN (N+1)TH DEGREE POLYNOMIAL

FMVCX  MULTIPLY A COMPLEX MATRIX ON THE RIGHT BY A COMPLEX VECTOR

FMVX  MATRIX-VECTOR MULTIPLICATION

FNORM1  NORMALIZE A VECTOR

FOURAP  FIND THE LEAST SQUARES APPROXIMATING TRIGONOMETRIC POLYNOMIAL TO A SET OF GIVEN DATA HAVING EQUISPAced ABSCISSAE
FOURI  FIND AN INTERPOLATING TRIGONOMETRIC POLYNOMIAL TO A SET OF
       DATA HAVING EQUISPACED ABCISSAE

FPUR   SUBTRACT FROM A VECTOR ITS COMPONENT ALONG ANOTHER VECTOR

GAMAIN COMPUTE THE INCOMPLETE GAMMA FUNCTION

GAMMA  EVALUATE THE GAMMA FUNCTION OF A REAL ARGUMENT X

GITRFM SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING M
       RIGHT-HAND SIDES WITH ITERATIVE REFINEMENT

GITRFS SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING ONE
       RIGHT-HAND SIDE WITH ITERATIVE REFINEMENT

GLESOM SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING M
       RIGHT-HAND SIDES

GLESOS SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING ONE
       RIGHT-HAND SIDE

GMI     EVALUATE NUMERICALLY A SINGLE, DOUBLE OR M-TUPLE (M.LE.10)
       INTEGRAL OF AN ARBITRARY INTEGRAND BETWEEN ARBITRARY LIMITS

HANKEL EVALUATE THE COMPLEX-VALUED HANKEL FUNCTION OF THE FIRST OR
       SECOND KIND FOR REAL ARGUMENT AND INTEGER ORDER

HARM   COMPUTE A FINITE DISCRETE COMPLEX FOURIER TRANSFORM OF A
       ONE-, TWO- OR THREE-DIMENSIONAL ARRAY OF COMPLEX FOURIER
       AMPLITUDES

HCF     FIND THE HIGHEST COMMON FACTOR OF TWO INTEGERS

HELP   CALCULATE THE ROOTS OF A POLYNOMIAL HAVING COMPLEX
       COEFFICIENTS

HERMIT EVALUATE THE INTEGRAL OF E**(-X**2)F(X)DX FROM NEGATIVE TO
       POSITIVE INFINITY WITH F(X) A REAL FUNCTION OF ONE VARIABLE

HRMT1  PERFORM INTERPOLATION, GIVEN A VALUE OF THE INDEPENDENT
       VARIABLE AND A TABLE OF CORRESPONDING VALUES OF THE
       INDEPENDENT AND DEPENDENT VARIABLE AND ITS DERIVATIVE -
       EXTRAPOLATION IS ALLOWED

HRMT2  PERFORM HERMITE INTERPOLATIONS, GIVEN AN ARRAY OF VALUES OF
       THE INDEPENDENT VARIABLE, AND A TABLE OF CORRESPONDING VALUES
       OF THE INDEPENDENT AND THE DEPENDENT VARIABLE AND ITS
       DERIVATIVE

HSSN   REDUCE A GENERAL REAL MATRIX TO AN UPPER HESSENBERG FORM BY A
       SIMILARITY TRANSFORMATION AND PROVIDE THE ELEMENTS IF THE
       TRANSFORMATION MATRIX

HSTGRM DETERMINE THE NUMBER OF OBSERVATIONS OF A RANDOM VARIABLE
       WHICH LIE IN USER SPECIFIED INTERVALS - USED FOR DISTRIBUTION
       TESTS AND FOR PLOTTING HISTOGRAMS
INRPRD  COMPUTE THE INNER PRODUCT OF TWO VECTORS

INT  GIVEN THE REAL COEFFICIENTS OF A POLYNOMIAL, COMPUTE THE
COEFFICIENTS OF THE INTEGRAL POLYNOMIAL

INVERS  FIND THE INVERSE OF A SQUARE MATRIX USING DECOM AND FBSUBM

INVITR  FIND THE INVERSE OF A SQUARE MATRIX WITH ITERATIVE REFINEMENT

IRAND  GENERATE RANDOM INTEGERS BETWEEN TWO GIVEN VALUES - EACH OF
THE INTEGERS BETWEEN THE GIVEN LIMITS HAS AN EQUAL
PROBABILITY OF OCCURRING

ITERFM  SOLVE LY=B AND LX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS
WITH AN ITERATIVE REFINEMENT, WHERE B IS A MATRIX CONSISTING
OF M COLUMN VECTORS, AND L AND U ARE LOWER AND UPPER
TRIANGULAR MATRICES OBTAINED FROM DECOM - PROVIDE THE DATA
FOR ESTIMATING THE CONDITION NUMBER OF THE COEFFICIENT MATRIX
AND THE NUMBER OF CORRECT DIGITS IN THE FIRST COMPUTED
SOLUTION

ITERFS  SOLVE LY=B AND LX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS
WITH AN ITERATIVE REFINEMENT, WHERE B IS A COLUMN VECTOR,
AND L AND U ARE LOWER AND UPPER TRIANGULAR MATRICES OBTAINED
FROM DECOM - PROVIDE THE DATA FOR ESTIMATING THE CONDITION
NUMBER OF THE COEFFICIENT MATRIX AND THE NUMBER OF CORRECT
DIGITS IN THE FIRST COMPUTED SOLUTION

ITERIN  PERFORM THE ITERATIVE REFINEMENT FOR THE INVERSE OF A SQUARE
MATRIX

ITRLSQ  PERFORM THE ITERATIVE REFINEMENT OF A LEAST SQUARES SOLUTION
OBTAINED FROM THE SUBROUTINE BSUBHT

ITRPDM  SOLVE LY=B AND UX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS
WITH AN ITERATIVE REFINEMENT FOR A POSITIVE DEFINITE SYSTEM
AX=B (B IS A MATRIX CONSISTING OF M COLUMN VECTORS AND L AND
U ARE THE LOWER TRIANGLE MATRIX AND ITS TRANSPOSE OBTAINED
FROM CHSDEC) - PROVIDE THE DATA FOR ESTIMATING THE CONDITION
NUMBER OF THE COEFFICIENT MATRIX AND THE NUMBER OF CORRECT
DIGITS IN THE FIRST COMPUTED SOLUTION

ITRPDS  SOLVE LY=B AND UX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS
WITH AN ITERATIVE REFINEMENT FOR A POSITIVE DEFINITE SYSTEM
AX=B (B IS A COLUMN VECTOR AND L AND U ARE THE LOWER TRIANGLE
MATRIX AND ITS TRANSPOSE OBTAINED FROM CHSDEC) - PROVIDE THE
DATA FOR ESTIMATING THE CONDITION NUMBER OF THE COEFFICIENT
MATRIX AND THE NUMBER OF CORRECT DIGITS IN THE FIRST COMPUTED
SOLUTION
ITRSPM SOLVE LY=B AND DLTX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS WITH ITERATIVE REFINEMENT (WHERE B IS A MATRIX CONSISTING OF M COLUMN VECTORS, AND L AND LT ARE A LOWER TRIANGULAR MATRIX AND ITS TRANSPOSE, D IS A DIAGONAL MATRIX, OBTAINED FROM SPDCOM) - PROVIDE THE DATA FOR ESTIMATING THE CONDITION NUMBER OF THE COEFFICIENT MATRIX AND THE NUMBER OF CORRECT DIGITS IN THE FIRST COMPUTED SOLUTION

ITRSPS SOLVE LY=B AND DLTX=Y BY FORWARD AND BACKWARD SUBSTITUTIONS WITH ITERATIVE REFINEMENT (WHERE B IS A COLUMN VECTOR, AND L AND LT ARE A LOWER TRIANGULAR MATRIX AND ITS TRANSPOSE, D IS A DIAGONAL MATRIX, OBTAINED FROM SPDCOM) - PROVIDE THE DATA FOR ESTIMATING THE CONDITION NUMBER OF THE COEFFICIENT MATRIX AND THE NUMBER OF CORRECT DIGITS IN THE FIRST COMPUTED SOLUTION

LAGDIF DIFFERENTIATE NUMERICALLY A TABULAR FUNCTION, AT ANY POINT

LAGINT PERFORM LAGRANGIAN INTERPOLATION AT A GIVEN ABSCISSA

LAGRAN EVALUATE THE INTEGRAL OF A REAL FUNCTION OF ONE VARIABLE, GIVEN THE ARRAYS OF THE INDEPENDENT AND THE DEPENDENT VARIABLES

LAGUER EVALUATE THE INTEGRAL OF F(X)DX FROM A TO E**X WITH F(X) A REAL FUNCTION OF ONE VARIABLE AND E**X THE WEIGHTING FN

LATNTR FIND THE EIGENVALUES (REAL AND COMPLEX) OF A REAL MATRIX

LCM FIND THE LEAST COMMON MULTIPLE OF TWO INTEGERS

LDIV DIVIDE A POLYNOMIAL WITH REAL COEFFICIENTS BY THE LINEAR EXPRESSION (X+B) - B IS REAL

LEGEND EVALUATE THE INTEGRAL OF A REAL FUNCTION OF ONE VARIABLE OVER A FINITE INTERVAL, WHEN THE FUNCTION GENERATOR IS GIVEN

LESWNE SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING ONE RIGHT-HAND SIDE WITH PARTIAL PIVOTING BUT WITHOUT ROW EQUILIBRATION - PROVIDE DATA FOR CALCULATING THE DETERMINANT

LESWNP SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING ONE RIGHT-HAND SIDE WITHOUT PIVOTING

LINBVP SOLVE NUMERICALLY LINEAR P-POINT BOUNDARY POINT PROBLEMS IN N FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS

LINSYS SOLVE GENERAL SYSTEMS OF LINEAR ALGEBRAIC EQUATIONS - PROVIDE THE DATA TO EVALUATE READILY THE DETERMINANT OF THE COEFFICIENT MATRIX

LITWNE SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING ONE RIGHT-HAND SIDE WITH ITERATIVE REFINEMENT, WITH PARTIAL P'V OTING, WITHOUT ROW EQUILIBRATION - PROVIDE THE DATA FOR CALCULATING THE DETERMINANT AND THE DATA FOR ESTIMATING THE CONDITION NUMBER OF THE COEFFICIENT MATRIX
LITWNP  SOLVE A GENERAL SYSTEM OF LINEAR EQUATIONS HAVING ONE RIGHT-HAND SIDE WITH ITERATIVE REFINEMENT AND WITHOUT PIVOTING

LOGGAM  COMPUTE THE NATURAL LOGARITHM OF THE GAMMA FUNCTION FOR COMPLEX ARGUMENT

LSQHTM  SOLVE LINEAR LEAST SQUARES PROBLEMS FOR AN OVERTODETERMINED SYSTEM WITH K RIGHT-HAND SIDES BY HOUSEHOLDER TRANSFORMATIONS

LSQHTS  SOLVE LINEAR LEAST SQUARES PROBLEMS FOR AN OVERTODETERMINED SYSTEM WITH ONE RIGHT-HAND SIDE BY HOUSEHOLDER TRANSFORMATIONS

LSQSIT  SOLVE LINEAR LEAST SQUARES PROBLEMS BY HOUSEHOLDER TRANSFORMATION, USING ITERATIVE REFINEMENT

MIGEN  FIND A MINIMAX FUNCTION APPROXIMATION TO A SET OF POINTS IN TERMS OF A LINEAR COMBINATION OF A PRESCRIBED SET OF FUNCTIONS

MILNZ  SMOOTH A SET OF DATA BY AN AVERAGING PROCESS

MINRAT  FIND A MINIMAX RATIONAL FUNCTION APPROXIMATION OF GIVEN DEGREE TO A SET OF POINTS

MPYR  FIND THE PRODUCT OF TWO POLYNOMIALS WHEN THE COEFFICIENTS ARE ALL REAL

MULLP  FIND ALL ZEROS OR A SINGLE ZERO OF A POLYNOMIAL HAVING COMPLEX COEFFICIENTS

NBESJ  COMPUTE BESSEL FUNCTIONS OF FIRST KIND FOR REAL ARGUMENT AND INTEGER ORDERS

NEWT  SOLVE A SYSTEM OF NON-LINEAR EQUATIONS

NONLIQ  SOLVE A SYSTEM OF NON-LINEAR ALGEBRAIC EQUATIONS

NRAND  GENERATE PSEUDO-RANDOM NUMBERS WHICH ARE NORMALLY DISTRIBUTED AND STORE VALUES IN A MULTIPLEXED ARRAY

NRICH  ENRICH A SET OF POINTS BY ADDING POINTS ON AN INTERPOLATING CURVE THROUGH THE GIVEN POINTS

NRKVS  SOLVE A SYSTEM OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AT A POINT B WITH INITIAL VALUES GIVEN AT A POINT A

NRKVSH  SOLVE A SYSTEM OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AT A POINT B WITH INITIAL VALUES GIVEN AT A POINT A

NRML  GENERATE PSEUDO-RANDOM NUMBERS HAVING A NORMAL DISTRIBUTION

NRMNO  GENERATE NORMALLY DISTRIBUTED PSEUDO-RANDOM NUMBERS WITH A CONVENIENT WAY OF HANDLING THE TAIL OF THE DISTRIBUTION - STORE THOSE NUMBERS IN A MULTIPLEXED DATA ARRAY
NRSG  SOLVE M BY N SYSTEM OF NON-LINEAR EQUATIONS

NSLVL  ESTIMATE THE ERROR PERFORMED IN THE EVALUATION OF A REAL
POLYNOMIAL AT A COMPLEX POINT IN THE NEIGHBORHOOD OF ONE OF
ITS ROOTS

OP1RAY  PERFORM ONE OF NINE POSSIBLE TRANSFORMATIONS ON THE
OBSERVATIONS OF A SINGLE VARIABLE IN A MULTIPLEXED DATA ARRAY

OP2RAY  PERFORM AN ARITHMETIC OPERATION (+, -, *, /, ^n) ON THE
CORRESPONDING OBSERVATIONS OF TWO VARIABLES STORED IN
MULTIPLEXED DATA ARRAYS

ORTHFT  FIT A GIVEN SET OF POINTS WITH A LINEAR COMBINATION OF
PRESCRIBED GENERAL FUNCTIONS OF LINEARLY INDEPENDENT
VARIABLE(S)

ORTHON  GIVEN A SET OF N LINEARLY INDEPENDENT REAL VECTORS OF
DIMENSION M, CONSTRUCT A SET WHICH SPANS THE SAME SUBSPACE
AND WHOSE VECTORS ARE ORTHONORMAL WITH RESPECT TO A DEFINED
INNER PRODUCT

PADE  APPROXIMATE FUNCTIONS WHICH HAVE MACLAURIN SERIES EXPANSIONS
BY RATIONAL FUNCTIONS USING PADE APPROXIMATIONS

PARBL  EVALUATE THE INTEGRAL OF A BOUNDED REAL FUNCTION OF ONE REAL
VARIABLE OVER A FINITE INTERVAL

PARFAC  RESOLVE A RATIONAL FUNCTION INTO PARTIAL FRACTIONS

PBETA  COMPUTE THE PROBABILITY OF OBTAINING A RANDOM VARIABLE HAVING
A VALUE LESS THAN OR EQUAL TO X FROM A BE A DISTRIBUTION

PBINOM  COMPUTE THE CUMULATIVE PROBABILITY FOR THE BINOMIAL
 DISTRIBUTION

PCHY  COMPUTE THE CUMULATIVE PROBABILITY FOR THE CAUCHY
 DISTRIBUTION

PDITRM  SOLVE A POSITIVE DEFINITE SYSTEM OF LINEAR EQUATIONS AX=B
HAVING M RIGHT-HAND SIDES

PDITRS  SOLVE A POSITIVE DEFINITE SYSTEM OF LINEAR EQUATIONS AX=B
HAVING ONE RIGHT-HAND SIDE

PDIV  PROVIDE THE QUOTIENT AND REMAINDER OBTAINED BY DIVIDING ONE
POLYNOMIAL BY ANOTHER - COEFFICIENTS ARE REAL

PDLSDM  SOLVE A POSITIVE DEFINITE SYSTEM AX=B HAVING M RIGHT-HAND
SIDES USING THE CHOLESKY DECOMPOSITION

PDLSSS  SOLVE A POSITIVE DEFINITE SYSTEM AX=B HAVING ONE RIGHT-HAND
SIDE USING THE CHOLESKY DECOMPOSITION
PDSFBM: Solve $LY = B$ and $UX = Y$ by forward and backward substitutions for a positive definite system $AX = B$. $B$ is a matrix of $m$ column vectors and $L$ and $U$ are the lower triangular matrix and its transpose obtained from CHSDEC.

PDSFBS: Solve $LY = B$ and $UX = Y$ by forward and backward substitutions for a positive definite system $AX = B$. $B$ is a column vector and $L$ and $U$ are the lower triangular matrix and its transpose obtained from CHSDEC.

PFDIST: Compute the probability of obtaining a random variable having a value less than or equal to $x$ from an F- (variance-ratio) distribution.

PGEOM: Compute the cumulative probability for the geometric distribution.

PGMMA: Compute the probability of obtaining a random variable having a value less than or equal to $x$ from a gamma distribution.

PHYPGE: Compute the cumulative probability for the hypergeometric distribution.

PIBETA: Determine the value of a random variable from a beta distribution when the cumulative probability is given.

PIBIN: Determine the value of a random variable from a binomial distribution when the cumulative probability is given.

PICHI: Determine the value of a random variable from a chi-square distribution when the cumulative probability is given.

PICHY: Determine the value of a random variable from a Cauchy distribution when the cumulative probability is given.

PIEXP: Determine the value of an exponentially distributed random variable when the cumulative probability is given.

PIFDIS: Determine the value of a random variable from an F distribution when the cumulative probability is given.

PIGAMA: Determine the value of a random variable from a gamma distribution when the cumulative probability is given.

PIGEO: Determine the value of a random variable from a geometric distribution when the cumulative probability is given.

PIHYPG: Determine the value of a random variable from a hypergeometric distribution when the cumulative probability is given.

PILGNM: Determine the value of a random variable from a log-normal distribution when the cumulative probability is given.

PINBIN: Determine the value of a random variable from a negative binomial distribution when the cumulative probability is given.
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<th>DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A NORMAL DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN</th>
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<td>PNBIN</td>
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<td>PNORM</td>
<td>COMPUTE THE CUMULATIVE PROBABILITY FOR A NORMAL DISTRIBUTION</td>
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<tr>
<td>POIS</td>
<td>COMPUTE THE CUMULATIVE PROBABILITY FOR THE POISSON DISTRIBUTION</td>
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<td>PORAND</td>
<td>GENERATE RANDOM INTEGERS HAVING THE POISSON DISTRIBUTION</td>
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<td>PRAYL</td>
<td>COMPUTE THE CUMULATIVE PROBABILITY FOR THE RAYLEIGH DISTRIBUTION</td>
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<td>PRBEXP</td>
<td>DETERMINE THE PROBABILITY OF OBTAINING A VARIABLE HAVING VALUE = X0 FROM A POPULATION HAVING AN EXPONENTIAL DISTRIBUTION</td>
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<td>PRUNF</td>
<td>DETERMINE THE PROBABILITY OF OBTAINING A VARIABLE HAVING VALUE = X0 FROM A POPULATION HAVING A UNIFORM DISTRIBUTION</td>
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<td>PRDSUM</td>
<td>COMPUTE THE INNER PRODUCT OF TWO VECTORS AND ADD IT TO AN INCOMING VALUE C</td>
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<td>PRICH</td>
<td>ENRICH A GIVEN ARRAY WHICH DEFINES A CURVE BY INSERTING POINTS SO AS TO OPTIMIZE THE MERIT FUNCTION DEFINED IN CURV</td>
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PRONY  CONSTRUCT AN APPROXIMATION WHICH IS THE SUM OF A PRESCRIBED NUMBER OF EXPONENTIALS TO A SET OF N DATA POINTS

PROOT  FIND ALL REAL AND COMPLEX ROO'TS OF A POLYNOMIAL WITH REAL COEFFICIENTS BY THE METHOD OF BAIRSTOW-NEWTON

PTDIST  COMPUTE THE PROBABILITY OF OBTAINING A RANDOM VARIABLE HAVING A VALUE LESS THAN OR EQUAL TO X FROM A T- (STUDENT'S) DISTRIBUTION

PTRAN  COORDINATE TRANSLATION SUCH THAT POLYNOMIAL P(X) BECOMES P(X+T) - P(X) HAS REAL COEFFICIENTS

PTRNRM  COMPUTE THE PROBABILITY OF OBTAINING A RANDOM VARIABLE HAVING A VALUE LESS THAN OR EQUAL TO X FROM A TRUNCATED NORMAL DISTRIBUTION IN THE RANGE BETWEEN A AND B

PUNFD  COMPUTE THE CUMULATIVE PROBABILITY FOR THE DISCRETE UNIFORM DISTRIBUTION

PWEBL  COMPUTE THE PROBABILITY OF OBTAINING A RANDOM VARIABLE HAVING A VALUE LESS THAN OR EQUAL TO X FROM A WEIBULL DISTRIBUTION

QDIV  DIVIDE A REAL POLYNOMIAL BY THE QUADRATIC EXPRESSION (X^2+B*X+C), B AND C REAL

QNWT  SOLVE SYSTEMS OF NON-LINEAR ALGEBRAIC OF TRANSCENDENTAL EQUATIONS

QREIGN  FIND ALL EIGENVALUES OF A COMPLEX MATRIX

QR1  PERFORM A SINGLE, COMPLEX QR-ITERATION ON A MATRIX IN UPPER HESSENBerg FORM, HAVING REAL SUBDIAGONAL ELEMENTS

QUAD  PERFORM NUMERICAL QUADRATURE ON BOTH WELL-BEHAVED AND POORLY-BEHAVED FUNCTIONS

RAND  GENERATE UNIFORMLY DISTRIBUTED OR NORMALLY DISTRIBUTED RANDOM NUMBERS

RATL  COMPUTE THE COEFFICIENTS OF THE LEAST SQUARES APPROXIMATION TO A SET OF DISCRETE DATA BY A RATIONAL FUNCTION

RAYLGH  COMPUTE THE RAYLEIGH QUOTIENT FOR REAL SYMMETRIC MATRICES

RBESY  COMPUTE BESSEL FUNCTION OF SECOND KIND FOR POSITIVE REAL ARGUMENT AND INTEGER ORDERS

RECOV1  RECOVER EIGENVECTORS AFTER A REDUCTION USING A TRIANGULAR MATRIX IN THE SIMILARITY TRANSFORMATION

RECOV2  RECOVER EIGENVECTORS OF THE EIGENPROBLEMS BAY=LAMBDAY OR YTAB=LAMBDAYT, WHERE A, B ARE REAL, SYMMETRIC AND B IS POSITIVE DEFINITE
REDSY1 REDUCE THE EIGENPROBLEM \((A-LAMBDA B)x = 0\) TO A STANDARD SYMMETRIC PROBLEM \((P-LAMBDA I)z = 0\) - \(A\) MUST BE REAL SYMMETRIC, \(B\) MUST BE REAL SYMMETRIC POSITIVE DEFINITE TO ALLOW THE DECOMPOSITION \(B = LL^T\)

REDSY2 REDUCE TO STANDARD FORM THE EIGENPROBLEMS \((AB-LAMBDA I)x = 0\) OR \((BA-LAMBDA I)y = 0\), WHERE \(A, B\) ARE REAL SYMMETRIC AND \(B\) IS POSITIVE DEFINITE

REV REVERSE THE ORDER OF REAL POLYNOMIAL COEFFICIENTS IN AN ARRAY

RICH ENRICH A GIVEN CURVE DEFINED BY AN ARRAY OF POINTS SO AS TO SATISFY A SPECIFIED CHORD HEIGHT TOLERANCE

RKNIT SOLVE A SYSTEM OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AT A POINT B WITH INITIAL VALUES GIVEN AS A POINT A

ROMBG EVALUATE THE INTEGRAL OF A REAL FUNCTION OF ONE REAL VARIABLE OVER A FINITE INTERVAL USING ROMBERG INTEGRATION

RQNWT USES QNWT TO SOLVE SYSTEMS OF NONLINEAR, ALGEBRAIC OR TRANSCENDENTAL EQUATIONS (IT APPEARS TO BE USEFUL IN THAT IT DOES NOT GIVE UP ON DIFFICULT PROBLEMS AS EASILY AS OTHER MSL SUBROUTINES - QNWT SOLVED 34 OF 40 TEST CASES, RQNWT SOLVED ALL 40)

RUNSAB COUNT THE NUMBER OF RUNS ABOVE AND BELOW ZERO OF DIFFERENT LENGTHS AND THE EXPECTED NUMBER OF RUNS FOR A SAMPLE WHICH IS RANDOMLY SELECTED FROM A POPULATION SYMMETRICALLY DISTRIBUTED ABOUT ZERO

RUNSUD COUNT THE RUNS UP AND DOWN OF DIFFERENT LENGTHS IN A SAMPLE AND DETERMINE THE EXPECTED NUMBER OF RUNS OF DIFFERENT LENGTHS FOR A RANDOM SAMPLE

SBR SUBTRACT COEFFICIENTS OF LIKE POWERS OF TWO REAL POLYNOMIALS

SCONG SOLVE THE EQUATION SYSTEM \(AX-BAR=B-BAR\) BY THE CONJUGATE GRADIENT METHOD - DESIGNED TO BE USED WHEN THE MATRIX \(A\) IS LARGE BUT HAS MANY ZERO ELEMENTS

SEARCH USED IN THE TBLU PACKAGE TO PERFORM A BINARY TABLE SEARCH

SEPAR FIND ALL EIGENVALUES OF A REAL, SYMMETRIC TRIDIAGONAL MATRIX

SEPAR2 FIND A SUBSET OF EIGENVALUES OF A REAL, SYMMETRIC TRIDIAGONAL MATRIX

SHRINK COMPUTE THE COEFFICIENTS OF THE POLYNOMIAL \(P(AX)\) FROM THE COEFFICIENTS OF THE POLYNOMIAL \(P(X)\) - REAL COEFFICIENTS

SICI EVALUATE THE SINE AND COSINE INTEGRALS

SIGSMT PERFORM SMOOTHING OF A TRIGONOMETRIC SERIES BY USE OF LANCZOS SIGMA-FACTORS
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<th>FUNCTION</th>
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<td>Transform eigenvectors of an upper Hessenberg matrix $H$, where $H = (P^{*}A - I)A$, to eigenvectors of the similar matrix $A$</td>
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<td>SIMPRC</td>
<td>Evaluate the integral of any function $y = f(x)$ between the limits $a$ and $b$ using Simpson's rule</td>
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<tr>
<td>SINEVL</td>
<td>Evaluate a sine polynomial at a given point</td>
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<td>SINSER</td>
<td>Interpolate a set of $n$ (abscissa, ordinate)-pairs</td>
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<tr>
<td>SMOCUB</td>
<td>Perform smoothing</td>
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<td>SMOOTH</td>
<td>Compute a vector of smoothed function values given vectors of argument and corresponding function values</td>
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<td>SMTVX</td>
<td>Multiply the transpose of a large, sparse matrix by a vector</td>
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<tr>
<td>SMVX</td>
<td>Matrix-vector multiplication when the matrix is large and sparse</td>
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<tr>
<td>SPDCOM</td>
<td>Decompose a positive definite symmetric matrix without using the square root routine</td>
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<tr>
<td>SPDFBM</td>
<td>Solve $LY = B$ and $X = Y$ by forward and backward substitutions for a positive definite system $AX = B$ ($B$ is a matrix of $m$ column vectors, and $L$ and $U$ are the lower triangular matrix and its transpose, and $D$ the diagonal matrix obtained from SPDCOM)</td>
</tr>
<tr>
<td>SPDFBS</td>
<td>Solve $LY = B$ and $X = Y$ by forward and backward substitutions for a positive definite system $AX = B$ ($B$ is a column vector, and $L$ and $U$ are the lower triangular matrix and its transpose, and $D$ the diagonal matrix obtained from SPDCOM)</td>
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<tr>
<td>SPDSOM</td>
<td>Solve a positive definite system $AX = B$ having $m$ right-hand sides without using the square root routine</td>
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<td>SPDSOS</td>
<td>Solve a positive definite system $AX = B$ having one right-hand side without using the square root routine</td>
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<tr>
<td>SPITRM</td>
<td>Solve a positive definite system of linear equations without using the square root routine with iterative refinement</td>
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<tr>
<td>SPITRS</td>
<td>Solve a positive definite system of linear equations without using the square root routine with iterative refinement</td>
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<tr>
<td>SPLINE</td>
<td>Construct a 5th degree spline interpolating a set of equispaced data</td>
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<tr>
<td>START</td>
<td>Read in and list input data which is to be enriched by using other MSL routines</td>
</tr>
<tr>
<td>SUBDIA</td>
<td>Reduce a complex matrix to upper Hessenberg form by similarity transformations, using unitary matrices</td>
</tr>
<tr>
<td>SUBDIR</td>
<td>Reduce a real matrix to upper Hessenberg form</td>
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</table>
SUMPS  COMPUTE DOUBLE PRECISION SUMS OF THE POWERS OF OBSERVATIONS
SURFS  FIT A SMOOTH SURFACE WITH CONTINUOUS FIRST PARTIAL
       DERIVATIVES TO A SET OF POINTS DEFINED OVER A RECTANGULAR
       GRID
SYMLR  FIND ALL EIGENVALUES OF A REAL, SYMMETRIC TRIDIAGONAL MATRIX
SYMQR  FIND ALL EIGENVALUES OF A REAL, SYMMETRIC TRIDIAGONAL MATRIX
TBLU1  TABLE SEARCH AND INTERPOLATION WITH ONE INDEPENDENT VARIABLE
TBLU2  TABLE SEARCH AND INTERPOLATION WITH TWO INDEPENDENT VARIABLES
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        WITHOUT PIVOTING
TRDCOM PERFORM TRIANGULAR DECOMPOSITION OF A TRIDIAGONAL MATRIX WITH
        PARTIAL PIVOTING
TRDFBM PERFORM BACK SUBSTITUTION
TRDSOM SOLVE A TRIDIAGONAL SYSTEM OF EQUATIONS USING TRIANGULAR
        DECOMPOSITION WITH PARTIAL PIVOTING AND BACK SUBSTITUTION
TRDSUB PERFORM BACK SUBSTITUTION
TRDWNP SOLVE A TRIDIAGONAL SYSTEM OF EQUATIONS USING TRIANGULAR
        DECOMPOSITION WITHOUT PIVOTING AND BACK SUBSTITUTION
TRGDIF DIFFERENTIATE FORMALLY A TRIGONOMETRIC POLYNOMIAL
TRGINT INTEGRATE FORMALLY A TRIGONOMETRIC POLYNOMIAL
TRIDI REDUCE A REAL, SYMMETRIC MATRIX TO TRIDIAGONAL FORM BY USE OF
        HOUSEHOLDER'S REDUCTION
TRILOM SOLVE A LOWER TRIANGULAR SYSTEM LX=B WHERE B IS A MATRIX
        CONSISTING OF M COLUMN VECTORS
TRilos SOLVE A LOWER TRIANGULAR SYSTEM LX=B WHERE B IS A SINGLE
        COLUMN VECTOR
TRIUPM SOLVE AN UPPER TRIANGULAR SYSTEM UX=B WHERE B IS A MATRIX
        CONSISTING OF M COLUMN VECTORS
TRIUPS  SOLVE AN UPPER TRIANGULAR SYSTEM UX=B WHERE B IS A SINGLE COLUMN VECTOR
TRLOIN  INVERT A LOWER TRIANGULAR MATRIX
TRUPIN  INVERT AN UPPER TRIANGULAR MATRIX
UNCSPL  CONSTRUCT A NONLINEAR CUBIC SPLINE WITH CONTINUOUS SECOND DERIVATIVE THROUGH A GIVEN SET OF DATA
URAND  GENERATE UNIFORMLY DISTRIBUTED PSEUDO-RANDOM NUMBERS WITH THE SPECIFIED UPPER AND LOWER LIMITS AND STORE VALUES AS ONE VARIABLE IN A MULTIPLEXED DATA ARRAY
VALVEC  FIND ALL (OR A SUBSET OF) EIGENVECTORS OF A COMPLEX MATRIX
VARORD  ARRANGE THE OBSERVATIONS OF ONE OF THE VARIABLES IN A MULTIPLEXED DATA ARRAY SO THAT THESE OBSERVATIONS ARE STORED IN INCREASING ORDER
VECORD  ORDER A SET OF COMPLEX NUMBERS ACCORDING TO MAGNITUDE, EITHER INCREASING OR DECREASING
VECTOR  GIVEN A GOOD APPROXIMATION TO AN EIGENVALUE OF A REAL, SYMMETRIC TRIDIAGONAL MATRIX, FIND THE CORRESPONDING EIGENVECTOR AND TRANSFORM THE RESULT ACCORDING TO STORED INFORMATION ABOUT THE ORIGINAL, FULL MATRIX
VIP    COMPUTE THE INNER PRODUCT OF TWO VECTORS
VIPA   COMPUTE THE INNER PRODUCT OF TWO VECTORS AND ADD IT TO AN INCOMING VALUE C
VIPD   COMPUTE THE INNER PRODUCT OF TWO VECTORS WITH DOUBLE PRECISION ACCUMULATION
VIPDA  COMPUTE THE INNER PRODUCT OF TWO VECTORS WITH DOUBLE PRECISION ACCUMULATION AND ADD IT TO AN INCOMING VALUE C
VIPDS  COMPUTE THE INNER PRODUCT OF TWO VECTORS WITH DOUBLE PRECISION ACCUMULATION AND SUBTRACT IT FROM AN INCOMING VALUE C
XIRAND GENERATE RANDOM FLOATING POINT NUMBERS BETWEEN TWO GIVEN VALUES - EACH OF THE FLOATING POINT NUMBERS BETWEEN THE GIVEN LIMITS HAS AN EQUAL PROBABILITY OF OCCURRING
XPILOT PRINTER PLOT OF UP TO 5 VARIABLES OR SETS OF DATA (ORDINATE) IN THE ORDER IN WHICH THE VALUES ARE STORED (ABSCISSA)
XYPILOT PRINTER PLOT OF UP TO 5 ORDINATE VARIABLES VERSUS A SINGLE ABSCISSA VARIABLE WHERE THE NUMBER OF VALUES FOR THE ABSCISSA IS THE SAME AS THE NUMBER OF VALUES FOR EACH OF THE ORDINATE VARIABLES
ZAFUJ  FIND N ZEROS OF AN ARBITRARY COMPLEX-VALUED FUNCTION OF A COMPLEX VARIABLE
ZAFUM
FIND N ZEROS OF AN ARBITRARY COMPLEX-VALUED FUNCTION OF A
COMPLEX VARIABLE

ZAFUR
FIND N ZEROS OF AN ARBITRARY REAL-VALUED FUNCTION OF A REAL
VARIABLE

ZCOUNT
COUNT THE NUMBER OF TIMES A FUNCTION F(Z) CIRCLES THE ORIGIN
AS Z TRANSVERSES ANY CONTOUR MADE UP OF STRAIGHT LINE
SEGMENTS IN A COMPLEX PLANE, AND HENCE THE NUMBER OF ZEROS OF
F(Z) WITHIN CLOSED CONTOURS (IF THERE ARE POLES WITHIN THE
CONTOUR THEN THE PHRASE "NUMBER OF ZEROS" SHOULD BE REPLACED
BY "NUMBER OF ZEROS - NUMBER OF POLES")

ZRNM
COMPUTE THE MEAN VALUE OF A SET OF OBSERVATIONS AND SUBTRACTS
THE MEAN FROM EACH OF THE OBSERVATIONS
'NSRDC' IS A LIBRARY OF DTNSRDC WRITTEN AND/OR SUPPORTED SCIENTIFIC AND UTILITY SUBPROGRAMS.

REFERENCES: MOST OF THESE ROUTINES ARE DOCUMENTED IN CLIB/N, WHICH MAY BE OBTAINED FROM USER SERVICES. OTHER EXISTING DOCUMENTS ARE ON FILE IN USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'NSRDC' INCLUDE:

AC GET ACCOUNT NUMBER FOR THIS JOB
ACP ADD CROSS PRODUCT VARIABLES - STATISTICS
ADJL LEFT ADJUST A LINE OF WORDS LEAVING ONE SPACE BETWEEN WORDS
ADJR RIGHT ADJUST A LINE OF WORDS LEAVING ONE SPACE BETWEEN WORDS
AI AIRY FUNCTION INTEGRAL
ALTIME OBTAIN CPA, CPB, CP, PP, IO AND WALL CLOCK TIMES SINCE START OF JOB (OR INTERCOM SESSION)
AMAXE FIND MAXIMUM VALUE OF AN ARRAY (ALSO CONTAINS MAXE)
AMINE FIND MINIMUM VALUE OF AN ARRAY (ALSO CONTAINS MINE)
ANOVA1 ONE-WAY ANALYSIS OF VARIANCE WITH UNEQUAL N
ANOVA2 TWO-WAY ANALYSIS OF VARIANCE WITH EQUAL N
AOV ANALYSIS OF VARIANCE FROM EQUAL NUMBER OF EQUAL WEIGHT DESIGNS - TOTALS, DEVIATES, SUMS OF SQUARES, DEGREES OF FREEDOM, MEAN SQUARES
APOWR EXPONENTIATION OF POWER SERIES - ONE VARIABLE
ASA AUTOCORRELATION AND SPECTRAL ANALYSIS FROM STATIONARY TIME SERIES, GIVES POWER SPECTRUM, LAGGED SUMMS AND PRODUCTS
ASCADD ADD AN ASCII STRING TO ANOTHER ASCII STRING
ASCADM ADD AN ASCII STRING TO ANOTHER ASCII STRING MULTIPLE TIMES
ASCBSX REMOVE BS (BACKSPACE) AND CAN (CTRL-X) FROM A STRING
ASCGET GET AN ASCII CHARACTER FROM AN ASCII STRING
ASCII CREATE AN ASCII MESSAGE FROM STRINGS OF ASCII CHARACTERS
ASCII  INITIALIZE COMMON BLOCK /ASCII/ WITH ASCII CHARACTERS
ASCLEN FIND LENGTH OF AN ASCII STRING
ASCPUT ADD AN ASCII CHARACTER TO AN ASCII STRING
ASCTXT CONVERT A DISPLAY CODE STRING TO AN ASCII STRING AND PUT IT INTO AN ASCII BUFFER
ASHIFT SHIFT EACH WORD OF AN ARRAY
ASORT FTN ALPHANUMERIC SORT
ASORTMV SORT 2-DIMENSIONAL ARRAY USING A FAST ARRAY MOVING SUBROUTINE
BANR PRINT A BANNER (LETTERS ARE 10 LINES HIGH, LINES ARE 110 CHARACTERS LONG)
BANR6 PRINT A BANNER (LETTERS ARE 6 LINES HIGH, LINES ARE 80 CHARACTERS LONG)
BDS BASIC DESCRIPTIVE STATISTICS - MEAN, SECOND, THIRD, FOURTH MOMENTS, VARIANCE, STANDARD DEVIATION, SKEWNESS, KURTOSIS
BEJYO ZERO-ORDER BESSEL FUNCTIONS FOR REAL ARGUMENTS
BEJY1 FIRST ORDER BESSEL FUNCTIONS FOR REAL ARGUMENTS
BESSI MODIFIED BESSEL FUNCTION OF THE FIRST KIND
BESSJ BESSEL FUNCTION OF THE FIRST KIND
BESSK MODIFIED BESSEL FUNCTION OF THE SECOND KIND
BESSY BESSEL FUNCTION OF THE SECOND KIND
BMAM SOLVE SYSTEM AX=B FOR BANDED SYMMETRIC MATRICES
BPOWR EXPONENTIAL OF POWER SERIES IN TWO VARIABLES
BSJ SPHERICAL BESSEL FUNCTION
CBSF COMPLEX BESSEL FUNCTION FOR LARGE ARGUMENT
CEI3 COMPLETE ELLIPTIC INTEGRAL OF THE THIRD KIND
CELLI COMPLETE AND INCOMPLETE ELLIPTIC INTEGRALS OF THE FIRST AND SECOND KIND
CENTER CENTER A CHARACTER STRING WITHIN AN OUTPUT FIELD
CGAUSS  COMPLEX SOLUTION OF SIMULTANEOUS EQUATIONS AND DETERMINANT BY
ITERATIVE GAUSSIAN ELIMINATION

CHFILL  FILL (PORTION OF) AN ARRAY WITH A CHARACTER

CHNGSEQ  ALLOW COBOL4 USER TO DEFINE A COLLATING SEQUENCE

CMPINV  COMPLEX MATRIX INVERSION

CHR  CORRELATION MATRIX WITH OPTIONAL MEAN AND STANDARD DEVIATION

COMBES  BESSEL FUNCTIONS FOR COMPLEX ARGUMENT AND ORDER

COMPSTR  COMPARE TWO CHARACTER STRINGS

CONTRCT  SQUEEZE ARRAY OF 1R-FORMAT CHARACTERS TO LEFT (SEE EXPAND)

COTAN  COTANGENT FUNCTION

COUPLE  LOGICALLY CONNECT TWO WORDS

CRDTAB  READ TABLES FOR FRMRAN AND FRMRA2 INTERPOLATION

DATCNV  CONVERT DATE FORMATS (USES INTEGERS)

DATFMT  CONVERT DATE FORMATS (USES CHARACTER STRINGS)

DAYONOF  PACKAGE OF SIX SUBROUTINES TO MANIPULATE THE DAYFILE SETTING
SETTINGS

DISCOT  SINGLE OR DOUBLE INTERPOLATION

DMPA  CALLABLE OCTAL AND CHARACTER DUMP OF SPECIFIED PORTION OF
USER'S FIELD LENGTH (FL) (BY ACTUAL LOCATION) (NO HEADINGS
ARE PROVIDED)

DMPCPA  DUMP JOB CONTROL POINT AREA

DOV  DELETION OF VARIABLES - STATISTICS

DPROOT  FIND ALL ROOTS OF A REAL DOUBLE PRECISION POLYNOMIAL

DUMPA  GIVE OCTAL AND CHARACTER DUMP OF USER-SPECIFIED AREA

DUMPCPA  EXPANDED DUMP OF JOB CONTROL POINT AREA

DUMPFL  CALLABLE OCTAL AND CHARACTER DUMP OF SPECIFIED PORTION OF
USER'S FIELD LENGTH (FL) (BY ACTUAL LOCATION)

D630I  INITIALIZE COMMON BLOCK /D630/ WITH ASCII CONTROL CODES
FOR DIABLO 630 TERMINALS
ELLI    ELLIPTIC INTEGRAL
ELLI    ELLIPTIC INTEGRAL
ELTIME  OBTAIN CP, CPB, CP, PP, IO AND WALL CLOCK TIMES SINCE LAST CALL TO ELTIME
EQU60   LOGICAL COMPARE OF TWO ARRAYS
ERROR   ERROR FUNCTION
EXPAND  EXPAND CHARACTER STRING INTO ARRAY OF 1R-FORMAT WORDS (SEE CONTRCT)
EXPINT  EXPONENTIAL INTEGRAL
EXPRM   EXTRACT NEXT PARAMETER FROM EXECUTE CARD
EXTBIT  EXTRACT BITS FROM A WORD
EXTPRM  EXTRACT NEXT PARAMETER FROM USER-SUPPLIED PARAMETER STRING
FASTIN  READ AND UNPACK DATA PREPARED ON THE XDS-910 A/D CONVERSION SYSTEM
FBINRD  UNPACK AN INPUT ARRAY (N BITS PER INPUT CHARACTER INTO CDC WORD)
FFT     FAST FOURIER TRANSFORM FOR COMPLEX TABULATED FUNCTION
FFT5    FAST FOURIER TRANSFORM
FGI     FORTRAN GAUSSIAN INTEGRATION
FINDC   FIND PRESENCE OR ABSENCE OF SPECIFIED CHARACTER IN AN ARRAY (USER SPECIFIES RELATIONAL OPERAND)
FINDW   FIND PRESENCE OR ABSENCE OF SPECIFIED WORD IN AN ARRAY (USER SPECIFIES RELATIONAL OPERAND)
FINDWRD FIND SPECIFIED WORD IN AN ARRAY
FNOL3   INTEGRATE SYSTEM OF ORDINARY DIFFERENTIAL EQUATIONS
FRESNEL EVALUATE FRESNEL INTEGRALS
FRMRAN  LINEAR TABLE INTERPOLATION (ONE OR TWO INDEPENDENT VARIABLES)
FRMRA2  LINEAR TABLE INTERPOLATION (MULTIPLE INDEPENDENT VARIABLES)
FINRFL  GET/SET CORE SIZE
GAMCAR  COMPLEX  GAMMA  FUNCTION  OF  A  COMPLEX  ARGUMENT  HAVING  POSITIVE  REAL  PART
GAMMA    INCOMPLETE  OR  COMPLETE  GAMMA  FUNCTION
GAUSS    SIMULTANEOUS  EQUATION  SOLUTION  WITH  DETERMINANT  BY  ITERATIVE  GAUSSIAN  ELIMINATION
GETCCL  GET  CCL  FIELDS  (REGISTERS  AND  FLAGS)
GETCHA  EXTRACT  CHARACTER  FROM  SPECIFIED  POSITION  IN  AN  ARRAY
GETCHR  EXTRACT  CHARACTER  FROM  SPECIFIED  POSITION  IN  A  WORD
GETDABA  GET  DYNAMIC  AREA  BASE  ADDRESS  AND  DETERMINE  IF  CMM  IS  ACTIVE
GETFIT  GET  SPECIFIED  FIT  ADDRESS
GETHOUR  FOR  A  SPECIFIED  PERIOD  OF  TIME  (UP  TO  2  HR  59  MIN  59  SEC)  DETERMINE  WHICH  HOUR  IS  OCCUPIED  THE  LONGEST
GETLFNS  GET  ACTUAL  LOCAL  FILE  NAMES  (FOR  FTN)
GETLG0  EXTRACT  FIRST  10  CHARACTERS  OF  ALL  EXECUTE  CARD  PARAMETERS
GETRA  GET  PROGRAM  COMMUNICATION  REGION  (RA+0  THRU  RA+77B)
GMHAS  HARMONIC  ANALYSIS
GODROP  ISSUE  USER-SPECIFIED  GO/DROP  MESSAGE
HELP    COMPLEX  ZEROES  OF  REAL  OR  COMPLEX  POLYNOMIAL
HERE    GET  TERMINAL  ID  FOR  THIS  JOB
HEX3    SQUEEZE  3-CHARACTER  HEX  INTO  12  BITS
HIFAC   HIGHEST  COMMON  FACTOR  OF  TWO  POLYNOMIALS
IAOC    COUNT  ONE-BITS  IN  SPECIFIED  WORD
IBL     CALCULATE  BEST  BLOCK  LENGTH  (MIN  TIME  REQ'D  FOR  RANDOM  ACCESS  AND  MINIMUM  BUFFER  SIZE)  FOR  INDEX  SEQUENTIAL  FILES
IBUNP   UNPACK  12-BIT  BYTES  FROM  ARRAY
IDAYWEK FUNCTION  TO  DETERMINE  THE  DAY  OF  THE  WEEK  FOR  ANY  DATE  FROM  10/15/1582  THRU  02/28/4000
IDID    GET  USER  INITIALS  (AND  INTERCOM  USER  ID)  FROM  CHARGE  CARD  OR  LOGIN
IDIGIT  CHECK  FOR  DIGITS  IN  A  FIELD  WITHIN  A  WORD
IFINDCH  FIND FIRST OCCURRENCE OF SPECIFIED CHARACTER IN ARRAY
IFMTV   FAST I-FORMAT DECODE OF VARIABLE LENGTH INPUT
IHMS    CONVERT SECONDS TO ' HH.MM.SS.' (SEE ISEC)
IPAKLFT SQUEEZE LEFT AND REMOVE ZEROS (00B) AND BLANKS (55B), RETURN
         NUMBER OF CHARACTERS
IROMAN  CONVERT ROMAN NUMBERS TO INTEGER
ISEC    CONVERT HH.MM.SS TO SECONDS (SEE IHMS)
ISITCNF TEST FOR CONNECTED FILE
ISSORT  FTN-CALLABLE SHELL SORT FOR INTEGER ARRAYS
ISTAPE  GENERATE TAPE NAME 'TAPENN'
ISUMIT  SUM ELEMENTS OF INTEGER ARRAY
JGDATE  CONVERT ANY GREGORIAN DATE TO A JULIAN DATE AND VICE VERSA
         (MULTI-YEAR)
JOBCM   GET JOB CARD CM
JOBNAME GET NOS/BE JOB NAME FOR THIS JOB
JOBORG  GET JOB ORIGIN (BATCH, INTERCOM, GRAPHICS, MULTI-USER)
JULIAN  CONVERT ANY GREGORIAN DATE TO A JULIAN DATE AND VICE VERSA
         (SINGLE YEAR)
KUTMER  INTEGRATE A SYSTEM OF FIRST-ORDER ORDINARY DIFFERENTIAL
         EQUATIONS USING THE KUTTA-MERSON FOURTH-ORDER, SINGLE-STEP
         METHOD
LASTCH  FIND LAST NON-BLANK CHARACTER IN ARRAY
LASTWRD FIND SUBSCRIPT OF LAST WORD OF ARRAY WHICH CONTAINS A
         NON-BLANK
LBYT    EXTRACT VARIABLE LENGTH BYTE
LEFTADJ SQUEEZE LEFT AND REMOVE BLANKS AND OOB (USER MAY SUPPLY
         TRAILING FILL CHARACTER)
LFPFERR DECODE THE "ERR" CODE FROM FILE MANIPULATION SUBROUTINES PF
         AND LF
LIBBAM  DUMMY SUBROUTINE TO FORCE LDSET,LIB=BAMLIB
LIBSYM  DUMMY SUBROUTINE TO FORCE LDSET,LIB=SYMLIB
LINE6   SET PRINT FILE TO 6 LINES PER INCH
LINE8   SET PRINT FILE TO 8 LINES PER INCH
LOGGAM LOGARITHM OF GAMMA FUNCTION FOR COMPLEX ARGUMENT
LSQSUB GENERAL WEIGHTED LEAST SQUARES FIT
MACHINE READ 4-WORD SYSTEM HEADING
MAM SOLVE SYMMETRIC SYSTEM OF LINEAR EQUATIONS
MAM200 SOLVE 200 SYMMETRIC LINEAR EQUATIONS
MASKIT DYNAMIC MASK GENERATOR
MATINS MATRIX INVERSE WITH SIMULTANEOUS EQUATION SOLUTION AND
DETERMINANT
MATRIX MATRIX ALGEBRA - TRANSPOSE, MOVE, SYMMETRIC PRODUCT, EIGEN-
VALUE/EIGENVECTOR, PACK SYMMETRIC, UNPACK SYMMETRIC, INVERSE,
SOLUTION OF LINEAR EQUATIONS, MULTIPLY, ADD, SUBTRACT,
TRANSPOSE MULTIPLY.
MAXE FIND MAXIMUM VALUE OF AN ARRAY (ALSO CONTAINS AMAXE)
MEMUSED PRINT MESSAGE IN DAYFILE GIVING FIELD LENGTH IN USE AT TIME
OF CALL TO THIS ROUTINE
MFETCH FETCH A SINGLE WORD FROM USER'S FL (SEE MSET)
MFRAME OBTAIN THE MACHINE AND MAINFRAME RUNNING THE PROGRAM
MF2CPU RETURN CPU NAME CORRESPONDING TO SUPPLIED MAINFRAME NAME
MINE FIND MINIMUM VALUE OF AN ARRAY (ALSO CONTAINS AMINE)
MINMAX GENERALIZED NONLINEAR ITERATOR
MONTH FROM A DATE (MM/DD/YY) FIND THE MONTH AND RETURN FULL
SPELLING AND 3- OR 4-CHARACTER ABBREVIATION
MOVCHAR MOVE ONE CHARACTER FROM ONE STRING TO ANOTHER
MOVECM MOVE WORDS FROM ONE AREA IN CORE TO ANOTHER
MOVEIT MOVE AN ARRAY (MOVLEV REPLACEMENT WHICH CALLS MOVECM)
MOVSTR MOVE A STRING OF CHARACTERS FROM ONE ARRAY TO ANOTHER
MRA MULTIPLE REGRESSION ANALYSIS - LEAST SQUARES ESTIMATE OF
LINEAR RELATIONSHIPS
MSET SET A SINGLE WORD IN USER'S FL (SEE MFETCH)
MXGET EXTRACT (RIGHT-JUSTIFIED, ZERO-FILLED) 0-10 6-BIT CHARACTERS
FROM 60-BIT WORDS
NEWDAT
ADDD/SUBTRACT SPECIFIED NUMBER OF DAYS TO/FROM A GIVEN DATE

NFILL
FILL ELEMENTS 1 THRU N OF AN ARRAY WITH THE VALUES 1 THRU N, RESPECTIVELY

NFILLT
TEST AN ARRAY FOR THE PRESENCE OF THE INTEGERS 1 THRU N IN ELEMENTS 1 THRU N, RESPECTIVELY

NROOTS
REAL AND COMPLEX ROOTS OF REAL POLYNOMIAL

NUMEXEC
GET NUMBER OF EXECUTE CARD PARAMETERS WHICH WERE USED IN THIS EXECUTION OF THE PROGRAM

NUMVAR
DETERMINE NUMBER OF ARGUMENTS IN CALL TO SUBPROGRAM

OFMTDE
FAST O-FORMAT DECODE

OFMTTV
FAST O-FORMAT DECODE OF VARIABLE LENGTH INPUT

OMRONI
INITIALIZE COMMON BLOCK /OMRON/ WITH ASCII CONTROL CODES FOR OMRON CRT'S

OPLSA
ORTHOGONAL POLYNOMIAL LEAST SQUARE APPROXIMATION

OVLNAME
GET NAME OF FILE CURRENTLY BEING EXECUTED

PARGET
GET ALL PARAMETERS OF USER-SUPPLIED PARAMETER STRING

PCA
PRINCIPLE COMPONENT ANALYSIS - EIGENVALUES AND EIGENVECTORS OF CORRELATION MATRIX, TRANSFORMS NORMALIZED OBSERVATION INTO ORTHOGONAL COMPONENTS AND CHECKS ACCURACY

PF
FORTRAN CALLABLE PERMANENT FILE FUNCTIONS AND AUXILIARY FILE ACTION REQUESTS

PFRC
SUPPLY DESCRIPTION OF PERMANENT FILE FUNCTION RETURN CODE

PLOTMY
PRINTER PLOT - MULTIPLE CURVES

PLOTPR
PRINTER PLOT - MULTIPLE CURVES

PLOTXY
PRINTER PLOT - SINGLE CURVE

POLDIV
POLYNOMIAL DIVISION

POLYNT
LEAST SQUARES POLYNOMIAL FIT

POWR1
1 TERM IN EXPONENTIATION OF POWER SERIES - ONE VARIABLE

POWR2
1 TERM IN EXPONENTIATION OF POWER SERIES - TWO VARIABLES

PROD2
1 TERM IN PRODUCT OF POWER SERIES - TWO VARIABLES

PROOT
FIND ALL ROOTS OF A REAL POLYNOMIAL
PRTFL  PRINT CURRENT FL (OR PUT INTO DAYFILE)
PRTIME GET AND PRINT CPA, CPB, CP, PP, IO AND WALL CLOCK TIMES SINCE
       LAST CALL AND PRINT USER-SUPPLIED MESSAGE
PSI    COMPLEX PSI FUNCTION
PUTCHA INSERT CHARACTER INTO SPECIFIED POSITION IN AN ARRAY
PUTCHR INSERT CHARACTER INTO SPECIFIED POSITION IN A WORD
QSORT IN-CORE ASCENDING SORT FOR ARRAYS LARGER THAN 500 WORDS
QSORT1 IN-CORE ASCENDING SORT WITH RE-ORDERING OF ASSOCIATED ARRAY
       (FOR ARRAYS LARGER THAN 500 WORDS)
QUADG INTEGRAL BY GAUSS-LEGENDRE 10-POINT QUADRATURE
QUART REAL OR COMPLEX ROOTS OF QUARTIC
RANNUM NORMALLY DISTRIBUTED RANDOM NUMBERS
RCPA  READ (A PORTION OF) CONTROL POINT AREA
RECOVRD ON RECOVERY, PRINT EXCHANGE JUMP PACKAGE, RA+0 THRU RA+77B
REDUCE REDUCE FL TO MINIMUM -OR- REQUEST ADDITIONAL FL RELATIVE TO
       START OF BLANK COMMON
REPLAC REPLACE ONE CHARACTER WITH ANOTHER IN AN ARRAY
REPLACM REPLACE SEVERAL CHARACTERS WITH OTHER CHARACTERS
REPLHI REPLACE ALL CHARACTERS GREATER THAN SPECIFIED CHARACTER WITH
       NEW CHARACTER
REPLLO REPLACE ALL CHARACTERS LESS THAN SPECIFIED CHARACTER WITH NEW
       CHARACTER
REPLNE REPLACE ALL CHARACTERS (EXCEPT SPECIFIED CHARACTER) WITH
       A SPECIFIED CHARACTER
RFFT  FAST FOURIER TRANSFORM FOR REAL TABULATED DATA
RFSN  REVERSE FAST FOURIER TRANSFORM
RNDMIZ EMULATE BASIC LANGUAGE 'RANDOMIZE' STATEMENT (CAN BE USED TO
       GUARANTEE FIRST CALL TO RANF WILL RESULT IN A DIFFERENT
       NUMBER WITH EACH EXECUTION OF A PROGRAM)
RN1   UNIFORM RANDOM NUMBER USING TWO CONGRUENTIAL GENERATORS
RN2   UNIFORM RANDOM NUMBER USING ONE CONGRUENTIAL GENERATOR
ROOTER     GENERAL ROOT FINDER
ROUTERC    SUPPLY DESCRIPTION OF ROUTE RETURN CODE
RSO        RANK ORDER STANDARDIZED OBSERVATIONS
SBYT       STORE VARIABLE LENGTH BYTE
SEMICO     REPLACE DISPLAY CODE 00B WITH 77B (SEMI-COLON)
SETREW     CONVERT ALPHABETIC REWIND OPTION INTO RM OPEN AND CLOSE CODES
SHIFTA     SHIFT ARRAY A SPECIFIED NUMBER OF BITS (CROSSING OVER WORD BOUNDARIES)
SIMP       SIMPSON'S RULE INTEGRATION
SIMPUN     SIMPSON'S RULE INTEGRATION - UNEQUAL INTERVALS
SKPFIL     REPOSITION A SEQUENTIAL FILE FORWARD OR BACKWARD BY A SPECIFIED NUMBER OF UNITS (FOR EXISTING RECORDS ONLY)
SKPSTAT    GET THE STATUS OF THE LAST CALL TO 'SKPFIL'
SKWEZL     SQUEEZE LEFT AND REMOVE BLANKS AND OOB
SKWEZR     SQUEEZE RIGHT AND REMOVE BLANKS AND OOB
SMOOTH     LEAST SQUARES POLYNOMIAL SMOOTHING
SNCNDN     JACOBIAN ELLIPTIC FUNCTION
SOV        STANDARDIZATION OF VARIABLES - STATISTICS
SPLFIT     SPLINE CURVE FIT
SQFIT      POLYNOMIAL LEAST SQUARE FIT
SR1        INITIAL STEPWISE REGRESSION ANALYSIS BASED ON BMD02R
SR2        ONE STEP IN STEPWISE REGRESSION ANALYSIS
SR3        COMPUTE RESIDUALS FROM SR2 REGRESSION
SSORT      FTN SHELL SORT
SSORTF     FTN CALLABLE SHELL SORT FOR TWO-DIMENSIONAL ARRAYS
SSORTI     FTN CALLABLE SHELL SORT FOR TWO-DIMENSIONAL ARRAYS
SSORTL     FTN LOGICAL SHELL SORT
SSORT3     FTN-CALLABLE SHELL SORT FOR REAL ARRAYS WITH ASSOCIATED REAL ARRAY AND INTEGER ARRAY
STUREE  STUDENT'S T DISTRIBUTION
SUMIT  SUM ELEMENTS OF REAL ARRAY
SWAP   SWAP TWO ARRAYS
TEKTRI  INITIALIZE COMMON BLOCK /TEKTRN/ WITH ASCII CONTROL CODES FOR THE TEKTRANIX GRAPHICS TERMINALS
TIMLEFT DETERMINE CP (AND IO) TIME LEFT SINCE START OF BATCH JOB OR INTERCOM COMMAND
TOV    TRANSFORMATION OF VARIABLES BY IDENTITY, LOG BASE 10, SQUARE ROOT, SQUARE
TRAILBZ CHANGE TRAILING BLANKS TO ZEROS (O0B)
UNHEX3 SPREAD 2 CHARACTERS INTO 3 HEX DIGITS
UNLOAD UNLOAD A FORTRAN FILE
VALDAT LOGICAL FUNCTION TO VALIDATE A DATE FORMAT
VALIDT VALIDATE AN ARRAY TO SEE THAT EACH ELEMENT IS ONE OF A USER-SPECIFIED LIST
VARAH1 EIGENVALUES AND EIGENVECTORS OF A GENERAL REAL MATRIX
VARAH2 IMPROVED ESTIMATES AND BOUNDS FOR EIGENSYSTEM OF A GENERAL REAL MATRIX
VFILL  FILL AN ARRAY WITH USER-SPECIFIED WORD
VT100I INITIALIZE COMMON BLOCK /VT100/ WITH ASCII CONTROL CODES FOR THE DEC VT100 CRT
WARNING FTN-CALLABLE 'WARNING' CONTROL CARD
WEKDAY DETERMINE THE DAY OF THE WEEK FOR ANY GREGORIAN DATE FROM OCTOBER 15, 1582 THRU FEBRUARY 28, 4000
XFIL  FILON'S METHOD FOR INTEGRALS WITH SIN AND COS
ZBLANK CHANGE BLANKS TO O0B AND VICE VERSA
ZEROFL ZERO FIELD LENGTH (SECURITY EOJ)
ZEROS REPLACE BLANKS WITH (DISPLAY CODE) ZEROS, MULTIPLE FIELDS
ZSYSEQ FORTRAN CALLABLE SYSTEM CALL
'NSRDC5' IS A LIBRARY OF DTNSRDC WRITTEN AND/OR SUPPORTED SCIENTIFIC AND UTILITY SUBPROGRAMS WRITTEN IN AND USING UNIQUE FEATURES OF FORTRAN 77.

REFERENCES: MOST OF THESE ROUTINES ARE DOCUMENTED IN CLIB/N, WHICH MAY BE OBTAINED FROM USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2).

ROUTINES IN LIBRARY 'NSRDC5' INCLUDE:

- AC GET ACCOUNT NUMBER FOR THIS JOB
- ALTYM OBTAIN CPA, CPB, CP, PP, IO AND WALL CLOCK TIMES SINCE START OF JOB (OR INTERCOM SESSION)
- BANR PRINT A BANNER (LETTERS ARE 10 LINES HIGH, LINES ARE 131 PRINT POSITIONS LONG)
- BANR6 PRINT A BANNER (LETTERS ARE 6 LINES HIGH, LINES ARE 80 PRINT POSITIONS LONG)
- CENTER CENTER A CHARACTER STRING
- CFIND SCAN CHARACTER ARRAY FOR CHARACTER WORD
- CHIN CONVERT I-FORMATTED CHARACTER STRING TO INTEGER
- CMMDUMP DUMP COMMON MEMORY MANAGER (CMM) DYNAMIC AREA HEADERS AND TRAILER WITH OPTIONAL DUMP OF THE CONTENTS OF EACH BLOCK
- CMMERC SUPPLY DESCRIPTION OF CMM MEMORY ERROR CODE
- CMMOVEF GET A LARGER AREA FROM CMM, MOVE OLD AREA TO NEW AREA, RELEASE OLD AREA AND RESET POINTERS
- CMMPGFS PRINT THE LARGEST BLOCK-SIZES AVAILABLE FOR ALL POSSIBLE CONDITIONS
- CMMPGOS PRINT THE CONTENTS OF THE ARRAY RETURNED BY SUBROUTINE CMMGOS
- CMMPGSS PRINT THE CONTENTS OF THE ARRAY RETURNED BY SUBROUTINE CMMGSS
- CMMUERC SUPPLY DESCRIPTION OF CMM USER ERROR CODE
- CSHUFL SHUFFLE A CHARACTER ARRAY
- CSORT SORT A CHARACTER ARRAY
- CSORTD SORT A CHARACTER ARRAY (DESCENDING)
- CSORTN SORT A CHARACTER ARRAY (HAVING AN ASSOCIATED NON-CHARACTER ARRAY)
JUNE 1984

CSORT2  SORT A CHARACTER ARRAY (HAVING AN ASSOCIATED CHARACTER ARRAY)
CVCHIN  CONVERT I-FORMATTED CHARACTER STRING TO INTEGER
CVCHOL  CONVERT CHARACTER STRING TO HOLLERITH STRING
CVHOCH  CONVERT HOLLERITH STRING TO CHARACTER STRING
CVINCH  CONVERT INTEGER TO CHARACTER STRING
DMCPA   SHORT DUMP OF JOB CONTROL POINT AREA
DUMPXPK  DUMP EXCHANGE PACKAGE (REGISTERS, POINTERS, ETC.)
ELTYM   OBTAIN CPA, CPB, CP, PP, IO AND WALL CLOCK TIMES SINCE LAST CALL
FIRSTCH FIND FIRST NON-BLANK IN CHARACTER VARIABLE
FRSTCH  FIND FIRST NON-BLANK IN CHARACTER VARIABLE
GETSTR  EXTRACT CHARACTER STRING ACCORDING TO USER-DEFINED CRITERIA
HMS2S   CONVERT HH.MM.SS TO SECONDS
IDID    GET USER INITIALS AND INTERCOM USER ID FROM CHARGE CARD OR LOGIN
ITRANS  TRANSLATE CHARACTERS ACCORDING TO USER-SPECIFIED TRANSLATE TABLES
JOBORG  DETERMINE JOB ORIGIN
LASTCH  DETERMINE NUMBER OF CHARACTERS THRU LAST NON-BLANK
LASTCHH DETERMINE NUMBER OF CHARACTERS THRU LAST NON-BLANK IN A HOLLERITH WORD OR ARRAY
LEFT    LEFT-JUSTIFY A CHARACTER STRING
LSTCH   DETERMINE NUMBER OF CHARACTERS THRU LAST NON-BLANK
MFRAME  OBTAIN THE MACHINE AND MAINFRAME RUNNING THE PROGRAM
MF2CPU  RETURN CPU NAME CORRESPONDING TO SUPPLIED MAINFRAME NAME
NEWDAT  ADD/SUBTRACT SPECIFIED NUMBER OF DAYS TO/FROM A GIVEN DATE
NUMER   TEST STRING FOR NUMERICS
PFRC    SUPPLY DESCRIPTION OF PERMANENT FILE FUNCTION RETURN CODE
PM      WRITE 'PM' PRINTER MESSAGE
PRTYM  GET AND PRINT CPA, CPB, CP, PP, IO AND WALL CLOCK TIMES SINCE LAST CALL AND PRINT USER-SUPPLIED MESSAGE

RIGHT  RIGHT-JUSTIFY A CHARACTER STRING

ROUTERC SUPPLY DESCRIPTION OF ROUTE RETURN CODE

SETREW CONVERT REWIND OPTION INTO OPEN AND CLOSE CODES

SM5PRNT PRINT CONTENTS OF SORT/MERGE 5 STATISTICS ARRAY

S2HMS CONVERT SECONDS TO 'HH.MM.SS.'

TRANS TRANSLATE CHARACTERS ACCORDING TO USER-SPECIFIED TRANSLATE TABLES

TTYMSG DRIVER TO WRITE A LINE TO AN INTERACTIVE TERMINAL

TTYOPN OPEN INTERACTIVE INPUT AND OUTPUT FILES
'SANDIA' IS A LIBRARY OF ORDINARY DIFFERENTIAL EQUATION SOLVERS OBTAINED FROM SANDIA LABORATORIES THROUGH THE ARGONNE CODE CENTER.

REFERENCE: SEE USER SERVICES.

ROUTINES IN LIBRARY 'SANDIA' INCLUDE:

DE    ORDINARY DIFFERENTIAL EQUATION SOLVER (DRIVER)
DEROOT INTEGRATES AN INITIAL VALUE PROBLEM FOR ORDINARY DIFFERENTIAL EQUATIONS UNTIL A ROOT IS LOCATED (DRIVER)
STEP  ADAM'S INTEGRATION (USED DE AND DEROOT BUT MAY BE CALLED BY THE USER)
SPECIAL-PURPOSE SUBPROGRAM LIBRARIES

THE FOLLOWING ARE SPECIAL-PURPOSE PACKAGES OF SUBPROGRAMS. ROUTINES IN THE PACKAGES ARE NOT LISTED INDIVIDUALLY.

CALCFN CALCOMP FUNCTIONAL PACKAGE
CALC936 BASIC PACKAGE FOR THE CALCOMP 936 PEN PLOTTER
CONMIN SOLUTION OF LINEAR AND NO-LINEAR CONSTRAINED OPTIMIZATION PROBLEMS
DISSPLA DISPLAY INTEGRATED SOFTWARE SYSTEM AND PLOTTING LANGUAGE
TEK30 TEKTRONIX PLOT PACKAGE FOR 40XX TERMINALS
***** CATALOGUED PROCEDURES *****

A CATALOGUED PROCEDURE IS A SET OF CONTROL CARDS WHICH ACCOMPLISH A TASK. THE COMPUTER CENTER MAINTAINS TWO LIBRARIES OF PROCEDURES: ONE FOR PROCEDURES DEALING WITH THE MAINTENANCE OF FILES ON THE MASS STORAGE SYSTEM, AND ONE FOR ALL OTHER PUBLIC-ACCESS PROCEDURES. THIS CHAPTER DESCRIBES THESE LIBRARIES AND LISTS THEIR CONTENTS WITH DESCRIPTIVE TITLES.

MOST PROCEDURES ARE Executed By:

BEGIN,<PROCNAME>,<PROCFIL>,<PARAMETERS>.

WHERE <PROCNAME> IS THE PROCEDURE NAME
<PROCFIL> IS THE PROCEDURE FILE
(OMITTED IF 'PROCFIL')
<PARAMETERS> IS 0 OR MORE PARAMETERS FOR THE PROCEDURE.

*** PROCFIL ***

'PROCFIL' IS A LIBRARY OF GENERAL-PURPOSE PROCEDURES WRITTEN AT DTNSRDC. THEY ARE EXECUTED BY:

BEGIN,<PROCNAME>,<PARAMETERS>.

REFERENCES: CLIB/P, WHICH MAY BE OBTAINED FROM USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2). MOST DOCUMENTS ARE 1 OR 2 PAGES LONG.

THE FOLLOWING PROCEDURES ARE AVAILABLE:

ADDEXT MODIFY PRIVATE PACK DUM FILE FOR LEVEL 508 DUMPF/LOADPF
ANYLIB EXECUTE A PROGRAM ON ANY EDITLIB USER LIBRARY
ANYPRO EXECUTE A PROCEDURE ON ANY CATALOGUED PROCEDURE FILE
ANYPROS EXECUTE A PROCEDURE ON ANY CATALOGUED SEQUENTIAL PROCEDURE FILE
ASCDOC PRINT DOCUMENTS FOR ALL ROUTINES IN THE ASCII PACKAGE
ASCIIO -CREATE LABELLED COMMON BLOCKS FOR ASCII PACKAGE
AUDIT SORTED (FAST) USER AUDIT
BANNERS  PRINT A PAGE WITH 1 TO 8 BANNERS
BDT  PRINT A BANNER PAGE WITH DATE AND TIME
BIGLOAD CREATE AN ABSOLUTE FILE WHICH WILL ALLOW SOME LARGE PROGRAMS TO LOAD IN LESS CORE THAN NORMALLY NEEDED
CALC3D THREE-D PROCEDURE FOR CALCOMP PLOTTERS
CCNOTE PRINT A COMPUTER CENTER NOTE OR THE CCN INDEX
COMQ PREPARE AND ROUTE A FILE TO THE MICROFICHE QUEUE
COPYBLK REBLOCK STRANGER TAPES TO SCOPE STANDARD FILES (BOTH UNBLOCKED CARD AND PRINT LINE IMAGE TAPES AND BLOCKED STRANGER TAPES)
COPYLIB CONDENSE (AND SORT) AN EDITLIB USER LIBRARY PRESERVING AL, FL, FLO VALUES. BINDEX AND LISTBIN LISTS ARE PROVIDED.
CV029 CONVERT TO 029 PUNCH CODE
DISPOST INVOKE DISSPLA POSTPROCESSORS (TEK300 OR TEK480)
DOCADD ADD ONE DOCUMENT TO A DOCUMENTATION FILE
DOCDATE LIST DOCUMENT NAMES (ON *DECK CARDS) TOGETHER WITH THE DOCUMENT DATE AND PAGE NUMBERS (FROM BOTTOM LINE OF EACH PAGE)
DOCDELE DELETE ONE DOCUMENT FROM A DOCUMENTATION FILE
DOCDOC LIST DOCUMENTATION FOR PROCEDURES DOCADD, DOCDATE, DOCDELE, DOCDOC, DOCFILE, DOCGET, DOCLIST, DOCREPL
DOCFILE ATTACH A DOCUMENTATION FILE
DOCGET GET (EXTRACT) DOCUMENT(S) FROM A DOCUMENT FILE
DOCLIST LIST DOCUMENT NAMES (ON *DECK CARDS) IN A DOCUMENTATION FILE
DOCREPL REPLACE ONE DOCUMENT IN A DOCUMENTATION FILE
DSAUDIT AUDIT DISKS ASSIGNED TO USER INITIALS
DSRLS RELEASING OF ASSIGNED DISKS
D2A CONVERT DISPLAY CODE FILE TO ASCII FOR FILE TRANSFER VIA NALCON/ARPANET
F451T SIMPLE CONVERSION OF FTN4 SOURCE TO FTN5
GETPROD  GET PRODUCTS FILE(S) FOR NOS/BE LEVELS 538, 518, 508, 461, 439, 434, 420, 414, 410, 406, 401, 380 FROM THE MASS STORAGE SYSTEM

GRIPE  ALLOW USER TO MAKE GRIPES OR SUGGESTIONS DIRECTLY TO THE COMPUTER

IDDS  PREPARE/EXAMINE GRAPHICALLY NUMERICAL DATA INPUT TO OR OUTPUT FROM A FORTRAN PROGRAM

LGOTREE  GENERATE CROSS-REFERENCE LISTS AND TREE STRUCTURE FROM BINARY RELOCATABLE OBJECT PROGRAM

LIBPRO  EXECUTE A PROCEDURE ON LIBRARY 'PROCFL' CATALOGED UNDER ANY ID

LIBPROA  EXECUTE A PROCEDURE ON ANY CATALOGUED PROCEDURE LIBRARY

LIBSET1  CREATE SIMPLE ABSOLUTE USING ONE EDITLIB LIBRARY

LIBSET2  CREATE SIMPLE ABSOLUTE USING TWO EDITLIB LIBRARIES

LINE6  SET PRINT FILE TO 6 LINES PER INCH

LINE8  SET PRINT FILE TO 8 LINES PER INCH

LIST  LIST A PERMANENT FILE

MANUAL  PRINT ONE COPY OF A MANUAL OR ITS REVISION PAGES

MFX  TELL INTERACTIVE USER WHICH MAINFRAME HE IS USING

MNSRDC  EXECUTE A PROGRAM ON EDITLIB USER LIBRARY 'MNSRDC'

MYPRO  EXECUTE A PROCEDURE ON FILE 'PROCFL' CATALOGED UNDER ANY ID

MYPROS  EXECUTE A PROCEDURE ON SEQUENTIAL FILE 'PROCFLS' CATALOGED UNDER ANY ID

NEWID  RENAME ID ON ONE PERMANENT FILE (BY COPYING THE FILE)

NOGO  CREATE SIMPLE ABSOLUTE FROM RELOCATABLE

NORERUN  INSURE THAT A BATCH JOB CANNOT BE RERUN BY OPERATOR TYPE-IN

OFLREQ  GENERATE AN OFF-LINE REQUEST (CALCOMP OR MICROFICHE)

PAC  PURGE ALL CYCLES OF A FILE

PAHC  PURGE ALL HIGH CYCLES WHILE RETAINING LOW CYCLE

PAKPAS  CHANGE PRIVATE PACK PASSWORDS, Optionally ADD EXTEND PASSWORD TO PRE-LEVEL 508 PACKS

PACL  PURGE ALL LOW CYCLES WHILE RETAINING HIGH CYCLE
PARMGET  GENERATE SUBROUTINE 'PARMGET' TO PROCESS USER EXECUTE
PARAMETERS FOR FTN5 PROGRAMS

PFRSTOR  CREATE A FILE OF DIRECTIVES TO RESTORE PERMANENT FILES

PGMTAPE  EXTRACT A SOURCE PROGRAM FROM TAPE

PHC      PURGE HIGH CYCLE WHILE RETAINING LOW CYCLE

PLC      PURGE LOW CYCLE WHILE RETAINING HIGH CYCLE

PM       CREATE CERTAIN PRINT MESSAGE (PM) RECORDS

PROADD   ADD ONE PROCEDURE TO A SEQUENTIAL PROCEDURE FILE

PROALL   LIST PROCEDURE NAMES, PROCEDURE HEADERS AND THE PROCEDURES IN
          A SEQUENTIAL PROCEDURE FILE (COMBINES PRONAM, PROHDR AND
          PROLIST)

PRODELE   DELETE ONE PROCEDURE FROM A SEQUENTIAL PROCEDURE FILE

PRODOC   LIST DOCUMENTATION FOR PROCEDURES PROADD, PROALL, PRODELE,
          PRODOC, PROGET, PROHDR, PROLIST, PRONAM, PROREPL, PROS2R

PROGET   GET (EXTRACT) ONE PROCEDURE FROM A SEQUENTIAL PROCEDURE FILE

PROGRAM  EXECUTE A CATALOGED PROGRAM (NOT IN A LIBRARY)

PROHDR   LIST PROCEDURE HEADERS IN A PROCEDURE FILE

PROLIST   LIST PROCEDURE(S) IN A SEQUENTIAL PROCEDURE FILE

PRONAM   LIST NAMES OF PROCEDURES IN A SEQUENTIAL PROCEDURE FILE

PROREPL   REPLACE ONE PROCEDURE IN A SEQUENTIAL PROCEDURE FILE

PROS2R   CONVERT SEQUENTIAL PROCEDURE FILE TO RANDOM EDITLIB USER
          LIBRARY

PURGALL  PURGE PERMANENT FILES OF SPECIFIED AC AND ID (PUBLIC FILES OR
          ON A USER DEVICE SET)

PURGEN   GENERATE PROCEDURE 'PUR' TO PURGE SEVERAL FILES WITH COMMON
          KERNEL

PURPOSE  DRIVER TO EXTRACT PURPOSES FROM A DOCUMENT FILE

RECADD1  ADD ONE OR MORE LOGICAL RECORDS TO A FILE

RECDELI  DELETE ONE OR MORE LOGICAL RECORDS FROM A FILE

RECDOC   LIST DOCUMENTATION FOR PROCEDURES RECADD1, RECDELI, RECDOC,
          RECGET1, RECREP1

RECGET1  EXTRACT ONE OR MORE LOGICAL RECORDS FROM A FILE

RECREP1  REPLACE ONE OR MORE LOGICAL RECORDS IN A FILE
RENAMAC  RENAME AC FIELD ON PERMANENT FILES OR MASS STORE FILES

RENAMID  RENAME ID ON ALL OF ONE USER'S PERMANENT FILES

RUNBAS  COMPILE AND EXECUTE BASIC PROGRAM (SIMILAR TO EDITOR RUN,BAS
FOR USE OUTSIDE OF EDITOR)

RUNFTN  COMPILE AND EXECUTE FTN PROGRAM (SIMILAR TO EDITOR RUN,FTN
FOR USE OUTSIDE OF EDITOR)

RUNFTN5  COMPILE AND EXECUTE FTN5 PROGRAM (SIMILAR TO EDITOR RUN,FTN5
FOR USE OUTSIDE OF EDITOR)

RUNMNF  COMPILE AND EXECUTE MNF PROGRAM UNDER INTERCOM

RUNPAS  COMPILE AND EXECUTE PASCAL PROGRAM UNDER INTERCOM

RUNSEQ  COMPILE AND EXECUTE FTN,SEQ PROGRAM (USES TS OPTION)

RUNTS  COMPILE AND EXECUTE FTN,TS PROGRAM

SEGLD  CREATE A SEGLOAD ABSOLUTE FILE

SEGO  SEGLOAD AND EXECUTE PROGRAM WITH OPTIONAL LIBRARY

SELDUMP  CREATE BACKUP DUMP TAPE OF THE USER PERMANENT FILES OF AN
ACCOUNT NUMBER

SELLOAD  RESTORE SELECTED ROUTINES FROM A BACKUP DUMPF TAPE

SEND  SEND MESSAGES TO AN INTERCOM USER WHO IS NOT LOGGED IN; LIST
MESSAGES

SORT  SORT (SORTMRG) UP TO 5 'DISPLAY' FIELDS USING 'COBOL6'
COLLATING SEQUENCE ('FILE' CARDS REQUIRED)

SORTCZ  SORT (SORTMRG) UP TO 5 'DISPLAY' FIELDS USING 'COBOL6'
COLLATING SEQUENCE ('FILE' CARDS NOT REQUIRED)

S2K260  ATTACH FILES FOR S2000 (VERSION 2.60) NATURAL LANGUAGE,
FORTAN, OR COBOL PROCEDURAL LANGUAGE INTERFACE.

S2K280  ATTACH FILES FOR S2000 (VERSION 2.80) SELF-CONTAINED
LANGUAGES, REPORT PROCESSOR, FORTAN OR COBOL PROGRAMMING
LANGUAGE EXTENSION (PLEX).

TAPRD  COPY ONE OR MORE FILES FROM A FIXED LENGTH, BLOCKED STRANGER
TAPE TO DISK

TAPWR  COPY A SEQUENTIAL FILE OR AN UPDATE PL ONTO A FIXED LENGTH,
BLOCKED STRANGER TAPE

TIDBITS  LIST FILE OF TIDBITS (HINTS ON IMPROVED COMPUTER USAGE)
TPAUDIT  AUDIT TAPES ASSIGNED TO USER INITIALS
TPGET   AUTOMATICALLY OBTAIN TAPES FROM THE COMPUTER CENTER'S TAPE LIBRARY
TPRLS   RELEASE ASSIGNED TAPES
TRANPK  COPY CONTENTS FROM ONE DEVICE SET TO ANOTHER FOR BACKUP
UPDADD  ADD ONE DECK TO AN UPDATE LIBRARY
UPDDELE DELETE ONE DECK FROM AN UPDATE LIBRARY
UPDDOC  LIST DOCUMENTATION FOR PROCEDURES UPDADD, UPDDELE, UPDDOC, UPDGET, UPDLIST, UPDREPL
UPDGET  EXTRACT ONE DECK FROM AN UPDATE LIBRARY (UPDATE,C) AND, OPTIONALLY, ADD EDITOR SEQUENCING
UPDGETS EXTRACT ONE DECK FROM AN UPDATE LIBRARY (UPDATE,S) AND, OPTIONALLY, ADD EDITOR SEQUENCING
UPDGETT EXTRACT ONE DECK FROM AN UPDATE LIBRARY (UPDATE,T) AND, OPTIONALLY, ADD EDITOR SEQUENCING
UPDLIST LIST DECK/COMDECK NAMES IN UPDATE LIBRARY WITH COUNT OF RECORDS IN EACH DECK/COMDECK
UPDREPL REPLACE ONE DECK IN AN UPDATE LIBRARY
UTILITY EXECUTE A PROGRAM ON EDITLIB USER LIBRARY 'UTILITY'
VENUS   ATTACH AND EXECUTE ONE OF THE VENUS RETRIEVAL PROGRAMS
WHATLIB LIST LIBRARIES SPECIFIED IN LAST 'LIBRARY' COMMAND
XEROX   ROUTE A COPY OF A FILE TO XEROX 8700
'*' IS A LIBRARY OF INTERACTIVE PROCEDURES WRITTEN AT DTNSRDc.
THEY ARE EXECUTED BY:

BEGIN,<PROCNAME>,I,<PARAMETERS>.

-OR-

BEGIN,<PROCNAME>,I,?.

-- FOR INTERACTIVE PROMPTING

REFERENCES: CLIB/P, WHICH MAY BE OBTAINED FROM USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING
PROCEDURE 'DOCGET' (SEE PAGE 1-2). MOST DOCUMENTS ARE 1 OR
2 PAGES LONG.

THE FOLLOWING PROCEDURES ARE AVAILABLE (NON-INTERACTIVE VERSIONS
ARE IN LIBRARY 'PROCFIL'):

ASCDOC PRINT DOCUMENTS FOR ALL ROUTINES IN THE ASCII PACKAGE
ASCIIO CREATE LABELLED COMMON BLOCKS FOR ASCII PACKAGE
DOCGET GET (EXTRACT) DOCUMENT(S) FROM A DOCUMENT FILE
MANUAL PRINT ONE COPY OF A MANUAL OR ITS REVISION PAGES
MSS2PF MOVE ALL YOUR MSS FILES TO PF
NEWID RENAME ID ON ONE PERMANENT FILE (BY COPYING THE FILE)
RENAMEAC RENAME AC FIELD ON PERMANENT FILES OR MASS STORE FILES
RENAMEID RENAME ID ON ALL OF ONE USER'S PERMANENT FILES
SEGLD CREATE A SEGLOAD ABSOLUTE FILE
SEGO SEGLOAD AND EXECUTE PROGRAM WITH OPTIONAL LIBRARY
XEROX ROUTE A COPY OF A FILE TO XEROX 8700
*** MSS ***

'MSS' IS A LIBRARY OF PROCEDURES WRITTEN AT DTNSRDC FOR THE HANDLING OF FILES ON THE MASS STORAGE SYSTEM. THEY ARE EXECUTED BY:

BEGIN,<PROCNAME>,MSS,<PARAMETERS>.

REFERENCES: CLIB/P, WHICH MAY BE OBTAINED FROM USER SERVICES.

MACHINE-READABLE DOCUMENTATION MAY BE PRINTED USING PROCEDURE 'DOCGET' (SEE PAGE 1-2). MOST DOCUMENTS ARE 1 OR 2 PAGES LONG.

THE FOLLOWING PROCEDURES ARE AVAILABLE:

C2M TRANSFER ONE CDC PERMANENT FILE (OF EXECUTING USER) TO MASS STORAGE SYSTEM (BASED ON USER'S CDC FILE TABLE/MFNPFN)

C2MALL TRANSFER ALL CDC PERMANENT FILES (OF EXECUTING USER) TO MASS THE EXECUTING USER'S ID. IT SHOULD HAVE A TK PASSWORD.

FETCHC GET CSYS OR PUBLIC FILES (FROM MSS, IF NECESSARY)

FETCHM GET ANY FILE (FROM MSS, IF NECESSARY)

GETMFNS DO MSAUDIT AND EXTRACT FILE NAMES

GETMS TRANSFER ONE MSS FILE (OF EXECUTING USER) TO A CDC PERMANENT FILE

MF2MF MOVE ALL FILES FROM ONE MAINFRAME TO ANOTHER VIA THE MASS STORAGE SYSTEM

MSAUDIT SORTED LO=F OR FULL LO=FP AUDIT OF MSS FILES

MSSALL GET DOCUMENTS DESCRIBING PROCEDURES RELATED TO THE MASS STORAGE SYSTEM (MSS)

MSS2PF MOVE ALL YOUR MSS FILES TO PF

MSTABLE GENERATE TABLE/MFNPFN INTERACTIVELY FOR MSS

M2C TRANSFER ONE MSS FILE (OF EXECUTING USER) TO A CDC PERMANENT FILE (BASED ON USER'S CDC FILE TABLE/MFNPFN)

M2CALL TRANSFER ALL MSS FILES (OF EXECUTING USER) TO CDC (BASED ON USER'S FILE TABLE/MFNPFN)

PUTMS TRANSFER ONE CDC PERMANENT FILE (OF EXECUTING USER) TO THE MASS STORAGE SYSTEM
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DTNSRDC ISSUES THREE TYPES OF REPORTS

1. DTNSRDC REPORTS, A FORMAL SERIES, CONTAIN INFORMATION OF PERMANENT TECHNICAL VALUE. THEY CARRY A CONSECUTIVE NUMERICAL IDENTIFICATION REGARDLESS OF THEIR CLASSIFICATION OR THE ORIGINATING DEPARTMENT.

2. DEPARTMENTAL REPORTS, A SEMIFORMAL SERIES, CONTAIN INFORMATION OF A PRELIMINARY, TEMPORARY, OR PROPRIETARY NATURE OR OF LIMITED INTEREST OR SIGNIFICANCE. THEY CARRY A DEPARTMENTAL ALPHANUMERICAL IDENTIFICATION.

3. TECHNICAL MEMORANDA, AN INFORMAL SERIES, CONTAIN TECHNICAL DOCUMENTATION OF LIMITED USE AND INTEREST. THEY ARE PRIMARILY WORKING PAPERS INTENDED FOR INTERNAL USE. THEY CARRY AN IDENTIFYING NUMBER WHICH INDICATES THEIR TYPE AND THE NUMERICAL CODE OF THE ORIGINATING DEPARTMENT. ANY DISTRIBUTION OUTSIDE DTNSRDC MUST BE APPROVED BY THE HEAD OF THE ORIGINATING DEPARTMENT ON A CASE-BY-CASE BASIS.