

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

12

CMLD-84-11

DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER



Bethesda, Maryland 20084

AD-A149 005

COMPUTER CENTER
CDC
LIBRARIES

by

David V. Sommer
Sharon E. Good

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

COMPUTER CENTER CDC LIBRARIES

DTIC FILE COPY

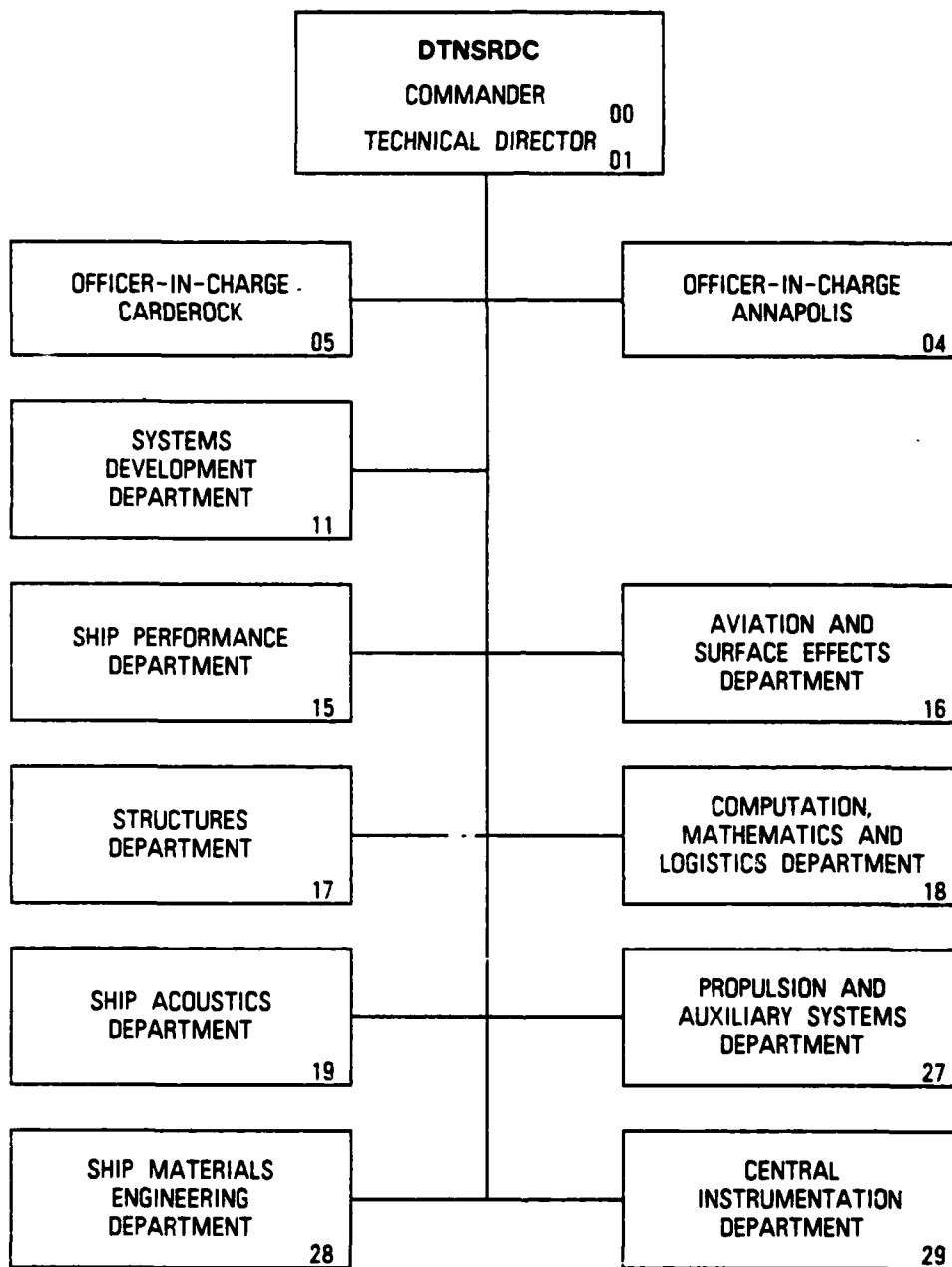
Computation, Mathematics and Logistics Department
Departmental Report

DTIC
ELECTE
S JAN 7 1985 D
B

June 1984

CMLD-84-11

MAJOR DTNSRDC ORGANIZATIONAL COMPONENTS



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CMLD-84-11	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) COMPUTER CENTER CDC LIBRARIES		5. TYPE OF REPORT & PERIOD COVERED FINAL
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) DAVID V. SOMMER SHARON E. GOOD		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS DTNSRDC, USER SERVICES, CODE 1892 BETHESDA, MARYLAND 20084		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS COMPUTATION, MATHEMATICS & LOGISTICS DEPT. COMPUTER FACILITIES DIVISION (189)		12. REPORT DATE JUNE 1984
		13. NUMBER OF PAGES 103
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) COMPUTER PROGRAMS SCIENTIFIC SUBROUTINES CATALOGUED PROCEDURES SOFTWARE DOCUMENTATION FORTRAN STATISTICS FUNCTIONAL CATEGORIES UTILITIES		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) 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 ALPHA- BETICALLY, BY LIBRARY, WITH DESCRIPTIVE TITLES.		

DAVID W. TAYLOR
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER
BETHESDA, MARYLAND 20084

* * * * *
* COMPUTER CENTER CDC LIBRARIES *
* * * * *

BY
DAVID V SOMMER
SHARON E GOOD
USER SERVICES BRANCH

CODE 1892

RE: Proprietary Information, Pages 3-10,
3-37
These pages do not contain proprietary
information. It means users cannot get
source from DTNSRDC.
Per Ms. Sharon Good, DTNSRDC

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or Special
A-1	

COMPUTATION, MATHEMATICS AND LOGISTICS DEPARTMENT
DEPARTMENTAL REPORT



JUNE 1984

CMLD-84-11

TABLE OF CONTENTS

1	INTRODUCTION	1-1
	HOW TO USE THIS MANUAL	1-1
	HOW TO PRINT INDIVIDUAL DOCUMENTS	1-2
	FUNCTIONAL CATEGORIES	1-3
	LIST OF ROUTINES BY CATEGORY	1-6
2	PROGRAMS	2-1
	INTRODUCTION	2-1
	BIMEDP	2-1
	MNSRDC	2-4
	SPSS	2-5
	UTILITY	2-8
	PROGRAMS NOT IN LIBRARIES	2-13
	PASCAL	2-15
3	SUBPROGRAMS	3-1
	INTRODUCTION	3-1
	ARLNALG	3-2
	EISPACK	3-4
	FUNPACK	3-8
	IMSL	3-10
	LINPACK	3-33
	MINPACK	3-36
	MSL	3-37
	NSRDC	3-57
	NSRDC5	3-68
	SANDIA	3-71
	SPECIAL-PURPOSE SUBPROGRAM LIBRARIES	3-72
4	CATALOGUED PROCEDURES	4-1
	INTRODUCTION	4-1
	PROCFIL	4-1
	I	4-7
	MSS	4-8

***** 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	CMLD-84-11
CLIB/N - COMPUTER CENTER CDC LIBRARIES/NSRDC AND NSRDC5 (SUBPROGRAMS)	CMLD-84-12
CLIB/P - COMPUTER CENTER CDC LIBRARIES/PROCFIL (PROCEDURES)	CMLD-84-13
CLIB/U - COMPUTER CENTER CDC LIBRARIES/UTILITY (PROGRAMS)	CMLD-84-14
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.

A0 ARITHMETIC ROUTINES
A1 REAL NUMBERS
A2 COMPLEX NUMBERS
A3 DECIMAL
A4 I/O ROUTINES

B0 ELEMENTARY FUNCTIONS
B1 TRIGONOMETRIC
B2 HYPERBOLIC
B3 EXPONENTIAL AND LOGARITHMIC
B4 ROOTS AND POWERS

C0 POLYNOMIALS AND SPECIAL FUNCTIONS
C1 EVALUATION OF POLYNOMIALS
C2 ROOTS OF POLYNOMIALS
C3 EVALUATION OF SPECIAL FUNCTIONS (NON-STATISTICAL)
C4 SIMULTANEOUS NON-LINEAR ALGEBRAIC EQUATIONS
C5 SIMULTANEOUS TRANSCENDENTAL EQUATIONS
* C6 ROOTS OF FUNCTIONS

D0 OPERATIONS ON FUNCTIONS AND SOLUTIONS OF DIFFERENTIAL EQUATIONS
D1 NUMERICAL INTEGRATION
D2 NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS
D3 NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS
D4 NUMERICAL DIFFERENTIATION

E0 INTERPOLATION AND APPROXIMATIONS
E1 TABLE LOOK-UP AND INTERPOLATION
E2 CURVE FITTING
E3 SMOOTHING
E4 MINIMIZING OR MAXIMIZING A FUNCTION

F0 OPERATIONS ON MATRICES, VECTORS & SIMULTANEOUS LINEAR EQUATIONS
F1 VECTOR AND MATRIX OPERATIONS
F2 EIGENVALUES AND EIGENVECTORS
F3 DETERMINANTS
F4 SIMULTANEOUS LINEAR EQUATIONS

G0 STATISTICAL ANALYSIS AND PROBABILITY
G1 DATA REDUCTION (COMMON STATISTICAL PARAMETERS)
G2 CORRELATION AND REGRESSION ANALYSIS
G3 SEQUENTIAL ANALYSIS
G4 ANALYSIS OF VARIANCE
G5 TIME SERIES
G6 SPECIAL FUNCTIONS (INCLUDES RANDOM NUMBERS AND PDF'S)
* G7 MULTIVARIATE ANALYSIS AND SCALE STATISTICS
* G8 NON-PARAMETRIC METHODS AND STATISTICAL TESTS
* G9 STATISTICAL INFERENCE

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/TYPE/LIB/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)
5 - 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

A0 ARITHMETIC ROUTINES			
FAFRAC	/S/M/ /	HCF	/S/M/ /
FFRAC	/S/M/ /	ICOMN	/S/N/*/
FMPFRAC	/S/M/ /	LCM	/S/M/ /
A1 REAL NUMBERS			
AMCON	/S/M/ /	ISUMIT	/S/N/N/
DASUM	/S/I/ /	NFILL	/S/N/N/
A2 COMPLEX NUMBERS			
CADR	/S/M/ /	COMBES	/S/M/ /
CBAREX	/S/M/ /	CPDIV	/S/M/ /
CCOMPE	/S/M/ /	CPOLRT	/S/M/ /
CCONGR	/S/M/ /	CPTRAN	/S/M/ /
CDERIV	/S/M/ /	CQDIV	/S/M/ /
CFBSUM	/S/M/ /	CREV	/S/M/ /
CGITRF	/S/M/ /	CSBR	/S/M/ /
CGLESM	/S/M/ /	CSHRNK	/S/M/ /
CINPRD	/S/M/ /	ELRH1C	/S/I/ /
CINT	/S/M/ /	ELRH2C	/S/I/ /
CITERF	/S/M/ /	ELZHC	/S/I/ /
CLDIV	/S/M/ /	ELZVC	/S/I/ /
CMPINV	/S/N/N/	HARM	/S/M/ /
CMPYR	/S/M/ /	HELP	/S/M/ /
CNSLVL	/S/M/ /	HELP	/S/N/N/
		MULLP	/S/M/ /
		POLYMUL	/M/R/M/
		PSI	/S/N/*/
		SASUM	/S/I/ /
		SCASUM	/S/I/ /
		SUBDIA	/S/M/ /
		VALVEC	/S/M/ /
		VECORD	/S/M/ /
		ZAFUJ	/S/M/ /
		ZAFUM	/S/M/ /
		ZAFUR	/S/M/ /
		ZCOUNT	/S/M/ /
		ZCPOLY	/S/I/ /
		ZQADC	/S/I/ /
		ZQADR	/S/I/ /
A4 I/O ROUTINES			
XEROX	/P/P/P/		
B0 ELEMENTARY FUNCTIONS			
DNRM2	/S/I/ /		
B1 TRIGONOMETRIC			
COTAN	/S/N/*/	SICI	/S/M/ /
B3 EXPONENTIAL AND LOGARITHMIC			
CBAREX	/S/M/ /		
B4 ROOTS AND POWERS			
DPROOT	/S/N/N/	PROOT	/S/N/N/
		SUMPS	/S/M/ /
C1 EVALUATION OF POLYNOMIALS			
ADR	/S/M/ /	CQDIV	/S/M/ /
APOWR	/S/N/*/	CREV	/S/M/ /
BPOWR	/S/N/*/	CSBR	/S/M/ /
CADR	/S/M/ /	CSHRNK	/S/M/ /
CCOMPE	/S/M/ /	DERIV	/S/M/ /
CDERIV	/S/M/ /	EVREAL	/S/M/ /
CLDIV	/S/M/ /	FMULT1	/S/M/ /
CMPYR	/S/M/ /	HIFAC	/S/N/*/
CNSLVL	/S/M/ /	IBCEVU	/S/I/ /
COMPEV	/S/M/ /	ICSEVU	/S/I/ /
COSEVL	/S/M/ /	LDIV	/S/M/ /
CPDIV	/S/M/ /	MPYR	/S/M/ /
CPTRAN	/S/M/ /	NSLVL	/S/M/ /
		PARFAC	/S/M/ /
		PDIV	/S/M/ /
		POLDIV	/S/N/*/
		POWR1	/S/N/*/
		POWR2	/S/N/*/
		PROD2	/S/N/*/
		PTRAN	/S/M/ /
		QDIV	/S/M/ /
		REV	/S/M/ /
		SBR	/S/M/ /
		SHRINK	/S/M/ /
		SINEVL	/S/M/ /

C2 ROOTS OF POLYNOMIALS

CINT	/S/M/ /	MULLP	/S/M/ /	ZCPOLY	/S/I/ /
CPOLRT	/S/M/ /	NROOTS	/S/N/*/	ZPOLR	/S/I/ /
DPROOT	/S/N/N/	POLYMUL	/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/*/
BESEIO	/S/F/ /	ELF	/S/M/ /	MERFCI	/S/I/ /
BESEI1	/S/F/ /	ELIEM	/S/F/ /	MERFI	/S/I/ /
BESEKO	/S/F/ /	ELIE1	/S/F/ /	MMBSIO	/S/I/ /
BESEK1	/S/F/ /	ELIKM	/S/F/ /	MMBSI1	/S/I/ /
BESIO	/S/F/ /	ELIK1	/S/F/ /	MMBSJO	/S/I/ /
BESI1	/S/F/ /	ELIPE	/S/F/ /	MMBSJ1	/S/I/ /
BESJO	/S/F/ /	ELIPK	/S/F/ /	MMBSKO	/S/I/ /
BESJ1	/S/F/ /	ELK	/S/M/ /	MMBSK1	/S/I/ /
BESKO	/S/F/ /	ELLI	/S/N/N/	MMBSYN	/S/I/ /
BESK1	/S/F/ /	ELLIP	/S/N/*/	MMDAS	/S/I/ /
BESNIS	/S/M/ /	EL3	/S/M/ /	MMDEI	/S/I/ /
BESNKS	/S/M/ /	EONE	/S/F/ /	MMDELE	/S/I/ /
BESSI	/S/N/N/	ERF	/S/I/ /	MMDELK	/S/I/ /
BESSJ	/S/N/N/	ERF	/S/M/ /	MMKELD	/S/I/ /
BESSK	/S/N/N/	ERF	/S/N/*/	MMKELO	/S/I/ /
BESSY	/S/N/N/	ERFC	/S/I/ /	MMKEL1	/S/I/ /
BESY	/S/F/ /	ERFINV	/S/M/ /	MMPSI	/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/ /	GAMCAR	/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/ /	ZSYSTEM	/S/I/ /
HYBRJ	/S/K/ /	NRSQ	/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/I/ /	HERMIT /S/M/ /	SICI /S/M/ /
DBCQDU /S/I/ /	LAGRAN /S/M/ /	SIMP /S/N/*/
DBLINT /S/I/ /	LAGUER /S/M/ /	SIMPRC /S/M/ /
DCADRE /S/I/ /	LEGEND /S/M/ /	SIMPUN /S/N/N/
DCSQDU /S/I/ /	PARBL /S/M/ /	TRGINT /S/M/ /
FGI /S/N/*/	QUAD /S/M/ /	UNCSPL /S/M/ /
FNOL3 /S/N/*/	QUADG /S/N/N/	XFIL /S/N/*/
GMI /S/M/ /	ROMBG /S/M/ /	

D2 NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

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

D3 NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

BLCKDQ /S/M/ /	LINBVP /S/M/ /	RKINIT /S/M/ /
BVP /S/M/ /	NRKVS /S/M/ /	
DRATEX /S/M/ /	NRKVS /S/M/ /	

D4 NUMERICAL DIFFERENTIATION

CDERIV /S/M/ /	DERIV /S/M/ /	LAGDIF /S/M/ /
DCSEVU /S/I/ /	DIFTAB /S/M/ /	TRGDIF /S/M/ /

E0 INTERPOLATION AND APPROXIMATIONS

COSEVL /S/M/ /	SINEVL /S/M/ /
OMNITAB/M/ /R/	ZSRCH /S/I/ /

E1 TABLE LOOK-UP AND INTERPOLATION

ACFI /S/M/ /	ICSCCU /S/I/ /	RICH /S/M/ /
AITKEN /S/M/ /	ICSICU /S/I/ /	SEARCH /S/M/ /
ATSM /S/M/ /	ICSPLN /S/I/ /	SINSER /S/M/ /
CRDTAB /S/N/*/	IQHSCU /S/I/ /	TBLU1 /S/M/ /
DISCOT /S/N/N/	IQHSCV /S/I/ /	TBLU2 /S/M/ /
FRMRAN /S/N/*/	IRATCU /S/I/ /	TBLU3 /S/M/ /
FRMRA2 /S/N/*/	LAGINT /S/M/ /	TERP1 /S/M/ /
HRMT1 /S/M/ /	NRICH /S/M/ /	TERP2 /S/M/ /
HRMT2 /S/M/ /	ORTHON /S/M/ /	TERP3 /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/	LSQSIT /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/ /	GMI /S/M/ /	RFSN /S/N/N/
FCGM2 /S/M/ /	IBCICU /S/I/ /	SPLFIT /S/N/*/

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/ /	SQRSL /S/L/ /
FFTCC /S/I/ /	ITRSLQ /S/M/ /	SURFS /S/M/ /
FFTRC /S/I/ /	LINWOOD/M/ /R/	UNCSP /S/M/ /
FFT2C /S/I/ /	LSQHTM /S/M/ /	

E3 SMOOTHING

ICSMOU /S/I/ /	MILN2 /S/M/ /	SMOOTH /S/M/ /
ICSSCU /S/I/ /	SIGSMT /S/M/ /	SMOOTH /S/N/*/
ICSSV /S/I/ /	SMOCUB /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/ /
LMCIF /S/K/ /	MINRAT /S/M/ /	ZXSSQ /S/I/ /
LMCIF1 /S/K/ /	ZSCNT /S/I/ /	
LMSTR /S/K/ /	ZXCGR /S/I/ /	

F0 OPERATIONS ON MATRICES, VECTORS & SIMULTANEOUS LINEAR EQUATIONS

OMNITAB/M/ /R/	SGECO /S/L/ /
----------------	---------------

F1 VECTOR AND MATRIX OPERATIONS

BALANC /S/E/ /	LEQ2S /S/I/ /	USCRDM /S/I/ /
BALANC /S/M/ /	LU1 /S/A/ /	USMNMX /S/I/ /
BANDR /S/E/ /	LU2 /S/A/ /	USRDM /S/I/ /
BCHSDC /S/M/ /	LU3 /S/A/ /	USRDV /S/I/ /
BDCWNP /S/M/ /	LU4 /S/A/ /	USWBM /S/I/ /
BDECOM /S/M/ /	LU5 /S/A/ /	USWBS /S/I/ /
BDTRGI /S/I/ /	LU6 /S/A/ /	USWFM /S/I/ /
BDTRGO /S/I/ /	MATINS /S/N/N/	USWV /S/I/ /
CAXPY /S/I/ /	MATRIX /S/N/*/	USWSM /S/I/ /
CBAL /S/E/ /	MINFIT /S/E/ /	VABMXF /S/I/ /
CCOPY /S/I/ /	ORTHES /S/E/ /	VABMXS /S/I/ /
CDECOM /S/M/ /	ORTHO /S/A/ /	VABSMF /S/I/ /
CDOTC /S/I/ /	ORTHO2 /S/A/ /	VABSMS /S/I/ /
CDOTU /S/I/ /	ORTRAN /S/E/ /	VCONVO /S/I/ /
CHSDEC /S/M/ /	PRDSUM /S/M/ /	VCVTBF /S/I/ /
CINPRD /S/M/ /	QZHES /S/E/ /	VCVTCH /S/I/ /
COMHES /S/E/ /	QZIT /S/E/ /	VCVTFB /S/I/ /
CORTH /S/E/ /	RAYLGH /S/M/ /	VCVTFQ /S/I/ /
CSCAL /S/I/ /	RLSUBM /S/I/ /	VCVTFM /S/I/ /
CSSCAL /S/I/ /	RLSUM /S/I/ /	VCVTHC /S/I/ /
CSWAP /S/I/ /	SAXPY /S/I/ /	VCVTQF /S/I/ /
CZDOTC /S/I/ /	SCHDC /S/L/ /	VCVTQS /S/I/ /
CZDOTU /S/I/ /	SCHDD /S/L/ /	VCVTSF /S/I/ /
DAXPY /S/I/ /	SCHEX /S/L/ /	VCVTSQ /S/I/ /
DCBHT /S/M/ /	SCHUD /S/L/ /	VHSH2C /S/I/ /
DCOPY /S/I/ /	SCNRM2 /S/I/ /	VHSH2R /S/I/ /
DCWNE /S/M/ /	SCOPY /S/I/ /	VHSH3R /S/I/ /
DCWNP /S/M/ /	SDOT /S/I/ /	VHS12 /S/I/ /
DDOT /S/I/ /	SDSDOT /S/I/ /	VIP /S/M/ /
DECOM /S/M/ /	SGBCO /S/L/ /	VIPA /S/M/ /
DROT /S/I/ /	SGBFA /S/L/ /	VIPD /S/M/ /

F1 VECTOR AND MATRIX OPERATIONS (CONTINUED)

DROTG	/S/I/ /	SGEFA	/S/L/ /	VIPDA	/S/M/ /
DROTM	/S/I/ /	SMTVX	/S/M/ /	VIPDS	/S/M/ /
DROTMG	/S/I/ /	SMVX	/S/M/ /	VIPRFF	/S/I/ /
DSCAL	/S/I/ /	SNRM2	/S/I/ /	VIPRSS	/S/I/ /
DSDOT	/S/I/ /	SPBCO	/S/L/ /	VIPS	/S/M/ /
DSWAP	/S/I/ /	SPBFA	/S/L/ /	VMULBB	/S/I/ /
EBALAC	/S/I/ /	SPDCGM	/S/M/ /	VMULBF	/S/I/ /
EBALAF	/S/I/ /	SPOCO	/S/L/ /	VMULBS	/S/I/ /
ELMHES	/S/E/ /	SPOFA	/S/L/ /	VMULFB	/S/I/ /
ELTRAN	/S/E/ /	SPPCO	/S/L/ /	VMULFF	/S/I/ /
FABSV	/S/M/ /	SPPFA	/S/L/ /	VMULFM	/S/I/ /
FCOMB	/S/M/ /	SQRDC	/S/L/ /	VMULFP	/S/I/ /
FIGI	/S/E/ /	SQRSL	/S/L/ /	VMULFQ	/S/I/ /
FIGI2	/S/E/ /	SROT	/S/I/ /	VMULFS	/S/I/ /
FIP	/S/A/ /	SROTG	/S/I/ /	VMULQB	/S/I/ /
FMMX	/S/M/ /	SROTM	/S/I/ /	VMULQF	/S/I/ /
FMTMX	/S/M/ /	SROTMG	/S/I/ /	VMULQQ	/S/I/ /
FMTR	/S/M/ /	SSCAL	/S/I/ /	VMULQS	/S/I/ /
FMTVCX	/S/M/ /	SSICO	/S/L/ /	VMULSB	/S/I/ /
FMTVX	/S/M/ /	SSIFA	/S/L/ /	VMULSF	/S/I/ /
FMVCX	/S/M/ /	SSPCO	/S/L/ /	VMULSQ	/S/I/ /
FMVX	/S/M/ /	SSPFA	/S/L/ /	VMULSS	/S/I/ /
FNORM1	/S/M/ /	SSVDC	/S/L/ /	VNRMF1	/S/I/ /
FPUR	/S/M/ /	SSWAP	/S/I/ /	VNRMF1	/S/I/ /
HSSN	/S/M/ /	STRCO	/S/L/ /	VNRMF2	/S/I/ /
HTRIDI	/S/E/ /	SUBDIA	/S/M/ /	VNRMS1	/S/I/ /
HTRID3	/S/E/ /	SUBDIR	/S/M/ /	VNRMS2	/S/I/ /
ICAMAX	/S/I/ /	SVD	/S/A/ /	VPOLYF	/S/I/ /
IDAMAX	/S/I/ /	SVD	/S/E/ /	VTPROF	/S/I/ /
INRPRD	/S/M/ /	TRED1	/S/E/ /	VTPROS	/S/I/ /
ISAMAX	/S/I/ /	TRED2	/S/E/ /	VTRAN	/S/I/ /
ITERIN	/S/M/ /	TRED3	/S/E/ /	VUABQ	/S/I/ /
LEQT1B	/S/I/ /	TRIDI	/S/M/ /	VUAFB	/S/I/ /
LEQT1C	/S/I/ /	TRI1	/S/A/ /	VUAFQ	/S/I/ /
LEQT2B	/S/I/ /	TRI2	/S/A/ /	VUAFS	/S/I/ /
LEQ1S	/S/I/ /	TRI3	/S/A/ /	VUASB	/S/I/ /
LEQ2C	/S/I/ /	TRI4	/S/A/ /	VUASQ	/S/I/ /

F2 EIGENVALUES AND EIGENVECTORS

BAC1	/S/A/ /	EIGRS	/S/I/ /	REBAKB	/S/E/ /
BAC2	/S/A/ /	EIGSYM	/S/M/ /	RECOV1	/S/M/ /
BAKVEC	/S/E/ /	EIGVCH	/S/M/ /	RECOV2	/S/M/ /
BALBAK	/S/E/ /	EIGZC	/S/I/ /	REDSY1	/S/M/ /
BANDV	/S/E/ /	EIGZF	/S/I/ /	REDSY2	/S/M/ /
BANEIG	/S/M/ /	EIG5	/S/M/ /	REDUC	/S/E/ /
BISEC	/S/A/ /	ELMBAK	/S/E/ /	REDUC1	/S/A/ /
BISECT	/S/E/ /	ELRH1C	/S/I/ /	REDUC2	/S/E/ /
BQR	/S/E/ /	ELRH2C	/S/I/ /	RG	/S/E/ /
CBABK2	/S/E/ /	ELZHC	/S/I/ /	RGG	/S/E/ /
CG	/S/E/ /	ELZVC	/S/I/ /	RITZIT	/S/A/ /
CH	/S/E/ /	EQRH1F	/S/I/ /	RNQL1	/S/A/ /
CINVIT	/S/E/ /	EQRH3F	/S/I/ /	RS	/S/E/ /
COMBAK	/S/E/ /	EQRT1S	/S/I/ /	RSB	/S/E/ /
COMLR	/S/E/ /	EQRT2S	/S/I/ /	RSG	/S/E/ /
COMLR2	/S/E/ /	EQRT3S	/S/I/ /	RSGAB	/S/E/ /

F2 EIGENVALUES AND EIGENVECTORS (CONTINUED)

COMQR /S/E/ /	EQZQF /S/I/ /	RSGBA /S/E/ /
COMQR2 /S/E/ /	EQZTF /S/I/ /	RSP /S/E/ /
CORTB /S/E/ /	EQZVF /S/I/ /	RST /S/E/ /
DEIG /S/M/ /	HQR /S/E/ /	RT /S/E/ /
DTSHFT /S/M/ /	HQR2 /S/E/ /	SEPAR /S/M/ /
EBALAC /S/I/ /	HTRIBK /S/E/ /	SEPAR2 /S/M/ /
EBALAF /S/I/ /	HTRIB3 /S/E/ /	SIMP /S/M/ /
EBBCKC /S/I/ /	IMQL1 /S/A/ /	SYMLR /S/M/ /
EBBCKF /S/I/ /	IMTQLV /S/E/ /	SYMQR /S/M/ /
EBCKF /S/I/ /	IMTQL1 /S/E/ /	TCDIAG /S/M/ /
EBCKH /S/I/ /	IMTQL2 /S/E/ /	TINVIT /S/E/ /
EHSSC /S/I/ /	INIT /S/A/ /	TQLRAT /S/E/ /
EHSSF /S/I/ /	INVIT /S/E/ /	TQL1 /S/E/ /
EHOBKS /S/I/ /	LATNTR /S/M/ /	TQL2 /S/E/ /
EHOUH /S/I/ /	MATRIX /S/N*/	TRBAK1 /S/E/ /
EHOUSS /S/I/ /	ORTBAK /S/E/ /	TRBAK3 /S/E/ /
EIGBS /S/I/ /	QREIGN /S/M/ /	TRIDIB /S/E/ /
EIGCC /S/I/ /	QZABX /S/A/ /	TSTURM /S/E/ /
EIGCH /S/I/ /	QZVAL /S/E/ /	VALVEC /S/M/ /
EIGCHK /S/M/ /	QZVEC /S/E/ /	VARAH1 /S/N*/
EIGCO1 /S/M/ /	RATQR /S/E/ /	VARAH2 /S/N*/
EIGIMP /S/M/ /	REBAK /S/E/ /	VECTOR /S/M/ /
EIGRF /S/I/ /	REBAKA /S/A/ /	

F3 DETERMINANTS

BPDSOM /S/M/ /	LITWNE /S/M/ /	SPITRM /S/M/ /
DETERM /S/M/ /	LITWNP /S/M/ /	SPITRS /S/M/ /
GAUSS /S/N/N/	MATINS /S/N/N/	SPODI /S/L/ /
LESWNE /S/M/ /	PDITRM /S/M/ /	SPPDI /S/L/ /
LESWNP /S/M/ /	PDITRS /S/M/ /	SSIDI /S/L/ /
LINSYS /S/M/ /	SGBDI /S/L/ /	SSPDI /S/L/ /
LINV3F /S/I/ /	SGEDI /S/L/ /	STRDI /S/L/ /
LINV3P /S/I/ /	SPBDI /S/L/ /	

F4 SIMULTANEOUS LINEAR EQUATIONS

BFBANP /S/M/ /	LEQT1C /S/I/ /	ORIMP /S/A/ /
BFBSUM /S/M/ /	LEQT1F /S/I/ /	ORSOL /S/A/ /
BITERM /S/M/ /	LEQT1P /S/I/ /	PDITRM /S/M/ /
BITRFM /S/M/ /	LEQT2B /S/I/ /	PDITRS /S/M/ /
BITRNP /S/M/ /	LEQT2F /S/I/ /	PDLSON /S/M/ /
BITRPD /S/M/ /	LEQT2P /S/I/ /	PDLSON /S/M/ /
BITWNP /S/M/ /	LEQ1PB /S/I/ /	PDSFBM /S/M/ /
BLESOM /S/M/ /	LEQ1S /S/I/ /	PDSFBS /S/M/ /
BLSWNP /S/M/ /	LEQ2C /S/I/ /	QR1 /S/M/ /
BMAM /S/N*/	LEQ2PB /S/I/ /	RQNWTS /S/M/ /
BPDITM /S/M/ /	LEQ2S /S/I/ /	SCONG /S/M/ /
BPDSFB /S/M/ /	LESWNE /S/M/ /	SGBSL /S/L/ /
BPDSOM /S/M/ /	LESWNP /S/M/ /	SGEDI /S/L/ /
BSUBHT /S/M/ /	LGINF /S/I/ /	SGESL /S/L/ /
CCONGR /S/M/ /	LINSYS /S/M/ /	SGTSL /S/L/ /
CFBSUM /S/M/ /	LINV1F /S/I/ /	SPBSL /S/L/ /
CGAUSS /S/N/N/	LINV1P /S/I/ /	SPDFBM /S/M/ /
CGITRF /S/M/ /	LINV2F /S/I/ /	SPDFBS /S/M/ /
CGLESM /S/M/ /	LINV2P /S/I/ /	SPDSOM /S/M/ /

F4 SIMULTANEOUS LINEAR EQUATIONS (CONTINUED)

CITERF /S/M/ /	LINV3F /S/I/ /	SPDSOS /S/M/ /
CMPINV /S/N/N/	LINV3P /S/I/ /	SPITRM /S/M/ /
FBSUBM /S/M/ /	LIN1PB /S/I/ /	SPITRS /S/M/ /
FBSUBS /S/M/ /	LIN2PB /S/I/ /	SPODI /S/L/ /
FCGM2 /S/M/ /	LITWNE /S/M/ /	SPOSL /S/L/ /
GAUSS /S/N/N/	LITWNP /S/M/ /	SPPDI /S/L/ /
GITRFM /S/M/ /	LLBQF /S/I/ /	SPPSL /S/L/ /
GITRFS /S/M/ /	LLSQF /S/I/ /	SPTSLS /S/L/ /
GLESOM /S/M/ /	LSQHTM /S/M/ /	SQRDC /S/L/ /
GLESOS /S/M/ /	LSQHTS /S/M/ /	SSIDI /S/L/ /
IMPR1 /S/A/ /	LSQSIT /S/M/ /	SSISL /S/L/ /
IMPR2 /S/A/ /	LSVDB /S/I/ /	SSPDI /S/L/ /
INVERS /S/M/ /	LSVDF /S/I/ /	SSPSL /S/L/ /
INVITR /S/M/ /	LUDAPB /S/I/ /	STRDI /S/L/ /
ITERFM /S/M/ /	LUDATF /S/I/ /	STRSL /S/L/ /
ITERFS /S/M/ /	LUDECP /S/I/ /	TRDCNP /S/M/ /
ITRPDM /S/M/ /	LUELMF /S/I/ /	TRDCOM /S/M/ /
ITRPDS /S/M/ /	LUELMP /S/I/ /	TRDFBM /S/M/ /
ITRSPM /S/M/ /	LUELPB /S/I/ /	TRDSOM /S/M/ /
ITRSPS /S/M/ /	LUREFF /S/I/ /	TRDSUB /S/M/ /
LEQS1 /S/A/ /	LUREFP /S/I/ /	TRDWNP /S/M/ /
LEQS2 /S/A/ /	LUREPB /S/I/ /	TRILOM /S/M/ /
LEQS3 /S/A/ /	MAM /S/N/*/	TRILOS /S/M/ /
LEQS4 /S/A/ /	MAM200 /S/N/*/	TRIUPM /S/M/ /
LEQS5 /S/A/ /	MATINS /S/N/N/	TRIUPS /S/M/ /
LEQS6 /S/A/ /	MATRIX /S/N/*/	TRLOIN /S/M/ /
LEQT1B /S/I/ /	OFIMA3 /S/I/ /	TRUPIN /S/M/ /

G0 STATISTICAL ANALYSIS AND PROBABILITY

ACP /S/N/*/	OMNITAB/M/ /R/	USLEAP /S/I/ /
DOV /S/N/*/	SOV /S/N/*/	USTREE /S/I/ /
EDIT /D/S/ /	TOV /S/N/*/	ZRMN /S/M/ /

G1 DATA REDUCTION (COMMON STATISTICAL PARAMETERS)

AGGREGA/D/S/ /	BEMIRO /S/I/ /	FREQUEN/D/S/ /
AGLMOD /S/I/ /	BEMMI /S/I/ /	GTMNT /S/I/ /
AMEANS /S/I/ /	BEMMO /S/I/ /	MULT RE/D/S/ /
AORDR /S/I/ /	BMDPAM /M/B/ /	OP1RAY /S/M/ /
BDCOU1 /S/I/ /	BMDP1D /M/B/ /	OP2RAY /S/M/ /
BDCOU2 /S/I/ /	BMDP2D /M/B/ /	REPORT /D/S/ /
BDLTV /S/I/ /	BMDP3D /M/B/ /	SSPAND /S/I/ /
BDS /S/N/*/	BMDP4D /M/B/ /	SSPBLK /S/I/ /
BECOR /S/I/ /	BMDP5D /M/B/ /	SSRAND /S/I/ /
BECORI /S/I/ /	BMDP6D /M/B/ /	SSRBLK /S/I/ /
BECOVN /S/I/ /	BMDP7D /M/B/ /	SSSAND /S/I/ /
BECVL /S/I/ /	BMDP8D /M/B/ /	SSSBLK /S/I/ /
BECVLI /S/I/ /	BMDP9D /M/B/ /	SSSCAN /S/I/ /
BEGRPS /S/I/ /	BREAKDO/D/S/ /	SSSEST /S/I/ /
BEIGRP /S/I/ /	CMR /S/N/*/	STUTEE /S/N/*/
BEIUGR /S/I/ /	CONDESC/D/S/ /	T-TEST /D/S/ /
BELBIN /S/I/ /	DLETE /S/M/ /	USBOX /S/I/ /
BELPOS /S/I/ /	DSCRPT /S/M/ /	USHIST /S/I/ /
BEMDP /S/I/ /	DSCRPT2 /S/M/ /	USHIUT /S/I/ /
BEMIRI /S/I/ /	FILTER /S/M/ /	USHV1 /S/I/ /

G2 CORRELATION AND REGRESSION ANALYSIS

ASA /S/N*/	LSQSIT /S/M/ /	RLGQMI /S/I/ /
BECTR /S/I/ /	MRA /S/N*/	RLGQMO /S/I/ /
BEMIRI /S/I/ /	NONLINE/D/S/ /	RLINCF /S/I/ /
BEMIRO /S/I/ /	NONPAR /D/S/ /	RLINPF /S/I/ /
BESRB /S/I/ /	OFRESI /S/I/ /	RLLAV /S/I/ /
BESRN /S/I/ /	PARTIAL/D/S/ /	RLLMV /S/I/ /
BMDPAR /M/B/ /	PCA /S/N*/	RLMUL /S/I/ /
BMDPLR /M/B/ /	PEARSON/D/S/ /	RLONE /S/I/ /
BMDP1R /M/B/ /	PLOT /D/S/ /	RLOPDC /S/I/ /
BMDP2R /M/B/ /	REGRESS/D/S/ /	RLPOL /S/I/ /
BMDP3R /M/B/ /	RLCOMP /S/I/ /	RLPRDI /S/I/ /
BMDP4R /M/B/ /	RLDCQM /S/I/ /	RLPRDO /S/I/ /
BMDP5R /M/B/ /	RLDCVA /S/I/ /	RLRES /S/I/ /
BMDP6R /M/B/ /	RLDCW /S/I/ /	RLSEP /S/I/ /
BMDP9R /M/B/ /	RLDOPM /S/I/ /	RLSTP /S/I/ /
CBNRHO /S/I/ /	RLEAP /S/I/ /	RSMITZ /S/I/ /
CMR /S/N*/	RLFITI /S/I/ /	SCATTER/D/S/ /
CORCOV /S/M/ /	RLFITO /S/I/ /	SR1 /S/N*/
G3SLS /D/S/ /	RLFOR /S/I/ /	SR2 /S/N*/
LSQHTM /S/M/ /	RLFOTH /S/I/ /	SR3 /S/N*/
LSQHTS /S/M/ /	RLFOTW /S/I/ /	TETRACH/D/S/ /

G3 SEQUENTIAL ANALYSIS
SURVIVA/D/S/ /

G4 ANALYSIS OF VARIANCE

ABIBN /S/I/ /	ANCOV1 /S/I/ /	BMDP2V /M/B/ /
ACRDAN /S/I/ /	ANESTE /S/I/ /	BMDP3V /M/B/ /
ACTRST /S/I/ /	ANESTU /S/I/ /	BMDP4V /M/B/ /
AFACN /S/I/ /	ANOVA /D/S/ /	BMDP7D /M/B/ /
AFACT /S/I/ /	ANOVA1 /S/N*/	BMDP8V /M/B/ /
AGBACP /S/I/ /	ANOVA2 /S/N*/	BRTLTT /S/M/ /
AGLMOD /S/I/ /	AORDR /S/I/ /	MANOVA /D/S/ /
AGVACL /S/I/ /	AOV /S/N*/	NOVACOM/M/ /R/
AGXPM /S/I/ /	ARCBAN /S/I/ /	ONEWAY /D/S/ /
ALSQAN /S/I/ /	ASNKMC /S/I/ /	
AMEANS /S/I/ /	BMDP1V /M/B/ /	

G5 TIME SERIES

ASA /S/N*/	FTAUTO /S/I/ /	FTMPS /S/I/ /
BMDP1T /M/B/ /	FTCAST /S/I/ /	FTMXL /S/I/ /
BMDP2T /M/B/ /	FTCMP /S/I/ /	FTRDIF /S/I/ /
FFTCC /S/I/ /	FTCROS /S/I/ /	FTTRN /S/I/ /
FFTRC /S/I/ /	FTCRXY /S/I/ /	FTWEIN /S/I/ /
FFTSC /S/I/ /	FTFPS /S/I/ /	FTWENM /S/I/ /
FFT2C /S/I/ /	FTFREQ /S/I/ /	FTWENX /S/I/ /
FFT3D /S/I/ /	FTGEN /S/I/ /	HARM /S/M/ /
FTARPS /S/I/ /	FTKALM /S/I/ /	SPECTRA/D/S/ /

G6 SPECIAL FUNCTIONS (INCLUDES RANDOM NUMBERS AND PDF'S)

BETAR	/S/M/ /	GTPBC	/S/I/ /	PBINOM	/S/M/ /
BMDP1S	/M/B/ /	GTPKP	/S/I/ /	PCHY	/S/M/ /
BOXJENK	/M/ /R/	GTPL	/S/I/ /	PFDIST	/S/M/ /
CHIDST	/S/M/ /	GTPOK	/S/I/ /	PGEOM	/S/M/ /
CHIPRB	/S/M/ /	GTPR	/S/I/ /	PGMMA	/S/M/ /
CHIRAB	/S/M/ /	GTPST	/S/I/ /	PHYPGE	/S/M/ /
CHIRUD	/S/M/ /	GTRN	/S/I/ /	PIBETA	/S/M/ /
CHSQO	/S/M/ /	GTRTN	/S/I/ /	PIBIN	/S/M/ /
CONRAY	/S/M/ /	GTTRT	/S/I/ /	PICHI	/S/M/ /
EXRAND	/S/M/ /	GTTT	/S/I/ /	PICHY	/S/M/ /
GFIT	/S/I/ /	IAOC	/S/N/N/	PIEXP	/S/M/ /
GGAMR	/S/I/ /	IDAYWEK	/S/N/N/	PIFDIS	/S/M/ /
GGBN	/S/I/ /	IRAND	/S/M/ /	PIGAMA	/S/M/ /
GGBNR	/S/I/ /	MDBETA	/S/I/ /	PIGEO	/S/M/ /
GGBTR	/S/I/ /	MDBETI	/S/I/ /	PIHYPG	/S/M/ /
GGCAY	/S/I/ /	MDBIN	/S/I/ /	PILGNM	/S/M/ /
GGCHS	/S/I/ /	MDBNOR	/S/I/ /	PINBIN	/S/M/ /
GGDA	/S/I/ /	MDCH	/S/I/ /	PINORM	/S/M/ /
GGDT	/S/I/ /	MDCHI	/S/I/ /	PIPOIS	/S/M/ /
GGEOT	/S/I/ /	MDCHN	/S/I/ /	PIRAYL	/S/M/ /
GGEXN	/S/I/ /	MDFD	/S/I/ /	PIS	/S/M/ /
GGEXT	/S/I/ /	MDFDRE	/S/I/ /	PIT	/S/M/ /
GGHPR	/S/I/ /	MDFI	/S/I/ /	PITRNM	/S/M/ /
GGMAR	/S/I/ /	MDGAM	/S/I/ /	PIUNF	/S/M/ /
GGMTN	/S/I/ /	MDGC	/S/I/ /	PIUNFD	/S/M/ /
GGNLG	/S/I/ /	MDGCI	/S/I/ /	PIWEBL	/S/M/ /
GGNML	/S/I/ /	MDHYP	/S/I/ /	PLGNRM	/S/M/ /
GGNPM	/S/I/ /	MDNOR	/S/I/ /	PNBIN	/S/M/ /
GGNQF	/S/I/ /	MDNRIS	/S/I/ /	PNORM	/S/M/ /
GGNSM	/S/I/ /	MDSMR	/S/I/ /	PORAND	/S/M/ /
GGPON	/S/I/ /	MDSTI	/S/I/ /	PRAYL	/S/M/ /
GGPOS	/S/I/ /	MDTD	/S/I/ /	PRBEXP	/S/M/ /
GGSPH	/S/I/ /	MDTN	/S/I/ /	PRBUNF	/S/M/ /
GGSTA	/S/I/ /	MDTNF	/S/I/ /	PTDIST	/S/M/ /
GGTRA	/S/I/ /	MDTPS	/S/I/ /	PTRNRM	/S/M/ /
GGUBFS	/S/I/ /	MMPSI	/S/I/ /	PUNFD	/S/M/ /
GGUBS	/S/I/ /	MSMRAT	/S/I/ /	PWEBL	/S/M/ /
GGUBT	/S/I/ /	NDEFT	/S/I/ /	RAND	/S/M/ /
GGUD	/S/I/ /	NDKER	/S/I/ /	RANNUM	/S/N/*/
GGUW	/S/I/ /	NDMPLE	/S/I/ /	RUNSAB	/S/M/ /
GGVCR	/S/I/ /	NONPAR	/D/S/ /	RUNSUD	/S/M/ /
GGWIB	/S/I/ /	NRAND	/S/M/ /	URAND	/S/M/ /
GTDDU	/S/I/ /	NRML	/S/M/ /	USPC	/S/I/ /
GTD2T	/S/I/ /	NRMNO	/S/M/ /	USPDF	/S/I/ /
GTNOR	/S/I/ /	PBETA	/S/M/ /	XIRAND	/S/M/ /

G7 MULTIVARIATE ANALYSIS AND SCALE STATISTICS

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

G8 NON-PARAMETRIC METHODS AND STATISTICAL TESTS

BMDP1F /M/B/ /	NBQT /S/I/ /	NMKSF /S/I/ /
BMDP2F /M/B/ /	NBSDL /S/I/ /	NMKTS /S/I/ /
BMDP3F /M/B/ /	NBSIGN /S/I/ /	NMRANK /S/I/ /
BMDP3S /M/B/ /	NDKER /S/I/ /	NMTIE /S/I/ /
BMDP4F /M/B/ /	NDMPLE /S/I/ /	NONPAR /D/S/ /
CROSSTA/D/S/ /	NHEXT /S/I/ /	NPAR /D/S/ /
NAK1 /S/I/ /	NHINC /S/I/ /	NRBHA /S/I/ /
NAWNRP /S/I/ /	NKS1 /S/I/ /	NRWMD /S/I/ /
NAWRPE /S/I/ /	NKS2 /S/I/ /	NRWRST /S/I/ /
NAWRPU /S/I/ /	NMCC /S/I/ /	RSO /S/N/* /
NBCYC /S/I/ /	NMKEN /S/I/ /	SUMMARY/D/S/ /

G9 STATISTICAL INFERENCE

AGVACL /S/I/ /	BENSON /S/I/ /	CTRBYC /S/I/ /
ASNKMC /S/I/ /	BEPAT /S/I/ /	GTCN /S/I/ /
BEMNON /S/I/ /	BEPET /S/I/ /	OIND /S/I/ /
BEMSON /S/I/ /	CTPR /S/I/ /	

H1 LINEAR PROGRAMMING

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

H4 SIMULATION MODELING

GPSS /M/ /R/	MIMIC /M/ /R/	SIMI15 /M/ /R/
--------------	---------------	----------------

I0 INPUT

FASTIN /S/N/* /

I2 OCTAL

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

I3 DECIMAL

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

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/I/ /	USWBS /S/I/ /	USWFV /S/I/ /
	USWBM /S/I/ /	USWFM /S/I/ /	USWSM /S/I/ /
J4	BCD (HOLLERITH)		
	BANNER /M/U/U/	BANR6 /S/5/N/	LINE8 /S/N/N/
	BANNERS/M/U/U/	COMQ /P/P/P/	PM /P/P/P/
	BANNERS/P/P/P/	COPYSF /M/ /R/	PRTIME /S/N/N/
	BANNER3/M/U/U/	ICOM /S/N/*/	PRTYM /S/5/N/
	BANNER6/M/U/U/	ICOMN /S/N/*/	REPORT /D/S/ /
	BANR /S/N/N/	LINE6 /P/P/P/	TTYMSG /S/5/N/
	BANR /S/5/N/	LINE6 /S/N/N/	
	BANR6 /S/N/N/	LINE8 /P/P/P/	
J5	PLOTTING		
	BMDP5D /M/B/ /	IDDS /P/P/P/	USHIUT /S/I/ /
	BMDP6D /M/B/ /	PLOT /D/S/ /	USHV1 /S/I/ /
	BMDP7D /M/B/ /	PLOTMY /S/N/*/	USPC /S/I/ /
	CALCFN /S/ /R/	PLOTPR /S/N/N/	USPDF /S/I/ /
	CALCOMP/S/ /R/	PLOTXY /S/N/*/	USPLT /S/I/ /
	CALC3D /P/P/P/	SCATTER/D/S/ /	USSLF /S/I/ /
	CALC936/S/ /R/	TEKTRNX/S/ /R/	USTREE /S/I/ /
	DISSPLA/S/ /R/	USBOX /S/I/ /	XPLOT /S/M/ /
	HSTGRM /S/M/ /	USHIST /S/I/ /	XYPLOT /S/M/ /
J9	COMPOSITE		
	PRUDMP /M/U/U/	TAPDMP9/M/U/U/	
K1	EXTERNAL-TO-EXTERNAL		
	COPYE /M/ /R/	DOCUMNT/M/U/U/	RECDEL1/P/P/P/
	COPYF /M/ /R/	D2A /P/P/P/	RECGET1/P/P/P/
	COPYR /M/ /R/	FETCHC /P/P/P/	RECREP1/P/P/P/
	COPYRE /M/U/U/	FETCHM /P/P/P/	TAPRD /P/P/P/
	COPYRM /M/ /R/	GETMS /P/P/P/	TAPWR /P/P/P/
	COPYS /M/ /R/	MF2MF /P/P/P/	VAXER /M/U/U/
	COPYS /P/P/P/	MF2MFA /M/U/U/	XFRC2M /M/U/U/
	COPYSEL/M/U/U/	MSS2PF /P/P/P/	XFRC2MA/M/U/U/
	COPYSF /M/ /R/	M2C /P/P/P/	XFRM2C /M/U/U/
	CVT360 /M/ /R/	M2CALL /P/P/P/	XFRM2CA/M/U/U/
	C2M /P/P/P/	PUTMS /P/P/P/	
	C2MALL /P/P/P/	RECADD1/P/P/P/	
K2	INTERNAL-TO-INTERNAL (RELOCATION)		
	CCOPY /S/I/ /	GETDABA/S/N/N/	RCPA /S/N/N/
	CMMOVEF/S/5/N/	GETRA /S/N/N/	SAXPY /S/I/ /
	CSWAP /S/I/ /	MFETCH /S/N/N/	SCOPY /S/I/ /
	DCOPY /S/I/ /	MOVEIT /S/N/N/	SSWAP /S/I/ /
	DSWAP /S/I/ /	MSET /S/N/N/	SWAP /S/N/N/

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/	UPDGETT/P/P/P/
COPYN /M/ /R/	TRANPK /P/P/P/	UPDREPL/P/P/P/
GETOBJ /M/U/U/	UPDADD /P/P/P/	
NEWNAME/M/U/U/	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/	LIBSET1/P/P/P/	SEGLD /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/5/N/
IDDS /P/P/P/	MYPROS /P/P/P/	UTILITY/P/P/P/

L2 COMPILING

APL /M/ /R/	MNF /M/ /*/	RUNMNF /P/P/P/
BASIC /M/ /R/	PASCAL /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/	F45IT /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/	VARORD /S/M/ /
AUDSORT/M/U/U/	QSORT1 /S/N/N/	VECORD /S/M/ /
CSHUFL /S/5/N/	SORT /P/P/P/	VSRTA /S/I/ /
CSORT /S/5/N/	SORTCZ /P/P/P/	VSRTM /S/I/ /
CSORTD /S/5/N/	SORTMRG/M/ /R/	VSRTTP /S/I/ /
CSORTN /S/5/N/	SORT5 /M/ /R/	VSRTR /S/I/ /
CSORT2 /S/5/N/	SSORT /S/N/N/	VSRTU /S/I/ /
DEKSORT/M/U/U/	SSORTF /S/N/N/	
HSTGRM /S/M/ /	SSORTI /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/	WEKDAY /S/N/N/
CV029 /M/U/U/	IROMAN /S/N/N/	WRITE /M/ /R/
CV029 /P/P/P/	JGDATE /S/N/N/	
DATCNV /S/N/N/	JULIAN /S/N/N/	

M3 MERGING

MERGE /M/ /R/	SORTMRG/M/ /R/
---------------	----------------

M4 CHARACTER MANIPULATION

ADJL /S/N/N/	D630I /S/N/N/	PUTCHR /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/
ASCADM /S/N/N/	EXTBIT /S/N/N/	REPLHI /S/N/N/
ASCBSX /S/N/N/	EXTPRM /S/N/N/	REPLLO /S/N/N/
ASDC /M/U/U/	FBINRD /S/N/N/	REPLNE /S/N/N/
ASCGET /S/N/N/	GETCHA /S/N/N/	RIGHT /S/5/N/
ASCII /S/N/N/	GETCHR /S/N/N/	SBYT /S/N/N/
ASCI11 /S/N/N/	GETPRM /S/N/* /	SEMICO /S/N/N/
ASCI10 /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/	ISTAPE /S/N/N/	SKWEZR /S/N/N/
CENTER /S/N/N/	ITRANS /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/	VFILL /S/N/N/
CONTRCT/S/N/N/	MOVECM /S/N/N/	VT100I /S/N/N/
COPYEXT/M/U/U/	MOVSTR /S/N/N/	ZBLANK /S/N/N/
CVCHIN /S/5/N/	MXGET /S/N/N/	ZEROFL /S/N/N/
CVCHOL /S/5/N/	OMRONI /S/N/N/	ZEROS /S/N/N/
CVHOCH /S/5/N/	PARGET /S/N/N/	
CVINCH /S/5/N/	PUTCHA /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/I/ /	LASTWRD/S/N/N/
FINDC /S/N/N/	IDAMAX /S/I/ /	LSTCH /S/5/N/
FINDW /S/N/N/	IDIGIT /S/N/N/	MAXE /S/N/N/
FINDWRD/S/N/N/	IFINDCH/S/N/N/	MINE /S/N/N/
FIRSTCH/S/5/N/	ISAMAX /S/I/ /	NFILLT /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/	CMPGOS/S/5/N/	MONERR /S/F/ /
ALTYM /S/5/N/	CMPGSS/S/5/N/	PRTIME /S/N/N/
CMPGFS/S/5/N/	GETCCL /S/N/N/	SM5PRNT/S/5/N/

N2 DUMPING

CMDUMP/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/	
DMPFIL /M/U/U/	FDMP /M/U/U/	

01 OFF-LINE EQUIPMENT (LISTERS, REPRODUCERS, ETC.)

BRaille/M/U/U/	LISTCMP/M/U/U/	PROALL /P/P/P/
CARDS /M/U/U/	LISTEOI/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/	LISTZ /M/U/U/	RECDOC /P/P/P/
CV029 /M/U/U/	LIST1 /M/U/U/	TIDBITS/P/P/P/
CV029 /P/P/P/	LIST2 /M/U/U/	UPDDOC /P/P/P/
DOCDATE/P/P/P/	LIST3 /M/U/U/	UPDLIST/P/P/P/
DOCDOC /P/P/P/	LIST4 /M/U/U/	WARNING/S/N/N/
FRAME /M/U/U/	LMFNPFN/M/U/U/	WRITE /M/ /R/
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/I/ /

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/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/	JOBDM /S/N/N/	PM /S/5/N/
BANR /S/N/N/	JOBNAME/S/N/N/	PRTFL /S/N/N/
BANR6 /S/N/N/	JOBORG /S/N/N/	PTIM /M/U/U/
BDT /P/P/P/	JOBTIME/M/U/U/	PUTMS /P/P/P/
BUFSIZE/S/N/N/	LFPFERR/S/N/N/	REDUCE /S/N/N/
CALCIBL/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/
CMMUERC/S/5/N/	LINERL /M/U/U/	SKPSTAT/S/N/N/
COMQ /P/P/P/	LONGEST/M/U/U/	S2KRNM /M/U/U/
COUNTLR/M/U/U/	LPL /M/U/U/	TIMLEFT/S/N/N/
C2M /P/P/P/	LPLM /M/U/U/	TPAUDIT/P/P/P/

Q0 SERVICE OR HOUSEKEEPING, PROGRAMMING AIDS (CONTINUED)

C2MALL /P/P/P/	MACHINE/S/N/N/	TPGET /P/P/P/
DFDATIM/M/U/U/	MAKSUB /M/U/U/	TPRLS /P/P/P/
DSAUDIT/P/P/P/	MEMUSED/S/N/N/	UHELP /S/I/ /
DSRLS /P/P/P/	MFNS /M/U/U/	UHELP1 /S/I/ /
EDIT /M/ /R/	MFRAME /S/N/N/	UHELP2 /S/I/ /
ELTIME /S/N/N/	MFRAME /S/5/N/	UHELP3 /S/I/ /
ELTYM /S/5/N/	MFN /P/P/P/	UHELP4 /S/I/ /
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/	MSAUFF1/M/U/U/	WHICHMF/M/U/U/
FRAME /M/U/U/	MSAUFF2/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/
GETLFNS/S/N/N/	M2CALL /P/P/P/	XFRM2CA/M/U/U/

Q1 CLEAR/RESET

UERSSET /S/I/ /	UGETIO /S/I/ /
-----------------	----------------

Q3 FILE MANIPULATION

ANYLIB /P/P/P/	LIBSET1/P/P/P/	SKPFIL /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/	MYPRO /P/P/P/	TTYOPN /S/5/N/
CLUNLD /S/N/N/	MYPROS /P/P/P/	UNLOAD /S/N/N/
DISPOST/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/5/N/	SELDUMP/P/P/P/
PALC /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/
DOCDAT /M/U/U/	DOCS /M/U/U/	PURPOSE/M/U/U/
DOCDELE/P/P/P/	DOCUMNT/M/U/U/	TAPLIST/M/U/U/
DOCFILE/P/P/P/	EXECARD/M/U/U/	UNDOCIT/M/U/U/
DOCGET /P/P/P/	GETDOC /M/U/U/	
DOCIT /M/U/U/	LGOTREE/P/P/P/	

Q7 PROGRAM LIBRARY UTILITIES

BINDEX /M/U/U/	LISTCMP/M/U/U/	SEGO /P/P/P/
COPYL /M/ /R/	PROADD /P/P/P/	SORTUP /M/U/U/
COPYLIB/P/P/P/	PRODELE/P/P/P/	UPDADD /P/P/P/
COPYN /M/ /R/	PROGET /P/P/P/	UPDATE /M/ /R/
DECKS /M/U/U/	PROHDR /P/P/P/	UPDDELE/P/P/P/
DEKSORT/M/U/U/	PRONAM /P/P/P/	UPDGET /P/P/P/
EDITLIB/M/ /R/	PROREPL/P/P/P/	UPDGETS/P/P/P/
ITEMIZE/M/ /R/	PROS2R /P/P/P/	UPDGETT/P/P/P/
LISTBIN/M/U/U/	REDECK /M/U/U/	UPDREPL/P/P/P/

R1 FORMAL LOGIC

COUPLE /S/N/N/

R3 LIST AND STRING PROCESSING

PROSE /M/ /R/ SNOBOL /M/ /R/

R4 TEXT EDITING

EDITOR /M/ /R/ NETED /M/ /*/ RNF /M/ /*/

S0 INFORMATION RETRIEVAL

ACCTRPT/M/ /R/	EXECARD/M/U/U/	PURPOSE/P/P/P/
ADPCOST/M/ /R/	GETDOC /M/U/U/	QQ /M/ /R/
AUDIT /P/P/P/	GETREV /M/U/U/	QU /M/ /R/
AUDPFT /M/U/U/	IDID /S/5/N/	RIQS /M/ /R/
AUDSORT/M/U/U/	JOBORG /S/5/N/	SHARP /M/ /R/
CCNOTE /P/P/P/	MANUAL /M/U/U/	S2K260 /M/ /R/
DBUTIL /M/ /R/	MSAUDIT/P/P/P/	S2K280 /M/ /R/
DDL /M/ /R/	PAGEPRT/M/U/U/	TAPLIST/M/U/U/
DMS170 /M/ /R/	PROMNT /M/U/U/	VENUS /P/P/P/
DOCDAT /M/U/U/	PURPOS /M/U/U/	
DOCUMNT/M/U/U/	PURPOSE/M/U/U/	

T4 ENGINEERING

ABAQUS /M/ /R/	ECAP /M/ /R/	STRESS /M/ /R/
ARDCFT /S/N/*/	ELBOW /M/ /R/	
CIVCO /M/ /R/	NASTRAN/M/ /R/	

T6 MANUFACTURING (NON-DATA) PROCESSING AND PROCESS CONTROL

APT /M/ /R/

V1 RANDOM NUMBER GENERATORS

EXRAND /S/M/ /	PORAND /S/M/ /	RN2 /S/N/*/
IRAND /S/M/ /	RAND /S/M/ /	URAND /S/M/ /
NRAND /S/M/ /	RANNUM /S/N/*/	XIRAND /S/M/ /
NRML /S/M/ /	RNDMIZ /S/N/N/	
NRMNO /S/M/ /	RN1 /S/N/*/	

V3 STANDARD AND SPECIAL PROBLEMS

BRAILLE/M/U/U/

X5 ANALYSIS (TIME-SERIES ANALYSIS)

BMDP1L /M/B/ /	BMDP2T /M/B/ /	SPECTRA/D/S/ /
BMDP2L /M/B/ /	BOXJENK/M/ /R/	SURVIVA/D/S/ /

Z0 ALL OTHERS

ALARM /M/U/U/

DAYONOF/S/N/N/

MF2CPU /S/N/N/

MF2CPU /S/5/N/

PASCLIB/S/T/R/

PTOOLS /M/T/R/

SSP /S/ /R/

***** 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 BMDQ3M)
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
BMDQ3M	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
BMDPAR	DERIVATIVE-FREE NONLINEAR REGRESSION
BMDPLR	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,....

*** MNSRDC ***

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.

REFERENCES: "SPSS, COMBINED EDITION", NIE, HULL, MCGRAW-HILL, INC., 1981 (ISBN07-079052-3) (INCLUDES 2ND ED. AND 7-9 UPDATE)

"SPSS PRIMER", KLECKA, NIE AND HULL, MCGRAW-HILL, 1975.

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 DISCRPTION
 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)
 SUMTABL - 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
CONDESCRIPTIVE	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

*** UTILITY ***

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 PFDUMP TAPES CREATED BY SELDUMP OR PRIVATE PACK PFDUMP

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

BRILLE 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 MODIFICATONS. (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

CV029 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

DUMPOBJ 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 COMPILE FILE, EACH DECK BEGINNING ON A NEW PAGE WITH A BANNER PAGE PRECEDING IT

LISTEOI LIST A FILE INSERTING *EOR, *EOF, *EOI WHERE APPROPRIATE

LISTER MULTI-OPTION LISTING PROGRAM

LISTM LIST IN MULTIPLE COLUMNS

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 VIS THE MSS

MSAUD SORT LO=F OUTPUT FROM MSAUDIT

MSAUF1 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 MSAUF2

MSAUF2 FROM MSAUDIT,LO=FP OUTPUT OF PROCEDURE GENERATED BY PROGRAM MSAUF1 AND OUTPUT OR PROGRAM MSAUF1, 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

PRZUP 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

S2KRNM 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

UNDOCIT 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/MFNPFN)

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

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

XFRM2CA CREATE PROCEDURE TO TRANSFER ALL MSS FILES OF EXECUTING USER TO A CDC PERMANENT FILE (BASED ON EXECUTING USER'S FILE TABLE/MFNPFN)

*** 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,MSACCES=<PASSWORD>.

WHERE <PROG> IS THE NAME OF THE PROGRAM WHOSE DOCUMENTATION IS DESIRED.

ABAQUS	A FAMILY OF MODELLING 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)
COPYBFR	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)

** PASCAL **

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 EOI
```

INDIVIDUAL MACHINE-READABLE DOCUMENTS, WHEN AVAILABLE, MAY BE PRINTED (SEE PAGE 1-2).

*** ARLNALG ***

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.

REFERENCES: THE ARL LINEAR ALGEBRA LIBRARY HANDBOOK, NIKOLAI AND TSAO, AEROSPACE RESEARCH LABORATORIES, DAYTON, OHIO, JULY 1974, ARL TR 74-0106.

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

ORTHO2 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

*** EISPACK ***

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:

BAKVEC BACK TRANSFORM THE EIGENVECTORS OF THAT SYMMETRIC TRIDIAGONAL MATRIX DETERMINED BY FIGI

BALANC BALANCE A REAL GENERAL MATRIX

BALBAK BACK TRANSFORM THE EIGENVECTORS OF THAT REAL MATRIX TRANSFORMED BY BALANC

BANDR REDUCE A REAL SYMMETRIC BAND MATRIX TO A SYMMETRIC TRIDIAGONAL MATRIX USING AND OPTIONALLY ACCUMULATING ORTHOGONAL TRANSFORMATIONS

BANDV DETERMINE SOME EIGENVECTORS OF A REAL SYMMETRIC BAND MATRIX OR SOLVE BAND EQUATIONS

BISECT DETERMINE SOME EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

BQR DETERMINE SOME EIGENVALUES OF A REAL SYMMETRIC BAND MATRIX

CBABK2 BACK TRANSFORM THE EIGENVECTORS OF THAT COMPLEX MATRIX TRANSFORMED BY CBAL

CBAL BALANCE A COMPLEX GENERAL MATRIX

CG DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX GENERAL MATRIX

CH DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX HERMITIAN MATRIX

CINVT DETERMINE THOSE EIGENVECTORS OF A COMPLEX UPPER HESSENBERG MATRIX CORRESPONDING TO SPECIFIED EIGENVALUES

COMBAK BACK TRANSFORM THE EIGENVECTORS OF THAT UPPER HESSENBERG MATRIX DETERMINED BY COMHES

COMHES REDUCE A COMPLEX GENERAL MATRIX TO COMPLEX UPPER HESSENBERG FORM USING ELEMENTARY TRANSFORMATIONS

COMLR DETERMINE THE EIGENVALUES OF A COMPLEX UPPER HESSENBERG MATRIX

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

FIG1 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

QZHESES 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 TRIDIAGONAL FORM AND THE OTHER IN UPPER TRIANGULAR FORM USING BACK SUBSTITUTION

RATQR DETERMINE SOME EXTREME EIGENVALUES OF A SYMMETRIC TRIDIAGONAL 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

REDUC 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 $A * X = (\text{LAMBDA}) * B * X$

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 $A^*X = (\text{LAMBDA})^*B^*X$

RSGAB DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS FOR THE REAL SYMMETRIC GENERALIZED EIGENPROBLEM $A^*B^*X = (\text{LAMBDA})^*X$

RSGBA DRIVER SUBROUTINE TO DETERMINE THE EIGENVALUES AND EIGENVECTORS FOR THE REAL SYMMETRIC GENERALIZED EIGENPROBLEM $B^*A^*X = (\text{LAMBDA})^*X$

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

*** FUNPACK ***

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:

BESEI0 FUNCTION TO CALCULATE MODIFIED BESSEL FUNCTIONS OF THE FIRST KIND OF ORDER ZERO, $\text{EXP}(-\text{ABS}(X)) * I_0(X)$

BESEI1 FUNCTION TO CALCULATE MODIFIED BESSEL FUNCTIONS OF THE FIRST KIND OF ORDER ONE, $\text{EXP}(-\text{ABS}(X)) * I_1(X)$

BESEK0 COMPUTE MODIFIED BESSEL FUNCTIONS OF THE SECOND KIND OF ORDER ZERO, $\text{EXP}(X) * K_0(X)$, FOR REAL, POSITIVE X

BESEK1 COMPUTE MODIFIED BESSEL FUNCTIONS OF THE SECOND KIND OF ORDER ONE, $\text{EXP}(X) * K_1(X)$, FOR REAL, POSITIVE X

BESI0 FUNCTION TO CALCULATE MODIFIED BESSEL FUNCTIONS OF THE FIRST KIND OF ORDER ZERO, $I_0(X)$

BESI1 FUNCTION TO CALCULATE MODIFIED BESSEL FUNCTIONS OF THE FIRST KIND OF ORDER ONE, $I_1(X)$

BESJ0 FUNCTION TO CALCULATE BESSEL FUNCTIONS OF THE FIRST KIND OF ORDER ZERO, $J_0(X)$

BESJ1 FUNCTION TO CALCULATE BESSEL FUNCTIONS OF THE FIRST KIND OF ORDER ONE, $J_1(X)$

BESK0 COMPUTE MODIFIED BESSEL FUNCTIONS OF THE SECOND KIND OF ORDER ZERO, $K_0(X)$, FOR REAL, POSITIVE X

BESK1 COMPUTE MODIFIED BESSEL FUNCTIONS OF THE SECOND KIND OF ORDER ONE, $K_1(X)$, FOR REAL, POSITIVE X

BESY SUBROUTINE TO COMPUTE BESSEL FUNCTIONS OF THE SECOND KIND OF NON-NEGATIVE ORDER, $Y\text{-SUB-}NU(X)$, FOR REAL, POSITIVE X (SEE YNU)

DAW FUNCTION TO COMPUTE DAWSON'S INTEGRAL FOR ALL REAL ARGUMENTS

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)

*** IMSL ***
(PROPRIETARY)

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)

BECOVN 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)

BGRPS 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) INFERENCES USING A SAMPLE FROM A NORMAL POPULATION WITH KNOWN VARIANCE

BEMSON MEAN AND VARIANCE INFERENCES USING A SAMPLE FROM A NORMAL POPULATION

BENSON VARIANCE INFERENCES USING A SAMPLE FROM A NORMAL POPULATION WITH KNOWN MEAN

BEPAT MEAN AND VARIANCE INFERENCES USING SAMPLES FROM EACH OF TWO NORMAL POPULATIONS WITH UNEQUAL VARIANCES

BEPET MEAN AND VARIANCE INFERENCES 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 EIGEN- VECTORS OF THE ORIGINAL MATRIX

EBBCKF BACK TRANSFORMATION OF THE EIGENVECTORS OF A BALANCED REAL
MATRIX TO FORM THE EIGEN- VECTORS 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

EHOUSH 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 $A^*X=LAMBDA^*B^*X$ WHERE A AND B ARE COMPLEX MATRICES

EIGZF EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF THE SYSTEM $A^*X=LAMBDA^*B^*X$ 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 BACKTRANS- FORMATION OF THE EIGENVECTORS

ELZHC REDUCE TWO COMPLEX MATRICES, A AND B, SIMUL- TANEOUSLY, A TO UPPER HESSENBERG AND B TO UPPER TRIANGULAR FORM

ELZVC CALCULATE THE EIGENVALUES AND, OPTIONALLY, EIGENVECTORS OF THE SYSTEM $A^*Z=LAMBDA^*B^*Z$ 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

EQRT1S SMALLEST OR LARGEST M EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX

EQRT2S EIGENVALUES AND (OPTIONALLY) EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX USING THE QL METHOD

EQRT3S 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 $A^*X=LAMBDA^*B^*X$. 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

FFT3D 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

GGBTR 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

GTTT 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 PERODIC END CONDITIONS

ICSSCU 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)

LEQT1B LINEAR EQUATION SOLUTION - BAND STORAGE MODE - SPACE ECONOMIZER SOLUTION

LEQT1C MATRIX DECOMPOSITION, LINEAR EQUATION SOLUTION - SPACE ECONOMIZER SOLUTION - COMPLEX MATRICES

LEQT1F LINEAR EQUATION SOLUTION - FULL STORAGE MODE - SPACE ECONOMIZER SOLUTION

LEQT1P LINEAR EQUATION SOLUTION - POSITIVE DEFINITE MATRIX - SYMMETRIC STORAGE MODE - SPACE ECONOMIZER SOLUTION

LEQT2B LINEAR EQUATION SOLUTION - BAND STORAGE MODE - HIGH ACCURACY SOLUTION

LEQT2F LINEAR EQUATION SOLUTION - FULL STORAGE MODE - HIGH ACCURACY SOLUTION

LEQT2P LINEAR EQUATION SOLUTION - POSITIVE DEFINITE MATRIX - SYMMETRIC STORAGE MODE - HIGH ACCURACY SOLUTION

LEQ1PB LINEAR EQUATION SOLUTION - POSITIVE DEFINITE SYMMETRIC BAND MATRIX - BAND SYMMETRIC STORAGE MODE - SPACE ECONOMIZER SOLUTION

LEQ1S LINEAR EQUATION SOLUTION - INDEFINITE MATRIX - SYMMETRIC STORAGE MODE - SPACE ECONOMIZER SOLUTION

LEQ2C LINEAR EQUATION SOLUTION - COMPLEX MATRIX - HIGH ACCURACY SOLUTION

LEQ2PB LINEAR EQUATION SOLUTION - POSITIVE DEFINITE BAND SYMMETRIC MATRIX - BAND SYMMETRIC STORAGE MODE - HIGH ACCURACY SOLUTION

LEQ2S LINEAR EQUATION SOLUTION - INDEFINITE MATRIX - SYMMETRIC STORAGE MODE - HIGH ACCURACY SOLUTION

LGINF GENERALIZED INVERSE OF REAL MATRIX

LINV1F INVERSION OF A MATRIX - FULL STORAGE MODE - SPACE ECONOMIZER SOLUTION

LINV1P INVERSION OF MATRIX - POSITIVE DEFINITE - SYMMETRIC STORAGE MODE - SPACE ECONOMIZER SOLUTION

LINV2F INVERSION OF A MATRIX - FULL STORAGE MODE - HIGH ACCURACY SOLUTION

LINV2P INVERSION OF A MATRIX - POSITIVE DEFINITE - SYMMETRIC STORAGE MODE - HIGH ACCURACY SOLUTION

LINV3F IN PLACE INVERSE, EQUATION SOLUTION, AND/OR DETERMINANT EVALUATION - FULL STORAGE MODE

LINV3P IN PLACE INVERSE, EQUATION SOLUTION, POSITIVE DEFINITE MATRIX - SYMMETRIC STORAGE MODE

LIN1PB INVERSION OF A MATRIX - POSITIVE DEFINITE BAND SYMMETRIC MATRIX - BAND SYMMETRIC STORAGE MODE - SPACE ECONOMIZER SOLUTION

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 STUDENTS 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

MMDEI EXPONENTIAL INTEGRALS

MMDELE COMPLETE ELLIPTIC INTEGRAL OF THE SECOND KIND

MMDELK COMPLETE ELLIPTIC INTEGRAL OF THE FIRST KIND

MMKELD DERIVATIVES OF THE KELVIN FUNCTIONS (BER,BEI, KER, AND KEI) OF ORDER ZERO

MMKEL KELVIN FUNCTIONS OF THE FIRST KIND, (BER,BEI), AND OF THE SECOND KIND, (KER,KEI), OF ORDER ZERO

MMKEL1 KELVIN FUNCTIONS OF THE FIRST KIND, (BER,BEI), AND OF THE SECOND KIND, (KER,KEI), OF ORDER ONE

MMPSI LOGARITHMIC DERIVATIVE OF THE GAMMA FUNCTION

MSMRAT RATIO OF THE ORDINATE TO THE UPPER TAIL AREA OF THE STANDARDIZED NORMAL (GAUSSIAN) DISTRIBUTION

NAK1 KRUSKAL-WALLIS TEST FOR IDENTICAL POPULATIONS

NAWNRP WILSONS ANOVA (2 OR 3 WAY DESIGNS) WITHOUT REPLICATES

NAWRPE WILSONS ANOVA (1, 2, OR 3 WAY DESIGNS) WITH EQUAL REPLICATION

NAWRPU WILSONS ANOVA (1, 2, OR 3 WAY DESIGNS) WITH UNEQUAL REPLICATION

NBCYC NOETHERS TEST FOR CYCLICAL TREND

NBQT COCHRAN Q TEST

NBSDL COX AND STUART SIGN TEST FOR TRENDS IN DISPERSION AND LOCATION

NBSIGN SIGN TEST (FOR PERCENTILES)

NDEST EVALUATE PROBABILITY DENSITY FUNCTION AT SPECIFIED POINTS

NDKER NONPARAMETRIC PROBABILITY DENSITY FUNCTION (ONE DIMENSIONAL) ESTIMATION BY KERNEL METHOD

NDMPLE NONPARAMETRIC PROBABILITY DENSITY FUNCTION (ONE DIMENSIONAL) ESTIMATION BY PENALIZED LIKELIHOOD METHOD

NHEXT FISHERS EXACT METHOD FOR 2 BY 2 TABLES

NHINC INCLUDANCE TEST

NKS1 KOLMOGOROV-SMIRNOV ONE-SAMPLE TEST

NKS2 KOLMOGOROV-SMIRNOV TWO-SAMPLE TEST

NMCC CALCULATE AND TEST THE SIGNIFICANCE OF THE KENDALL COEFFICIENT OF CONCORDANCE

NMKEN KENDALLS TEST FOR CORRELATION (RANK CORRELATION COEFFICIENT)

NMKSF 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

NMKTS K-SAMPLE TRENDS TEST AGAINST ORDERED ALTERNATIVES

NMRANK NUMERICAL RANKING

NMTIE TIE STATISTICS, GIVEN A SAMPLE OF OBSERVATIONS

NRBHA BHAPKAR V TEST

NRWMD WILCOXON SIGNED RANK TEST

NRWRST WILCOXONS RANK-SUM TEST

OCDIS PAIRWISE EUCLIDEAN DISTANCE BETWEEN COLUMNS OF A MATRIX

OCLINK PERFORM A SINGLE-LINKAGE OR COMPLETE-LINKAGE HIERARCHICAL CLUSTER ANALYSIS GIVEN A SIMILARITY MATRIX

ODFISH LINEAR DISCRIMINANT ANALYSIS METHOD OF FISHER FOR REDUCING THE NUMBER OF VARIABLES

ODNORM MULTIVARIATE NORMAL LINEAR DISCRIMINANT ANALYSIS AMONG SEVERAL KNOWN GROUPS

OFCOEF COMPUTE A MATRIX OF FACTOR SCORE COEFFICIENTS FOR INPUT TO IMSL ROUTINE OFSCOR

OFCOMM COMPUTE AN UNROTATED FACTOR LOADING MATRIX ACCORDING TO A COMMON FACTOR MODEL BY UNWEIGHTED OR GENERALIZED LEAST SQUARES, OR BY MAXIMUM LIKELIHOOD PROCEDURES

OFHARR TRANSFORMATION OF UNROTATED FACTOR LOADING MATRIX TO OBLIQUE AXES BY HARRIS-KAISER METHOD

OFIMAG COMPUTE AN UNROTATED FACTOR LOADING MATRIX ACCORDING TO AN IMAGE MODEL

OFIMA3 LEAST SQUARES SOLUTION TO THE MATRIX EQUATION $AT = B$

OPPRI COMPUTE AN UNROTATED FACTOR LOADING MATRIX ACCORDING TO A PRINCIPAL COMPONENT MODEL

OFPROT OBLIQUE TRANSFORMATION OF THE FACTOR LOADING MATRIX USING A TARGET MATRIX, INCLUDING PIVOT AND POWER VECTOR OPTIONS

OFRESI COMMUNALITIES AND NORMALIZED FACTOR RESIDUAL CORRELATION MATRIX CALCULATION

OFROTA ORTHOGONAL ROTATION OF A FACTOR LOADING MATRIX USING A GENERALIZED ORTHOMAX CRITERION, INCLUDING QUARTIMAX, VARIMAX, AND EQUAMAX

OFSCHN ORTHOGONAL TRANSFORMATION OF THE FACTOR LOADING MATRIX USING A TARGET MATRIX

OFSCOR COMPUTE A SET OF FACTOR SCORES GIVEN THE FACTOR SCORE COEFFICIENT MATRIX

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 $Y(I) = \text{ALPHA} + \text{BETA} * \text{GAMMA} ** X(I) + E(I)$

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

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

UERSSET 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)

USHV1 PRINT A HISTOGRAM (HORIZONTAL)

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

USNMNX 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

USWFV 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)

VCVTFB 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

VMULBB MATRIX MULTIPLICATION (BAND STORAGE MODE)
VMULBF MATRIX MULTIPLICATION (BAND BY FULL MATRICES)
VMULBS MATRIX MULTIPLICATION (BAND BY SYMMETRIC
VMULFB MATRIX MULTIPLICATION (FULL BY BAND MATRICES)
VMULFF MATRIX MULTIPLICATION (FULL STORAGE MODE)
VMULFM MATRIX MULTIPLICATION OF THE TRANSPOSE OF MATRIX A BY MATRIX
B (FULL STORAGE MODE)
VMULFP MATRIX MULTIPLICATION OF MATRIX A BY THE TRANSPOSE OF MATRIX
B (FULL STORAGE MODE)
VMULFQ MATRIX MULTIPLICATION (FULL BY BAND SYMMETRIC MATRICES)
VMULFS MATRIX MULTIPLICATION (FULL BY SYMMETRIC MATRICES)
VMULQB MATRIX MULTIPLICATION (BAND SYMMETRIC BY BAND MATRICES)
VMULQF MATRIX MULTIPLICATION (BAND SYMMETRIC BY FULL MATRICES)
VMULQQ MATRIX MULTIPLICATION (BAND SYMMETRIC STORAGE MODE)
VMULQS MATRIX MULTIPLICATION (BAND SYMMETRIC BY SYMMETRIC MATRICES)
VMULSB MATRIX MULTIPLICATION (SYMMETRIC BY BAND MATRICES)
VMULSF MATRIX MULTIPLICATION (SYMMETRIC BY FULL MATRICES)
VMULSQ MATRIX MULTIPLICATION (SYMMETRIC BY BAND SYMMETRIC MATRICES)
VMULSS MATRIX MULTIPLICATION (SYMMETRIC STORAGE MODE)
VNRMFI INFINITY-NORM MATRICES (FULL STORAGE MODE)
VNRMF1 1-NORM OF MATRICES (FULL STORAGE MODE)
VNRMF2 EUCLIDEAN-NORM OF MATRICES (FULL STORAGE MODE)
VNRMS1 1-NORM OF MATRICES (SYMMETRIC STORAGE MODE)
VNRMS2 EUCLIDEAN-NORM OF MATRICES (SYMMETRIC STORAGE MODE)
VPOLYF MATRIX POLYNOMIAL (FULL STORAGE MODE)
VSRTA SORTING OF ARRAYS BY ALGEBRAIC VALUE
VSRTM SORTING OF ARRAYS BY ABSOLUTE VALUE
VSRTP SORTING OF ARRAYS BY ABSOLUTE VALUE - PERMUTATIONS RETURNED
VSRTR SORTING OF ARRAYS BY ALGEBRAIC VALUE - PERMUTATIONS RETURNED

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

ZSYSTEM DETERMINATION OF A ROOT OF A SYSTEM OF N SIMULTANEOUS NONLINEAR EQUATIONS IN N UNKNOWNNS

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

ZX0LP 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 ***

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 QR AND SINGLE VALUE DECOMPOSITIONS OF RECTANGULAR MATRICES. THE PACKAGE ALSO INCLUDES 11 BASIC LINEAR ALGEBRA SUBPROGRAMS.

REFERENCE: "LINPACK USERS' GUIDE", J. J. DONGARA, J. R. BUNCH, C. D. MOLER, G. W. STEWART, SIAM, 1979.

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 $A = \text{TRANS}(R) * R$ OF A POSITIVE DEFINITE MATRIX A OF ORDER P UNDER DIAGONAL PERMUTATIONS OF THE FORM $\text{TRANS}(E) * A * E$ 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 $\text{TRANS}(A) * X = B$ 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 $TRANS(A) * X = B$ USING THE FACTORS COMPUTED BY SGECCO OR SGEFA.

SGTSL 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 $A * X = B$ 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.

SPOSL SOLVES THE REAL SYMMETRIC POSITIVE DEFINITE SYSTEM $A * X = B$ 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 $A * X = B$ 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 $N \times P$ 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 ***

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 LEVELBERG-MARQUARDT ALGORITHM

LMDER1 MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVELBERG-MARQUARDT ALGORITHM

LMSTR MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVELBERG-MARQUARDT WHICH USES MINIMAL STORAGE

LMSTR1 MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVELBERG-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 LEVELBERG-MARQUARDT ALGORITHM

LMDIF1 MINIMIZE THE SUM OF THE SQUARES OF M NON-LINEAR FUNCTIONS IN N VARIABLES BY A MODIFICATION OF THE LEVELBERG-MARQUARDT ALGORITHM

*** MSL ***
(PROPRIETARY)

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
- AITKEN 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 ABSCISSAE 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 $A*VI=LAMBDA*B*VI$ 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 $N=0,1,2,3,\dots,J-1$

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)

BFBANP 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 $N=-1, 0, \dots, I$

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 $AX\text{-BAR}=B\text{-BAR}$ IN THE LEAST SQUARES SENSE, IF NO EXACT SOLUTION EXISTS - A, B-BAR, X-BAR 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 DECOMPOSE 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 AUTOVARIANCE 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
($X^2+B*X+C$), 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
 $D1*(2*D2)$ 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

DSCRPT COMPUTE MEANS, STANDARD DEVIATIONS, VARIANCES, AND
COEFFICIENTS OF SKEWNESS AND KURTOSIS FOR MULTIPLEXED DATA
ARRAYS

DSCR2 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

EIGCO1 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 $AX-\bar{B}=B-\bar{B}$ 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 $M \leq N$

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 -- AUTOGRESSIVE
 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 $N+1$ 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 ABSCISSAE

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 SODE 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 BSBHT

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 PIVOTING, 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 OVERDETERMINED SYSTEM WITH K RIGHT-HAND SIDES BY HOUSEHOLDER TRANSFORMATIONS

LSQHTS SOLVE LINEAR LEAST SQUARES PROBLEMS FOR AN OVERDETERMINED 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

MILN2 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 (+, -, *, /, **) 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 BETA 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

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

PDLSOS 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

PGMA 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

PINORM DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A NORMAL DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PIPOIS DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A POISSON DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PIRAYL DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A RAYLEIGH DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PIT DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A STUDENT'S T DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PITRNM DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A TRUNCATED NORMAL DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PIUNF DETERMINE THE VALUE OF A UNIFORMLY DISTRIBUTED, RANDOM VARIABLE WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PIUNFD DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A UNIFORM DISCRETE DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PIWEBL DETERMINE THE VALUE OF A RANDOM VARIABLE FROM A WEIBULL DISTRIBUTION WHEN THE CUMULATIVE PROBABILITY IS GIVEN

PLAGR FORMS AND READS, AT A GIVEN STATION X, THE POLYNOMIAL PASSING THROUGH ALL OF A GIVEN SET OF POINTS

PLGNRM COMPUTE THE PROBABILITY OF OBTAINING A RANDOM VARIABLE HAVING A VALUE LESS THAN OR EQUAL TO X FROM A LOG-NORMAL DISTRIBUTION

PNBIN COMPUTE THE CUMULATIVE PROBABILITY FOR THE NEGATIVE BINOMIAL DISTRIBUTION

PNORM COMPUTE THE CUMULATIVE PROBABILITY FOR A NORMAL DISTRIBUTION

POIS COMPUTE THE CUMULATIVE PROBABILITY FOR THE POISSON DISTRIBUTION

PORAND GENERATE RANDOM INTEGERS HAVING THE POISSON DISTRIBUTION

PRAYL COMPUTE THE CUMULATIVE PROBABILITY FOR THE RAYLEIGH DISTRIBUTION

PRBEXP DETERMINE THE PROBABILITY OF OBTAINING A VARIABLE HAVING VALUE = X_0 FROM A POPULATION HAVING AN EXPONENTIAL DISTRIBUTION

PREUNF DETERMINE THE PROBABILITY OF OBTAINING A VARIABLE HAVING VALUE = X_0 FROM A POPULATION HAVING A UNIFORM DISTRIBUTION

PRDSUM COMPUTE THE INNER PRODUCT OF TWO VECTORS AND ADD IT TO AN INCOMING VALUE C

PRICH ENRICH A GIVEN ARRAY WHICH DEFINES A CURVE BY INSERTING POINTS SO AS TO OPTIMIZE THE MERIT FUNCTION DEFINED IN CURV

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 ROOTS 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 OR 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 $AY = \lambda B Y$ OR $YTAB = \lambda DAYT$, 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 $B=LLT$

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

RKINIT 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)

RUN SAB 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 $AX-\bar{B}=B-\bar{B}$ 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

SIMP TRANSFORM EIGENVECTORS OF AN UPPER HESSENBERG MATRIX H, WHERE $H=(P^{*-1})AP$, TO EIGENVECTORS OF THE SIMILAR MATRIX A

SIMPRC EVALUATE THE INTEGRAL OF ANY FUNCTION $Y=F(X)$ BETWEEN THE LIMITS A AND B USING SIMPSON'S RULE

SINEVL EVALUATE A SINE POLYNOMIAL AT A GIVEN POINT

SINSER INTERPOLATE A SET OF N (ABSCISSA,ORDINATE)-PAIRS

SMOCUB PERFORM SMOOTHING

SMOOTH COMPUTE A VECTOR OF SMOOTHED FUNCTION VALUES GIVEN VECTORS OF ARGUMENT AND CORRESPONDING FUNCTION VALUES

SMTVX MULTIPLY THE TRANSPOSE OF A LARGE, SPARSE MATRIX BY A VECTOR

SMVX MATRIX-VECTOR MULTIPLICATION WHEN THE MATRIX IS LARGE AND SPARSE

SPDCOM DECOMPOSE A POSITIVE DEFINITE SYMMETRIC MATRIX WITHOUT USING THE SQUARE ROOT ROUTINE

SPDFBM 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)

SPDFBS 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)

SPDSOM SOLVE A POSITIVE DEFINITE SYSTEM $AX=B$ HAVING M RIGHT-HAND SIDES WITHOUT USING THE SQUARE ROOT ROUTINE

SPDSOS SOLVE A POSITIVE DEFINITE SYSTEM $AX=B$ HAVING ONE RIGHT-HAND SIDE WITHOUT USING THE SQUARE ROOT ROUTINE

SPITRM SOLVE A POSITIVE DEFINITE SYSTEM OF LINEAR EQUATIONS WITHOUT USING THE SQUARE ROOT ROUTINE WITH ITERATIVE REFINEMENT

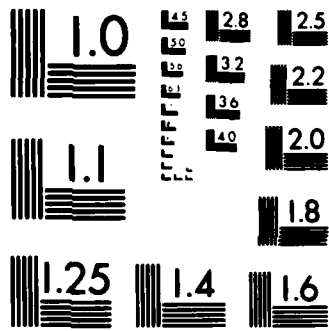
SPITRS SOLVE A POSITIVE DEFINITE SYSTEM OF LINEAR EQUATIONS WITHOUT USING THE SQUARE ROOT ROUTINE WITH ITERATIVE REFINEMENT

SPLINE CONSTRUCT A 5TH DEGREE SPLINE INTERPOLATING A SET OF EQUISPACED DATA

START READ IN AND LIST INPUT DATA WHICH IS TO BE ENRICHED BY USING OTHER MSL ROUTINES

SUBDIA REDUCE A COMPLEX MATRIX TO UPPER HESSENBERG FORM BY SIMILARITY TRANSFORMATIONS, USING UNITARY MATRICES

SUBDIR REDUCE A REAL MATRIX TO UPPER HESSENBERG FORM



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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

TBLU3 TABLE SEARCH AND INTERPOLATION WITH THREE INDEPENDENT VARIABLES

TCDIAG COMPUTE PARTIAL OR COMPLETE EIGENSYSTEMS OF HERMETIAN MATRICES

TERP1 POLYNOMIAL INTERPOLATION FOR ONE INDEPENDENT VARIABLE

TERP2 POLYNOMIAL INTERPOLATION FOR TWO INDEPENDENT VARIABLES

TERP3 POLYNOMIAL INTERPOLATION FOR THREE INDEPENDENT VARIABLES

TRDCNP PERFORM TRIANGULAR DECOMPOSITION OF A TRIDIAGONAL MATRIX 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

XPLOT PRINTER PLOT OF UP TO 5 VARIABLES OR SETS OF DATA (ORDINATE) IN THE ORDER IN WHICH THE VALUES ARE STORED (ABSCISSA)

XYPLOT 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 ***

'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

APOWER 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

ASCI3 INITIALIZE COMMON BLOCK /ASCII/ WITH ASCII CHARACTERS

ASCLN 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

BEJY0 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 EXPONENTIATION 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

CMR 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

ELLIP ELLIPTIC INTEGRAL

ELTIME OBTAIN CPA, 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)

FTNRFL 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)

GETLGO 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 00B (USER MAY SUPPLY TRAILING FILL CHARACTER)

LPPFERR 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 ADD/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

OFMTV 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

POLYN 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 PLOYNOMIAL

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 00B

SKWEZR SQUEEZE RIGHT AND REMOVE BLANKS AND 00B

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

STUTEE 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 TEKTRONIX 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 (OOB)

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 OOB AND VICE VERSA

ZEROFL ZERO FIELD LENGTH (SECURITY EOJ)

ZEROS REPLACE BLANKS WITH (DISPLAY CODE) ZEROS, MULTIPLE FIELDS

ZSYSEQ FORTRAN CALLABLE SYSTEM CALL

*** NSRDC5 ***

'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

CMMMERC 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)

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

DMPCPA SHORT DUMP OF JOB CONTROL POINT AREA

DUMPKPK 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

PFR 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

'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
ASCII0 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. BINDEXT 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

F45IT 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 'PROCFIL' 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

MFY TELL INTERACTIVE USER WHICH MAINFRAME HE IS USING

MNSRDC EXECUTE A PROGRAM ON EDITLIB USER LIBRARY 'MNSRDC'

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

MYPROS EXECUTE A PROCEDURE ON SEQUENTIAL FILE 'PROCFILS' 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

PALC 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

RECDEL1 DELETE ONE OR MORE LOGICAL RECORDS FROM A FILE

RECDOC LIST DOCUMENTATION FOR PROCEDURES RECADD1, RECDEL1, 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, FORTRAN, OR COBOL PROCEDURAL LANGUAGE INTERFACE.

S2K280 ATTACH FILES FOR S2000 (VERSION 2.80) SELF-CONTAINED LANGUAGES, REPORT PROCESSOR, FORTRAN 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

*** I ***

'I' 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)
RENAMAC	RENAME AC FIELD ON PERMANENT FILES OR MASS STORE FILES
RENAMID	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: CLTB/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

INITIAL DISTRIBUTION

COPIES:

12 DIRECTOR
DEFENSE TECHNICAL INFORMATION CENTER (DTIC)
CAMERON STATION
ALEXANDRIA, VIRGINIA 23314

CENTER DISTRIBUTION

COPIES:

1 18/1809 GLEISSNER, G. H.
1 1804 AVRUNIN, L.
1 1805 CUTHILL, E. H.
2 1808 WILDY, D.
1 182 CAMARA, A. W.
1 .84 SCHOT, J. W.
1 185 CORIN, T.
1 187 ZUBKOFF, M. J.
1 189 GRAY, G. R.
1 189.2 HAYDEN, H. P.
1 189.3 MORRIS, JEAN
40 1892.1 STRICKLAND, J. D.
5 1892.2 SOMMER, D. V.
1 1892.3 MINOR, L. R.
1 1894 SEALS, W.
1 1896 GLOVER, A.
1 1896.2 DENNIS, L.
1 522 TIC (C)
1 522.2 TID (A)
1 93 PATENT COUNSEL

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.

END

FILMED

2-85

DTIC