

## GAMS Index for the NAG Fortran 77 Library

This index classifies NAG Fortran 77 Library routines according to Version 2 of the GAMS classification scheme described in [1]. Note that only those GAMS classes which contain Library routines, either directly or in a subclass, are included below.

<b>A</b>	Arithmetic, error analysis	
<b>A3</b>	Real	
<b>A3a</b>	Standard precision	
	F06BLF	Compute quotient of two real scalars, with overflow flag
<b>A4</b>	Complex	
<b>A4a</b>	Standard precision	
	A02ABF	Modulus of a complex number
	A02ACF	Quotient of two complex numbers
	F06CLF	Compute quotient of two complex scalars, with overflow flag
<b>A7</b>	Sequences (e.g., convergence acceleration)	
	C06BAF	Acceleration of convergence of sequence, Shanks' transformation and epsilon algorithm
<b>C</b>	Elementary and special functions ( <i>search also class L5</i> )	
<b>C1</b>	Integer-valued functions (e.g., factorial, binomial coefficient, permutations, combinations, floor, ceiling)	
<b>C10</b>	Bessel functions	
<b>C10a</b>	$J, Y, H_1, H_2$	
<b>C10a1</b>	Real argument, integer order	
	S17ACF	Bessel function $Y_0(x)$
	S17ADF	Bessel function $Y_1(x)$
	S17AEF	Bessel function $J_0(x)$
	S17AFF	Bessel function $J_1(x)$
<b>C10a4</b>	Complex argument, real order	
	S17DCF	Bessel functions $Y_{\nu+a}(z)$ , real $a \geq 0$ , complex $z$ , $\nu = 0, 1, 2, \dots$
	S17DEF	Bessel functions $J_{\nu+a}(z)$ , real $a \geq 0$ , complex $z$ , $\nu = 0, 1, 2, \dots$
	S17DLF	Hankel functions $H_{\nu+a}^{(j)}(z)$ , $j = 1, 2$ , real $a \geq 0$ , complex $z$ , $\nu = 0, 1, 2, \dots$
<b>C10b</b>	$I, K$	
<b>C10b1</b>	Real argument, integer order	
	S18ACF	Modified Bessel function $K_0(x)$
	S18ADF	Modified Bessel function $K_1(x)$
	S18AEF	Modified Bessel function $I_0(x)$
	S18AFF	Modified Bessel function $I_1(x)$
	S18CCF	Modified Bessel function $e^x K_0(x)$
	S18CDF	Modified Bessel function $e^x K_1(x)$
	S18CEF	Modified Bessel function $e^{- x } I_0(x)$
	S18CFF	Modified Bessel function $e^{- x } I_1(x)$
<b>C10b4</b>	Complex argument, real order	
	S18DCF	Modified Bessel functions $K_{\nu+a}(z)$ , real $a \geq 0$ , complex $z$ , $\nu = 0, 1, 2, \dots$
	S18DEF	Modified Bessel functions $I_{\nu+a}(z)$ , real $a \geq 0$ , complex $z$ , $\nu = 0, 1, 2, \dots$
<b>C10c</b>	Kelvin functions	
	S19AAF	Kelvin function ber $x$
	S19ABF	Kelvin function bei $x$
	S19ACF	Kelvin function ker $x$
	S19ADF	Kelvin function kei $x$
<b>C10d</b>	Airy and Scorer functions	
	S17AGF	Airy function $Ai(x)$
	S17AHF	Airy function $Bi(x)$
	S17AJF	Airy function $Ai'(x)$
	S17AKF	Airy function $Bi'(x)$
	S17DGF	Airy functions $Ai(z)$ and $Ai'(z)$ , complex $z$
	S17DHF	Airy functions $Bi(z)$ and $Bi'(z)$ , complex $z$
<b>C13</b>	Jacobian elliptic functions, theta functions	
	S21CAF	Jacobian elliptic functions sn, cn and dn
<b>C14</b>	Elliptic integrals	
	S21BAF	Degenerate symmetrised elliptic integral of 1st kind $R_C(x, y)$
	S21BBF	Symmetrised elliptic integral of 1st kind $R_F(x, y, z)$
	S21BCF	Symmetrised elliptic integral of 2nd kind $R_D(x, y, z)$
	S21BDF	Symmetrised elliptic integral of 3rd kind $R_J(x, y, z, r)$
<b>C2</b>	Powers, roots, reciprocals	
	A02AAF	Square root of a complex number
<b>C3</b>	Polynomials	
<b>C3a</b>	Orthogonal	
<b>C3a2</b>	Chebyshev, Legendre	
	C06DBF	Sum of a Chebyshev series

	E02AEF	Evaluation of fitted polynomial in one variable from Chebyshev series form (simplified parameter list)
	E02AHF	Derivative of fitted polynomial in Chebyshev series form
	E02AJF	Integral of fitted polynomial in Chebyshev series form
	E02AKF	Evaluation of fitted polynomial in one variable, from Chebyshev series form
<b>C4</b>	Elementary transcendental functions	
<b>C4a</b>	Trigonometric, inverse trigonometric	
	F06BCF	Recover cosine and sine from given real tangent
	F06CCF	Recover cosine and sine from given complex tangent, real cosine
	F06CDF	Recover cosine and sine from given complex tangent, real sine
	S07AAF	$\tan x$
	S09AAF	$\arcsin x$
	S09ABF	$\arccos x$
<b>C4b</b>	Exponential, logarithmic	
	S01BAF	$\ln(1 + x)$
	S01EAF	Complex exponential, $e^z$
<b>C4c</b>	Hyperbolic, inverse hyperbolic	
	S10AAF	$\tanh x$
	S10ABF	$\sinh x$
	S10ACF	$\cosh x$
	S11AAF	$\operatorname{arctanh} x$
	S11ABF	$\operatorname{arcsinh} x$
	S11ACF	$\operatorname{arccosh} x$
<b>C5</b>	Exponential and logarithmic integrals	
	S13AAF	Exponential integral $E_1(x)$
<b>C6</b>	Cosine and sine integrals	
	S13ACF	Cosine integral $\operatorname{Ci}(x)$
	S13ADF	Sine integral $\operatorname{Si}(x)$
<b>C7</b>	Gamma	
<b>C7a</b>	Gamma, log gamma, reciprocal gamma	
	S14AAF	Gamma function
	S14ABF	Log Gamma function
<b>C7c</b>	Psi function	
	S14ACF	$\psi(x) - \ln x$
	S14ADF	Scaled derivatives of $\psi(x)$
<b>C7e</b>	Incomplete gamma	
	S14BAF	Incomplete gamma functions $P(a, x)$ and $Q(a, x)$
<b>C8</b>	Error functions	
<b>C8a</b>	Error functions, their inverses, integrals, including the normal distribution function	
	S15ABF	Cumulative normal distribution function $P(x)$
	S15ACF	Complement of cumulative normal distribution function $Q(x)$
	S15ADF	Complement of error function $\operatorname{erfc}(x)$
	S15AEF	Error function $\operatorname{erf}(x)$
	S15DDF	Scaled complex complement of error function, $\exp(-z^2)\operatorname{erfc}(-iz)$
<b>C8b</b>	Fresnel integrals	
	S20ACF	Fresnel integral $S(x)$
	S20ADF	Fresnel integral $C(x)$
<b>C8c</b>	Dawson's integral	
	S15AFF	Dawson's integral
<b>D</b>	Linear Algebra	
<b>D1</b>	Elementary vector and matrix operations	
<b>D1a</b>	Elementary vector operations	
<b>D1a1</b>	Set to constant	
	F06DBF	Broadcast scalar into integer vector
	F06EVF	Gather and set to zero a real sparse vector (SGTHRZ/DGTHRZ)
	F06FBF	Broadcast scalar into real vector
	F06GVF	Gather and set to zero a complex sparse vector (CGTHRZ/ZGTHRZ)
	F06HBF	Broadcast scalar into complex vector
<b>D1a10</b>	Convolutions	
	C06EKF	Circular convolution or correlation of two real vectors, no extra workspace
	C06FKF	Circular convolution or correlation of two real vectors, extra workspace for greater speed
<b>D1a11</b>	Other vector operations	
	F06EUF	Gather a real sparse vector (SGTHR/DGTHR)
	F06EVF	Gather and set to zero a real sparse vector (SGTHRZ/DGTHRZ)
	F06EWF	Scatter a real sparse vector (SSCTR/DSCTR)
	F06FAF	Compute cosine of angle between two real vectors
	F06GUF	Gather a complex sparse vector (CGTHR/ZGTHR)
	F06GVF	Gather and set to zero a complex sparse vector (CGTHRZ/ZGTHRZ)
	F06GWF	Scatter a complex sparse vector (CSCTR/ZSCTR)
	F06KLF	Last non-negligible element of real vector

<b>D1a2</b>	Minimum and maximum components
	F06FLF Elements of real vector with largest and smallest absolute value
	F06JLF Index, real vector element with largest absolute value (ISAMAX/IDAMAX)
	F06JMF Index, complex vector element with largest absolute value (ICAMAX/IZAMAX)
	F06KLF Last non-negligible element of real vector
<b>D1a3</b>	Norm
<b>D1a3a</b>	$L_1$ (sum of magnitudes)
	F06EKF Sum the absolute values of real vector elements (SASUM/DASUM)
	F06JKF Sum the absolute values of complex vector elements (SCASUM/DZASUM)
<b>D1a3b</b>	$L_2$ (Euclidean norm)
	F06BMF Compute Euclidean norm from scaled form
	F06BNF Compute square root of $(a^2 + b^2)$ , real $a$ and $b$
	F06EJF Compute Euclidean norm of real vector (SNRM2/DNRM2)
	F06FJF Update Euclidean norm of real vector in scaled form
	F06FKF Compute weighted Euclidean norm of real vector
	F06JJF Compute Euclidean norm of complex vector (SCNRM2/DZNRM2)
	F06KJF Update Euclidean norm of complex vector in scaled form
<b>D1a3c</b>	$L_\infty$ (maximum magnitude)
	F06FLF Elements of real vector with largest and smallest absolute value
	F06JLF Index, real vector element with largest absolute value (ISAMAX/IDAMAX)
	F06JMF Index, complex vector element with largest absolute value (ICAMAX/IZAMAX)
<b>D1a4</b>	Dot product (inner product)
	F06EAF Dot product of two real vectors (SDOT/DDOT)
	F06ERF Dot product of two real sparse vectors (SDOTI/DDOTI)
	F06GAF Dot product of two complex vectors, unconjugated (CDOTU/ZDOTU)
	F06GBF Dot product of two complex vectors, conjugated (CDOTC/ZDOTC)
	F06GRF Dot product of two complex sparse vector, unconjugated (CDOTUI/ZDOTUI)
	F06GSF Dot product of two complex sparse vector, conjugated (CDOTCI/ZDOTCI)
	X03AAF Real inner product added to initial value, basic/additional precision
	X03ABF Complex inner product added to initial value, basic/additional precision
<b>D1a5</b>	Copy or exchange (swap)
	F06DFF Copy integer vector
	F06EFF Copy real vector (SCOPY/DCOPY)
	F06EGF Swap two real vectors (SSWAP/DSWAP)
	F06GFF Copy complex vector (CCOPY/ZCOPY)
	F06GGF Swap two complex vectors (CSWAP/ZSWAP)
	F06KFF Copy real vector to complex vector
<b>D1a6</b>	Multiplication by scalar
	F06EDF Multiply real vector by scalar (SSCAL/DSCAL)
	F06FDF Multiply real vector by scalar, preserving input vector
	F06FGF Negate real vector
	F06GDF Multiply complex vector by complex scalar (CSCAL/ZSCAL)
	F06HDF Multiply complex vector by complex scalar, preserving input vector
	F06HGF Negate complex vector
	F06JDF Multiply complex vector by real scalar (CSSCAL/ZDSCAL)
	F06KDF Multiply complex vector by real scalar, preserving input vector
<b>D1a7</b>	Triad ( $\alpha x + y$ for vectors $x$ , $y$ and scalar $\alpha$ )
	F06ECF Add scalar times real vector to real vector (SAXPY/DAXPY)
	F06ETF Add a scalar times a real sparse vector to another real sparse vector (SAXPYI/DAXPYI)
	F06GCF Add scalar times complex vector to complex vector (CAXPY/ZAXPY)
	F06GTF Add a scalar times a complex sparse vector to another complex sparse vector (CAXPYI/ZAXPYI)
<b>D1a8</b>	Elementary rotation (Givens transformation)
	F06AAF Generate real plane rotation (SROTG/DROTG)
	F06BAF Generate real plane rotation, storing tangent
	F06BEF Generate real Jacobi plane rotation
	F06BHF Apply real similarity rotation to 2 by 2 symmetric matrix
	F06CAF Generate complex plane rotation, storing tangent, real cosine
	F06CBF Generate complex plane rotation, storing tangent, real sine
	F06CHF Apply complex similarity rotation to 2 by 2 Hermitian matrix
	F06EPF Apply real plane rotation (SROT/DROT)
	F06EXF Apply plane rotation to two real sparse vectors (SROTI/DROTI)
	F06FPF Apply real symmetric plane rotation to two vectors
	F06FQF Generate sequence of real plane rotations
	F06HFF Apply complex plane rotation
	F06HQF Generate sequence of complex plane rotations
	F06KPF Apply real plane rotation to two complex vectors
<b>D1a9</b>	Elementary reflection (Householder transformation)
	F06FRF Generate real elementary reflection, NAG style
	F06FSF Generate real elementary reflection, LINPACK style

		F06FTF	Apply real elementary reflection, NAG style
		F06FUF	Apply real elementary reflection, LINPACK style
		F06HRF	Generate complex elementary reflection
		F06HTF	Apply complex elementary reflection
<b>D1b</b>	Elementary matrix operations	F06QJF	Permute rows or columns, real rectangular matrix, permutations represented by an integer array
		F06QKF	Permute rows or columns, real rectangular matrix, permutations represented by a real array
		F06VJF	Permute rows or columns, complex rectangular matrix, permutations represented by an integer array
		F06VKF	Permute rows or columns, complex rectangular matrix, permutations represented by a real array
<b>D1b1</b>	Initialize (e.g., to zero or identity)	F06QHF	Matrix initialisation, real rectangular matrix
		F06THF	Matrix initialisation, complex rectangular matrix
<b>D1b10</b>	Elementary rotation (Givens transformation)	F06QMF	Orthogonal similarity transformation of a real symmetric matrix as a sequence of plane rotations
		F06QVF	Compute upper Hessenberg matrix by sequence of plane rotations, real upper triangular matrix
		F06QWF	Compute upper spiked matrix by sequence of plane rotations, real upper triangular matrix
		F06QXF	Apply sequence of plane rotations, real rectangular matrix
		F06TMF	Unitary similarity transformation of a Hermitian matrix as a sequence of plane rotations
		F06TVF	Compute upper Hessenberg matrix by sequence of plane rotations, complex upper triangular matrix
		F06TWF	Compute upper spiked matrix by sequence of plane rotations, complex upper triangular matrix
		F06TXF	Apply sequence of plane rotations, complex rectangular matrix, real cosine and complex sine
		F06TYF	Apply sequence of plane rotations, complex rectangular matrix, complex cosine and real sine
		F06VXF	Apply sequence of plane rotations, complex rectangular matrix, real cosine and sine
<b>D1b2</b>	Norm	F04YCF	Norm estimation (for use in condition estimation), real matrix
		F04ZCF	Norm estimation (for use in condition estimation), complex matrix
		F06RAF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real general matrix
		F06RBF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real band matrix
		F06RCF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real symmetric matrix
		F06RDF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real symmetric matrix, packed storage
		F06REF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real symmetric band matrix
		F06RJF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real trapezoidal/triangular matrix
		F06RKF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real triangular matrix, packed storage
		F06RLF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real triangular band matrix
		F06RMF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, real Hessenberg matrix
		F06UAF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex general matrix
		F06UBF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex band matrix
		F06UCF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex Hermitian matrix
		F06UDF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex Hermitian matrix, packed storage
		F06UEF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex Hermitian band matrix
		F06UFF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex symmetric matrix
		F06UGF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex symmetric matrix, packed storage
		F06UHF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex symmetric band matrix
		F06UJF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex trapezoidal/triangular matrix
		F06UKF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex triangular matrix, packed storage
		F06ULF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex triangular band matrix

	F06UMF	1-norm, $\infty$ -norm, Frobenius norm, largest absolute element, complex Hessenberg matrix
<b>D1b3</b>	Transpose	
	F01CRF	Matrix transposition
	F01CTF	Sum or difference of two real matrices, optional scaling and transposition
	F01CWF	Sum or difference of two complex matrices, optional scaling and transposition
<b>D1b4</b>	Multiplication by vector	
	F06HCF	Multiply complex vector by complex diagonal matrix
	F06KCF	Multiply complex vector by real diagonal matrix
	F06PAF	Matrix-vector product, real rectangular matrix (SGEMV/DGEMV)
	F06PBF	Matrix-vector product, real rectangular band matrix (SGBMV/DGBMV)
	F06PCF	Matrix-vector product, real symmetric matrix (SSYMV/DSYMV)
	F06PDF	Matrix-vector product, real symmetric band matrix (SSBMV/DSBMV)
	F06PEF	Matrix-vector product, real symmetric packed matrix (SSPMV/DSPMV)
	F06PFF	Matrix-vector product, real triangular matrix (STRMV/DTRMV)
	F06PGF	Matrix-vector product, real triangular band matrix (STBMV/DTBMV)
	F06PHF	Matrix-vector product, real triangular packed matrix (STPMV/DTPMV)
	F06SAF	Matrix-vector product, complex rectangular matrix (CGEMV/ZGEMV)
	F06SBF	Matrix-vector product, complex rectangular band matrix (CGBMV/ZGBMV)
	F06SCF	Matrix-vector product, complex Hermitian matrix (CHEMV/ZHEMV)
	F06SDF	Matrix-vector product, complex Hermitian band matrix (CHBMV/ZHBMV)
	F06SEF	Matrix-vector product, complex Hermitian packed matrix (CHPMV/ZHPMV)
	F06SFF	Matrix-vector product, complex triangular matrix (CTRMV/ZTRMV)
	F06SGF	Matrix-vector product, complex triangular band matrix (CTBMV/ZTBMV)
	F06SHF	Matrix-vector product, complex triangular packed matrix (CTPMV/ZTPMV)
	F11XAF	Real sparse nonsymmetric matrix vector multiply
	F11XEF	Real sparse symmetric matrix vector multiply
<b>D1b5</b>	Addition, subtraction	
	F01CTF	Sum or difference of two real matrices, optional scaling and transposition
	F01CWF	Sum or difference of two complex matrices, optional scaling and transposition
	F06PMF	Rank-1 update, real rectangular matrix (SGER/DGER)
	F06PPF	Rank-1 update, real symmetric matrix (SSYR/DSYR)
	F06PQF	Rank-1 update, real symmetric packed matrix (SSPR/DSPR)
	F06PRF	Rank-2 update, real symmetric matrix (SSYR2/DSYR2)
	F06PSF	Rank-2 update, real symmetric packed matrix (SSPR2/DSPR2)
	F06SMF	Rank-1 update, complex rectangular matrix, unconjugated vector (CGERU/ZGERU)
	F06SNF	Rank-1 update, complex rectangular matrix, conjugated vector (CGERC/ZGERC)
	F06SPF	Rank-1 update, complex Hermitian matrix (CHER/ZHER)
	F06SQF	Rank-1 update, complex Hermitian packed matrix (CHPR/ZHPR)
	F06SRF	Rank-2 update, complex Hermitian matrix (CHER2/ZHER2)
	F06SSF	Rank-2 update, complex Hermitian packed matrix (CHPR2/ZHPR2)
	F06YPF	Rank- $k$ update of a real symmetric matrix (SSYRK/DSYRK)
	F06ZPF	Rank- $k$ update of a complex Hermitian matrix (CHERK/ZHERK)
	F06ZRF	Rank- $2k$ update of a complex Hermitian matrix (CHER2K/ZHER2K)
	F06ZUF	Rank- $k$ update of a complex symmetric matrix (CSYRK/ZSYRK)
	F06ZWF	Rank- $2k$ update of a complex symmetric matrix (CSYR2K/ZHER2K)
<b>D1b6</b>	Multiplication	
	F01CKF	Matrix multiplication
	F06FCF	Multiply real vector by diagonal matrix
	F06YAF	Matrix-matrix product, two real rectangular matrices (SGEMM/DGEMM)
	F06YCF	Matrix-matrix product, one real symmetric matrix, one real rectangular matrix (SSYMM/DSYMM)
	F06YFF	Matrix-matrix product, one real triangular matrix, one real rectangular matrix (STRMM/DTRMM)
	F06YRF	Rank- $2k$ update of a real symmetric matrix (SSYR2K/DSYR2K)
	F06ZAF	Matrix-matrix product, two complex rectangular matrices (CGEMM/ZGEMM)
	F06ZCF	Matrix-matrix product, one complex Hermitian matrix, one complex rectangular matrix (CHEMM/ZHEMM)
	F06ZFF	Matrix-matrix product, one complex triangular matrix, one complex rectangular matrix (CTRMM/ZTRMM)
	F06ZTF	Matrix-matrix product, one complex symmetric matrix, one complex rectangular matrix (CSYMM/ZSYMM)
<b>D1b8</b>	Copy	
	F06QFF	Matrix copy, real rectangular or trapezoidal matrix
	F06TFF	Matrix copy, complex rectangular or trapezoidal matrix
<b>D1b9</b>	Storage mode conversion	
	F01ZAF	Convert real matrix between packed triangular and square storage schemes
	F01ZBF	Convert complex matrix between packed triangular and square storage schemes
	F01ZCF	Convert real matrix between packed banded and rectangular storage schemes
	F01ZDF	Convert complex matrix between packed banded and rectangular storage schemes
	F11ZAF	Real sparse nonsymmetric matrix reorder routine

		F11ZBF	Real sparse symmetric matrix reorder routine
<b>D2</b>	Solution of systems of linear equations (including inversion, <i>LU</i> and related decompositions)		
<b>D2a</b>	Real nonsymmetric matrices		
<b>D2a1</b>	General	F03AFF	<i>LU</i> factorization and determinant of real matrix
		F04AAF	Solution of real simultaneous linear equations with multiple right-hand sides (Black Box)
		F04AEF	Solution of real simultaneous linear equations with multiple right-hand sides using iterative refinement (Black Box)
		F04AHF	Solution of real simultaneous linear equations using iterative refinement (coefficient matrix already factorized by F03AFF)
		F04AJF	Solution of real simultaneous linear equations (coefficient matrix already factorized by F03AFF)
		F04ARF	Solution of real simultaneous linear equations, one right-hand side (Black Box)
		F04ATF	Solution of real simultaneous linear equations, one right-hand side using iterative refinement (Black Box)
		F07ADF	<i>LU</i> factorization of real <i>m</i> by <i>n</i> matrix (SGETRF/DGETRF)
		F07AEF	Solution of real system of linear equations, multiple right-hand sides, matrix already factorized by F07ADF (SGETRS/DGETRS)
		F07AGF	Estimate condition number of real matrix, matrix already factorized by F07ADF (SGECON/DGECON)
		F07AHF	Refined solution with error bounds of real system of linear equations, multiple right-hand sides (SGERFS/DGERFS)
		F07AJF	Inverse of a real matrix, matrix already factorized by F07ADF (SGETRI/DGETRI)
<b>D2a2</b>	Banded	F01LHF	<i>LU</i> factorization of real almost block diagonal matrix
		F04LHF	Solution of real almost block diagonal simultaneous linear equations (coefficient matrix already factorized by F01LHF)
		F07BDF	<i>LU</i> factorization of real <i>m</i> by <i>n</i> band matrix (SGBTRF/DGBTRF)
		F07BEF	Solution of real band system of linear equations, multiple right-hand sides, matrix already factorized by F07BDF (SGBTRS/DGBTRS)
		F07BGF	Estimate condition number of real band matrix, matrix already factorized by F07BDF (SGBCON/DGBCON)
		F07BHF	Refined solution with error bounds of real band system of linear equations, multiple right-hand sides (SGBRFS/DGBRFS)
		F07VEF	Solution of real band triangular system of linear equations, multiple right-hand sides (STBTRS/DTBTRS)
		F07VGF	Estimate condition number of real band triangular matrix (STBCON/DTBCON)
		F07VHF	Error bounds for solution of real band triangular system of linear equations, multiple right-hand sides (STBRFS/DTBRFS)
<b>D2a2a</b>	Tridiagonal	F01LEF	<i>LU</i> factorization of real tridiagonal matrix
		F04EAF	Solution of real tridiagonal simultaneous linear equations, one right-hand side (Black Box)
		F04LEF	Solution of real tridiagonal simultaneous linear equations (coefficient matrix already factorized by F01LEF)
<b>D2a3</b>	Triangular	F06PJF	System of equations, real triangular matrix (STRSV/DTRSV)
		F06PKF	System of equations, real triangular band matrix (STBSV/DTBSV)
		F06PLF	System of equations, real triangular packed matrix (STPSV/DTPSV)
		F06YJF	Solves a system of equations with multiple right-hand sides, real triangular coefficient matrix (STRSM/DTRSM)
		F07TEF	Solution of real triangular system of linear equations, multiple right-hand sides (STRTRS/DTRTRS)
		F07TGF	Estimate condition number of real triangular matrix (STRCON/DTRCON)
		F07THF	Error bounds for solution of real triangular system of linear equations, multiple right-hand sides (STRRFS/DTRRFS)
		F07TJF	Inverse of a real triangular matrix (STRTRI/DTRTRI)
		F07UEF	Solution of real triangular system of linear equations, multiple right-hand sides, packed storage (STPTRS/DTPTRS)
		F07UGF	Estimate condition number of real triangular matrix, packed storage (STPCON/DTPCON)
		F07UHF	Error bounds for solution of real triangular system of linear equations, multiple right-hand sides, packed storage (STPRFS/DTPRFS)
		F07UJF	Inverse of a real triangular matrix, packed storage (STPTRI/DTPTRI)
		F07VEF	Solution of real band triangular system of linear equations, multiple right-hand sides (STBTRS/DTBTRS)
		F07VGF	Estimate condition number of real band triangular matrix (STBCON/DTBCON)
		F07VHF	Error bounds for solution of real band triangular system of linear equations, multiple right-hand sides (STBRFS/DTBRFS)
<b>D2a4</b>	Sparse	F01BRF	<i>LU</i> factorization of real sparse matrix

	F01BSF	<i>LU</i> factorization of real sparse matrix with known sparsity pattern
	F04AXF	Solution of real sparse simultaneous linear equations (coefficient matrix already factorized)
	F04QAF	Sparse linear least-squares problem, $m$ real equations in $n$ unknowns
	F11BAF	Real sparse nonsymmetric linear systems, set-up for F11BBF
	F11BBF	Real sparse nonsymmetric linear systems, preconditioned RGMRES, CGS or Bi-CGSTAB
	F11BCF	Real sparse nonsymmetric linear systems, diagnostic for F11BBF
	F11DAF	Real sparse nonsymmetric linear systems, incomplete <i>LU</i> factorization
	F11DBF	Solution of linear system involving incomplete <i>LU</i> preconditioning matrix generated by F11DAF
	F11DCF	Solution of real sparse nonsymmetric linear system, RGMRES, CGS or Bi-CGSTAB method, preconditioner computed by F11DAF (Black Box)
	F11DDF	Solution of linear system involving pre-conditioning matrix generated by applying SSOR to real sparse nonsymmetric matrix
	F11DEF	Solution of real sparse nonsymmetric linear system, RGMRES, CGS, or Bi-CGSTAB method, Jacobi or SSOR preconditioner (Black Box)
<b>D2b</b>	Real symmetric matrices	
<b>D2b1</b>	General	
<b>D2b1a</b>	Indefinite	
	F07MDF	Bunch–Kaufman factorization of real symmetric indefinite matrix (SSYTRF/DSYTRF)
	F07MEF	Solution of real symmetric indefinite system of linear equations, multiple right-hand sides, matrix already factorized by F07MDF (SSYTRS/DSYTRS)
	F07MGF	Estimate condition number of real symmetric indefinite matrix, matrix already factorized by F07MDF (SSYCON/DSYCON)
	F07MHF	Refined solution with error bounds of real symmetric indefinite system of linear equations, multiple right-hand sides (SSYRFS/DSYRFS)
	F07MJF	Inverse of a real symmetric indefinite matrix, matrix already factorized by F07MDF (SSYTRI/DSYTRI)
	F07PDF	Bunch–Kaufman factorization of real symmetric indefinite matrix, packed storage (SSPTRF/DSPTRF)
	F07PEF	Solution of real symmetric indefinite system of linear equations, multiple right-hand sides, matrix already factorized by F07PDF, packed storage (SSPTRS/DSPTRS)
	F07PGF	Estimate condition number of real symmetric indefinite matrix, matrix already factorized by F07PDF, packed storage (SSPCON/DSPCON)
	F07PHF	Refined solution with error bounds of real symmetric indefinite system of linear equations, multiple right-hand sides, packed storage (SSPRFS/DSPRFS)
	F07PJF	Inverse of a real symmetric indefinite matrix, matrix already factorized by F07PDF, packed storage (SSPTRI/DSPTRI)
<b>D2b1b</b>	Positive-definite	
	F01ABF	Inverse of real symmetric positive-definite matrix using iterative refinement
	F01ADF	Inverse of real symmetric positive-definite matrix
	F01BUF	$ULDL^T U^T$ factorization of real symmetric positive-definite band matrix
	F03AEF	$LL^T$ factorization and determinant of real symmetric positive-definite matrix
	F04ABF	Solution of real symmetric positive-definite simultaneous linear equations with multiple right-hand sides using iterative refinement (Black Box)
	F04AFF	Solution of real symmetric positive-definite simultaneous linear equations using iterative refinement (coefficient matrix already factorized by F03AEF)
	F04AGF	Solution of real symmetric positive-definite simultaneous linear equations (coefficient matrix already factorized by F03AEF)
	F04ASF	Solution of real symmetric positive-definite simultaneous linear equations, one right-hand side using iterative refinement (Black Box)
	F04FEF	Solution of the Yule–Walker equations for a real symmetric positive-definite Toeplitz matrix, one right-hand side
	F04FFF	Solution of real symmetric positive-definite Toeplitz system, one right-hand side
	F04MEF	Update solution of the Yule–Walker equations for a real symmetric positive-definite Toeplitz matrix
	F04MFF	Update solution of real symmetric positive-definite Toeplitz system
	F07FDF	Cholesky factorization of real symmetric positive-definite matrix (SPOTRF/DPOTRF)
	F07FEF	Solution of real symmetric positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by F07FDF (SPOTRS/DPOTRS)
	F07FGF	Estimate condition number of real symmetric positive-definite matrix, matrix already factorized by F07FDF (SPOCON/DPOCON)
	F07FHF	Refined solution with error bounds of real symmetric positive-definite system of linear equations, multiple right-hand sides (SPORFS/DPORFS)
	F07FJF	Inverse of a real symmetric positive-definite matrix, matrix already factorized by F07FDF (SPOTRI/DPOTRI)
	F07GDF	Cholesky factorization of a real symmetric positive-definite matrix, packed storage (SPPTRF/DPPTRF)

	F07GEF	Solution of real symmetric positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by F07GDF, packed storage (SPPTRS/DPPTRS)
	F07GGF	Estimate condition number of real symmetric positive-definite matrix, matrix already factorized by F07GDF, packed storage (SPPCON/DPPCON)
	F07GHF	Refined solution with error bounds of real symmetric positive-definite system of linear equations, multiple right-hand sides, packed storage (SPPRFS/DPPRFS)
	F07GJF	Inverse of a real symmetric positive-definite matrix, matrix already factorized by F07GDF, packed storage (SPPTRI/DPPTRI)
<b>D2b2</b>	Positive-definite banded	
	F01MCF	$LDL^T$ factorization of real symmetric positive-definite variable-bandwidth matrix
	F04ACF	Solution of real symmetric positive-definite banded simultaneous linear equations with multiple right-hand sides (Black Box)
	F04MCF	Solution of real symmetric positive-definite variable-bandwidth simultaneous linear equations (coefficient matrix already factorized by F01MCF)
	F07HDF	Cholesky factorization of real symmetric positive-definite band matrix (SPBTRF/DPBTRF)
	F07HEF	Solution of real symmetric positive-definite band system of linear equations, multiple right-hand sides, matrix already factorized by F07HDF (SPBTRS/DPBTRS)
	F07HGF	Estimate condition number of real symmetric positive-definite band matrix, matrix already factorized by F07HDF (SPBCON/DPBCON)
	F07HHF	Refined solution with error bounds of real symmetric positive-definite band system of linear equations, multiple right-hand sides (SPBRFS/DPBRFS)
<b>D2b2a</b>	Tridiagonal	
	F04FAF	Solution of real symmetric positive-definite tridiagonal simultaneous linear equations, one right-hand side (Black Box)
<b>D2b4</b>	Sparse	
	F11GAF	Real sparse symmetric linear systems, set-up for F11GBF
	F11GBF	Real sparse symmetric linear systems, pre-conditioned conjugate gradient or Lanczos
	F11GCF	Real sparse symmetric linear systems, diagnostic for F11GBF
	F11JAF	Real sparse symmetric matrix, incomplete Cholesky factorization
	F11JBF	Solution of linear system involving incomplete Cholesky preconditioning matrix generated by F11JAF
	F11JCF	Solution of real sparse symmetric linear system, conjugate gradient/Lanczos method, preconditioner computed by F11JAF (Black Box)
	F11JDF	Solution of linear system involving preconditioning matrix generated by applying SSOR to real sparse symmetric matrix
	F11JEF	Solution of real sparse symmetric linear system, conjugate gradient/Lanczos method, Jacobi or SSOR preconditioner (Black Box)
<b>D2c</b>	Complex non-Hermitian matrices	
<b>D2c1</b>	General	
	F04ADF	Solution of complex simultaneous linear equations with multiple right-hand sides (Black Box)
	F07ARF	$LU$ factorization of complex $m$ by $n$ matrix (CGETRF/ZGETRF)
	F07ASF	Solution of complex system of linear equations, multiple right-hand sides, matrix already factorized by F07ARF (CGETRS/ZGETRS)
	F07AUF	Estimate condition number of complex matrix, matrix already factorized by F07ARF (CGECON/ZGECON)
	F07AVF	Refined solution with error bounds of complex system of linear equations, multiple right-hand sides (CGERFS/ZGERFS)
	F07AWF	Inverse of a complex matrix, matrix already factorized by F07ARF (CGETRI/ZGETRI)
	F07NRF	Bunch–Kaufman factorization of complex symmetric matrix (CSYTRF/ZSYTRF)
	F07NSF	Solution of complex symmetric system of linear equations, multiple right-hand sides, matrix already factorized by F07NRF (CSYTRS/ZSYTRS)
	F07NUF	Estimate condition number of complex symmetric matrix, matrix already factorized by F07NRF (CSYCON/ZSYCON)
	F07NVF	Refined solution with error bounds of complex symmetric system of linear equations, multiple right-hand sides (CSYRFS/ZSYRFS)
	F07NWF	Inverse of a complex symmetric matrix, matrix already factorized by F07NRF (CSYTRI/ZSYTRI)
	F07QRF	Bunch–Kaufman factorization of complex symmetric matrix, packed storage (CSPTRF/ZSPTRF)
	F07QSF	Solution of complex symmetric system of linear equations, multiple right-hand sides, matrix already factorized by F07QRF, packed storage (CSPTRS/ZSPTRS)
	F07QUF	Estimate condition number of complex symmetric matrix, matrix already factorized by F07QRF, packed storage (CSPCON/ZSPCON)
	F07QVF	Refined solution with error bounds of complex symmetric system of linear equations, multiple right-hand sides, packed storage (CSPRFS/ZSPRFS)
	F07QWF	Inverse of a complex symmetric matrix, matrix already factorized by F07QRF, packed storage (CSPTRI/ZSPTRI)
<b>D2c2</b>	Banded	

	F07BRF	<i>LU</i> factorization of complex $m$ by $n$ band matrix (CGBTRF/ZGBTRF)
	F07BSF	Solution of complex band system of linear equations, multiple right-hand sides, matrix already factorized by F07BRF (CGBTRS/ZGBTRS)
	F07BUF	Estimate condition number of complex band matrix, matrix already factorized by F07BRF (CGBCON/ZGBCON)
	F07BVF	Refined solution with error bounds of complex band system of linear equations, multiple right-hand sides (CGBRFS/ZGBRFS)
	F07VSF	Solution of complex band triangular system of linear equations, multiple right-hand sides (CTBTRS/ZTBTRS)
	F07VUF	Estimate condition number of complex band triangular matrix (CTBCON/ZTBCON)
	F07VVF	Error bounds for solution of complex band triangular system of linear equations, multiple right-hand sides (CTBRFS/ZTBRFS)
<b>D2c3</b>	Triangular	
	F06SJF	System of equations, complex triangular matrix (CTRSV/ZTRSV)
	F06SKF	System of equations, complex triangular band matrix (CTBSV/ZTBSV)
	F06SLF	System of equations, complex triangular packed matrix (CTPSV/ZTPSV)
	F06ZJF	Solves system of equations with multiple right-hand sides, complex triangular coefficient matrix (CTRSM/ZTRSM)
	F07TSF	Solution of complex triangular system of linear equations, multiple right-hand sides (CTRTRS/ZTRTRS)
	F07TUF	Estimate condition number of complex triangular matrix (CTRCON/ZTRCON)
	F07TVF	Error bounds for solution of complex triangular system of linear equations, multiple right-hand sides (CTRRFS/ZTRRFS)
	F07TWF	Inverse of a complex triangular matrix (CTRTRI/ZTRTRI)
	F07USF	Solution of complex triangular system of linear equations, multiple right-hand sides, packed storage (CTPTRS/ZTPTRS)
	F07UUF	Estimate condition number of complex triangular matrix, packed storage (CTPCON/ZTPCON)
	F07UVF	Error bounds for solution of complex triangular system of linear equations, multiple right-hand sides, packed storage (CTPRFS/ZTPRFS)
	F07UWF	Inverse of a complex triangular matrix, packed storage (CTPTRI/ZTPTRI)
	F07VSF	Solution of complex band triangular system of linear equations, multiple right-hand sides (CTBTRS/ZTBTRS)
	F07VUF	Estimate condition number of complex band triangular matrix (CTBCON/ZTBCON)
	F07VVF	Error bounds for solution of complex band triangular system of linear equations, multiple right-hand sides (CTBRFS/ZTBRFS)
<b>D2d</b>	Complex Hermitian matrices	
<b>D2d1</b>	General	
<b>D2d1a</b>	Indefinite	
	F07MRF	Bunch–Kaufman factorization of complex Hermitian indefinite matrix (CHETRF/ZHETRF)
	F07MSF	Solution of complex Hermitian indefinite system of linear equations, multiple right-hand sides, matrix already factorized by F07MRF (CHETRS/ZHETRS)
	F07MUF	Estimate condition number of complex Hermitian indefinite matrix, matrix already factorized by F07MRF (CHECON/ZHECON)
	F07MVF	Refined solution with error bounds of complex Hermitian indefinite system of linear equations, multiple right-hand sides (CHERFS/ZHERFS)
	F07MWF	Inverse of a complex Hermitian indefinite matrix, matrix already factorized by F07MRF (CHETRI/ZHETRI)
	F07PRF	Bunch–Kaufman factorization of complex Hermitian indefinite matrix, packed storage (CHPTRF/ZHPTRF)
	F07PSF	Solution of complex Hermitian indefinite system of linear equations, multiple right-hand sides, matrix already factorized by F07PRF, packed storage (CHPTRS/ZHPTRS)
	F07PUF	Estimate condition number of complex Hermitian indefinite matrix, matrix already factorized by F07PRF, packed storage (CHPCON/ZHPCON)
	F07PVF	Refined solution with error bounds of complex Hermitian indefinite system of linear equations, multiple right-hand sides, packed storage (CHPRFS/ZHPRFS)
	F07PWF	Inverse of a complex Hermitian indefinite matrix, matrix already factorized by F07PRF, packed storage (CHPTRI/ZHPTRI)
<b>D2d1b</b>	Positive-definite	
	F07FRF	Cholesky factorization of complex Hermitian positive-definite matrix (CPOTRF/ZPOTRF)
	F07FSF	Solution of complex Hermitian positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by F07FRF (CPOTRS/ZPOTRS)
	F07FUF	Estimate condition number of complex Hermitian positive-definite matrix, matrix already factorized by F07FRF (CPOCON/ZPOCON)
	F07FVF	Refined solution with error bounds of complex Hermitian positive-definite system of linear equations, multiple right-hand sides (CPORFS/ZPORFS)
	F07FWF	Inverse of a complex Hermitian positive-definite matrix, matrix already factorized by F07FRF (CPOTRI/ZPOTRI)

	F07GRF	Cholesky factorization of complex Hermitian positive-definite matrix, packed storage (CPPTRF/ZPPTRF)
	F07GSF	Solution of complex Hermitian positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by F07GRF, packed storage (CPPTRS/ZPPTRS)
	F07GUF	Estimate condition number of complex Hermitian positive-definite matrix, matrix already factorized by F07GRF, packed storage (CPPCON/ZPPCON)
	F07GVF	Refined solution with error bounds of complex Hermitian positive-definite system of linear equations, multiple right-hand sides, packed storage (CPPRFS/ZPPRFS)
	F07GWF	Inverse of a complex Hermitian positive-definite matrix, matrix already factorized by F07GRF, packed storage (CPPTRI/ZPPTRI)
<b>D2d2</b>	Positive-definite banded	
	F07HRF	Cholesky factorization of complex Hermitian positive-definite band matrix (CPBTRF/ZPBTRF)
	F07HSF	Solution of complex Hermitian positive-definite band system of linear equations, multiple right-hand sides, matrix already factorized by F07HRF (CPBTRS/ZPBTRS)
	F07HUF	Estimate condition number of complex Hermitian positive-definite band matrix, matrix already factorized by F07HRF (CPBCON/ZPBCON)
	F07HVF	Refined solution with error bounds of complex Hermitian positive-definite band system of linear equations, multiple right-hand sides (CPBRFS/ZPBRFS)
<b>D2e</b>	Associated operations (e.g., matrix reorderings)	
	F11XAF	Real sparse nonsymmetric matrix vector multiply
	F11XEF	Real sparse symmetric matrix vector multiply
	F11ZAF	Real sparse nonsymmetric matrix reorder routine
	F11ZEF	Real sparse symmetric matrix reorder routine
<b>D3</b>	Determinants	
<b>D3a</b>	Real nonsymmetric matrices	
<b>D3a1</b>	General	
	F03AAF	Determinant of real matrix (Black Box)
	F03AFF	$LU$ factorization and determinant of real matrix
<b>D3b</b>	Real symmetric matrices	
<b>D3b1</b>	General	
<b>D3b1b</b>	Positive-definite	
	F03ABF	Determinant of real symmetric positive-definite matrix (Black Box)
	F03AEF	$LL^T$ factorization and determinant of real symmetric positive-definite matrix
<b>D3b2</b>	Positive-definite banded	
	F03ACF	Determinant of real symmetric positive-definite band matrix (Black Box)
<b>D3c</b>	Complex non-Hermitian matrices	
<b>D3c1</b>	General	
	F03ADF	Determinant of complex matrix (Black Box)
<b>D4</b>	Eigenvalues, eigenvectors	
<b>D4a</b>	Ordinary eigenvalue problems ( $Ax = \lambda x$ )	
<b>D4a1</b>	Real symmetric	
	F02FAF	All eigenvalues and eigenvectors of real symmetric matrix (Black Box)
	F02FCF	Selected eigenvalues and eigenvectors of real symmetric matrix (Black Box)
	F06BPF	Compute eigenvalue of 2 by 2 real symmetric matrix
<b>D4a2</b>	Real nonsymmetric	
	F02EAF	All eigenvalues and Schur factorization of real general matrix (Black Box)
	F02EBF	All eigenvalues and eigenvectors of real general matrix (Black Box)
	F02ECF	Selected eigenvalues and eigenvectors of real nonsymmetric matrix (Black Box)
<b>D4a3</b>	Complex Hermitian	
	F02HAF	All eigenvalues and eigenvectors of complex Hermitian matrix (Black Box)
	F02HCF	Selected eigenvalues and eigenvectors of complex Hermitian matrix (Black Box)
<b>D4a4</b>	Complex non-Hermitian	
	F02GAF	All eigenvalues and Schur factorization of complex general matrix (Black Box)
	F02GBF	All eigenvalues and eigenvectors of complex general matrix (Black Box)
	F02GCF	Selected eigenvalues and eigenvectors of complex nonsymmetric matrix (Black Box)
<b>D4a5</b>	Tridiagonal	
	F08JEF	All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from real symmetric matrix using implicit $QL$ or $QR$ (SSTEQR/DSTEQR)
	F08JFF	All eigenvalues of real symmetric tridiagonal matrix, root-free variant of $QL$ or $QR$ (SSTERF/DSTERF)
	F08JGF	All eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from real symmetric positive definite matrix (SPTEQR/DPTEQR)
	F08JJF	Selected eigenvalues of real symmetric tridiagonal matrix by bisection (SSTEBZ/DSTEBZ)
	F08JKF	Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array (SSTEIN/DSTEIN)
<b>D4a7</b>	Sparse	
	F02FJF	Selected eigenvalues and eigenvectors of sparse symmetric eigenproblem (Black Box)
<b>D4b</b>	Generalized eigenvalue problems (e.g. $Ax = \lambda Bx$ )	

<b>D4b1</b>	Real symmetric	
	F02FDF	All eigenvalues and eigenvectors of real symmetric-definite generalized problem (Black Box)
	F02FJF	Selected eigenvalues and eigenvectors of sparse symmetric eigenproblem (Black Box)
<b>D4b2</b>	Real general	
	F02BJF	All eigenvalues and optionally eigenvectors of generalized eigenproblem by $QZ$ algorithm, real matrices (Black Box)
<b>D4b3</b>	Complex Hermitian	
	F02HDF	All eigenvalues and eigenvectors of complex Hermitian-definite generalized problem (Black Box)
<b>D4b4</b>	Complex general	
	F02GJF	All eigenvalues and optionally eigenvectors of generalized complex eigenproblem by $QZ$ algorithm (Black Box)
<b>D4b5</b>	Banded	
	F02FHF	All eigenvalues of generalized banded real symmetric-definite eigenproblem (Black Box)
	F02SDF	Eigenvector of generalized real banded eigenproblem by inverse iteration
<b>D4c</b>	Associated operations	
	F08QFF	Reorder Schur factorization of real matrix using orthogonal similarity transformation (STREXC/DTREXC)
	F08QGF	Reorder Schur factorization of real matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities (STRSEN/DTRSEN)
	F08QLF	Estimates of sensitivities of selected eigenvalues and eigenvectors of real upper quasi-triangular matrix (STRSNA/DTRSNA)
	F08QTF	Reorder Schur factorization of complex matrix using unitary similarity transformation (CTREXC/ZTREXC)
	F08QUF	Reorder Schur factorization of complex matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities (CTRSEN/ZTRSEN)
	F08QYF	Estimates of sensitivities of selected eigenvalues and eigenvectors of complex upper triangular matrix (CTRSNA/ZTRSNA)
<b>D4c1</b>	Transform problem	
<b>D4c1a</b>	Balance matrix	
	F08NHF	Balance real general matrix (SGEBAL/DGEBAL)
	F08NVF	Balance complex general matrix (CGEBAL/ZGEBAL)
<b>D4c1b</b>	Reduce to compact form	
<b>D4c1b1</b>	Tridiagonal	
	F08FEF	Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form (SSYTRD/DSYTRD)
	F08FFF	Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08FEF (SORGTR/DORGTR)
	F08FSF	Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form (CHETRD/ZHETRD)
	F08FTF	Generate unitary transformation matrix from reduction to tridiagonal form determined by F08FSF (CUNGTR/ZUNGTR)
	F08GEF	Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form, packed storage (SSPTRD/DSPTRD)
	F08GFF	Generate orthogonal transformation matrix from reduction to tridiagonal form determined by F08GEF (SOPGTR/DOPGTR)
	F08GSF	Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form, packed storage (CHPTRD/ZHPTRD)
	F08GTF	Generate unitary transformation matrix from reduction to tridiagonal form determined by F08GSF (CUPGTR/ZUPGTR)
	F08HEF	Orthogonal reduction of real symmetric band matrix to symmetric tridiagonal form (SSBTRD/DBSTRD)
	F08HSF	Unitary reduction of complex Hermitian band matrix to real symmetric tridiagonal form (CHBTRD/ZHBTRD)
<b>D4c1b2</b>	Hessenberg	
	F08NEF	Orthogonal reduction of real general matrix to upper Hessenberg form (SGEHRD/DGEHRD)
	F08NFF	Generate orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (SORGHR/DORGHR)
	F08NSF	Unitary reduction of complex general matrix to upper Hessenberg form (CGEHRD/ZGEHRD)
	F08NTF	Generate unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (CUNGHR/ZUNGHR)
<b>D4c1c</b>	Standardize problem	
	F01BVF	Reduction to standard form, generalized real symmetric-definite banded eigenproblem
	F08SEF	Reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$ , $ABx = \lambda x$ or $BAx = \lambda x$ , $B$ factorized by F07FDF (SSYGST/DSYGST)

	F08SSF	Reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$ , $ABx = \lambda x$ or $BAx = \lambda x$ , $B$ factorized by F07FRF (CHEGST/ZHEGST)
	F08TEF	Reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$ , $ABx = \lambda x$ or $BAx = \lambda x$ , packed storage, $B$ factorized by F07GDF (SSPGST/DSPGST)
	F08TSF	Reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$ , $ABx = \lambda x$ or $BAx = \lambda x$ , packed storage, $B$ factorized by F07GRF (CHPGST/ZHPGST)
<b>D4c2</b>	Compute eigenvalues of matrix in compact form	
<b>D4c2a</b>	Tridiagonal	
	F08JEF	All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from real symmetric matrix using implicit $QL$ or $QR$ (SSTEQR/DSTEQR)
	F08JFF	All eigenvalues of real symmetric tridiagonal matrix, root-free variant of $QL$ or $QR$ (SSTERF/DSTERF)
	F08JGF	All eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from real symmetric positive definite matrix (SPTEQR/DPTEQR)
	F08JJF	Selected eigenvalues of real symmetric tridiagonal matrix by bisection (SSTEBZ/DSTEBZ)
	F08JSF	All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from complex Hermitian matrix, using implicit $QL$ or $QR$ (CSTEQR/ZSTEQR)
	F08JUF	All eigenvalues and eigenvectors of real symmetric positive definite tridiagonal matrix, reduced from complex Hermitian positive definite matrix (CPTEQR/ZPTEQR)
<b>D4c2b</b>	Hessenberg	
	F08PEF	Eigenvalues and Schur factorization of real upper Hessenberg matrix reduced from real general matrix (SHSEQR/DHSEQR)
	F08PSF	Eigenvalues and Schur factorization of complex upper Hessenberg matrix reduced from complex general matrix (CHSEQR/ZHSEQR)
<b>D4c3</b>	Form eigenvectors from eigenvalues	
	F08JKF	Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array (SSTEIN/DSTEIN)
	F08JXF	Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in complex array (CSTEIN/ZSTEIN)
	F08PKF	Selected right and/or left eigenvectors of real upper Hessenberg matrix by inverse iteration (SHSEIN/DHSEIN)
	F08PXF	Selected right and/or left eigenvectors of complex upper Hessenberg matrix by inverse iteration (CHSEIN/ZHSEIN)
	F08QKF	Left and right eigenvectors of a real upper quasi-triangular matrix (STREVC/DTREVC)
	F08QXF	Left and right eigenvectors of a complex upper triangular matrix (CTREVC/ZTREVC)
<b>D4c4</b>	Back transform eigenvectors	
	F08FGF	Apply orthogonal transformation determined by F08FEF (SORMTR/DORMTR)
	F08FUF	Apply unitary transformation matrix determined by F08FSF (CUNMTR/ZUNMTR)
	F08GGF	Apply orthogonal transformation determined by F08GEF (SOPMTR/DOPMTR)
	F08GUF	Apply unitary transformation matrix determined by F08GSF (CUPMTR/ZUPMTR)
	F08NGF	Apply orthogonal transformation matrix from reduction to Hessenberg form determined by F08NEF (SORMHR/DORMHR)
	F08NJF	Transform eigenvectors of real balanced matrix to those of original matrix supplied to F08NHF (SGEBAK/DGEBAK)
	F08NUF	Apply unitary transformation matrix from reduction to Hessenberg form determined by F08NSF (CUNMHR/ZUNMHR)
	F08NWF	Transform eigenvectors of complex balanced matrix to those of original matrix supplied to F08NVF (CGEBAK/ZGEBAK)
<b>D5</b>	$QR$ decomposition, Gram–Schmidt orthogonalization	
	F01QGF	$RQ$ factorization of real $m$ by $n$ upper trapezoidal matrix ( $m \leq n$ )
	F01QJF	$RQ$ factorization of real $m$ by $n$ matrix ( $m \leq n$ )
	F01QKF	Operations with orthogonal matrices, form rows of $Q$ , after $RQ$ factorization by F01QJF
	F01RGF	$RQ$ factorization of complex $m$ by $n$ upper trapezoidal matrix ( $m \leq n$ )
	F01RJF	$RQ$ factorization of complex $m$ by $n$ matrix ( $m \leq n$ )
	F01RKF	Operations with unitary matrices, form rows of $Q$ , after $RQ$ factorization by F01RJF
	F05AAF	Gram–Schmidt orthogonalisation of $n$ vectors of order $m$
	F06QPF	$QR$ factorization by sequence of plane rotations, rank-1 update of real upper triangular matrix
	F06QQF	$QR$ factorization by sequence of plane rotations, real upper triangular matrix augmented by a full row
	F06QRF	$QR$ or $RQ$ factorization by sequence of plane rotations, real upper Hessenberg matrix
	F06QSF	$QR$ or $RQ$ factorization by sequence of plane rotations, real upper spiked matrix

	F06QTF	$QR$ factorization of $UZ$ or $RQ$ factorization of $ZU$ , $U$ real upper triangular, $Z$ a sequence of plane rotations
	F06TPF	$QR$ factorization by sequence of plane rotations, rank-1 update of complex upper triangular matrix
	F06TQF	$QRrk$ factorization by sequence of plane rotations, complex upper triangular matrix augmented by a full row
	F06TRF	$QR$ or $RQ$ factorization by sequence of plane rotations, complex upper Hessenberg matrix
	F06TSF	$QR$ or $RQ$ factorization by sequence of plane rotations, complex upper spiked matrix
	F06TTF	$QR$ factorization of $UZ$ or $RQ$ factorization of $ZU$ , $U$ complex upper triangular, $Z$ a sequence of plane rotations
	F08AEF	$QR$ factorization of real general rectangular matrix (SGEQRF/DGEQRF)
	F08AFF	Form all or part of orthogonal $Q$ from $QR$ factorization determined by F08AEF or F08BEF (SORGQR/DORGQR)
	F08AGF	Apply orthogonal transformation determined by F08AEF or F08BEF (SORMQR/DORMQR)
	F08AHF	$LQ$ factorization of real general rectangular matrix (SGELQF/DGELQF)
	F08AJF	Form all or part of orthogonal $Q$ from $LQ$ factorization determined by F08AHF (SORGLQ/DORGLQ)
	F08AKF	Apply orthogonal transformation determined by F08AHF (SORMLQ/DORMLQ)
	F08ASF	$QR$ factorization of complex general rectangular matrix (CGEQRF/ZGEQRF)
	F08ATF	Form all or part of unitary $Q$ from $QR$ factorization determined by F08ASF or F08BSF (CUNGQR/ZUNGQR)
	F08AUF	Apply unitary transformation determined by F08ASF or F08BSF (CUNMQR/ZUNMQR)
	F08AVF	$LQ$ factorization of complex general rectangular matrix (CGELQF/ZGELQF)
	F08AWF	Form all or part of unitary $Q$ from $LQ$ factorization determined by F08AVF (CUNGLQ/ZUNGLQ)
	F08AXF	Apply unitary transformation determined by F08AVF (CUNMLQ/ZUNMLQ)
	F08BEF	Form all or part of orthogonal $Q$ from $QR$ factorization determined by F08AEF or F08BEF (SORGQR/DORGQR)
	F08BSF	Form all or part of unitary $Q$ from $QR$ factorization determined by F08ASF or F08BSF (CUNGQR/ZUNGQR)
<b>D6</b>	Singular value decomposition	
	F02WDF	$QR$ factorization, possibly followed by SVD
	F02WEF	SVD of real matrix (Black Box)
	F02WUF	SVD of a real upper triangular matrix (Black Box)
	F02XEF	SVD of complex matrix (Black Box)
	F02XUF	SVD of complex upper triangular matrix (Black Box)
	F08KEF	Orthogonal reduction of real general rectangular matrix to bidiagonal form (SGEBRD/DGEBRD)
	F08KFF	Generate orthogonal transformation matrices from reduction to bidiagonal form determined by F08KEF (SORGQR/DORGQR)
	F08KGF	Apply orthogonal transformations from reduction to bidiagonal form determined by F08KEF (SORMBR/DORMBR)
	F08KSF	Unitary reduction of complex general rectangular matrix to bidiagonal form (CGEBRD/ZGEBRD)
	F08KTF	Generate unitary transformation matrices from reduction to bidiagonal form determined by F08KSF (CUNGBR/ZUNGBR)
	F08KUF	Apply unitary transformations from reduction to bidiagonal form determined by F08KSF (CUNMBR/ZUNMBR)
	F08MEF	SVD of real bidiagonal matrix reduced from real general matrix (SBDSQR/DBDSQR)
	F08MSF	SVD of real bidiagonal matrix reduced from complex general matrix (CBDSQR/ZBDSQR)
<b>D8</b>	Other matrix equations (e.g., $AX + XB = C$ )	
	F08QHF	Solve real Sylvester matrix equation $AX + XB = C$ , $A$ and $B$ are upper quasi-triangular or transposes (STRSYL/DTRSYL)
	F08QVF	Solve complex Sylvester matrix equation $AX + XB = C$ , $A$ and $B$ are upper triangular or conjugate-transposes (CTRSYL/ZTRSYL)
<b>D9</b>	Singular, overdetermined or underdetermined systems of linear equations, generalized inverses	
<b>D9a</b>	Unconstrained	
<b>D9a1</b>	Least squares ( $L_2$ ) solution	
	F04AMF	Least-squares solution of $m$ real equations in $n$ unknowns, rank = $n$ , $m \geq n$ using iterative refinement (Black Box)
	F04JAF	Minimal least-squares solution of $m$ real equations in $n$ unknowns, rank $\leq n$ , $m \geq n$
	F04JDF	Minimal least-squares solution of $m$ real equations in $n$ unknowns, rank $\leq n$ , $m \geq n$
	F04JGF	Least-squares (if rank= $n$ ) or minimal least-squares (if rank $< n$ ) solution of $m$ real equations in $n$ unknowns, rank $\leq n$ , $m \geq n$
	F04JLF	Real general Gauss–Markov linear model (including weighted least-squares)
	F04KLF	Complex general Gauss–Markov linear model (including weighted least-squares)
	F04QAF	Sparse linear least-squares problem, $m$ real equations in $n$ unknowns

		F04YAF	Covariance matrix for linear least-squares problems, $m$ real equations in $n$ unknowns
<b>D9a2</b>	Chebyshev ( $L_\infty$ ) solution		
		E02GCF	$L_\infty$ -approximation by general linear function
<b>D9a3</b>	Least absolute value ( $L_1$ ) solution		
		E02GAF	$L_1$ -approximation by general linear function
<b>D9b</b>	Constrained		
<b>D9b1</b>	Least squares ( $L_2$ ) solution		
		E04NCF	Convex QP problem or linearly-constrained linear least-squares problem (dense)
		F04JMF	Equality-constrained real linear least squares problem
		F04KMF	Equality-constrained complex linear least-squares
<b>D9b3</b>	Least absolute value ( $L_1$ )		
		E02GBF	$L_1$ -approximation by general linear function subject to linear inequality constraints
<b>D9c</b>	Generalized inverses		
		F01BLF	Pseudo-inverse and rank of a real $m$ by $n$ matrix ( $m \geq n$ )
<b>E</b>	Interpolation		
<b>E1</b>	Univariate data (curve fitting)		
<b>E1a</b>	Polynomial splines (piecewise polynomials)		
		E01BAF	Interpolating functions, cubic spline interpolant, one variable
		E01BEF	Interpolating functions, monotonicity-preserving, piecewise cubic Hermite, one variable
		E02BAF	Least-squares curve cubic spline fit (including interpolation)
<b>E1b</b>	Polynomials		
		E01AAF	Interpolated values, Aitken's technique, unequally spaced data, one variable
		E01ABF	Interpolated values, Everett's formula, equally spaced data, one variable
		E01AEF	Interpolating functions, polynomial interpolant, data may include derivative values, one variable
		E02AFF	Least-squares polynomial fit, special data points (including interpolation)
<b>E1c</b>	Other functions (e.g., rational, trigonometric)		
		E01RAF	Interpolating functions, rational interpolant, one variable
<b>E2</b>	Multivariate data (surface fitting)		
<b>E2a</b>	Gridded		
		E01DAF	Interpolating functions, fitting bicubic spline, data on rectangular grid
<b>E2b</b>	Scattered		
		E01SAF	Interpolating functions, method of Renka and Cline, two variables
		E01SGF	Interpolating functions, modified Shepard's method, two variables
		E01SHF	Interpolated values, evaluate interpolant computed by E01SGF, function and first derivatives, two variables
		E01TGF	Interpolating functions, modified Shepard's method, three variables
		E01THF	Interpolated values, evaluate interpolant computed by E01TGF, function and first derivatives, three variables
<b>E3</b>	Service routines for interpolation		
<b>E3a</b>	Evaluation of fitted functions, including quadrature		
<b>E3a1</b>	Function evaluation		
		E01BFF	Interpolated values, interpolant computed by E01BEF, function only, one variable,
		E01RBF	Interpolated values, evaluate rational interpolant computed by E01RAF, one variable
		E01SBF	Interpolated values, evaluate interpolant computed by E01SAF, two variables
		E02AEF	Evaluation of fitted polynomial in one variable from Chebyshev series form (simplified parameter list)
		E02AKF	Evaluation of fitted polynomial in one variable, from Chebyshev series form
		E02BBF	Evaluation of fitted cubic spline, function only
		E02BCF	Evaluation of fitted cubic spline, function and derivatives
		E02CBF	Evaluation of fitted polynomial in two variables
		E02DEF	Evaluation of a fitted bicubic spline at a vector of points
		E02DFE	Evaluation of a fitted bicubic spline at a mesh of points
<b>E3a2</b>	Derivative evaluation		
		E01BGF	Interpolated values, interpolant computed by E01BEF, function and 1st derivative, one variable
		E02AHF	Derivative of fitted polynomial in Chebyshev series form
		E02BCF	Evaluation of fitted cubic spline, function and derivatives
<b>E3a3</b>	Quadrature		
		E01BHF	Interpolated values, interpolant computed by E01BEF, definite integral, one variable
		E02AJF	Integral of fitted polynomial in Chebyshev series form
		E02BDF	Evaluation of fitted cubic spline, definite integral
<b>E3d</b>	Other		
		E02ZAF	Sort 2-D data into panels for fitting bicubic splines
<b>F</b>	Solution of nonlinear equations		
<b>F1</b>	Single equation		
<b>F1a</b>	Polynomial		
<b>F1a1</b>	Real coefficients		
		C02AGF	All zeros of real polynomial, modified Laguerre method

		C02AJF	All zeros of real quadratic
<b>F1a2</b>	Complex coefficients	C02AFF	All zeros of complex polynomial, modified Laguerre method
		C02AHF	All zeros of complex quadratic
<b>F1b</b>	Nonpolynomial		
		C05ADF	Zero of continuous function in given interval, Bus and Dekker algorithm
		C05AGF	Zero of continuous function, Bus and Dekker algorithm, from given starting value, binary search for interval
		C05AJF	Zero of continuous function, continuation method, from a given starting value
		C05AVF	Binary search for interval containing zero of continuous function (reverse communication)
		C05AXF	Zero of continuous function by continuation method, from given starting value (reverse communication)
		C05AZF	Zero in given interval of continuous function by Bus and Dekker algorithm (reverse communication)
<b>F2</b>	System of equations		
		C05NBF	Solution of system of nonlinear equations using function values only (easy-to-use)
		C05NCF	Solution of system of nonlinear equations using function values only (comprehensive)
		C05NDF	Solution of systems of nonlinear equations using function values only (reverse communication)
		C05PBF	Solution of system of nonlinear equations using 1st derivatives (easy-to-use)
		C05PCF	Solution of system of nonlinear equations using 1st derivatives (comprehensive)
		C05PDF	Solution of systems of nonlinear equations using 1st derivatives (reverse communication)
<b>F3</b>	Service routines (e.g., check user-supplied derivatives)		
		C05ZAF	Check user's routine for calculating 1st derivatives
		E04HCF	Check user's routine for calculating 1st derivatives of function
		E04HDF	Check user's routine for calculating 2nd derivatives of function
<b>G</b>	Optimization ( <i>search also classes K, L8</i> )		
<b>G1</b>	Unconstrained		
<b>G1a</b>	Univariate		
<b>G1a1</b>	Smooth function		
<b>G1a1a</b>	User provides no derivatives		
		E04ABF	Minimum, function of one variable using function values only
<b>G1a1b</b>	User provides first derivatives		
		E04BBF	Minimum, function of one variable, using 1st derivative
<b>G1b</b>	Multivariate		
<b>G1b1</b>	Smooth function		
<b>G1b1b</b>	User provides first derivatives		
		E04DGF	Unconstrained minimum, pre-conditioned conjugate gradient algorithm, function of several variables using 1st derivatives (comprehensive)
<b>G1b2</b>	General function (no smoothness assumed)		
		E04CCF	Unconstrained minimum, simplex algorithm, function of several variables using function values only (comprehensive)
<b>G2</b>	Constrained		
<b>G2a</b>	Linear programming		
<b>G2a1</b>	Dense matrix of constraints		
		E04MFF	LP problem
		E04NCF	Convex QP problem or linearly-constrained linear least-squares problem (dense)
		E04NFF	QP problem (dense)
		H02BFF	Interpret MPSX data file defining IP or LP problem, optimize and print solution
<b>G2a2</b>	Sparse matrix of constraints		
		E04NKF	LP or QP problem (sparse)
<b>G2b</b>	Transportation and assignments problem		
		H03ABF	Transportation problem, modified 'stepping stone' method
<b>G2c</b>	Integer programming		
<b>G2c1</b>	Zero/one		
		H02BBF	Integer programming problem, branch and bound method
<b>G2c6</b>	Pure integer programming		
		H02BBF	Integer programming problem, branch and bound method
<b>G2c7</b>	Mixed integer programming		
		H02BBF	Integer programming problem, branch and bound method
		H02BFF	Interpret MPSX data file defining IP or LP problem, optimize and print solution
<b>G2d</b>	Network ( <i>for network reliability search class M</i> )		
<b>G2d1</b>	Shortest path		
		H03ADF	Shortest path problem, Dijkstra's algorithm
<b>G2e</b>	Quadratic programming		
<b>G2e1</b>	Positive-definite Hessian (i.e., convex problem)		
		E04NCF	Convex QP problem or linearly-constrained linear least-squares problem (dense)
		E04NFF	QP problem (dense)
		E04NKF	LP or QP problem (sparse)
<b>G2e2</b>	Indefinite Hessian		

	E04NFF	QP problem (dense)
	E04NKF	LP or QP problem (sparse)
<b>G2h</b>	General nonlinear programming	
<b>G2h1</b>	Simple bounds	
<b>G2h1a</b>	Smooth function	
<b>G2h1a1</b>	User provides no derivatives	
	E04JYF	Minimum, function of several variables, quasi-Newton algorithm, simple bounds, using function values only (easy-to-use)
	E04UCF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
	E04UFF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
	E04UNF	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G2h1a2</b>	User provides first derivatives	
	E04KDF	Minimum, function of several variables, modified Newton algorithm, simple bounds, using 1st derivatives (comprehensive)
	E04KYF	Minimum, function of several variables, quasi-Newton algorithm, simple bounds, using 1st derivatives (easy-to-use)
	E04KZF	Minimum, function of several variables, modified Newton algorithm, simple bounds, using 1st derivatives (easy-to-use)
	E04UCF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
	E04UFF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
	E04UNF	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G2h1a3</b>	User provides first and second derivatives	
	E04LBF	Minimum, function of several variables, modified Newton algorithm, simple bounds, using 1st and 2nd derivatives (comprehensive)
	E04LYF	Minimum, function of several variables, modified Newton algorithm, simple bounds, using 1st and 2nd derivatives (easy-to-use)
<b>G2h2</b>	Linear equality or inequality constraints	
<b>G2h2a</b>	Smooth function	
<b>G2h2a1</b>	User provides no derivatives	
	E04UCF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
	E04UFF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
	E04UNF	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G2h2a2</b>	User provides first derivatives	
	E04UCF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
	E04UFF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
	E04UNF	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G2h3</b>	Nonlinear constraints	
<b>G2h3a</b>	Equality constraints only	
<b>G2h3a1</b>	Smooth function and constraints	
	E04UCF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
	E04UFF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
	E04UNF	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G2h3b</b>	Equality and inequality constraints	
<b>G2h3b1</b>	Smooth function and constraints	
<b>G2h3b1a</b>	User provides no derivatives	
	E04UCF	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)

		<b>E04UFF</b>	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
		<b>E04UNF</b>	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G2h3b1b</b>	User provides		first derivatives of function and constraints
		<b>E04UCF</b>	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
		<b>E04UFF</b>	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
		<b>E04UNF</b>	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G4</b>	Service routines		
<b>G4a</b>	Problem input (e.g., matrix generation)		
		<b>E04MZF</b>	Converts MPSX data file defining LP or QP problem to format required by E04NKF
		<b>E04UQF</b>	Read optional parameter values for E04UNF or E04UPF from external file
		<b>H02BUF</b>	Converts MPSX data file defining IP or LP problem to format required by H02BBF or E04MFF
<b>G4c</b>	Check user-supplied derivatives		
		<b>E04HCF</b>	Check user's routine for calculating 1st derivatives of function
		<b>E04HDF</b>	Check user's routine for calculating 2nd derivatives of function
		<b>E04YAF</b>	Check user's routine for calculating Jacobian of 1st derivatives
		<b>E04YBF</b>	Check user's routine for calculating Hessian of a sum of squares
		<b>E04ZCF</b>	Check user's routines for calculating 1st derivatives of function and constraints
<b>G4d</b>	Find feasible point		
		<b>E04MFF</b>	LP problem
		<b>E04NCF</b>	Convex QP problem or linearly-constrained linear least-squares problem (dense)
		<b>E04NFF</b>	QP problem (dense)
		<b>E04NKF</b>	LP or QP problem (sparse)
		<b>E04UCF</b>	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (forward communication, comprehensive)
		<b>E04UFF</b>	Minimum, function of several variables, sequential QP method, nonlinear constraints, using function values and optionally 1st derivatives (reverse communication, comprehensive)
		<b>E04UNF</b>	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>G4f</b>	Other		
		<b>E04DJF</b>	Read optional parameter values for E04DGF from external file
		<b>E04DKF</b>	Supply optional parameter values to E04DGF
		<b>E04MGF</b>	Read optional parameter values for E04MFF from external file
		<b>E04MHF</b>	Supply optional parameter values to E04MFF
		<b>E04NDF</b>	Read optional parameter values for E04NCF from external file
		<b>E04NEF</b>	Supply optional parameter values to E04NCF
		<b>E04NGF</b>	Read optional parameter values for E04NFF from external file
		<b>E04NHF</b>	Supply optional parameter values to E04NFF
		<b>E04NLF</b>	Read optional parameter values for E04NKF from external file
		<b>E04NMF</b>	Supply optional parameter values to E04NKF
		<b>E04UDF</b>	Read optional parameter values for E04UCF or E04UFF from external file
		<b>E04UEF</b>	Supply optional parameter values to E04UCF or E04UFF
		<b>E04UQF</b>	Read optional parameter values for E04UNF or E04UPF from external file
		<b>E04URF</b>	Supply optional parameter values to E04UNF or E04UPF
		<b>E04XAF</b>	Estimate (using numerical differentiation) gradient and/or Hessian of a function
		<b>H02BVF</b>	Prints IP or LP solutions with user specified names for rows and columns
		<b>H02BZF</b>	Integer programming solution, supplies further information on solution obtained by H02BBF
<b>H</b>	Differentiation, integration		
<b>H1</b>	Numerical differentiation		
		<b>D04AAF</b>	Numerical differentiation, derivatives up to order 14, function of one real variable
		<b>E04XAF</b>	Estimate (using numerical differentiation) gradient and/or Hessian of a function
<b>H2</b>	Quadrature (numerical evaluation of definite integrals)		
<b>H2a</b>	One-dimensional integrals		
<b>H2a1</b>	Finite interval (general integrand)		
<b>H2a1a</b>	Integrand available via user-defined procedure		
<b>H2a1a1</b>	Automatic (user need only specify required accuracy)		
		<b>D01AHF</b>	1-D quadrature, adaptive, finite interval, strategy due to Patterson, suitable for well-behaved integrands
		<b>D01AJF</b>	1-D quadrature, adaptive, finite interval, strategy due to Piessens and de Doncker, allowing for badly-behaved integrands
		<b>D01ARF</b>	1-D quadrature, non-adaptive, finite interval with provision for indefinite integrals

	D01ATF	1-D quadrature, adaptive, finite interval, variant of D01AJF efficient on vector machines
	D01BDF	1-D quadrature, non-adaptive, finite interval
<b>H2a1a2</b>	Nonautomatic	
	D01BAF	1-D Gaussian quadrature
<b>H2a1b</b>	Integrand available only on grid	
<b>H2a1b2</b>	Nonautomatic	
	D01GAF	1-D quadrature, integration of function defined by data values, Gill–Miller method
<b>H2a2</b>	Finite interval (specific or special type integrand including weight functions, oscillating and singular integrands, principal value integrals, splines, etc.)	
<b>H2a2a</b>	Integrand available via user-defined procedure	
<b>H2a2a1</b>	Automatic (user need only specify required accuracy)	
	D01AKF	1-D quadrature, adaptive, finite interval, method suitable for oscillating functions
	D01ALF	1-D quadrature, adaptive, finite interval, allowing for singularities at user-specified break-points
	D01ANF	1-D quadrature, adaptive, finite interval, weight function $\cos(\omega x)$ or $\sin(\omega x)$
	D01APF	1-D quadrature, adaptive, finite interval, weight function with end-point singularities of algebraico-logarithmic type
	D01AQF	1-D quadrature, adaptive, finite interval, weight function $1/(x-c)$ , Cauchy principal value (Hilbert transform)
	D01AUF	1-D quadrature, adaptive, finite interval, variant of D01AKF efficient on vector machines
<b>H2a2b</b>	Integrand available only on grid	
<b>H2a2b1</b>	Automatic (user need only specify required accuracy)	
	E02AJF	Integral of fitted polynomial in Chebyshev series form
	E02BDF	Evaluation of fitted cubic spline, definite integral
<b>H2a3</b>	Semi-infinite interval (including $e^{-x}$ weight function)	
<b>H2a3a</b>	Integrand available via user-defined procedure	
<b>H2a3a1</b>	Automatic (user need only specify required accuracy)	
	D01AMF	1-D quadrature, adaptive, infinite or semi-infinite interval
	D01ASF	1-D quadrature, adaptive, semi-infinite interval, weight function $\cos(\omega x)$ or $\sin(\omega x)$
<b>H2a3a2</b>	Nonautomatic	
	D01BAF	1-D Gaussian quadrature
<b>H2a4</b>	Infinite interval (including $e^{-x^2}$ weight function)	
<b>H2a4a</b>	Integrand available via user-defined procedure	
<b>H2a4a1</b>	Automatic (user need only specify required accuracy)	
	D01AMF	1-D quadrature, adaptive, infinite or semi-infinite interval
<b>H2a4a2</b>	Nonautomatic	
	D01BAF	1-D Gaussian quadrature
<b>H2b</b>	Multidimensional integrals	
<b>H2b1</b>	One or more hyper-rectangular regions (includes iterated integrals)	
<b>H2b1a</b>	Integrand available via user-defined procedure	
<b>H2b1a1</b>	Automatic (user need only specify required accuracy)	
	D01DAF	2-D quadrature, finite region
	D01EAF	Multi-dimensional adaptive quadrature over hyper-rectangle, multiple integrands
	D01FCF	Multi-dimensional adaptive quadrature over hyper-rectangle
	D01GBF	Multi-dimensional quadrature over hyper-rectangle, Monte Carlo method
<b>H2b1a2</b>	Nonautomatic	
	D01FBF	Multi-dimensional Gaussian quadrature over hyper-rectangle
	D01FDF	Multi-dimensional quadrature, Sag–Szekeres method, general product region or $n$ -sphere
	D01GCF	Multi-dimensional quadrature, general product region, number-theoretic method
	D01GDF	Multi-dimensional quadrature, general product region, number-theoretic method, variant of D01GCF efficient on vector machines
<b>H2b2</b>	$n$ -dimensional quadrature on a nonrectangular region	
<b>H2b2a</b>	Integrand available via user-defined procedure	
<b>H2b2a1</b>	Automatic (user need only specify required accuracy)	
	D01JAF	Multi-dimensional quadrature over an $n$ -sphere, allowing for badly-behaved integrands
<b>H2b2a2</b>	Nonautomatic	
	D01PAF	Multi-dimensional quadrature over an $n$ -simplex
<b>H2c</b>	Service routines (e.g., compute weights and nodes for quadrature formulas)	
	D01BBF	Pre-computed weights and abscissae for Gaussian quadrature rules, restricted choice of rule
	D01BCF	Calculation of weights and abscissae for Gaussian quadrature rules, general choice of rule
	D01GYF	Korobov optimal coefficients for use in D01GCF or D01GDF, when number of points is prime
	D01GZF	Korobov optimal coefficients for use in D01GCF or D01GDF, when number of points is product of two primes
<b>I</b>	Differential and integral equations	
<b>II</b>	Ordinary differential equations (ODE's)	

<b>I1a</b>	Initial value problems	
<b>I1a1</b>	General, nonstiff or mildly stiff	
<b>I1a1a</b>	One-step methods (e.g., Runge–Kutta)	
	D02BGF	ODEs, IVP, Runge–Kutta–Merson method, until a component attains given value (simple driver)
	D02BHF	ODEs, IVP, Runge–Kutta–Merson method, until function of solution is zero (simple driver)
	D02BJF	ODEs, IVP, Runge–Kutta method, until function of solution is zero, integration over range with intermediate output (simple driver)
	D02LAF	2nd order ODEs, IVP, Runge–Kutta–Nystrom method
	D02PCF	ODEs, IVP, Runge–Kutta method, integration over range with output
	D02PDF	ODEs, IVP, Runge–Kutta method, integration over one step
<b>I1a1b</b>	Multistep methods (e.g. Adams predictor-corrector)	
	D02CJF	ODEs, IVP, Adams method, until function of solution is zero, intermediate output (simple driver)
	D02QFF	ODEs, IVP, Adams method with root-finding (forward communication, comprehensive)
	D02QGF	ODEs, IVP, Adams method with root-finding (reverse communication, comprehensive)
<b>I1a2</b>	Stiff and mixed algebraic- differential equations	
	D02EJF	ODEs, stiff IVP, BDF method, until function of solution is zero, intermediate output (simple driver)
	D02NBF	Explicit ODEs, stiff IVP, full Jacobian (comprehensive)
	D02NCF	Explicit ODEs, stiff IVP, banded Jacobian (comprehensive)
	D02NDF	Explicit ODEs, stiff IVP, sparse Jacobian (comprehensive)
	D02NGF	Implicit/algebraic ODEs, stiff IVP, full Jacobian (comprehensive)
	D02NHF	Implicit/algebraic ODEs, stiff IVP, banded Jacobian (comprehensive)
	D02NJF	Implicit/algebraic ODEs, stiff IVP, sparse Jacobian (comprehensive)
	D02NMF	Explicit ODEs, stiff IVP (reverse communication, comprehensive)
	D02NNF	Implicit/algebraic ODEs, stiff IVP (reverse communication, comprehensive)
	D03PKF	General system of first order PDEs, coupled DAEs, method of lines, Keller box discretisation, one space variable
	D03PPF	General system of parabolic PDEs, coupled DAEs, method of lines, finite differences, remeshing, one space variable
	D03PRF	General system of first order PDEs, coupled DAEs, method of lines, Keller box discretisation, remeshing, one space variable
<b>I1b</b>	Multipoint boundary value problems	
<b>I1b1</b>	Linear	
	D02GBF	ODEs, boundary value problem, finite difference technique with deferred correction, general linear problem
	D02JAF	ODEs, boundary value problem, collocation and least-squares, single $n$ th order linear equation
	D02JBF	ODEs, boundary value problem, collocation and least-squares, system of 1st order linear equations
	D02TGF	$n$ th order linear ODEs, boundary value problem, collocation and least-squares
<b>I1b2</b>	Nonlinear	
	D02AGF	ODEs, boundary value problem, shooting and matching technique, allowing interior matching point, general parameters to be determined
	D02GAF	ODEs, boundary value problem, finite difference technique with deferred correction, simple nonlinear problem
	D02HAF	ODEs, boundary value problem, shooting and matching, boundary values to be determined
	D02HBF	ODEs, boundary value problem, shooting and matching, general parameters to be determined
	D02RAF	ODEs, general nonlinear boundary value problem, finite difference technique with deferred correction, continuation facility
	D02SAF	ODEs, boundary value problem, shooting and matching technique, subject to extra algebraic equations, general parameters to be determined
	D02TKF	ODEs, general nonlinear boundary value problem, collocation technique
<b>I1b3</b>	Eigenvalue (e.g., Sturm-Liouville)	
	D02AGF	ODEs, boundary value problem, shooting and matching technique, allowing interior matching point, general parameters to be determined
	D02HBF	ODEs, boundary value problem, shooting and matching, general parameters to be determined
	D02KAF	2nd order Sturm–Liouville problem, regular system, finite range, eigenvalue only
	D02KDF	2nd order Sturm–Liouville problem, regular/singular system, finite/infinite range, eigenvalue only, user-specified break-points
	D02KEF	2nd order Sturm–Liouville problem, regular/singular system, finite/infinite range, eigenvalue and eigenfunction, user-specified break-points
<b>I1c</b>	Service routines (e.g., interpolation of solutions, error handling, test programs)	
	D02LXF	2nd order ODEs, IVP, set-up for D02LAF
	D02LYF	2nd order ODEs, IVP, diagnostics for D02LAF

	D02LZF	2nd order ODEs, IVP, interpolation for D02LAF
	D02MVF	ODEs, IVP, DASSL method, set-up for D02M-N routines
	D02MZF	ODEs, IVP, interpolation for D02M-N routines, natural interpolant
	D02NRF	ODEs, IVP, for use with D02M-N routines, sparse Jacobian, enquiry routine
	D02NSF	ODEs, IVP, for use with D02M-N routines, full Jacobian, linear algebra set-up
	D02NTF	ODEs, IVP, for use with D02M-N routines, banded Jacobian, linear algebra set-up
	D02NUF	ODEs, IVP, for use with D02M-N routines, sparse Jacobian, linear algebra set-up
	D02NVF	ODEs, IVP, BDF method, set-up for D02M-N routines
	D02NWF	ODEs, IVP, Blend method, set-up for D02M-N routines
	D02NXF	ODEs, IVP, sparse Jacobian, linear algebra diagnostics, for use with D02M-N routines
	D02NYF	ODEs, IVP, integrator diagnostics, for use with D02M-N routines
	D02NZF	ODEs, IVP, set-up for continuation calls to integrator, for use with D02M-N routines
	D02PVF	ODEs, IVP, set-up for D02PCF and D02PDF
	D02PWF	ODEs, IVP, resets end of range for D02PDF
	D02PXF	ODEs, IVP, interpolation for D02PDF
	D02PYF	ODEs, IVP, integration diagnostics for D02PCF and D02PDF
	D02PZF	ODEs, IVP, error assessment diagnostics for D02PCF and D02PDF
	D02QWF	ODEs, IVP, set-up for D02QFF and D02QGF
	D02QXF	ODEs, IVP, diagnostics for D02QFF and D02QGF
	D02QYF	ODEs, IVP, root-finding diagnostics for D02QFF and D02QGF
	D02QZF	ODEs, IVP, interpolation for D02QFF or D02QGF
	D02TVF	ODEs, general nonlinear boundary value problem, set-up for D02TKF
	D02TXF	ODEs, general nonlinear boundary value problem, continuation facility for D02TKF
	D02TYF	ODEs, general nonlinear boundary value problem, interpolation for D02TKF
	D02TZF	ODEs, general nonlinear boundary value problem, diagnostics for D02TKF
	D02XJF	ODEs, IVP, interpolation for D02M-N routines, natural interpolant
	D02XKF	ODEs, IVP, interpolation for D02M-N routines, $C_1$ interpolant
	D02ZAF	ODEs, IVP, weighted norm of local error estimate for D02M-N routines
<b>I2</b>	Partial differential equations	
<b>I2a</b>	Initial boundary value problems	
<b>I2a1</b>	Parabolic	
<b>I2a1a</b>	One spatial dimension	
	D03PCF	General system of parabolic PDEs, method of lines, finite differences, one space variable
	D03PDF	General system of parabolic PDEs, method of lines, Chebyshev $C^0$ collocation, one space variable
	D03PEF	General system of first order PDEs, method of lines, Keller box discretisation, one space variable
	D03PHF	General system of parabolic PDEs, coupled DAEs, method of lines, finite differences, one space variable
	D03PJF	General system of parabolic PDEs, coupled DAEs, method of lines, Chebyshev $C^0$ collocation, one space variable
	D03PKF	General system of first order PDEs, coupled DAEs, method of lines, Keller box discretisation, one space variable
	D03PPF	General system of parabolic PDEs, coupled DAEs, method of lines, finite differences, remeshing, one space variable
	D03PRF	General system of first order PDEs, coupled DAEs, method of lines, Keller box discretisation, remeshing, one space variable
	D03PYF	PDEs, spatial interpolation with D03PDF or D03PJF
	D03PZF	PDEs, spatial interpolation with D03PCF, D03PEF, D03PPF, D03PHF, D03PKF, D03PLF, D03PPF, D03PRF or D03PSF
<b>I2a1b</b>	Two or more spatial dimensions	
	D03RAF	General system of second order PDEs, method of lines, finite differences, remeshing, two space variables, rectangular region
	D03RBF	General system of second order PDEs, method of lines, finite differences, remeshing, two space variables, rectilinear region
	D03RYF	Check initial grid data in D03RBF
	D03RZF	Extract grid data from D03RBF
<b>I2a2</b>	Hyperbolic	
	D03PFF	General system of convection-diffusion PDEs with source terms in conservative form, method of lines, upwind scheme using numerical flux function based on Riemann solver, one space variable
	D03PLF	General system of convection-diffusion PDEs with source terms in conservative form, coupled DAEs, method of lines, upwind scheme using numerical flux function based on Riemann solver, one space variable
	D03PSF	General system of convection-diffusion PDEs with source terms in conservative form, coupled DAEs, method of lines, upwind scheme using numerical flux function based on Riemann solver, remeshing, one space variable
	D03PUF	Roe's approximate Riemann solver for Euler equations in conservative form, for use with D03PFF, D03PLF and D03PSF

		D03PVF	Osher's approximate Riemann solver for Euler equations in conservative form, for use with D03PFF, D03PLF and D03PSF
		D03PWF	Modified HLL Riemann solver for Euler equations in conservative form, for use with D03PFF, D03PLF and D03PSF
		D03PXF	Exact Riemann Solver for Euler equations in conservative form, for use with D03PFF, D03PLF and D03PSF
<b>I2b</b>	Elliptic boundary value problems		
<b>I2b1</b>	Linear		
<b>I2b1a</b>	Second order		
<b>I2b1a1</b>	Poisson (Laplace) or Helmholtz equation		
<b>I2b1a1a</b>	Rectangular domain (or topologically rectangular in the coordinate system)	D03FAF	Elliptic PDE, Helmholtz equation, 3-D Cartesian co-ordinates
<b>I2b1a1b</b>	Nonrectangular domain	D03EAF	Elliptic PDE, Laplace's equation, 2-D arbitrary domain
<b>I2b1a3</b>	Nonseparable problems	D03EEF	Discretize a second order elliptic PDE on a rectangle
<b>I2b4</b>	Service routines	D03EEF	Discretize a second order elliptic PDE on a rectangle
		D03PYF	PDEs, spatial interpolation with D03PDF or D03PJF
		D03PZF	PDEs, spatial interpolation with D03PCF, D03PEF, D03PFF, D03PHF, D03PKF, D03PLF, D03PPF, D03PRF or D03PSF
<b>I2b4a</b>	Domain triangulation ( <i>search also class P</i> )	D03MAF	Triangulation of a plane region
<b>I2b4b</b>	Solution of discretized elliptic equations	D03EBF	Elliptic PDE, solution of finite difference equations by SIP, five-point 2-D molecule, iterate to convergence
		D03ECF	Elliptic PDE, solution of finite difference equations by SIP for seven-point 3-D molecule, iterate to convergence
		D03EDF	Elliptic PDE, solution of finite difference equations by a multigrid technique
		D03UAF	Elliptic PDE, solution of finite difference equations by SIP, five-point 2-D molecule, one iteration
		D03UBF	Elliptic PDE, solution of finite difference equations by SIP, seven-point 3-D molecule, one iteration
<b>I3</b>	Integral equations	D05AAF	Linear non-singular Fredholm integral equation, 2nd kind, split kernel
		D05ABF	Linear non-singular Fredholm integral equation, 2nd kind, smooth kernel
		D05BAF	Nonlinear Volterra convolution equation, 2nd kind
		D05BDF	Nonlinear convolution Volterra-Abel equation, 2nd kind, weakly singular
		D05BEF	Nonlinear convolution Volterra-Abel equation, 1st kind, weakly singular
		D05BWF	Generate weights for use in solving Volterra equations
		D05BYF	Generate weights for use in solving weakly singular Abel type equations
<b>J</b>	Integral transforms		
<b>J1</b>	Trigonometric transforms including fast Fourier transforms		
<b>J1a</b>	One-dimensional		
<b>J1a1</b>	Real	C06EAF	Single 1-D real discrete Fourier transform, no extra workspace
		C06FAF	Single 1-D real discrete Fourier transform, extra workspace for greater speed
		C06FPF	Multiple 1-D real discrete Fourier transforms
<b>J1a2</b>	Complex	C06EBF	Single 1-D Hermitian discrete Fourier transform, no extra workspace
		C06ECF	Single 1-D complex discrete Fourier transform, no extra workspace
		C06FBF	Single 1-D Hermitian discrete Fourier transform, extra workspace for greater speed
		C06FCF	Single 1-D complex discrete Fourier transform, extra workspace for greater speed
		C06FFF	1-D complex discrete Fourier transform of multi-dimensional data
		C06FQF	Multiple 1-D Hermitian discrete Fourier transforms
		C06FRF	Multiple 1-D complex discrete Fourier transforms
		C06GBF	Complex conjugate of Hermitian sequence
		C06GCF	Complex conjugate of complex sequence
		C06GQF	Complex conjugate of multiple Hermitian sequences
		C06GSF	Convert Hermitian sequences to general complex sequences
<b>J1a3</b>	Sine and cosine transforms	C06HAF	Discrete sine transform
		C06HBF	Discrete cosine transform
		C06HCF	Discrete quarter-wave sine transform
		C06HDF	Discrete quarter-wave cosine transform
<b>J1b</b>	Multidimensional	C06FJF	Multi-dimensional complex discrete Fourier transform of multi-dimensional data
		C06FUF	2-D complex discrete Fourier transform
		C06FXF	3-D complex discrete Fourier transform
<b>J2</b>	Convolutions	C06EKF	Circular convolution or correlation of two real vectors, no extra workspace

		C06FKF	Circular convolution or correlation of two real vectors, extra workspace for greater speed
<b>J3</b>	Laplace transforms		
		C06LAF	Inverse Laplace transform, Crump's method
		C06LBF	Inverse Laplace transform, modified Weeks' method
		C06LCF	Evaluate inverse Laplace transform as computed by C06LBF
<b>J4</b>	Hilbert transforms		
		D01AQF	1-D quadrature, adaptive, finite interval, weight function $1/(x-c)$ , Cauchy principal value (Hilbert transform)
<b>K</b>	Approximation ( <i>search also class L8</i> )		
<b>K1</b>	Least squares ( $L_2$ ) approximation		
<b>K1a</b>	Linear least squares ( <i>search also classes D5, D6, D9</i> )		
<b>K1a1</b>	Unconstrained		
<b>K1a1a</b>	Univariate data (curve fitting)		
<b>K1a1a1</b>	Polynomial splines (piecewise polynomials)		
		E02BAF	Least-squares curve cubic spline fit (including interpolation)
		E02BEF	Least-squares cubic spline curve fit, automatic knot placement
<b>K1a1a2</b>	Polynomials		
		E02ADF	Least-squares curve fit, by polynomials, arbitrary data points
		E02AFF	Least-squares polynomial fit, special data points (including interpolation)
<b>K1a1b</b>	Multivariate data (surface fitting)		
		E02CAF	Least-squares surface fit by polynomials, data on lines
		E02DAF	Least-squares surface fit, bicubic splines
		E02DCF	Least-squares surface fit by bicubic splines with automatic knot placement, data on rectangular grid
		E02DDF	Least-squares surface fit by bicubic splines with automatic knot placement, scattered data
<b>K1a2</b>	Constrained		
<b>K1a2a</b>	Linear constraints		
		E02AGF	Least-squares polynomial fit, values and derivatives may be constrained, arbitrary data points,
<b>K1b</b>	Nonlinear least squares		
<b>K1b1</b>	Unconstrained		
<b>K1b1a</b>	Smooth functions		
<b>K1b1a1</b>	User provides no derivatives		
		E04FCF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using function values only (comprehensive)
		E04FYF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using function values only (easy-to-use)
<b>K1b1a2</b>	User provides first derivatives		
		E04GBF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and quasi-Newton algorithm using 1st derivatives (comprehensive)
		E04GDF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using 1st derivatives (comprehensive)
		E04GYF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and quasi-Newton algorithm, using 1st derivatives (easy-to-use)
		E04GZF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using 1st derivatives (easy-to-use)
<b>K1b1a3</b>	User provides first and second derivatives		
		E04HEF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm, using 2nd derivatives (comprehensive)
		E04HYF	Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm, using 2nd derivatives (easy-to-use)
<b>K1b2</b>	Constrained		
<b>K1b2b</b>	Nonlinear constraints		
		E04UNF	Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
<b>K2</b>	Minimax ( $L_\infty$ ) approximation		
		E02ACF	Minimax curve fit by polynomials
<b>K4</b>	Other analytic approximations (e.g., Taylor polynomial, Padé)		
		E02RAF	Padé-approximants
<b>K6</b>	Service routines for approximation		
<b>K6a</b>	Evaluation of fitted functions, including quadrature		
<b>K6a1</b>	Function evaluation		
		E02AEF	Evaluation of fitted polynomial in one variable from Chebyshev series form (simplified parameter list)
		E02AKF	Evaluation of fitted polynomial in one variable, from Chebyshev series form
		E02BBF	Evaluation of fitted cubic spline, function only
		E02BCF	Evaluation of fitted cubic spline, function and derivatives
		E02CBF	Evaluation of fitted polynomial in two variables
		E02RBF	Evaluation of fitted rational function as computed by E02RAF
<b>K6a2</b>	Derivative evaluation		
		E02AHF	Derivative of fitted polynomial in Chebyshev series form

	E02BCF	Evaluation of fitted cubic spline, function and derivatives
<b>K6a3</b>	Quadrature	
	E02AJF	Integral of fitted polynomial in Chebyshev series form
	E02BDF	Evaluation of fitted cubic spline, definite integral
<b>K6d</b>	Other	
	E02ZAF	Sort 2-D data into panels for fitting bicubic splines
<b>L</b>	Statistics, probability	
<b>L1</b>	Data summarization	
<b>L10</b>	Time series analysis ( <i>search also class J</i> )	
<b>L10a</b>	Univariate ( <i>search also classes L3a6 and L3a7</i> )	
<b>L10a1</b>	Transformations	
<b>L10a1c</b>	Filters ( <i>search also class K5</i> )	
<b>L10a1c1</b>	Difference	
	G13AAF	Univariate time series, seasonal and non-seasonal differencing
<b>L10a1c4</b>	Other	
	G13BBF	Multivariate time series, filtering by a transfer function model
<b>L10a2</b>	Time domain analysis	
<b>L10a2a</b>	Summary statistics	
	G13AUF	Computes quantities needed for range-mean or standard deviation-mean plot
<b>L10a2a1</b>	Autocorrelations and autocovariances	
	G13ABF	Univariate time series, sample autocorrelation function
<b>L10a2a2</b>	Partial autocorrelations	
	G13ACF	Univariate time series, partial autocorrelations from autocorrelations
<b>L10a2b</b>	Stationarity analysis ( <i>search also class L10a2a</i> )	
	G13AUF	Computes quantities needed for range-mean or standard deviation-mean plot
<b>L10a2c</b>	Autoregressive models	
<b>L10a2c1</b>	Model identification	
	G13ACF	Univariate time series, partial autocorrelations from autocorrelations
<b>L10a2d</b>	ARMA and ARIMA models (including Box–Jenkins methods)	
<b>L10a2d1</b>	Model identification	
	G13ADF	Univariate time series, preliminary estimation, seasonal ARIMA model
<b>L10a2d2</b>	Parameter estimation	
	G13AEF	Univariate time series, estimation, seasonal ARIMA model (comprehensive)
	G13AFF	Univariate time series, estimation, seasonal ARIMA model (easy-to-use)
	G13ASF	Univariate time series, diagnostic checking of residuals, following G13AEF or G13AFF
	G13BEF	Multivariate time series, estimation of multi-input model
<b>L10a2d3</b>	Forecasting	
	G13AGF	Univariate time series, update state set for forecasting
	G13AHF	Univariate time series, forecasting from state set
	G13AJF	Univariate time series, state set and forecasts, from fully specified seasonal ARIMA model
<b>L10a2e</b>	State-space analysis (e.g., Kalman filtering)	
	G13EAF	Combined measurement and time update, one iteration of Kalman filter, time-varying, square root covariance filter
	G13EBF	Combined measurement and time update, one iteration of Kalman filter, time-invariant, square root covariance filter
<b>L10a2f</b>	Analysis of a locally stationary series	
	G13DXF	Calculates the zeros of a vector autoregressive (or moving average) operator
<b>L10a3</b>	Frequency domain analysis ( <i>search also class J1</i> )	
<b>L10a3a</b>	Spectral analysis	
<b>L10a3a3</b>	Spectrum estimation using the periodogram	
	G13CBF	Univariate time series, smoothed sample spectrum using spectral smoothing by the trapezium frequency (Daniell) window
<b>L10a3a4</b>	Spectrum estimation using the Fourier transform of the autocorrelation function	
	G13CAF	Univariate time series, smoothed sample spectrum using rectangular, Bartlett, Tukey or Parzen lag window
<b>L10b</b>	Two time series ( <i>search also classes L3b3c, L10c, and L10d</i> )	
<b>L10b2</b>	Time domain analysis	
<b>L10b2a</b>	Summary statistics (e.g., cross-correlations)	
	G13BCF	Multivariate time series, cross-correlations
<b>L10b2b</b>	Transfer function models	
	G13BAF	Multivariate time series, filtering (pre-whitening) by an ARIMA model
	G13BDF	Multivariate time series, preliminary estimation of transfer function model
	G13BEF	Multivariate time series, estimation of multi-input model
	G13BGF	Multivariate time series, update state set for forecasting from multi-input model
	G13BHF	Multivariate time series, forecasting from state set of multi-input model
	G13BJF	Multivariate time series, state set and forecasts from fully specified multi-input model
<b>L10b3</b>	Frequency domain analysis ( <i>search also class J1</i> )	
<b>L10b3a</b>	Cross-spectral analysis	
<b>L10b3a3</b>	Cross-spectrum estimation using the cross-periodogram	

- G13CDF    Multivariate time series, smoothed sample cross spectrum using spectral smoothing by the trapezium frequency (Daniell) window
- L10b3a4**    Cross-spectrum estimation using the Fourier transform of the cross-correlation or cross-covariance function
  - G13CCF    Multivariate time series, smoothed sample cross spectrum using rectangular, Bartlett, Tukey or Parzen lag window
- L10b3a6**    Spectral functions
  - G13CEF    Multivariate time series, cross amplitude spectrum, squared coherency, bounds, univariate and bivariate (cross) spectra
  - G13CFF    Multivariate time series, gain, phase, bounds, univariate and bivariate (cross) spectra
  - G13CGF    Multivariate time series, noise spectrum, bounds, impulse response function and its standard error
- L10c**        Multivariate time series (*search also classes J1, L3e3 and L10b*)
  - G13DBF    Multivariate time series, multiple squared partial autocorrelations
  - G13DCF    Multivariate time series, estimation of VARMA model
  - G13DJF    Multivariate time series, forecasts and their standard errors
  - G13DKF    Multivariate time series, updates forecasts and their standard errors
  - G13DLF    Multivariate time series, differences and/or transforms (for use before G13DCF)
  - G13DMF    Multivariate time series, sample cross-correlation or cross-covariance matrices
  - G13DNF    Multivariate time series, sample partial lag correlation matrices,  $\chi^2$  statistics and significance levels
  - G13DPF    Multivariate time series, partial autoregression matrices
  - G13DSF    Multivariate time series, diagnostic checking of residuals, following G13DCF
  - G13DXF    Calculates the zeros of a vector autoregressive (or moving average) operator
- L12**        Discriminant analysis
  - G03ACF    Performs canonical variate analysis
  - G03DAF    Computes test statistic for equality of within-group covariance matrices and matrices for discriminant analysis
  - G03DBF    Computes Mahalanobis squared distances for group or pooled variance-covariance matrices (for use after G03DAF)
  - G03DCF    Allocates observations to groups according to selected rules (for use after G03DAF)
- L13**        Covariance structure models
- L13a**        Factor analysis
  - G03BAF    Computes orthogonal rotations for loading matrix, generalized orthomax criterion
  - G03BCF    Computes Procrustes rotations
  - G03CAF    Computes the maximum likelihood estimates of the parameters of a factor analysis model, factor loadings, communalities and residual correlations
  - G03CCF    Computes factor score coefficients (for use after G03CAF)
  - G11SAF    Contingency table, latent variable model for binary data
- L13b**        Principal components analysis
  - G03AAF    Performs principal component analysis
- L13c**        Canonical correlation
  - G03ACF    Performs canonical variate analysis
  - G03ADF    Performs canonical correlation analysis
- L14**        Cluster analysis
- L14a**        One-way
- L14a1**        Unconstrained
- L14a1a**        Nested
- L14a1a1**        Joining (e.g., single link)
  - G03ECF    Hierarchical cluster analysis
  - G03EHF    Constructs dendrogram (for use after G03ECF)
  - G03EJF    Computes cluster indicator variable (for use after G03ECF)
- L14a1b**        Non-nested (e.g., K means)
  - G03EFF    *K*-means cluster analysis
- L14d**        Service routines (e.g., compute distance matrix)
  - G03EAF    Computes distance matrix
- L15**        Life testing, survival analysis
  - G12AAF    Computes Kaplan–Meier (product-limit) estimates of survival probabilities
  - G12BAF    Fits Cox’s proportional hazard model
- L16**        Multidimensional scaling
  - G03FAF    Performs principal co-ordinate analysis, classical metric scaling
  - G03FCF    Performs non-metric (ordinal) multidimensional scaling
- L1a**        One-dimensional data
- L1a1**        Raw data
  - G01AAF    Mean, variance, skewness, kurtosis etc, one variable, from raw data
  - G01ALF    Computes a five-point summary (median, hinges and extremes)
  - G07DAF    Robust estimation, median, median absolute deviation, robust standard deviation
  - G07DBF    Robust estimation, *M*-estimates for location and scale parameters, standard weight functions
  - G07DCF    Robust estimation, *M*-estimates for location and scale parameters, user-defined weight functions

		G07DDF	Computes a trimmed and winsorized mean of a single sample with estimates of their variance
<b>L1a3</b>	Grouped data	G01ADF	Mean, variance, skewness, kurtosis etc, one variable, from frequency table
<b>L1b</b>	Two dimensional data ( <i>search also class L1c</i> )	G01ABF	Mean, variance, skewness, kurtosis etc, two variables, from raw data
<b>L1c</b>	Multi-dimensional data		
<b>L1c1</b>	Raw data	G02BDF	Correlation-like coefficients (about zero), all variables, no missing values
		G02BKF	Correlation-like coefficients (about zero), subset of variables, no missing values
		G11BAF	Computes multiway table from set of classification factors using selected statistic
		G11BBF	Computes multiway table from set of classification factors using given percentile/quantile
<b>L1c1b</b>	Covariance, correlation	G02BAF	Pearson product-moment correlation coefficients, all variables, no missing values
		G02BGF	Pearson product-moment correlation coefficients, subset of variables, no missing values
		G02BNF	Kendall/Spearman non-parametric rank correlation coefficients, no missing values, overwriting input data
		G02BQF	Kendall/Spearman non-parametric rank correlation coefficients, no missing values, preserving input data
		G02BTF	Update a weighted sum of squares matrix with a new observation
		G02BUF	Computes a weighted sum of squares matrix
		G02BWF	Computes a correlation matrix from a sum of squares matrix
		G02BXF	Computes (optionally weighted) correlation and covariance matrices
		G02BYF	Computes partial correlation/variance-covariance matrix from correlation/variance-covariance matrix computed by G02BXF
		G02HKF	Calculates a robust estimation of a correlation matrix, Huber's weight function
		G02HLF	Calculates a robust estimation of a correlation matrix, user-supplied weight function plus derivatives
		G02HMF	Calculates a robust estimation of a correlation matrix, user-supplied weight function
<b>L1c2</b>	Raw data containing missing values ( <i>search also class L1c1</i> )	G02BBF	Pearson product-moment correlation coefficients, all variables, casewise treatment of missing values
		G02BCF	Pearson product-moment correlation coefficients, all variables, pairwise treatment of missing values
		G02BEF	Correlation-like coefficients (about zero), all variables, casewise treatment of missing values
		G02BFF	Correlation-like coefficients (about zero), all variables, pairwise treatment of missing values
		G02BHF	Pearson product-moment correlation coefficients, subset of variables, casewise treatment of missing values
		G02BJF	Pearson product-moment correlation coefficients, subset of variables, pairwise treatment of missing values
		G02BLF	Correlation-like coefficients (about zero), subset of variables, casewise treatment of missing values
		G02BMF	Correlation-like coefficients (about zero), subset of variables, pairwise treatment of missing values
		G02BPF	Kendall/Spearman non-parametric rank correlation coefficients, casewise treatment of missing values, overwriting input data
		G02BRF	Kendall/Spearman non-parametric rank correlation coefficients, casewise treatment of missing values, preserving input data
		G02BSF	Kendall/Spearman non-parametric rank correlation coefficients, pairwise treatment of missing values
<b>L2</b>	Data manipulation		
<b>L2a</b>	Transform ( <i>search also classes L10a1, N6, and N8</i> )	G03ZAF	Produces standardized values ( <i>z</i> -scores) for a data matrix
<b>L2b</b>	Tally	G01AEF	Frequency table from raw data
		G11BAF	Computes multiway table from set of classification factors using selected statistic
		G11BBF	Computes multiway table from set of classification factors using given percentile/quantile
		G11BCF	Computes marginal tables for multiway table computed by G11BAF or G11BBF
		G11SEF	Frequency count for G11SAF
<b>L2c</b>	Subset	G02CEF	Service routines for multiple linear regression, select elements from vectors and matrices
<b>L3</b>	Elementary statistical graphics ( <i>search also class Q</i> )		
<b>L3a</b>	One-dimensional data		
<b>L3a1</b>	Histograms	G01AJF	Lineprinter histogram of one variable
<b>L3a3</b>	EDA (e.g., box-plots)		

- G01ARF Constructs a stem and leaf plot
- G01ASF Constructs a box and whisker plot
- L3b** Two-dimensional data (*search also class L3e*)
- L3b3** Scatter diagrams
- L3b3a** Y vs. X
  - G01AGF Lineprinter scatterplot of two variables
- L4** Elementary data analysis
- L4a** One-dimensional data
- L4a1** Raw data
- L4a1a** Parametric analysis
- L4a1a2** Probability plots
- L4a1a2n** Negative binomial, normal
  - G01AHF Lineprinter scatterplot of one variable against Normal scores
  - G01DCF Normal scores, approximate variance-covariance matrix
  - G01DHF Ranks, Normal scores, approximate Normal scores or exponential (Savage) scores
- L4a1a4** Parameter estimates and tests
- L4a1a4b** Binomial
  - G07AAF Computes confidence interval for the parameter of a binomial distribution
- L4a1a4n** Normal
  - G01DDF Shapiro and Wilk's  $W$  test for Normality
  - G07BBF Computes maximum likelihood estimates for parameters of the Normal distribution from grouped and/or censored data
  - G07CAF Computes  $t$ -test statistic for a difference in means between two Normal populations, confidence interval
- L4a1a4p** Poisson
  - G07ABF Computes confidence interval for the parameter of a Poisson distribution
- L4a1a4w** Weibull
  - G07BEF Computes maximum likelihood estimates for parameters of the Weibull distribution
- L4a1b** Nonparametric analysis
- L4a1b1** Estimates and tests regarding location (e.g., median), dispersion, and shape
  - G07EAF Robust confidence intervals, 1 sample
  - G07EBF Robust confidence intervals, 2 sample
  - G08AGF Performs the Wilcoxon one-sample (matched pairs) signed rank test
  - G08AHF Performs the Mann-Whitney  $U$  test on two independent samples
  - G08AJF Computes the exact probabilities for the Mann-Whitney  $U$  statistic, no ties in pooled sample
  - G08AKF Computes the exact probabilities for the Mann-Whitney  $U$  statistic, ties in pooled sample
- L4a1b2** Density function estimation
  - G10BAF Kernel density estimate using Gaussian kernel
- L4a1c** Goodness-of-fit tests
  - G08CBF Performs the one-sample Kolmogorov-Smirnov test for standard distributions
  - G08CCF Performs the one-sample Kolmogorov-Smirnov test for a user-supplied distribution
  - G08CDF Performs the two-sample Kolmogorov-Smirnov test
  - G08CGF Performs the  $\chi^2$  goodness of fit test, for standard continuous distributions
- L4a1d** Analysis of a sequence of numbers (*search also class L10a*)
  - G08EAF Performs the runs up or runs down test for randomness
  - G08EEF Performs the pairs (serial) test for randomness
  - G08ECF Performs the triplets test for randomness
  - G08EDF Performs the gaps test for randomness
- L4a3** Grouped and/or censored data
  - G07BBF Computes maximum likelihood estimates for parameters of the Normal distribution from grouped and/or censored data
  - G07BEF Computes maximum likelihood estimates for parameters of the Weibull distribution
- L4a5** Categorical data
  - G11AAF  $\chi^2$  statistics for two-way contingency table
- L4b** Two dimensional data (*search also class L4c*)
- L4b1** Pairwise independent data
- L4b1b** Nonparametric analysis (e.g., rank tests)
  - G08ACF Median test on two samples of unequal size
  - G08BAF Mood's and David's tests on two samples of unequal size
- L4b3** Pairwise dependent data
  - G08AAF Sign test on two paired samples
- L4c** Multi-dimensional data (*search also classes L4b and L7a1*)
- L4c1** Independent data
- L4c1b** Nonparametric analysis
  - G08DAF Kendall's coefficient of concordance
- L5** Function evaluation (*search also class C*)
- L5a** Univariate
- L5a1** Cumulative distribution functions, probability density functions
  - G01EMF Computes probability for the Studentized range statistic
  - G01EPF Computes bounds for the significance of a Durbin-Watson statistic

		G01JDF	Computes lower tail probability for a linear combination of (central) $\chi^2$ variables
<b>L5a1b</b>	Beta, binomial	G01BJF	Binomial distribution function
		G01EEF	Computes upper and lower tail probabilities and probability density function for the beta distribution
		G01GEF	Computes probabilities for the non-central beta distribution
<b>L5a1c</b>	Cauchy, $\chi^2$	G01ECF	Computes probabilities for $\chi^2$ distribution
		G01GCF	Computes probabilities for the non-central $\chi^2$ distribution
		G01JCF	Computes probability for a positive linear combination of $\chi^2$ variables
<b>L5a1e</b>	Error function, exponential, extreme value	S15ADF	Complement of error function $\operatorname{erfc}(x)$
		S15AEF	Error function $\operatorname{erf}(x)$
<b>L5a1f</b>	$F$ distribution	G01EDF	Computes probabilities for $F$ -distribution
		G01GDF	Computes probabilities for the non-central $F$ -distribution
<b>L5a1g</b>	Gamma, general, geometric	G01EFF	Computes probabilities for the gamma distribution
<b>L5a1h</b>	Halfnormal, hypergeometric	G01BLF	Hypergeometric distribution function
<b>L5a1k</b>	Kendall $F$ statistic, Kolmogorov-Smirnov	G01EYF	Computes probabilities for the one-sample Kolmogorov-Smirnov distribution
		G01EZF	Computes probabilities for the two-sample Kolmogorov-Smirnov distribution
<b>L5a1n</b>	Negative binomial, normal	G01EAF	Computes probabilities for the standard Normal distribution
		G01MBF	Computes reciprocal of Mills' Ratio
		S15ABF	Cumulative normal distribution function $P(x)$
		S15ACF	Complement of cumulative normal distribution function $Q(x)$
<b>L5a1p</b>	Pareto, Poisson	G01BKF	Poisson distribution function
<b>L5a1t</b>	$t$ distribution	G01EBF	Computes probabilities for Student's $t$ -distribution
		G01GBF	Computes probabilities for the non-central Student's $t$ -distribution
<b>L5a1v</b>	Von Mises	G01ERF	Computes probability for Von Mises distribution
<b>L5a2</b>	Inverse distribution functions, sparsity functions	G01FMF	Computes deviates for the Studentized range statistic
<b>L5a2b</b>	Beta, binomial	G01FEF	Computes deviates for the beta distribution
<b>L5a2c</b>	Cauchy, $\chi^2$	G01FCF	Computes deviates for the $\chi^2$ distribution
<b>L5a2f</b>	$F$ distribution	G01FDF	Computes deviates for the $F$ -distribution
<b>L5a2g</b>	Gamma, general, geometric	G01FFF	Computes deviates for the gamma distribution
<b>L5a2n</b>	Negative binomial, normal, normal order statistics	G01DAF	Normal scores, accurate values
		G01DBF	Normal scores, approximate values
		G01FAF	Computes deviates for the standard Normal distribution
<b>L5a2t</b>	$t$ distribution	G01FBF	Computes deviates for Student's $t$ -distribution
<b>L5b</b>	Multivariate	G01NAF	Cumulants and moments of quadratic forms in Normal variables
		G01NBF	Moments of ratios of quadratic forms in Normal variables, and related statistics
<b>L5b1</b>	Cumulative multivariate distribution functions, probability density functions		
<b>L5b1n</b>	Normal	G01HAF	Computes probability for the bivariate Normal distribution
		G01HBF	Computes probabilities for the multivariate Normal distribution
<b>L6</b>	Random number generation		
<b>L6a</b>	Univariate	G05EYF	Pseudo-random integer from reference vector
<b>L6a12</b>	Lambda, logistic, lognormal	G05DCF	Pseudo-random real numbers, logistic distribution
		G05DEF	Pseudo-random real numbers, lognormal distribution
<b>L6a14</b>	Negative binomial, normal, normal order statistics	G05DDF	Pseudo-random real numbers, Normal distribution
		G05EEF	Set up reference vector for generating pseudo-random integers, negative binomial distribution
		G05FDF	Generates a vector of random numbers from a Normal distribution
<b>L6a16</b>	Pareto, Pascal, permutations, Poisson	G05DRF	Pseudo-random integer, Poisson distribution

		G05ECF	Set up reference vector for generating pseudo-random integers, Poisson distribution
		G05EHF	Pseudo-random permutation of an integer vector
<b>L6a19</b>	Samples, stable distribution		
		G05EJF	Pseudo-random sample from an integer vector
<b>L6a2</b>	Beta, binomial, Boolean		
		G05DZF	Pseudo-random logical (boolean) value
		G05EDF	Set up reference vector for generating pseudo-random integers, binomial distribution
		G05FEF	Generates a vector of pseudo-random numbers from a beta distribution
<b>L6a20</b>	$t$ distribution, time series, triangular		
		G05DJF	Pseudo-random real numbers, Student's $t$ -distribution
		G05EGF	Set up reference vector for univariate ARMA time series model
		G05EWF	Generate next term from reference vector for ARMA time series model
<b>L6a21</b>	Uniform (continuous, discrete), uniform order statistics		
		G05CAF	Pseudo-random real numbers, uniform distribution over (0,1)
		G05DAF	Pseudo-random real numbers, uniform distribution over ( $a, b$ )
		G05DYF	Pseudo-random integer from uniform distribution
		G05EBF	Set up reference vector for generating pseudo-random integers, uniform distribution
		G05FAF	Generates a vector of random numbers from a uniform distribution
<b>L6a22</b>	Von Mises		
		G05FSF	Generates vector of pseudo-random variates from Von Mises distribution
<b>L6a23</b>	Weibull		
		G05DPF	Pseudo-random real numbers, Weibull distribution
<b>L6a3</b>	Cauchy, $\chi^2$		
		G05DFF	Pseudo-random real numbers, Cauchy distribution
		G05DHF	Pseudo-random real numbers, $\chi^2$ distribution
<b>L6a5</b>	Exponential, extreme value		
		G05DBF	Pseudo-random real numbers, (negative) exponential distribution
		G05FBF	Generates a vector of random numbers from an (negative) exponential distribution
<b>L6a6</b>	$F$ distribution		
		G05DKF	Pseudo-random real numbers, $F$ -distribution
<b>L6a7</b>	Gamma, general (continuous, discrete), geometric		
		G05EXF	Set up reference vector from supplied cumulative distribution function or probability distribution function
		G05FFF	Generates a vector of pseudo-random numbers from a gamma distribution
<b>L6a8</b>	Halfnormal, hypergeometric		
		G05EFF	Set up reference vector for generating pseudo-random integers, hypergeometric distribution
<b>L6b</b>	Multivariate		
		G05HDF	Generates a realisation of a multivariate time series from a VARMA model
<b>L6b14</b>	Normal		
		G05EAF	Set up reference vector for multivariate Normal distribution
		G05EZF	Pseudo-random multivariate Normal vector from reference vector
<b>L6b15</b>	Orthogonal matrix		
		G05GAF	Computes random orthogonal matrix
<b>L6b3</b>	Contingency table, correlation matrix		
		G05GBF	Computes random correlation matrix
<b>L6c</b>	Service routines (e.g., seed)		
		G05CBF	Initialise random number generating routines to give repeatable sequence
		G05CCF	Initialise random number generating routines to give non-repeatable sequence
		G05CFF	Save state of random number generating routines
		G05CGF	Restore state of random number generating routines
<b>L7</b>	Analysis of variance (including analysis of covariance)		
<b>L7a</b>	One-way		
<b>L7a1</b>	Parametric		
		G04BBF	Analysis of variance, randomized block or completely randomized design, treatment means and standard errors
		G04DAF	Computes sum of squares for contrast between means
		G04DBF	Computes confidence intervals for differences between means computed by G04BBF or G04BCF
<b>L7a2</b>	Nonparametric		
		G08AFF	Kruskal-Wallis one-way analysis of variance on $k$ samples of unequal size
<b>L7b</b>	Two-way (search also class L7d)		
		G04AGF	Two-way analysis of variance, hierarchical classification, subgroups of unequal size
		G04BBF	Analysis of variance, randomized block or completely randomized design, treatment means and standard errors
		G08AEF	Friedman two-way analysis of variance on $k$ matched samples
		G08ALF	Performs the Cochran $Q$ test on cross-classified binary data
<b>L7c</b>	Three-way (e.g., Latin squares) (search also class L7d)		
		G04BCF	Analysis of variance, general row and column design, treatment means and standard errors
<b>L7d</b>	Multi-way		
<b>L7d1</b>	Balanced complete data (e.g., factorial designs)		

	G04CAF	Analysis of variance, complete factorial design, treatment means and standard errors
<b>L7d2</b>	Balanced incomplete data	
	F04JLF	Real general Gauss–Markov linear model (including weighted least-squares)
<b>L7f</b>	Generate experimental designs	
	G02DAF	Fits a general (multiple) linear regression model
	G02DNF	Computes estimable function of a general linear regression model and its standard error
<b>L7g</b>	Service routines	
	G04EAF	Computes orthogonal polynomials or dummy variables for factor/classification variable
<b>L8</b>	Regression ( <i>search also classes D5, D6, D9, G, K</i> )	
<b>L8a</b>	Simple linear (i.e., $y = b_0 + b_1x$ ) ( <i>search also class L8h</i> )	
<b>L8a1</b>	Ordinary least squares	
<b>L8a1a</b>	Parameter estimation	
<b>L8a1a1</b>	Unweighted data	
	G02CAF	Simple linear regression with constant term, no missing values
	G02CBF	Simple linear regression without constant term, no missing values
	G02CCF	Simple linear regression with constant term, missing values
	G02CDF	Simple linear regression without constant term, missing values
<b>L8a2</b>	$L_p$ for $p$ different from 2 (e.g. least absolute value, minimax)	
	E02GAF	$L_1$ -approximation by general linear function
	E02GCF	$L_\infty$ -approximation by general linear function
<b>L8b</b>	Polynomial (e.g., $y = b_0 + b_1x + b_2x^2$ ) ( <i>search also class L8c</i> )	
<b>L8b1</b>	Ordinary least squares	
<b>L8b1b</b>	Parameter estimation	
<b>L8b1b2</b>	Using orthogonal polynomials	
	E02ADF	Least-squares curve fit, by polynomials, arbitrary data points
<b>L8c</b>	Multiple linear (i.e. $y = b_0 + b_1x_1 + \dots + b_px_p$ )	
	F04JLF	Real general Gauss–Markov linear model (including weighted least-squares)
	F04JMF	Equality-constrained real linear least squares problem
<b>L8c1</b>	Ordinary least squares	
<b>L8c1a</b>	Variable selection	
	G02ECF	Calculates $R^2$ and $C_P$ values from residual sums of squares
<b>L8c1a1</b>	Using raw data	
	G02DDF	Estimates of linear parameters and general linear regression model from updated model
	G02DEF	Add a new variable to a general linear regression model
	G02DFF	Delete a variable from a general linear regression model
	G02EAF	Computes residual sums of squares for all possible linear regressions for a set of independent variables
	G02EEF	Fits a linear regression model by forward selection
<b>L8c1b</b>	Parameter estimation ( <i>search also class L8c1a</i> )	
<b>L8c1b1</b>	Using raw data	
	G02DAF	Fits a general (multiple) linear regression model
	G02DCF	Add/delete an observation to/from a general linear regression model
	G02DDF	Estimates of linear parameters and general linear regression model from updated model
	G02DEF	Add a new variable to a general linear regression model
	G02DFF	Delete a variable from a general linear regression model
	G02DKF	Estimates and standard errors of parameters of a general linear regression model for given constraints
	G02DNF	Computes estimable function of a general linear regression model and its standard error
<b>L8c1b2</b>	Using correlation data	
	G02CGF	Multiple linear regression, from correlation coefficients, with constant term
	G02CHF	Multiple linear regression, from correlation-like coefficients, without constant term
<b>L8c1c</b>	Analysis ( <i>search also classes L8c1a and L8c1b</i> )	
	G02FAF	Calculates standardized residuals and influence statistics
<b>L8c1d</b>	Inference ( <i>search also classes L8c1a and L8c1b</i> )	
	G02DNF	Computes estimable function of a general linear regression model and its standard error
	G02FCF	Computes Durbin–Watson test statistic
<b>L8c2</b>	Several regressions	
	G02DGF	Fits a general linear regression model for new dependent variable
<b>L8c4</b>	Robust	
	G02HAF	Robust regression, standard $M$ -estimates
	G02HBF	Robust regression, compute weights for use with G02HDF
	G02HDF	Robust regression, compute regression with user-supplied functions and weights
	G02HFF	Robust regression, variance-covariance matrix following G02HDF
<b>L8c6</b>	Models based on ranks	
	G08RAF	Regression using ranks, uncensored data
	G08RBF	Regression using ranks, right-censored data

- L8e** Nonlinear (i.e.,  $y = F(X, b)$ ) (*search also class L8h*)
- G02GBF Fits a generalized linear model with binomial errors
  - G02GCF Fits a generalized linear model with Poisson errors
  - G02GDF Fits a generalized linear model with gamma errors
  - G02GKF Estimates and standard errors of parameters of a general linear model for given constraints
  - G02GNF Computes estimable function of a generalized linear model and its standard error
- L8e1** Ordinary least squares
- L8e1b** Parameter estimation (*search also class L8e1a*)
- E04YCF Covariance matrix for nonlinear least-squares problem (unconstrained)
  - G02GAF Fits a generalized linear model with Normal errors
- L8e1b1** Unweighted data, user provides no derivatives
- E04FCF Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using function values only (comprehensive)
  - E04FYF Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using function values only (easy-to-use)
  - E04UNF Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
- L8e1b2** Unweighted data, user provides derivatives
- E04GBF Unconstrained minimum of a sum of squares, combined Gauss–Newton and quasi-Newton algorithm using 1st derivatives (comprehensive)
  - E04GDF Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using 1st derivatives (comprehensive)
  - E04GYF Unconstrained minimum of a sum of squares, combined Gauss–Newton and quasi-Newton algorithm, using 1st derivatives (easy-to-use)
  - E04GZF Unconstrained minimum of a sum of squares, combined Gauss–Newton and modified Newton algorithm using 1st derivatives (easy-to-use)
  - E04UNF Minimum of a sum of squares, nonlinear constraints, sequential QP method, using function values and optionally 1st derivatives (comprehensive)
- L8g** Spline (i.e., piecewise polynomial)
- E02BAF Least-squares curve cubic spline fit (including interpolation)
  - E02BEF Least-squares cubic spline curve fit, automatic knot placement
  - G10ABF Fit cubic smoothing spline, smoothing parameter given
  - G10ACF Fit cubic smoothing spline, smoothing parameter estimated
- L8h** EDA (e.g., smoothing)
- G10CAF Compute smoothed data sequence using running median smoothers
- L8i** Service routines (e.g., matrix manipulation for variable selection)
- G02CEF Service routines for multiple linear regression, select elements from vectors and matrices
  - G02CFF Service routines for multiple linear regression, re-order elements of vectors and matrices
  - G04EAF Computes orthogonal polynomials or dummy variables for factor/classification variable
  - G10ZAF Reorder data to give ordered distinct observations
- L9** Categorical data analysis
- G11BAF Computes multiway table from set of classification factors using selected statistic
  - G11BBF Computes multiway table from set of classification factors using given percentile/quantile
  - G11BCF Computes marginal tables for multiway table computed by G11BAF or G11BBF
- L9b** Two-way tables (*search also class L9d*)
- G01AFF Two-way contingency table analysis, with  $\chi^2$ /Fisher’s exact test
  - G11AAF  $\chi^2$  statistics for two-way contingency table
- L9c** Log-linear model
- G02GCF Fits a generalized linear model with Poisson errors
  - G02GKF Estimates and standard errors of parameters of a general linear model for given constraints
  - G02GNF Computes estimable function of a generalized linear model and its standard error
- M** Simulation, stochastic modelling (*search also classes L6 and L10*)
- N** Data handling (*search also class L2*)
- N1** Input, output
- X04BAF Write formatted record to external file
  - X04BBF Read formatted record from external file
  - X04CAF Print a real general matrix (easy-to-use)
  - X04CFB Print a real general matrix (comprehensive)
  - X04CCF Print a real packed triangular matrix (easy-to-use)
  - X04CDF Print a real packed triangular matrix (comprehensive)
  - X04CEF Print a real packed banded matrix (easy-to-use)
  - X04CFF Print a real packed banded matrix (comprehensive)
  - X04DAF Print a complex general matrix (easy-to-use)
  - X04DBF Print a complex general matrix (comprehensive)
  - X04DCF Print a complex packed triangular matrix (easy-to-use)
  - X04DDF Print a complex packed triangular matrix (comprehensive)

		X04DEF	Print a complex packed banded matrix (easy-to-use)
		X04DFF	Print a complex packed banded matrix (comprehensive)
		X04EAF	Print an integer matrix (easy-to-use)
		X04EBF	Print an integer matrix (comprehensive)
<b>N4</b>	Storage management (e.g., stacks, heaps, trees)		
		F06EUF	Gather a real sparse vector (SGTHR/DGTHR)
		F06EVF	Gather and set to zero a real sparse vector (SGTHRZ/DGTHRZ)
		F06EWF	Scatter a real sparse vector (SSCTR/DSCTR)
		F06GUF	Gather a complex sparse vector (CGTHR/ZGTHR)
		F06GVF	Gather and set to zero a complex sparse vector (CGTHRZ/ZGTHRZ)
		F06GWF	Scatter a complex sparse vector (CSCTR/ZSCTR)
<b>N5</b>	Searching		
<b>N5a</b>	Extreme value		
		F06FLF	Elements of real vector with largest and smallest absolute value
		F06JLF	Index, real vector element with largest absolute value (ISAMAX/IDAMAX)
		F06JMF	Index, complex vector element with largest absolute value (ICAMAX/IZAMAX)
		F06KLF	Last non-negligible element of real vector
<b>N6</b>	Sorting		
<b>N6a</b>	Internal		
<b>N6a1</b>	Passive (i.e. construct pointer array, rank)		
		M01DZF	Rank arbitrary data
<b>N6a1a</b>	Integer		
		M01DBF	Rank a vector, integer numbers
		M01DFF	Rank rows of a matrix, integer numbers
		M01DKF	Rank columns of a matrix, integer numbers
<b>N6a1b</b>	Real		
		G01DHF	Ranks, Normal scores, approximate Normal scores or exponential (Savage) scores
		M01DAF	Rank a vector, real numbers
		M01DEF	Rank rows of a matrix, real numbers
		M01DJF	Rank columns of a matrix, real numbers
<b>N6a1c</b>	Character		
		M01DCF	Rank a vector, character data
<b>N6a2</b>	Active		
<b>N6a2a</b>	Integer		
		M01CBF	Sort a vector, integer numbers
<b>N6a2b</b>	Real		
		M01CAF	Sort a vector, real numbers
<b>N6a2c</b>	Character		
		M01CCF	Sort a vector, character data
<b>N8</b>	Permuting		
		F06QJF	Permute rows or columns, real rectangular matrix, permutations represented by an integer array
		F06QKF	Permute rows or columns, real rectangular matrix, permutations represented by a real array
		F06VJF	Permute rows or columns, complex rectangular matrix, permutations represented by an integer array
		F06VKF	Permute rows or columns, complex rectangular matrix, permutations represented by a real array
		M01EAF	Rearrange a vector according to given ranks, real numbers
		M01EBF	Rearrange a vector according to given ranks, integer numbers
		M01ECF	Rearrange a vector according to given ranks, character data
		M01ZAF	Invert a permutation
		M01ZBF	Check validity of a permutation
		M01ZCF	Decompose a permutation into cycles
<b>P</b>	Computational geometry ( <i>search also classes G and Q</i> )		
		D03MAF	Triangulation of a plane region
<b>Q</b>	Graphics ( <i>search also class L3</i> )		
		G01ARF	Constructs a stem and leaf plot
		G01ASF	Constructs a box and whisker plot
<b>R</b>	Service routines		
		A00AAF	Prints details of the NAG Fortran Library implementation
		X05AAF	Return date and time as an array of integers
		X05ABF	Convert array of integers representing date and time to character string
		X05ACF	Compare two character strings representing date and time
		X05BAF	Return the CPU time
<b>R1</b>	Machine-dependent constants		
		X01AAF	Provides the mathematical constant $\pi$
		X01ABF	Provides the mathematical constant $\gamma$ (Euler's Constant)
		X02AHF	The largest permissible argument for sin and cos
		X02AJF	The machine precision
		X02AKF	The smallest positive model number

	X02ALF	The largest positive model number
	X02AMF	The safe range parameter
	X02ANF	The safe range parameter for complex floating-point arithmetic
	X02BBF	The largest representable integer
	X02BEF	The maximum number of decimal digits that can be represented
	X02BHF	The floating-point model parameter, $b$
	X02BJF	The floating-point model parameter, $p$
	X02BKF	The floating-point model parameter $e_{\min}$
	X02BLF	The floating-point model parameter $e_{\max}$
	X02DAF	Switch for taking precautions to avoid underflow
	X02DJF	The floating-point model parameter ROUNDS
<b>R3</b>	Error handling	
<b>R3b</b>	Set unit number for error messages	
	X04AAF	Return or set unit number for error messages
	X04ABF	Return or set unit number for advisory messages
<b>R3c</b>	Other utilities	
	P01ABF	Return value of error indicator/terminate with error message

## References

- [1] Boisvert R F, Howe S E and Kahaner D K (1990) The guide to available mathematical software problem classification scheme. *Report NISTIR 4475* Applied and Computational Mathematics Division, National Institute of Standards and Technology.
  - [2] Boisvert R F, Howe S E and Kahaner D K (1985) GAMS — a framework for the management of scientific software. *ACM Trans. Math. Software* **11** 313–355.
  - [3] Boisvert R F (1989) The guide to available mathematical software advisory system. *Math. Comput. Simul.* **31** 453–464.
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