NAG C Library

Mark 7 Library Contents

a00 – Library Identification

Routine Name	Mark of Introduction	Purpose
a00aac	1	nag_implementation_details Library identification, details of implementation and mark

a02 – Complex Arithmetic

Routine Name	Mark of Introduction	Purpose
a02bac	2	nag_complex Complex number from real and imaginary parts
a02bbc	2	nag_complex_real Real part of a complex number
a02bcc	2	nag_complex_imag Imaginary part of a complex number
a02cac	2	nag_complex_add Addition of two complex numbers
a02cbc	2	nag_complex_subtract Subtraction of two complex numbers
a02ccc	2	nag_complex_multiply Multiplication of two complex numbers
a02cdc	2	nag_complex_divide Quotient of two complex numbers
a02cec	2	nag_complex_negate Negation of a complex number
a02cfc	2	nag_complex_conjg Conjugate of a complex number
a02cgc	2	nag_complex_equal Equality of two complex numbers
a02chc	2	nag_complex_not_equal Inequality of two complex numbers
a02dac	2	nag_complex_arg Argument of a complex number
a02dbc	2	nag_complex_abs Modulus of a complex number
a02dcc	2	nag_complex_sqrt Square root of a complex number
a02ddc	2	nag_complex_i_power Complex number raised to integer power
a02dec	2	nag_complex_r_power Complex number raised to real power
a02dfc	2	nag_complex_c_power Complex number raised to complex power
a02dgc	2	nag_complex_log Complex logarithm
a02dhc	2	nag_complex_exp Complex exponential
a02djc	2	nag_complex_sin Complex sine

a02dkc	2	nag_complex_cos Complex cosine
a02dlc	2	nag_complex_tan Complex tangent

c02 – Zeros of Polynomials

Routine Name	Mark of Introduction	Purpose
c02afc	2	nag_zeros_complex_poly Zeros of a polynomial with complex coefficients
c02agc	2	nag_zeros_real_poly Zeros of a polynomial with real coefficients
c02akc	6	nag_cubic_roots Zeros of a cubic polynomial with real coefficients
c02alc	6	nag_quartic_roots Zeros of a real quartic polynomial with real coefficients

c05 – Roots of One or More Transcendental Equations

Routine Name	Mark of Introduction	Purpose
c05adc	2	nag_zero_cont_func_bd Zero of a continuous function of one variable
c05nbc	2	nag_zero_nonlin_eqns Solution of a system of nonlinear equations (function values only)
c05pbc	2	nag_zero_nonlin_eqns_deriv Solution of a system of nonlinear equations (using first derivatives)
c05sdc	5	nag_zero_cont_func_bd_1 Zero of a continuous function of one variable, thread-safe
c05tbc	5	nag_zero_nonlin_eqns_1 Solution of a system of nonlinear equations (function values only), thread-safe
c05ubc	5	nag_zero_nonlin_eqns_deriv_1 Solution of a system of nonlinear equations (using first derivatives), thread-safe
c05zbc	2	nag_check_deriv Derivative checker for nag_zero_nonlin_eqns_deriv (c05pbc)
c05zcc	5	nag_check_deriv_1 Derivative checker for nag_zero_nonlin_eqns_deriv_1 (c05ubc), thread-safe

c06 – Fourier Transforms

Routine Name	Mark of Introduction	Purpose
c06eac	1	nag_fft_real Single one-dimensional real discrete Fourier transform
c06ebc	1	nag_fft_hermitian Single one-dimensional Hermitian discrete Fourier transform
c06ecc	1	nag_fft_complex Single one-dimensional complex discrete Fourier transform
c06ekc	1	nag_convolution_real Circular convolution or correlation of two real vectors
c06fpc	1	nag_fft_multiple_real Multiple one-dimensional real discrete Fourier transforms
c06fqc	1	nag_fft_multiple_hermitian Multiple one-dimensional Hermitian discrete Fourier transforms

c06frc	1	nag_fft_multiple_complex Multiple one-dimensional complex discrete Fourier transforms
c06fuc	1	nag_fft_2d_complex two-dimensional complex discrete Fourier transform
c06gbc	1	nag_conjugate_hermitian Complex conjugate of Hermitian sequence
c06gcc	1	nag_conjugate_complex Complex conjugate of complex sequence
c06gqc	1	nag_multiple_conjugate_hermitian Complex conjugate of multiple Hermitian sequences
c06gsc	1	nag_multiple_hermitian_to_complex Convert Hermitian sequences to general complex sequences
c06gzc	1	nag_fft_init_trig Initialisation function for other c06 functions
c06hac	2	nag_fft_multiple_sine Discrete sine transform
c06hbc	2	nag_fft_multiple_cosine Discrete cosine transform
c06hcc	2	nag_fft_multiple_qtr_sine Discrete quarter-wave sine transform
c06hdc	2	nag_fft_multiple_qtr_cosine Discrete quarter-wave cosine transform
c06pfc	7	nag_fft_multid_single One-dimensional complex discrete Fourier transform of multi-dimensional data (using complex data type)
c06pjc	7	nag_fft_multid_full Multi-dimensional complex discrete Fourier transform of multi-dimensional data (using complex data type)
c06pxc	7	nag_fft_3d Three-dimensional complex discrete Fourier transform, complex data format

d01 – Quadrature

Routine Name	Mark of Introduction	Purpose
d01ajc	2	nag_1d_quad_gen One-dimensional adaptive quadrature, allowing for badly behaved integrands
d01akc	2	nag_1d_quad_osc One-dimensional adaptive quadrature, suitable for oscillating functions
d01alc	2	nag_1d_quad_brkpts One-dimensional adaptive quadrature, allowing for singularities at specified points
d01amc	2	nag_1d_quad_inf One-dimensional adaptive quadrature over infinite or semi-infinite interval
d01anc	2	nag_1d_quad_wt_trig One-dimensional adaptive quadrature, finite interval, sine or cosine weight functions
d01apc	2	nag_1d_quad_wt_alglog One-dimensional adaptive quadrature, weight function with end-point singularities of algebraic-logarithmic type
d01aqc	2	nag_1d_quad_wt_cauchy One-dimensional adaptive quadrature, weight function $1/(x-c)$, Cauchy principal value
d01asc	2	nag_1d_quad_inf_wt_trig One-dimensional adaptive quadrature, semi-infinite interval, sine or cosine weight function
d01bac	2	nag_1d_quad_guass One-dimensional Gaussian quadrature rule evaluation

d01fcc	2	nag_multid_quad_adapt Multi-dimensional adaptive quadrature
d01gac	2	nag_1d_quad_vals One-dimensional integration of a function defined by data values only
d01gbc	2	nag_multid_quad_monte_carlo Multi-dimensional quadrature, using Monte Carlo method
d01sjc	5	nag_1d_quad_gen_1 One-dimensional adaptive quadrature, allowing for badly behaved integrands, thread-safe
d01skc	5	nag_1d_quad_osc_1 One-dimensional adaptive quadrature, suitable for oscillating functions, thread-safe
d01slc	5	nag_1d_quad_brkpts_1 One-dimensional adaptive quadrature, allowing for singularities at specified points, thread-safe
d01smc	5	nag_1d_quad_inf_1 One-dimensional adaptive quadrature over infinite or semi-infinite interval, thread-safe
d01snc	5	nag_1d_quad_wt_trig_1 One-dimensional adaptive quadrature, finite interval, sine or cosine weight functions, thread-safe
d01spc	5	nag_1d_quad_wt_alglog_1 One-dimensional adaptive quadrature, weight function with end-point singularities of algebraic-logarithmic type, thread-safe
d01sqc	5	nag_1d_quad_wt_cauchy_1 One-dimensional adaptive quadrature, weight function $1/(x-c)$, Cauchy principal value, thread-safe
d01ssc	5	nag_1d_quad_inf_wt_trig_1 One-dimensional adaptive quadrature, semi-infinite interval, sine or cosine weight function, thread-safe
d01tac	5	nag_1d_quad_gauss_1 One-dimensional Gaussian quadrature rule evaluation, thread-safe
d01wcc	5	nag_multid_quad_adapt_1 Multi-dimensional adaptive quadrature, thread-safe
d01xbc	5	nag_multid_quad_monte_carlo_1 Multi-dimensional quadrature, using Monte Carlo method, thread-safe

d02 – Ordinary Differential Equations

Routine Name	Mark of Introduction	Purpose
d02cjc	2	nag_ode_ivp_adams_gen Ordinary differential equation solver using a variable-order variable-step Adams method (Black Box)
d02ejc	3	nag_ode_ivp_bdf_gen Ordinary differential equations solver, stiff, initial value problems using the Backward Differentiation Formulae
d02gac	3	nag_ode_bvp_fd_nonlin_fixedbc Ordinary differential equations solver, for simple nonlinear two-point boundary value problems, using a finite difference technique with deferred correction
d02gbc	3	nag_ode_bvp_fd_lin_gen Ordinary differential equations solver, for general linear two-point boundary value problems, using a finite difference technique with deferred correction
d02pcc	3	nag_ode_ivp_rk_range Ordinary differential equations solver, initial value problems over a range using Runge–Kutta methods

d02pdc	3	nag_ode_ivp_rk_onestep Ordinary differential equations solver, initial value problems, one time step using Runge–Kutta methods
d02ppc	3	nag_ode_ivp_rk_free Freeing function for use with the Runge–Kutta suite (d02p functions)
d02pvc	3	nag_ode_ivp_rk_setup Setup function for use with nag_ode_ivp_rk_range (d02pcc) and/or nag_ode_ivp_rk_onestep (d02pdc)
d02pwc	3	nag_ode_ivp_rk_reset_tend A function to re-set the end point following a call to nag_ode_ivp_rk_onestep (d02pdc)
d02pxc	3	nag_ode_ivp_rk_interp Ordinary differential equations solver, computes the solution by interpolation anywhere on an integration step taken by nag_ode_ivp_rk_onestep (d02pdc)
d02pzc	3	nag_ode_ivp_rk_errass A function to provide global error assessment during an integration with either nag_ode_ivp_rk_range (d02pcc) or nag_ode_ivp_rk_onestep (d02pdc)
d02qfc	2	nag_ode_ivp_adams_roots Ordinary differential equation solver using Adams method (sophisticated use)
d02qwc	2	nag_ode_ivp_adams_setup Setup function for nag_ode_ivp_adams_roots (d02qfc)
d02qyc	2	nag_ode_ivp_adams_free Freeing function for use with nag_ode_ivp_adams_roots (d02qfc)
d02qzc	2	nag_ode_ivp_adams_interp Interpolation function for use with nag_ode_ivp_adams_roots (d02qfc)
d02rac	3	nag_ode_bvp_fd_nonlin_gen Ordinary differential equations solver, for general nonlinear two-point boundary value problems, using a finite difference technique with deferred correction

d03 – Partial Differential Equations

Routine Name	Mark of Introduction	Purpose
d03ncc	7	nag_pde_bs_1d Finite difference solution of the Black–Scholes equations
d03ndc	7	nag_pde_bs_1d_analytic Analytic solution of the Black–Scholes equations
d03nec	7	nag_pde_bs_1d_means Compute average values for nag_pde_bs_1d_analytic (d03ndc)
d03pcc	7	nag_pde_parab_1d_fd General system of parabolic PDEs, method of lines, finite differences, one space variable
d03pdc	7	nag_pde_parab_1d_coll General system of parabolic PDEs, method of lines, Chebyshev C^0 collocation, one space variable
d03pec	7	nag_pde_parab_1d_keller General system of first-order PDEs, method of lines, Keller box discretisation, one space variable
d03pfc	7	nag_pde_parab_1d_cd 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
d03phc	7	nag_pde_parab_1d_fd_ode General system of parabolic PDEs, coupled DAEs, method of lines, finite differences, one space variable
d03pjc	7	nag_pde_parab_1d_coll_ode General system of parabolic PDEs, coupled DAEs, method of lines, Chebyshev C^0 collocation, one space variable

d03pkc	7	nag_pde_parab_1d_keller_ode General system of first-order PDEs, coupled DAEs, method of lines, Keller box discretisation, one space variable
d03plc	7	nag_pde_parab_1d_cd_ode 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
d03ppc	7	nag_pde_parab_1d_fd_ode_remesh General system of parabolic PDEs, coupled DAEs, method of lines, finite differences, remeshing, one space variable
d03prc	7	nag_pde_parab_1d_keller_ode_remesh General system of first-order PDEs, coupled DAEs, method of lines, Keller box discretisation, remeshing, one space variable
d03psc	7	nag_pde_parab_1d_cd_ode_remesh 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
d03puc	7	nag_pde_parab_1d_euler_roe Roe's approximate Riemann solver for Euler equations in conservative form, for use with nag_pde_parab_1d_cd (d03pfc), nag_pde_parab_1d_cd_ode (d03plc) and nag_pde_parab_1d_cd_ode_remesh (d03psc)
d03pvc	7	nag_pde_parab_1d_euler_osher Osher's approximate Riemann solver for Euler equations in conservative form, for use with nag_pde_parab_1d_cd (d03pfc), nag_pde_parab_1d_cd_ode (d03plc) and nag_pde_parab_1d_cd_ode_remesh (d03psc)
d03pwc	7	nag_pde_parab_1d_euler_hll Modified HLL Riemann solver for Euler equations in conservative form, for use with nag_pde_parab_1d_cd (d03pfc), nag_pde_parab_1d_cd_ode (d03plc) and nag_pde_parab_1d_cd_ode_remesh (d03psc)
d03pxc	7	nag_pde_parab_1d_euler_exact Exact Riemann Solver for Euler equations in conservative form, for use with nag_pde_parab_1d_cd (d03pfc), nag_pde_parab_1d_cd_ode (d03plc) and nag_pde_parab_1d_cd_ode_remesh (d03psc)
d03pyc	7	nag_pde_interp_1d_coll PDEs, spatial interpolation with nag_pde_parab_1d_coll (d03pdc) or nag_pde_parab_1d_coll_ode (d03pjc)
d03pzc	7	nag_pde_interp_1d_fd PDEs, spatial interpolation with nag_pde_parab_1d_fd (d03pcc), nag_pde_parab_1d_keller (d03pec), nag_pde_parab_1d_cd (d03pfc), nag_pde_parab_1d_fd_ode (d03phc), nag_pde_parab_1d_keller_ode (d03pkc), nag_pde_parab_1d_cd_ode (d03plc), nag_pde_parab_1d_fd_ode_remesh (d03ppc), nag_pde_parab_1d_keller_ode_remesh (d03prc) or nag_pde_parab_1d_cd_ode_remesh (d03psc)

d06 – Mesh Generation

Routine Name	Mark of Introduction	Purpose
d06aac	7	nag_mesh2d_inc Generates a two-dimensional mesh using a simple incremental method
d06abc	7	nag_mesh2d_delaunay Generates a two-dimensional mesh using a Delaunay–Voronoi process
d06acc	7	nag_mesh2d_front Generates a two-dimensional mesh using an Advancing-front method
d06bac	7	nag_mesh2d_bound Generates a boundary mesh
d06cac	7	nag_mesh2d_smooth Uses a barycentering technique to smooth a given mesh

d06cbc	7	nag_mesh2d_sparse Generates a sparsity pattern of a Finite Element matrix associated with a given mesh
d06ccc	7	nag_mesh2d_renum Renumbers a given mesh using Gibbs method
d06dac	7	nag_mesh2d_trans Generates a mesh resulting from an affine transformation of a given mesh
d06dbc	7	nag_mesh2d_join Joins together two given adjacent (possibly overlapping) meshes

e01 – Interpolation

Routine Name	Mark of Introduction	Purpose
e01aec	7	nag_1d_cheb_interp Interpolating functions, polynomial interpolant, data may include derivative values, one variable
e01bac	2	nag_1d_spline_interpolant Interpolating function, cubic spline interpolant, one variable
e01bec	1	nag_monotonic_interpolant Interpolating function, monotonicity-preserving, piecewise cubic Hermite, one variable
e01bfc	1	nag_monotonic_evaluate Evaluation of interpolant computed by nag_monotonic_interpolant (e01bec), function only
e01bgc	2	nag_monotonic_deriv Evaluation of interpolant computed by nag_monotonic_interpolant (e01bec), function and first derivative
e01bhc	2	nag_monotonic_intg Evaluation of interpolant computed by nag_monotonic_interpolant (e01bec), definite integral
e01dac	2	nag_2d_spline_interpolant Interpolating function, bicubic spline interpolant, two variables
e01rac	7	nag_1d_ratnl_interp Interpolating functions, rational interpolant, one variable
e01rbc	7	nag_1d_ratnl_eval Interpolated values, evaluate rational interpolant computed by nag_1d_ratnl_interp (e01rac), one variable
e01sac	3	nag_2d_scat_interpolant A function to generate a two-dimensional surface interpolating a set of data points, using either the method of Renka and Cline or the modified Shepard's method
e01sbc	3	nag_2d_scat_eval A function to evaluate, at a set of points, the two-dimensional interpolant function generated by nag_2d_scat_interpolant (e01sac)
e01szc	3	nag_2d_scat_free Freeing function for use with nag_2d_scat_eval (e01sbc)
e01tgc	7	nag_3d_shep_interp Interpolating functions, modified Shepard's method, three variables
e01thc	7	nag_3d_shep_eval Interpolated values, evaluate interpolant computed by nag_3d_shep_interp (e01tgc), function and first derivatives, three variables

e02 – Curve and Surface Fitting

Routine Name	Mark of Introduction	Purpose
e02adc	5	nag_1d_cheb_fit Computes the coefficients of a Chebyshev series polynomial for arbitrary data
e02aec	5	nag_1d_cheb_eval Evaluates the coefficients of a Chebyshev series polynomial
e02afc	5	nag_1d_cheb_interp_fit Computes the coefficients of a Chebyshev series polynomial for interpolated data
e02agc	7	nag_1d_cheb_fit_constr Least-squares polynomial fit, values and derivatives may be constrained, arbitrary data points
e02ahc	7	nag_1d_cheb_deriv Derivative of fitted polynomial in Chebyshev series form
e02ajc	7	nag_1d_cheb_intg Integral of fitted polynomial in Chebyshev series form
e02akc	7	nag_1d_cheb_eval2 Evaluation of fitted polynomial in one variable from Chebyshev series form
e02bac	2	nag_1d_spline_fit_knots Least-squares curve cubic spline fit (including interpolation), one variable
e02bbc	2	nag_1d_spline_evaluate Evaluation of fitted cubic spline, function only
e02bcc	2	nag_1d_spline_deriv Evaluation of fitted cubic spline, function and derivatives
e02bdc	2	nag_1d_spline_intg Evaluation of fitted cubic spline, definite integral
e02bec	2	nag_1d_spline_fit Least-squares cubic spline curve fit, automatic knot placement, one variable
e02cac	7	nag_2d_cheb_fit_lines Least-squares surface fit by polynomials, data on lines
e02cbc	7	nag_2d_cheb_eval Evaluation of fitted polynomial in two variables
e02dcc	2	nag_2d_spline_fit_grid Least-squares bicubic spline fit with automatic knot placement, two variables (rectangular grid)
e02ddc	2	nag_2d_spline_fit_scat Least-squares bicubic spline fit with automatic knot placement, two variables (scattered data)
e02dec	2	nag_2d_spline_eval Evaluation of bicubic spline, at a set of points
e02dfc	2	nag_2d_spline_eval_rect Evaluation of bicubic spline, at a mesh of points
e02gac	7	nag_lone_fit L_1-approximation by general linear function
e02gcc	7	nag_linf_fit L_∞-approximation by general linear function
e02rac	7	nag_1d_pade Padé-approximants
e02rbc	7	nag_1d_pade_eval Evaluation of fitted rational function as computed by nag_1d_pade (e02rac)

e04 – Minimizing or Maximizing a Function

Routine Name	Mark of Introduction	Purpose
e04abc	5	nag_opt_one_var_no_deriv Minimizes a function of one variable, using function values only
e04bbc	5	nag_opt_one_var_deriv Minimizes a function of one variable, requires first derivatives
e04ccc	4	nag_opt_simplex Unconstrained minimization using simplex algorithm
e04dgc	2	nag_opt_conj_grad Unconstrained minimization using conjugate gradients
e04fcc	2	nag_opt_lsq_no_deriv Unconstrained nonlinear least squares (no derivatives required)
e04gbc	2	nag_opt_lsq_deriv Unconstrained nonlinear least squares (first derivatives required)
e04hcc	2	nag_opt_check_deriv Derivative checker for use with nag_opt_bounds_deriv (e04kbc)
e04hdc	5	nag_opt_check_2nd_deriv Checks second derivatives of a user-defined function
e04jbc	2	nag_opt_bounds_no_deriv Bound constrained nonlinear minimization (no derivatives required)
e04kbc	2	nag_opt_bounds_deriv Bound constrained nonlinear minimization (first derivatives required)
e04lbc	5	nag_opt_bounds_2nd_deriv Solves bound constrained problems (first and second derivatives required)
e04mfc	2	nag_opt_lp Linear programming
e04myc	5	nag_opt_sparse_mps_free Free memory allocated by nag_opt_sparse_mps_read (e04mzc)
e04mzc	5	nag_opt_sparse_mps_read Read MPSX data for sparse LP or QP problem from a file
e04ncc	5	nag_opt_lin_lsq Solves linear least-squares and convex quadratic programming problems (non-sparse)
e04nfc	2	nag_opt_qp Quadratic programming
e04nkc	5	nag_opt_sparse_convex_qp Solves sparse linear programming or convex quadratic programming problems
e04ucc	4	nag_opt_nlp Minimization with nonlinear constraints using a sequential QP method
e04ugc	6	nag_opt_nlp_sparse NLP problem (sparse)
e04unc	5	nag_opt_nlin_lsq Solves nonlinear least-squares problems using the sequential QP method
e04xac	5	nag_opt_estimate_deriv Computes an approximation to the gradient vector and/or the Hessian matrix for use with nag_opt_nlp (e04ucc) and other nonlinear optimization functions
e04xxc	2	nag_opt_init Initialisation function for option setting
e04xyc	2	nag_opt_read Read options from a text file
e04xzc	2	nag_opt_free Memory freeing function for use with option setting
e04yac	2	nag_opt_lsq_check_deriv Least-squares derivative checker for use with nag_opt_lsq_deriv (e04gbc)
e04ycc	2	nag_opt_lsq_covariance Covariance matrix for nonlinear least-squares

f01 – Matrix Factorizations

Routine Name	Mark of Introduction	Purpose
f01bnc	1	nag_complex_cholesky UU^H factorization of complex Hermitian positive-definite matrix
f01mcc	1	nag_real_cholesky_skyline LDL^T factorization of real symmetric positive-definite variable-bandwidth (skyline) matrix
f01qcc	1	nag_real_qr QR factorization of real m by n matrix ($m \geq n$)
f01qdc	1	nag_real_apply_q Compute QB or Q^TB after factorization by nag_real_qr (f01qcc)
f01qec	1	nag_real_form_q Form columns of Q after factorization by nag_real_qr (f01qcc)
f01rcc	1	nag_complex_qr QR factorization of complex m by n matrix ($m \geq n$)
f01rdc	1	nag_complex_apply_q Compute QB or Q^HB after factorization by nag_complex_qr (f01rcc)
f01rec	1	nag_complex_form_q Form columns of Q after factorization by nag_complex_qr (f01rcc)

f02 – Eigenvalues and Eigenvectors

Routine Name	Mark of Introduction	Purpose
f02aac	1	nag_real_symm_eigenvalues All eigenvalues of real symmetric matrix
f02abc	1	nag_real_symm_eigensystem All eigenvalues and eigenvectors of real symmetric matrix
f02adc	1	nag_real_symm_general_eigenvalues All eigenvalues of generalized real symmetric-definite eigenproblem
f02aec	1	nag_real_symm_general_eigensystem All eigenvalues and eigenvectors of generalized real symmetric-definite eigenproblem
f02afc	1	nag_real_eigenvalues All eigenvalues of real matrix
f02agc	1	nag_real_eigensystem All eigenvalues and eigenvectors of real matrix
f02awc	2	nag_hermitian_eigenvalues All eigenvalues of complex Hermitian matrix
f02axc	2	nag_hermitian_eigensystem All eigenvalues and eigenvectors of complex Hermitian matrix
f02bjc	2	nag_real_general_eigensystem All eigenvalues and optionally eigenvectors of real generalized eigenproblem, by QZ algorithm
f02ecc	5	nag_real_eigensystem_sel Computes selected eigenvalues and eigenvectors of a real general matrix
f02gcc	5	nag_complex_eigensystem_sel Computes selected eigenvalues and eigenvectors of a complex general matrix
f02wec	1	nag_real_svd SVD of real matrix
f02xec	1	nag_complex_svd SVD of complex matrix

f03 – Determinants

Routine Name	Mark of Introduction	Purpose
f03aec	1	nag_real_cholesky LL^T factorization and determinant of real symmetric positive-definite matrix
f03afc	1	nag_real_lu LU factorization and determinant of real matrix
f03ahc	1	nag_complex_lu LU factorization and determinant of complex matrix

f04 – Simultaneous Linear Equations

Routine Name	Mark of Introduction	Purpose
f04adc	1	nag_complex_lin_eqn_mult_rhs Approximate solution of complex simultaneous linear equations with multiple right-hand sides
f04agc	1	nag_real_cholesky_solve_mult_rhs Approximate solution of real symmetric positive-definite simultaneous linear equations (coefficient matrix already factorized by nag_real_cholesky (f03aec))
f04ajc	1	nag_real_lu_solve_mult_rhs Approximate solution of real simultaneous linear equations (coefficient matrix already factorized by nag_real_lu (f03afc))
f04akc	1	nag_complex_lu_solve_mult_rhs Approximate solution of complex simultaneous linear equations (coefficient matrix already factorized by nag_complex_lu (f03ahc))
f04arc	1	nag_real_lin_eqn Approximate solution of real simultaneous linear equations, one right-hand side
f04awc	1	nag_hermitian_lin_eqn_mult_rhs Approximate solution of complex Hermitian positive-definite simultaneous linear equations (coefficient matrix already factorized by nag_complex_cholesky (f01bnc))
f04mcc	1	nag_real_cholesky_skyline_solve Approximate solution of real symmetric positive-definite variable-bandwidth simultaneous linear equations (coefficient matrix already factorized by nag_real_cholesky_skyline (f01mcc))

f06 – Linear Algebra Support Functions

Routine Name	Mark of Introduction	Purpose
f06pac	3	dgemv Matrix-vector product, real rectangular matrix
f06pbc	3	dgbmv Matrix-vector product, real rectangular band matrix
f06pcc	3	dsymv Matrix-vector product, real symmetric matrix
f06pdc	3	dsbmv Matrix-vector product, real symmetric band matrix
f06pec	3	dspmv Matrix-vector product, real symmetric packed matrix
f06pfc	3	dtrmv Matrix-vector product, real triangular matrix
f06pgc	3	dtbmv Matrix-vector product, real triangular band matrix

f06phc	3	dtpmv Matrix-vector product, real triangular packed matrix
f06pjc	3	dtrsv System of equations, real triangular matrix
f06pkc	3	dtbsv System of equations, real triangular band matrix
f06plc	3	dtpsv System of equations, real triangular packed matrix
f06pmc	3	dger Rank-1 update, real rectangular matrix
f06ppc	3	dsyr Rank-1 update, real symmetric matrix
f06pqc	3	dspr Rank-1 update, real symmetric packed matrix
f06prc	3	dsyr2 Rank-2 update, real symmetric matrix
f06psc	3	dspr2 Rank-2 update, real symmetric packed matrix
f06sac	3	zgemv Matrix-vector product, complex rectangular matrix
f06sbc	3	zgbmv Matrix-vector product, complex rectangular band matrix
f06scc	3	zhemv Matrix-vector product, complex Hermitian matrix
f06sdc	3	zhbmv Matrix-vector product, complex Hermitian band matrix
f06sec	3	zhpmv Matrix-vector product, complex Hermitian packed matrix
f06sfc	3	ztrmv Matrix-vector product, complex triangular matrix
f06sgc	3	ztbmv Matrix-vector product, complex triangular band matrix
f06shc	3	ztpmv Matrix-vector product, complex triangular packed matrix
f06sjc	3	ztrsv System of equations, complex triangular matrix
f06skc	3	ztbsv System of equations, complex triangular band matrix
f06slc	3	ztpsv System of equations, complex triangular packed matrix
f06smc	3	zgeru Rank-1 update, complex rectangular matrix, unconjugated vector
f06snc	3	zgerc Rank-1 update, complex rectangular matrix, conjugated vector
f06spc	3	zher Rank-1 update, complex Hermitian matrix
f06sqc	3	zhpr Rank-1 update, complex Hermitian packed matrix
f06src	3	zher2 Rank-2 update, complex Hermitian matrix
f06ssc	3	zhpr2 Rank-2 update, complex Hermitian packed matrix
f06yac	3	dgemm Matrix-matrix product, two real rectangular matrices
f06ycc	3	dsymm Matrix-matrix product, one real symmetric matrix, one real rectangular matrix
f06yfc	3	dtrmm Matrix-matrix product, one real triangular matrix, one real rectangular matrix

f06yjc	3	dtrsm Solves a system of equations with multiple right-hand sides, real triangular coefficient matrix
f06ypc	3	dsyrk Rank-k update of a real symmetric matrix
f06yrc	3	dsyr2k Rank-2k update of a real symmetric matrix
f06zac	3	zgemm Matrix-matrix product, two complex rectangular matrices
f06zcc	3	zhemm Matrix-matrix product, one complex Hermitian matrix, one complex rectangular matrix
f06zfc	3	ztrmm Matrix-matrix product, one complex triangular matrix, one complex rectangular matrix
f06zjc	3	ztrsm Solves system of equations with multiple right-hand sides, complex triangular coefficient matrix
f06zpc	3	zherk Rank-k update of a complex Hermitian matrix
f06zrc	3	zher2k Rank-2k update of a complex Hermitian matrix
f06ztc	3	zsymm Matrix-matrix product, one complex symmetric matrix, one complex rectangular matrix
f06zuc	3	zsyrk Rank-k update of a complex symmetric matrix
f06zwc	3	zsyr2k Rank-2k update of a complex symmetric matrix

f07 – Linear Equations (LAPACK)

A list of the LAPACK equivalent names is included in the f07 Chapter Introduction.

Routine Name	**Mark of Introduction**	**Purpose**
f07adc	7	nag_dgetrf LU factorization of real m by n matrix
f07aec	7	nag_dgetrs Solution of real system of linear equations, multiple right-hand sides, matrix already factorized by nag_dgetrf (f07adc)
f07agc	7	nag_dgecon Estimate condition number of real matrix, matrix already factorized by nag_dgetrf (f07adc)
f07ahc	7	nag_dgerfs Refined solution with error bounds of real system of linear equations, multiple right-hand sides
f07ajc	7	nag_dgetri Inverse of real matrix, matrix already factorized by nag_dgetrf (f07adc)
f07arc	7	nag_zgetrf LU factorization of complex m by n matrix
f07asc	7	nag_zgetrs Solution of complex system of linear equations, multiple right-hand sides, matrix already factorized by nag_zgetrf (f07arc)
f07auc	7	nag_zgecon Estimate condition number of complex matrix, matrix already factorized by nag_zgetrf (f07arc)

f07avc	7	nag_zgerfs Refined solution with error bounds of complex system of linear equations, multiple right-hand sides
f07awc	7	nag_zgetri Inverse of complex matrix, matrix already factorized by nag_zgetrf (f07arc)
f07bdc	7	nag_dgbtrf LU factorization of real m by n band matrix
f07bec	7	nag_dgbtrs Solution of real band system of linear equations, multiple right-hand sides, matrix already factorized by nag_dgbtrf (f07bdc)
f07bgc	7	nag_dgbcon Estimate condition number of real band matrix, matrix already factorized by nag_dgbtrf (f07bdc)
f07bhc	7	nag_dgbrfs Refined solution with error bounds of real band system of linear equations, multiple right-hand sides
f07brc	7	nag_zgbtrf LU factorization of complex m by n band matrix
f07bsc	7	nag_zgbtrs Solution of complex band system of linear equations, multiple right-hand sides, matrix already factorized by nag_zgbtrf (f07brc)
f07buc	7	nag_zgbcon Estimate condition number of complex band matrix, matrix already factorized by nag_zgbtrf (f07brc)
f07bvc	7	nag_zgbrfs Refined solution with error bounds of complex band system of linear equations, multiple right-hand sides
f07fdc	7	nag_dpotrf Cholesky factorization of real symmetric positive-definite matrix
f07fec	7	nag_dpotrs Solution of real symmetric positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by nag_dpotrf (f07fdc)
f07fgc	7	nag_dpocon Estimate condition number of real symmetric positive-definite matrix, matrix already factorized by nag_dpotrf (f07fdc)
f07fhc	7	nag_dporfs Refined solution with error bounds of real symmetric positive-definite system of linear equations, multiple right-hand sides
f07fjc	7	nag_dpotri Inverse of real symmetric positive-definite matrix, matrix already factorized by nag_dpotrf (f07fdc)
f07frc	7	nag_zpotrf Cholesky factorization of complex Hermitian positive-definite matrix
f07fsc	7	nag_zpotrs Solution of complex Hermitian positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by nag_zpotrf (f07frc)
f07fuc	7	nag_zpocon Estimate condition number of complex Hermitian positive-definite matrix, matrix already factorized by nag_zpotrf (f07frc)
f07fvc	7	nag_zporfs Refined solution with error bounds of complex Hermitian positive-definite system of linear equations, multiple right-hand sides
f07fwc	7	nag_zpotri Inverse of complex Hermitian positive-definite matrix, matrix already factorized by nag_zpotrf (f07frc)
f07gdc	7	nag_dpptrf Cholesky factorization of real symmetric positive-definite matrix, packed storage

f07gec	7	nag_dpptrs Solution of real symmetric positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by nag_dpptrf (f07gdc), packed storage
f07ggc	7	nag_dppcon Estimate condition number of real symmetric positive-definite matrix, matrix already factorized by nag_dpptrf (f07gdc), packed storage
f07ghc	7	nag_dpprfs Refined solution with error bounds of real symmetric positive-definite system of linear equations, multiple right-hand sides, packed storage
f07gjc	7	nag_dpptri Inverse of real symmetric positive-definite matrix, matrix already factorized by nag_dpptrf (f07gdc), packed storage
f07grc	7	nag_zpptrf Cholesky factorization of complex Hermitian positive-definite matrix, packed storage
f07gsc	7	nag_zpptrs Solution of complex Hermitian positive-definite system of linear equations, multiple right-hand sides, matrix already factorized by nag_zpptrf (f07grc), packed storage
f07guc	7	nag_zppcon Estimate condition number of complex Hermitian positive-definite matrix, matrix already factorized by nag_zpptrf (f07grc), packed storage
f07gvc	7	nag_zpprfs Refined solution with error bounds of complex Hermitian positive-definite system of linear equations, multiple right-hand sides, packed storage
f07gwc	7	nag_zpptri Inverse of complex Hermitian positive-definite matrix, matrix already factorized by nag_zpptrf (f07grc), packed storage
f07hdc	7	nag_dpbtrf Cholesky factorization of real symmetric positive-definite band matrix
f07hec	7	nag_dpbtrs Solution of real symmetric positive-definite band system of linear equations, multiple right-hand sides, matrix already factorized by nag_dpbtrf (f07hdc)
f07hgc	7	nag_dpbcon Estimate condition number of real symmetric positive-definite band matrix, matrix already factorized by nag_dpbtrf (f07hdc)
f07hhc	7	nag_dpbrfs Refined solution with error bounds of real symmetric positive-definite band system of linear equations, multiple right-hand sides
f07hrc	7	nag_zpbtrf Cholesky factorization of complex Hermitian positive-definite band matrix
f07hsc	7	nag_zpbtrs Solution of complex Hermitian positive-definite band system of linear equations, multiple right-hand sides, matrix already factorized by nag_zpbtrf (f07hrc)
f07huc	7	nag_zpbcon Estimate condition number of complex Hermitian positive-definite band matrix, matrix already factorized by nag_zpbtrf (f07hrc)
f07hvc	7	nag_zpbrfs Refined solution with error bounds of complex Hermitian positive-definite band system of linear equations, multiple right-hand sides
f07mdc	7	nag_dsytrf Bunch–Kaufman factorization of real symmetric indefinite matrix
f07mec	7	nag_dsytrs Solution of real symmetric indefinite system of linear equations, multiple right-hand sides, matrix already factorized by nag_dsytrf (f07mdc)

f07mgc	7	nag_dsycon Estimate condition number of real symmetric indefinite matrix, matrix already factorized by nag_dsytrf (f07mdc)
f07mhc	7	nag_dsyrfs Refined solution with error bounds of real symmetric indefinite system of linear equations, multiple right-hand sides
f07mjc	7	nag_dsytri Inverse of real symmetric indefinite matrix, matrix already factorized by nag_dsytrf (f07mdc)
f07mrc	7	nag_zhetrf Bunch–Kaufman factorization of complex Hermitian indefinite matrix
f07msc	7	nag_zhetrs Solution of complex Hermitian indefinite system of linear equations, multiple right-hand sides, matrix already factorized by nag_zhetrf (f07mrc)
f07muc	7	nag_zhecon Estimate condition number of complex Hermitian indefinite matrix, matrix already factorized by nag_zhetrf (f07mrc)
f07mvc	7	nag_zherfs Refined solution with error bounds of complex Hermitian indefinite system of linear equations, multiple right-hand sides
f07mwc	7	nag_zhetri Inverse of complex Hermitian indefinite matrix, matrix already factorized by nag_zhetrf (f07mrc)
f07nrc	7	nag_zsytrf Bunch–Kaufman factorization of complex symmetric matrix
f07nsc	7	nag_zsytrs Solution of complex symmetric system of linear equations, multiple right-hand sides, matrix already factorized by nag_zsytrf (f07nrc)
f07nuc	7	nag_zsycon Estimate condition number of complex symmetric matrix, matrix already factorized by nag_zsytrf (f07nrc)
f07nvc	7	nag_zsyrfs Refined solution with error bounds of complex symmetric system of linear equations, multiple right-hand sides
f07nwc	7	nag_zsytri Inverse of complex symmetric matrix, matrix already factorized by nag_zsytrf (f07nrc)
f07pdc	7	nag_dsptrf Bunch–Kaufman factorization of real symmetric indefinite matrix, packed storage
f07pec	7	nag_dsptrs Solution of real symmetric indefinite system of linear equations, multiple right-hand sides, matrix already factorized by nag_dsptrf (f07pdc), packed storage
f07pgc	7	nag_dspcon Estimate condition number of real symmetric indefinite matrix, matrix already factorized by nag_dsptrf (f07pdc), packed storage
f07phc	7	nag_dsprfs Refined solution with error bounds of real symmetric indefinite system of linear equations, multiple right-hand sides, packed storage
f07pjc	7	nag_dsptri Inverse of real symmetric indefinite matrix, matrix already factorized by nag_dsptrf (f07pdc), packed storage
f07prc	7	nag_zhptrf Bunch–Kaufman factorization of complex Hermitian indefinite matrix, packed storage
f07psc	7	nag_zhptrs Solution of complex Hermitian indefinite system of linear equations, multiple right-hand sides, matrix already factorized by nag_zhptrf (f07prc), packed storage

f07puc	7	nag_zhpcon Estimate condition number of complex Hermitian indefinite matrix, matrix already factorized by nag_zhptrf (f07prc), packed storage
f07pvc	7	nag_zhprfs Refined solution with error bounds of complex Hermitian indefinite system of linear equations, multiple right-hand sides, packed storage
f07pwc	7	nag_zhptri Inverse of complex Hermitian indefinite matrix, matrix already factorized by nag_zhptrf (f07prc), packed storage
f07qrc	7	nag_zsptrf Bunch–Kaufman factorization of complex symmetric matrix, packed storage
f07qsc	7	nag_zsptrs Solution of complex symmetric system of linear equations, multiple right-hand sides, matrix already factorized by nag_zsptrf (f07qrc), packed storage
f07quc	7	nag_zspcon Estimate condition number of complex symmetric matrix, matrix already factorized by nag_zsptrf (f07qrc), packed storage
f07qvc	7	nag_zsprfs Refined solution with error bounds of complex symmetric system of linear equations, multiple right-hand sides, packed storage
f07qwc	7	nag_zsptri Inverse of complex symmetric matrix, matrix already factorized by nag_zsptrf (f07qrc), packed storage
f07tec	7	nag_dtrtrs Solution of real triangular system of linear equations, multiple right-hand sides
f07tgc	7	nag_dtrcon Estimate condition number of real triangular matrix
f07thc	7	nag_dtrrfs Error bounds for solution of real triangular system of linear equations, multiple right-hand sides
f07tjc	7	nag_dtrtri Inverse of real triangular matrix
f07tsc	7	nag_ztrtrs Solution of complex triangular system of linear equations, multiple right-hand sides
f07tuc	7	nag_ztrcon Estimate condition number of complex triangular matrix
f07tvc	7	nag_ztrrfs Error bounds for solution of complex triangular system of linear equations, multiple right-hand sides
f07twc	7	nag_ztrtri Inverse of complex triangular matrix
f07uec	7	nag_dtptrs Solution of real triangular system of linear equations, multiple right-hand sides, packed storage
f07ugc	7	nag_dtpcon Estimate condition number of real triangular matrix, packed storage
f07uhc	7	nag_dtprfs Error bounds for solution of real triangular system of linear equations, multiple right-hand sides, packed storage
f07ujc	7	nag_dtptri Inverse of real triangular matrix, packed storage
f07usc	7	nag_ztptrs Solution of complex triangular system of linear equations, multiple right-hand sides, packed storage
f07uuc	7	nag_ztpcon Estimate condition number of complex triangular matrix, packed storage

f07uvc	7	nag_ztprfs Error bounds for solution of complex triangular system of linear equations, multiple right-hand sides, packed storage
f07uwc	7	nag_ztptri Inverse of complex triangular matrix, packed storage
f07vec	7	nag_dtbtrs Solution of real band triangular system of linear equations, multiple right-hand sides
f07vgc	7	nag_dtbcon Estimate condition number of real band triangular matrix
f07vhc	7	nag_dtbrfs Error bounds for solution of real band triangular system of linear equations, multiple right-hand sides
f07vsc	7	nag_ztbtrs Solution of complex band triangular system of linear equations, multiple right-hand sides
f07vuc	7	nag_ztbcon Estimate condition number of complex band triangular matrix
f07vvc	7	nag_ztbrfs Error bounds for solution of complex band triangular system of linear equations, multiple right-hand sides

f08 – Least-squares and Eigenvalue Problems (LAPACK)

A list of the LAPACK equivalent names is included in the f08 Chapter Introduction.

Routine Name	Mark of Introduction	Purpose
f08aec	7	nag_dgeqrf QR factorization of real general rectangular matrix
f08afc	7	nag_dorgqr Form all or part of orthogonal Q from QR factorization determined by nag_dgeqrf (f08aec) or nag_dgeqpf (f08bec)
f08agc	7	nag_dormqr Apply orthogonal transformation determined by nag_dgeqrf (f08aec) or nag_dgeqpf (f08bec)
f08ahc	7	nag_dgelqf LQ factorization of real general rectangular matrix
f08ajc	7	nag_dorglq Form all or part of orthogonal Q from LQ factorization determined by nag_dgelqf (f08ahc)
f08akc	7	nag_dormlq Apply orthogonal transformation determined by nag_dgelqf (f08ahc)
f08asc	7	nag_zgeqrf QR factorization of complex general rectangular matrix
f08atc	7	nag_zungqr Form all or part of unitary Q from QR factorization determined by nag_zgeqrf (f08asc) or nag_zgeqpf (f08bsc)
f08auc	7	nag_zunmqr Apply unitary transformation determined by nag_zgeqrf (f08asc) or nag_zgeqpf (f08bsc)
f08avc	7	nag_zgelqf LQ factorization of complex general rectangular matrix
f08awc	7	nag_zunglq Form all or part of unitary Q from LQ factorization determined by nag_zgelqf (f08avc)
f08axc	7	nag_zunmlq Apply unitary transformation determined by nag_zgelqf (f08avc)

f08bec	7	nag_dgeqpf QR factorization of real general rectangular matrix with column pivoting
f08bsc	7	nag_zgeqpf QR factorization of complex general rectangular matrix with column pivoting
f08fcc	7	nag_dsyevd All eigenvalues and optionally all eigenvectors of real symmetric matrix, using divide and conquer
f08fec	7	nag_dsytrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form
f08ffc	7	nag_dorgtr Generate orthogonal transformation matrix from reduction to tridiagonal form determined by nag_dsytrd (f08fec)
f08fgc	7	nag_dormtr Apply orthogonal transformation determined by nag_dsytrd (f08fec)
f08fqc	7	nag_zheevd All eigenvalues and optionally all eigenvectors of complex Hermitian matrix, using divide and conquer
f08fsc	7	nag_zhetrd Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form
f08ftc	7	nag_zungtr Generate unitary transformation matrix from reduction to tridiagonal form determined by nag_zhetrd (f08fsc)
f08fuc	7	nag_zunmtr Apply unitary transformation matrix determined by nag_zhetrd (f08fsc)
f08gcc	7	nag_dspevd All eigenvalues and optionally all eigenvectors of real symmetric matrix, packed storage, using divide and conquer
f08gec	7	nag_dsptrd Orthogonal reduction of real symmetric matrix to symmetric tridiagonal form, packed storage
f08gfc	7	nag_dopgtr Generate orthogonal transformation matrix from reduction to tridiagonal form determined by nag_dsptrd (f08gec)
f08ggc	7	nag_dopmtr Apply orthogonal transformation determined by nag_dsptrd (f08gec)
f08gqc	7	nag_zhpevd All eigenvalues and optionally all eigenvectors of complex Hermitian matrix, packed storage, using divide and conquer
f08gsc	7	nag_zhptrd Unitary reduction of complex Hermitian matrix to real symmetric tridiagonal form, packed storage
f08gtc	7	nag_zupgtr Generate unitary transformation matrix from reduction to tridiagonal form determined by nag_zhptrd (f08gsc)
f08guc	7	nag_zupmtr Apply unitary transformation matrix determined by nag_zhptrd (f08gsc)
f08hcc	7	nag_dsbevd All eigenvalues and optionally all eigenvectors of real symmetric band matrix, using divide and conquer
f08hec	7	nag_dsbtrd Orthogonal reduction of real symmetric band matrix to symmetric tridiagonal form
f08hqc	7	nag_zhbevd All eigenvalues and optionally all eigenvectors of complex Hermitian band matrix, using divide and conquer
f08hsc	7	nag_zhbtrd Unitary reduction of complex Hermitian band matrix to real symmetric tridiagonal form

f08jcc	7	nag_dstevd All eigenvalues and optionally all eigenvectors of real symmetric tridiagonal matrix, using divide and conquer
f08jec	7	nag_dsteqr All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from real symmetric matrix using implicit QL or QR
f08jfc	7	nag_dsterf All eigenvalues of real symmetric tridiagonal matrix, root-free variant of QL or QR
f08jgc	7	nag_dpteqr All eigenvalues and eigenvectors of real symmetric positive-definite tridiagonal matrix, reduced from real symmetric positive-definite matrix
f08jjc	7	nag_dstebz Selected eigenvalues of real symmetric tridiagonal matrix by bisection
f08jkc	7	nag_dstein Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in real array
f08jsc	7	nag_zsteqr All eigenvalues and eigenvectors of real symmetric tridiagonal matrix, reduced from complex Hermitian matrix, using implicit QL or QR
f08juc	7	nag_zpteqr All eigenvalues and eigenvectors of real symmetric positive-definite tridiagonal matrix, reduced from complex Hermitian positive-definite matrix
f08jxc	7	nag_zstein Selected eigenvectors of real symmetric tridiagonal matrix by inverse iteration, storing eigenvectors in complex array
f08kec	7	nag_dgebrd Orthogonal reduction of real general rectangular matrix to bidiagonal form
f08kfc	7	nag_dorgbr Generate orthogonal transformation matrices from reduction to bidiagonal form determined by nag_dgebrd (f08kec)
f08kgc	7	nag_dormbr Apply orthogonal transformations from reduction to bidiagonal form determined by nag_dgebrd (f08kec)
f08ksc	7	nag_zgebrd Unitary reduction of complex general rectangular matrix to bidiagonal form
f08ktc	7	nag_zungbr Generate unitary transformation matrices from reduction to bidiagonal form determined by nag_zgebrd (f08ksc)
f08kuc	7	nag_zunmbr Apply unitary transformations from reduction to bidiagonal form determined by nag_zgebrd (f08ksc)
f08lec	7	nag_dgbbrd Reduction of real rectangular band matrix to upper bidiagonal form
f08lsc	7	nag_zgbbrd Reduction of complex rectangular band matrix to upper bidiagonal form
f08mec	7	nag_dbdsqr SVD of real bidiagonal matrix reduced from real general matrix
f08msc	7	nag_zbdsqr SVD of real bidiagonal matrix reduced from complex general matrix
f08nec	7	nag_dgehrd Orthogonal reduction of real general matrix to upper Hessenberg form
f08nfc	7	nag_dorghr Generate orthogonal transformation matrix from reduction to Hessenberg form determined by nag_dgehrd (f08nec)
f08ngc	7	nag_dormhr Apply orthogonal transformation matrix from reduction to Hessenberg form determined by nag_dgehrd (f08nec)

f08nhc	7	nag_dgebal Balance real general matrix
f08njc	7	nag_dgebak Transform eigenvectors of real balanced matrix to those of original matrix supplied to nag_dgebal (f08nhc)
f08nsc	7	nag_zgehrd Unitary reduction of complex general matrix to upper Hessenberg form
f08ntc	7	nag_zunghr Generate unitary transformation matrix from reduction to Hessenberg form determined by nag_zgehrd (f08nsc)
f08nuc	7	nag_zunmhr Apply unitary transformation matrix from reduction to Hessenberg form determined by nag_zgehrd (f08nsc)
f08nvc	7	nag_zgebal Balance complex general matrix
f08nwc	7	nag_zgebak Transform eigenvectors of complex balanced matrix to those of original matrix supplied to nag_zgebal (f08nvc)
f08pec	7	nag_dhseqr Eigenvalues and Schur factorization of real upper Hessenberg matrix reduced from real general matrix
f08pkc	7	nag_dhsein Selected right and/or left eigenvectors of real upper Hessenberg matrix by inverse iteration
f08psc	7	nag_zhseqr Eigenvalues and Schur factorization of complex upper Hessenberg matrix reduced from complex general matrix
f08pxc	7	nag_zhsein Selected right and/or left eigenvectors of complex upper Hessenberg matrix by inverse iteration
f08qfc	7	nag_dtrexc Reorder Schur factorization of real matrix using orthogonal similarity transformation
f08qgc	7	nag_dtrsen Reorder Schur factorization of real matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
f08qhc	7	nag_dtrsyl Solve real Sylvester matrix equation $AX + XB = C$, A and B are upper quasi-triangular or transposes
f08qkc	7	nag_dtrevc Left and right eigenvectors of real upper quasi-triangular matrix
f08qlc	7	nag_dtrsna Estimates of sensitivities of selected eigenvalues and eigenvectors of real upper quasi-triangular matrix
f08qtc	7	nag_ztrexc Reorder Schur factorization of complex matrix using unitary similarity transformation
f08quc	7	nag_ztrsen Reorder Schur factorization of complex matrix, form orthonormal basis of right invariant subspace for selected eigenvalues, with estimates of sensitivities
f08qvc	7	nag_ztrsyl Solve complex Sylvester matrix equation $AX + XB = C$, A and B are upper triangular or conjugate-transposes
f08qxc	7	nag_ztrevc Left and right eigenvectors of complex upper triangular matrix
f08qyc	7	nag_ztrsna Estimates of sensitivities of selected eigenvalues and eigenvectors of complex upper triangular matrix

f08sec	7	nag_dsygst Reduction to standard form of real symmetric-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $BAx = \lambda x$, B factorized by nag_dpotrf (f07fdc)
f08ssc	7	nag_zhegst Reduction to standard form of complex Hermitian-definite generalized eigenproblem $Ax = \lambda Bx$, $ABx = \lambda x$ or $BAx = \lambda x$, B factorized by nag_zpotrf (f07frc)
f08tec	7	nag_dspgst 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 nag_dpptrf (f07gdc)
f08tsc	7	nag_zhpgst 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 nag_zpptrf (f07grc)
f08uec	7	nag_dsbgst Reduction of real symmetric-definite banded generalized eigenproblem $Ax = \lambda Bx$ to standard form $Cy = \lambda y$, such that C has the same bandwidth as A
f08ufc	7	nag_dpbstf Computes a split Cholesky factorization of real symmetric positive-definite band matrix A
f08usc	7	nag_zhbgst Reduction of complex Hermitian-definite banded generalized eigenproblem $Ax = \lambda Bx$ to standard form $Cy = \lambda y$, such that C has the same bandwidth as A
f08utc	7	nag_zpbstf Computes a split Cholesky factorization of complex Hermitian positive-definite band matrix A
f08wec	7	nag_dgghrd Orthogonal reduction of a pair of real general matrices to generalized upper Hessenberg form
f08whc	7	nag_dggbal Balance a pair of real general matrices
f08wjc	7	nag_dggbak Transform eigenvectors of a pair of real balanced matrices to those of original matrix pair supplied to nag_dggbal (f08whc)
f08wsc	7	nag_zgghrd Unitary reduction of a pair of complex general matrices to generalized upper Hessenberg form
f08wvc	7	nag_zggbal Balance a pair of complex general matrices
f08wwc	7	nag_zggbak Transform eigenvectors of a pair of complex balanced matrices to those of original matrix pair supplied to nag_zggbal (f08wvc)
f08xec	7	nag_dhgeqz Eigenvalues and generalized Schur factorization of real generalized upper Hessenberg form reduced from a pair of real general matrices
f08xsc	7	nag_zhgeqz Eigenvalues and generalized Schur factorization of complex generalized upper Hessenberg form reduced from a pair of complex general matrices
f08ykc	7	nag_dtgevc Left and right eigenvectors of a pair of real upper quasi-triangular matrices
f08yxc	7	nag_ztgevc Left and right eigenvectors of a pair of complex upper triangular matrices

f11 – Sparse Linear Algebra

Routine Name	Mark of Introduction	Purpose
f11dac	5	nag_sparse_nsym_fac Incomplete LU factorization (nonsymmetric)
f11dcc	5	nag_sparse_nsym_fac_sol Solver with incomplete LU preconditioning (nonsymmetric)
f11dec	5	nag_sparse_nsym_sol Solver with no Jacobi/SSOR preconditioning (nonsymmetric)
f11jac	5	nag_sparse_sym_chol_fac Incomplete Cholesky factorization (symmetric)
f11jcc	5	nag_sparse_sym_chol_sol Solver with incomplete Cholesky preconditioning (symmetric)
f11jec	5	nag_sparse_sym_sol Solver with Jacobi, SSOR, or no preconditioning (symmetric)
f11zac	5	nag_sparse_nsym_sort Sparse sort (nonsymmetric)
f11zbc	5	nag_sparse_sym_sort Sparse sort (symmetric)

f16 – NAG Interface to BLAS

Routine Name	Mark of Introduction	Purpose
f16dbc	7	nag_iload Broadcast scalar into integer vector
f16ecc	7	nag_daxpby Multiply real vector by scalar, preserving input vector
f16fbc	7	nag_dload Broadcast scalar into real vector
f16hbc	7	nag_zload Broadcast scalar into complex vector
f16pjc	7	nag_dtrsv System of equations, real triangular matrix
f16qec	7	nag_dtr_copy Matrix copy, real triangular matrix
f16qfc	7	nag_dge_copy Matrix copy, real rectangular matrix
f16qgc	7	nag_dtr_load Matrix initialisation, real triangular matrix
f16qhc	7	nag_dge_load Matrix initialisation, real rectangular matrix
f16rac	7	nag_dge_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, real general matrix
f16rbc	7	nag_dgb_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, real band matrix
f16rcc	7	nag_dsy_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, real symmetric matrix
f16rdc	7	nag_dsp_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, real symmetric matrix, packed storage
f16rec	7	nag_dsb_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, real symmetric band matrix
f16sjc	7	nag_ztrsv System of equations, complex triangular matrix

f16tec	7	nag_ztr_copy Matrix copy, complex triangular matrix
f16tfc	7	nag_zge_copy Matrix copy, complex rectangular matrix
f16tgc	7	nzg_ztr_load Matrix initialisation, complex triangular matrix
f16thc	7	nag_zge_load Matrix initialisation, complex rectangular matrix
f16uac	7	nag_zge_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex general matrix
f16ubc	7	nag_zgb_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex band matrix
f16ucc	7	nag_zhe_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex Hermitian matrix
f16udc	7	nag_zhp_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex Hermitian matrix, packed storage
f16uec	7	nag_zhb_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex Hermitian band matrix
f16ufc	7	nag_zsy_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex symmetric matrix
f16ugc	7	nag_zsp_norm 1-norm, ∞-norm, Frobenius norm, largest absolute element, complex symmetric matrix, packed storage
f16yjc	7	nag_dtrsm Solves a system of equations with multiple right-hand sides, real triangular coefficient matrix
f16zjc	7	nag_ztrsm Solves system of equations with multiple right-hand sides, complex triangular coefficient matrix

g01 – Simple Calculations on Statistical Data

Routine Name	Mark of Introduction	Purpose
g01aac	1	nag_summary_stats_1var Mean, variance, skewness, kurtosis, etc., one variable, from raw data
g01adc	7	nag_summary_stats_freq Mean, variance, skewness, kurtosis, etc., one variable, from frequency table
g01aec	6	nag_frequency_table Frequency table from raw data
g01alc	4	nag_5pt_summary_stats Five-point summary (median, hinges and extremes)
g01bjc	4	nag_binomial_dist Binomial distribution function
g01bkc	4	nag_poisson_dist Poisson distribution function
g01blc	4	nag_hypergeom_dist Hypergeometric distribution function
g01cec	1	nag_deviates_normal_dist Deviate of Normal distribution function
g01dac	7	nag_normal_scores_exact Normal scores, accurate values

g01dcc	7	nag_normal_scores_var Normal scores, approximate variance-covariance matrix
g01ddc	4	nag_shapiro_wilk_test Shapiro and Wilk's W test for Normality
g01dhc	4	nag_ranks_and_scores Ranks, Normal scores, approximate Normal scores or exponential (Savage) scores
g01eac	4	nag_prob_normal Probabilities for the standard Normal distribution
g01ebc	1	nag_prob_students_t Probabilities for Student's t-distribution
g01ecc	1	nag_prob_chi_sq Probabilities for χ^2 distribution
g01edc	1	nag_prob_f_dist Probabilities for F-distribution
g01eec	1	nag_prob_beta_dist Upper and lower tail probabilities and probability density function for the beta distribution
g01efc	1	nag_gamma_dist Probabilities for the gamma distribution
g01emc	7	nag_prob_studentized_range Computes probability for the Studentized range statistic
g01epc	7	nag_prob_durbin_watson Computes bounds for the significance of a Durbin–Watson statistic
g01erc	7	nag_prob_von_mises Computes probability for von Mises distribution
g01etc	7	nag_prob_landau Landau distribution function $\Phi(\lambda)$
g01euc	7	nag_prob_vavilov Vavilov distribution function $\Phi_V(\lambda;\kappa,\beta^2)$
g01eyc	7	nag_prob_1_sample_ks Computes probabilities for the one-sample Kolmogorov–Smirnov distribution
g01ezc	7	nag_prob_2_sample_ks Computes probabilities for the two-sample Kolmogorov–Smirnov distribution
g01fac	4	nag_deviates_normal Deviates for the Normal distribution
g01fbc	1	nag_deviates_students_t Deviates for Student's t-distribution
g01fcc	1	nag_deviates_chi_sq Deviates for the χ^2 distribution
g01fdc	1	nag_deviates_f_dist Deviates for the F-distribution
g01fec	1	nag_deviates_beta Deviates for the beta distribution
g01ffc	1	nag_deviates_gamma_dist Deviates for the gamma distribution
g01fmc	7	nag_deviates_studentized_range Computes deviates for the Studentized range statistic
g01ftc	7	nag_deviates_landau Landau inverse function $\Psi(x)$
g01gbc	6	nag_prob_non_central_students_t Computes probabilities for the non-central Student's t-distribution
g01gcc	6	nag_prob_non_central_chi_sq Computes probabilities for the non-central χ^2 distribution
g01gdc	6	nag_prob_non_central_f_dist Computes probabilities for the non-central F-distribution
g01gec	6	nag_prob_non_central_beta_dist Computes probabilities for the non-central beta distribution

g01hac	1	nag_bivariate_normal_dist Probability for the bivariate Normal distribution
g01hbc	6	nag_multi_normal Computes probabilities for the multivariate Normal distribution
g01jcc	7	nag_prob_lin_non_central_chi_sq Computes probability for a positive linear combination of χ^2 variables
g01jdc	7	nag_prob_lin_chi_sq Computes lower tail probability for a linear combination of (central) χ^2 variables
g01mbc	7	nag_mills_ratio Computes reciprocal of Mills' Ratio
g01mtc	7	nag_prob_density_landau Landau density function $\phi(\lambda)$
g01muc	7	nag_prob_density_vavilov Vavilov density function $\phi_V(\lambda;\kappa,\beta^2)$
g01nac	7	nag_moments_quad_form Cumulants and moments of quadratic forms in Normal variables
g01nbc	7	nag_moments_ratio_quad_forms Moments of ratios of quadratic forms in Normal variables, and related statistics
g01ptc	7	nag_moment_1_landau Landau first moment function $\Phi_1(x)$
g01qtc	7	nag_moment_2_landau Landau second moment function $\Phi_2(x)$
g01rtc	7	nag_prob_der_landau Landau derivative function $\phi'(\lambda)$
g01zuc	7	nag_init_vavilov Initialisation function for nag_prob_density_vavilov (g01muc) and nag_prob_vavilov (g01euc)

g02 – Correlation and Regression Analysis

Routine Name	Mark of Introduction	Purpose
g02brc	3	nag_ken_spe_corr_coeff Kendall and/or Spearman non-parametric rank correlation coefficients, allows variables and observations to be selectively disregarded
g02btc	7	nag_sum_sqs_update Update a weighted sum of squares matrix with a new observation
g02buc	7	nag_sum_sqs Computes a weighted sum of squares matrix
g02bwc	7	nag_cov_to_corr Computes a correlation matrix from a sum of squares matrix
g02bxc	3	nag_corr_cov Product-moment correlation, unweighted/weighted correlation and covariance matrix, allows variables to be disregarded
g02byc	6	nag_partial_corr Computes partial correlation/variance-covariance matrix from correlation/ variance-covariance matrix computed by nag_corr_cov (g02bxc)
g02cac	3	nag_simple_linear_regression Simple linear regression with or without a constant term, data may be weighted
g02cbc	3	nag_regress_confid_interval Simple linear regression confidence intervals for the regression line and individual points
g02dac	1	nag_regsn_mult_linear Fits a general (multiple) linear regression model
g02dcc	2	nag_regsn_mult_linear_addrem_obs Add/delete an observation to/from a general linear regression model

g02ddc	2	nag_regsn_mult_linear_upd_model Estimates of regression parameters from an updated model
g02dec	2	nag_regsn_mult_linear_add_var Add a new independent variable to a general linear regression model
g02dfc	2	nag_regsn_mult_linear_delete_var Delete an independent variable from a general linear regression model
g02dgc	1	nag_regsn_mult_linear_newyvar Fits a general linear regression model to new dependent variable
g02dkc	2	nag_regsn_mult_linear_tran_model Estimates of parameters of a general linear regression model for given constraints
g02dnc	2	nag_regsn_mult_linear_est_func Estimate of an estimable function for a general linear regression model
g02eac	7	nag_all_regsn Computes residual sums of squares for all possible linear regressions for a set of independent variables
g02ecc	7	nag_cp_stat Calculates R^2 and C_P values from residual sums of squares
g02eec	7	nag_step_regsn Fits a linear regression model by forward selection
g02fac	1	nag_regsn_std_resid_influence Calculates standardized residuals and influence statistics
g02fcc	7	nag_durbin_watson_stat Computes Durbin–Watson test statistic
g02gac	4	nag_glm_normal Fits a generalized linear model with Normal errors
g02gbc	4	nag_glm_binomial Fits a generalized linear model with binomial errors
g02gcc	4	nag_glm_poisson Fits a generalized linear model with Poisson errors
g02gdc	4	nag_glm_gamma Fits a generalized linear model with gamma errors
g02gkc	4	nag_glm_tran_model Estimates and standard errors of parameters of a general linear model for given constraints
g02gnc	4	nag_glm_est_func Estimable function and the standard error of a generalized linear model
g02hac	4	nag_robust_m_regsn_estim Robust regression, standard M-estimates
g02hbc	7	nag_robust_m_regsn_wts Robust regression, compute weights for use with nag_robust_m_regsn_user_fn (g02hdc)
g02hdc	7	nag_robust_m_regsn_user_fn Robust regression, compute regression with user-supplied functions and weights
g02hfc	7	nag_robust_m_regsn_param_var Robust regression, variance-covariance matrix following nag_robust_m_regsn_user_fn (g02hdc)
g02hkc	4	nag_robust_corr_estim Robust estimation of a correlation matrix, Huber's weight function
g02hlc	7	nag_robust_m_corr_user_fn Calculates a robust estimation of a correlation matrix, user-supplied weight function plus derivatives
g02hmc	7	nag_robust_m_corr_user_fn_no_derr Calculates a robust estimation of a correlation matrix, user-supplied weight function

g03 – Multivariate Methods

Routine Name	Mark of Introduction	Purpose
g03aac	5	nag_mv_prin_comp Principal component analysis
g03acc	5	nag_mv_canon_var Canonical variate analysis
g03adc	5	nag_mv_canon_corr Canonical correlation analysis
g03bac	5	nag_mv_orthomax Orthogonal rotations for loading matrix
g03bcc	5	nag_mv_procustes Procrustes rotations
g03cac	5	nag_mv_factor Maximum likelihood estimates of parameters
g03ccc	5	nag_mv_fac_score Factor score coefficients, following nag_mv_factor (g03cac)
g03dac	5	nag_mv_discrim Test for equality of within-group covariance matrices
g03dbc	5	nag_mv_discrim_mahaldist Mahalanobis squared distances, following nag_mv_discrim (g03dac)
g03dcc	5	nag_mv_discrim_group Allocates observations to groups, following nag_mv_discrim (g03dac)
g03eac	5	nag_mv_distance_mat Compute distance (dissimilarity) matrix
g03ecc	5	nag_mv_hierar_cluster_analysis Hierarchical cluster analysis
g03efc	5	nag_mv_kmeans_cluster_analysis K-means
g03ehc	5	nag_mv_dendrogram Construct dendogram following nag_mv_hierar_cluster_analysis (g03ecc)
g03ejc	5	nag_mv_cluster_indicator Construct clusters following nag_mv_hierar_cluster_analysis (g03ecc)
g03fac	5	nag_mv_prin_coord_analysis Principal co-ordinate analysis
g03fcc	5	nag_mv_ordinal_multidimscale Multidimensional scaling
g03xzc	5	nag_mv_dend_free Frees memory allocated to the dendrogram array in nag_mv_dendrogram (g03ehc)
g03zac	5	nag_mv_z_scores Standardize values of a data matrix

g04 – Analysis of Variance

Routine Name	Mark of Introduction	Purpose
g04bbc	5	nag_anova_random General block design or completely randomized design
g04bcc	6	nag_anova_row_col Analysis of variance, general row and column design, treatment means and standard errors
g04cac	5	nag_anova_factorial Complete factorial design
g04czc	5	nag_anova_factorial_free Memory freeing function for nag_anova_factorial (g04cac)

g04dbc	6	nag_anova_confid_interval Computes confidence intervals for differences between means computed by nag_anova_random (g04bbc) or nag_anova_row_col (g04bcc)
g04eac	6	nag_dummy_vars Computes orthogonal polynomials or dummy variables for factor/classification variable

g05 – Random Number Generators

Routine Name	Mark of Introduction	Purpose
g05cac	1	nag_random_continuous_uniform Pseudo-random real numbers, uniform distribution over (0,1)
g05cbc	1	nag_random_init_repeatable Initialise random number generating functions to give repeatable sequence
g05ccc	1	nag_random_init_nonrepeatable Initialise random number generating functions to give non-repeatable sequence
g05cfc	1	nag_save_random_state Save state of random number generating functions
g05cgc	1	nag_restore_random_state Restore state of random number generating functions
g05dac	1	nag_random_continuous_uniform_ab Pseudo-random real numbers, uniform distribution over (a, b)
g05dbc	1	nag_random_exp Pseudo-random real numbers, (negative) exponential distribution
g05ddc	1	nag_random_normal Pseudo-random real numbers, Normal distribution
g05dyc	1	nag_random_discrete_uniform Pseudo-random integer from uniform distribution
g05eac	2	nag_ref_vec_multi_normal Set up reference vector for multivariate Normal distribution
g05ecc	2	nag_ref_vec_poisson Set up reference vector for generating pseudo-random integers, Poisson distribution
g05edc	2	nag_ref_vec_binomial Set up reference vector for generating pseudo-random integers, binomial distribution
g05ehc	3	nag_ran_permut_vec Pseudo-random permutation of an integer vector
g05ejc	3	nag_ran_sample_vec Pseudo-random sample without replacement from an integer vector
g05exc	2	nag_ref_vec_discrete_pdf_cdf Set up reference vector from supplied cumulative distribution function or probability distribution function
g05eyc	2	nag_return_discrete Pseudo-random integer from reference vector
g05ezc	2	nag_return_multi_normal Pseudo-random multivariate Normal vector from reference vector
g05fec	2	nag_random_beta Pseudo-random real numbers from the beta distribution
g05ffc	2	nag_random_gamma Pseudo-random real numbers from the gamma distribution
g05hac	3	nag_arma_time_series ARMA time series of n terms
g05hkc	6	nag_generate_agarchI Univariate time series, generate n terms of either a symmetric GARCH process or a GARCH process with asymmetry of the form $(\epsilon_{t-1} + \gamma)^2$

g05hlc	6	nag_generate_agarchII Univariate time series, generate n terms of a GARCH process with asymmetry of the form $(\lvert\epsilon_{t-1}\rvert + \gamma\epsilon_{t-1})^2$
g05hmc	6	nag_generate_garchGJR Univariate time series, generate n terms of an asymmetric Glosten, Jagannathan and Runkle (GJR) GARCH process
g05kac	7	nag_rngs_basic Pseudo-random real numbers, uniform distribution over (0,1), seeds and generator number passed explicitly
g05kbc	7	nag_rngs_init_repeatable Initialise seeds of a given generator for random number generating functions (that pass seeds explicitly) to give a repeatable sequence
g05kcc	7	nag_rngs_init_nonrepeatable Initialise seeds of a given generator for random number generating functions (that pass seeds expicitly) to give non-repeatable sequence
g05kec	7	nag_rngs_logical Pseudo-random logical (boolean) value, seeds and generator number passed explicitly
g05lac	7	nag_rngs_normal Generates a vector of random numbers from a Normal distribution, seeds and generator number passed explicitly
g05lbc	7	nag_rngs_students_t Generates a vector of random numbers from a Student's t-distribution, seeds and generator number passed explicitly
g05lcc	7	nag_rngs_chi_sq Generates a vector of random numbers from a χ^2 distribution, seeds and generator number passed explicitly
g05ldc	7	nag_rngs_f Generates a vector of random numbers from an F-distribution, seeds and generator number passed explicitly
g05lec	7	nag_rngs_beta Generates a vector of random numbers from a β distribution, seeds and generator number passed explicitly
g05lfc	7	nag_rngs_gamma Generates a vector of random numbers from a γ distribution, seeds and generator number passed explicitly
g05lgc	7	nag_rngs_uniform Generates a vector of random numbers from a uniform distribution, seeds and generator number passed explicitly
g05lhc	7	nag_rngs_triangular Generates a vector of random numbers from a triangular distribution, seeds and generator number passed explicitly
g05ljc	7	nag_rngs_exp Generates a vector of random numbers from an exponential distribution, seeds and generator number passed explicitly
g05lkc	7	nag_rngs_lognormal Generates a vector of random numbers from a lognormal distribution, seeds and generator number passed explicitly
g05llc	7	nag_rngs_cauchy Generates a vector of random numbers from a Cauchy distribution, seeds and generator number passed explicitly
g05lmc	7	nag_rngs_weibull Generates a vector of random numbers from a Weibull distribution, seeds and generator number passed explicitly
g05lnc	7	nag_rngs_logistic Generates a vector of random numbers from a logistic distribution, seeds and generator number passed explicitly

g05lpc	7	nag_rngs_von_mises Generates a vector of random numbers from a von Mises distribution, seeds and generator number passed explicitly
g05lqc	7	nag_rngs_exp_mix Generates a vector of random numbers from an exponential mixture distribution, seeds and generator number passed explicitly
g05lzc	7	nag_rngs_multi_normal Generates a vector of random numbers from a multivariate Normal distribution, seeds and generator number passed explicitly
g05mac	7	nag_rngs_discrete_uniform Generates a vector of random integers from a uniform distribution, seeds and generator number passed explicitly
g05mbc	7	nag_rngs_geom Generates a vector of random integers from a geometric distribution, seeds and generator number passed explicitly
g05mcc	7	nag_rngs_neg_bin Generates a vector of random integers from a negative binomial distribution, seeds and generator number passed explicitly
g05mdc	7	nag_rngs_logarithmic Generates a vector of random integers from a logarithmic distribution, seeds and generator number passed explicitly
g05mec	7	nag_rngs_compd_poisson Generates a vector of random integers from a Poisson distribution with varying mean, seeds and generator number passed explicitly
g05mjc	7	nag_rngs_binomial Generates a vector of random integers from a binomial distribution, seeds and generator number passed explicitly
g05mkc	7	nag_rngs_poisson Generates a vector of random integers from a Poisson distribution, seeds and generator number passed explicitly
g05mlc	7	nag_rngs_hypergeometric Generates a vector of random integers from a hypergeometric distribution, seeds and generator number passed explicitly
g05mrc	7	nag_rngs_gen_multinomial Generates a vector of random integers from a multinomial distribution, seeds and generator number passed explicitly
g05mzc	7	nag_rngs_gen_discrete Generates a vector of random integers from a general discrete distribution, seeds and generator number passed explicitly
g05nac	7	nag_rngs_permute Pseudo-random permutation of an integer vector
g05nbc	7	nag_rngs_sample Pseudo-random sample from an integer vector
g05pac	7	nag_rngs_arma_time_series Generates a realisation of a time series from an ARMA model
g05pcc	7	nag_rngs_varma_time_series Generates a realisation of a multivariate time series from a VARMA model
g05qac	7	nag_rngs_orthog_matrix Computes a random orthogonal matrix
g05qbc	7	nag_rngs_corr_matrix Computes a random correlation matrix
g05qdc	7	nag_rngs_2_way_table Generates a random table matrix
g05yac	7	nag_quasi_random_uniform Multi-dimensional quasi-random number generator with a uniform probability distribution
g05ybc	7	nag_quasi_random_normal Multi-dimensional quasi-random number generator with a Gaussian or log-normal probability distribution

g07 – Univariate Estimation

Routine Name	Mark of Introduction	Purpose
g07aac	7	nag_binomial_ci Computes confidence interval for the parameter of a binomial distribution
g07abc	7	nag_poisson_ci Computes confidence interval for the parameter of a Poisson distribution
g07bbc	7	nag_censored_normal Computes maximum likelihood estimates for parameters of the Normal distribution from grouped and/or censored data
g07bec	7	nag_estim_weibull Computes maximum likelihood estimates for parameters of the Weibull distribution
g07cac	4	nag_2_sample_t_test Computes t-test statistic for a difference in means between two Normal populations, confidence interval
g07dac	1	nag_median_1var Robust estimation, median, median absolute deviation, robust standard deviation
g07dbc	4	nag_robust_m_estim_1var Robust estimation, M-estimates for location and scale parameters, standard weight functions
g07dcc	7	nag_robust_m_estim_1var_usr Robust estimation, M-estimates for location and scale parameters, user-defined weight functions
g07ddc	4	nag_robust_trimmed_1var Trimmed and winsorized mean of a sample with estimates of the variances of the two means
g07eac	7	nag_rank_ci_1var Robust confidence intervals, one-sample
g07ebc	7	nag_rank_ci_2var Robust confidence intervals, two-sample

g08 – Nonparametric Statistics

Routine Name	Mark of Introduction	Purpose
g08aac	6	nag_sign_test Sign test on two paired samples
g08acc	6	nag_median_test Median test on two samples of unequal size
g08aec	6	nag_friedman_test Friedman two-way analysis of variance on k matched samples
g08afc	6	nag_kruskal_wallis_test Kruskal–Wallis one-way analysis of variance on k samples of unequal size
g08agc	6	nag_wilcoxon_test Performs the Wilcoxon one-sample (matched pairs) signed rank test
g08amc	6	nag_mann_whitney Performs the Mann–Whitney U test on two independent samples
g08cbc	6	nag_1_sample_ks_test Performs the one-sample Kolmogorov–Smirnov test for standard distributions
g08cdc	6	nag_2_sample_ks_test Performs the two-sample Kolmogorov–Smirnov test
g08cgc	6	nag_chi_sq_goodness_of_fit_test Performs the χ^2 goodness of fit test, for standard continuous distributions
g08eac	6	nag_runs_test Performs the runs up or runs down test for randomness

g08ebc	6	nag_pairs_test Performs the pairs (serial) test for randomness
g08ecc	6	nag_triplets_test Performs the triplets test for randomness
g08edc	6	nag_gaps_test Performs the gaps test for randomness
g08rac	7	nag_rank_regsn Regression using ranks, uncensored data
g08rbc	7	nag_rank_regsn_censored Regression using ranks, right-censored data

g10 – Smoothing in Statistics

Routine Name	Mark of Introduction	Purpose
g10abc	6	nag_smooth_spline_fit Fit cubic smoothing spline, smoothing parameter given
g10acc	6	nag_smooth_spline_estim Fit cubic smoothing spline, smoothing parameter estimated
g10bac	6	nag_kernel_density_estim Kernel density estimate using Gaussian kernel
g10cac	3	nag_running_median_smoother Compute smoothed data sequence using running median smoothers
g10zac	6	nag_order_data Reorder data to give ordered distinct observations

g11 – Contingency Table Analysis

Routine Name	Mark of Introduction	Purpose
g11aac	4	nag_chi_sq_2_way_table χ^2 statistics for two-way contingency table
g11bac	6	nag_tabulate_stats Computes multiway table from set of classification factors using selected statistic
g11bbc	6	nag_tabulate_percentile Computes multiway table from set of classification factors using given percentile/quantile
g11bcc	7	nag_tabulate_margin Computes marginal tables for multiway table computed by nag_tabulate_stats (g11bac) or nag_tabulate_percentile (g11bbc)
g11cac	7	nag_condl_logistic Returns parameter estimates for the conditional analysis of stratified data
g11sac	7	nag_binary_factor Contingency table, latent variable model for binary data
g11sbc	7	nag_binary_factor_service Frequency count for nag_binary_factor (g11sac)

g12 – Survival Analysis

Routine Name	Mark of Introduction	Purpose
g12aac	4	nag_prod_limit_surviv_fn Computes Kaplan–Meier (product-limit) estimates of survival probabilities
g12bac	6	nag_surviv_cox_model Fits Cox's proportional hazard model

g12zac	7	nag_surviv_risk_sets Creates the risk sets associated with the Cox proportional hazards model for fixed covariates

g13 – Time Series Analysis

Routine Name	Mark of Introduction	Purpose
g13aac	7	nag_tsa_diff Univariate time series, seasonal and non-seasonal differencing
g13abc	2	nag_tsa_auto_corr Sample autocorrelation function
g13acc	2	nag_tsa_auto_corr_part Partial autocorrelation function
g13asc	6	nag_tsa_resid_corr Univariate time series, diagnostic checking of residuals, following nag_tsa_multi_inp_model_estim (g13bec)
g13auc	7	nag_tsa_mean_range Computes quantities needed for range-mean or standard deviation-mean plot
g13bac	7	nag_tsa_arma_filter Multivariate time series, filtering (pre-whitening) by an ARIMA model
g13bbc	7	nag_tsa_transf_filter Multivariate time series, filtering by a transfer function model
g13bcc	7	nag_tsa_cross_corr Multivariate time series, cross-correlations
g13bdc	7	nag_tsa_transf_prelim_fit Multivariate time series, preliminary estimation of transfer function model
g13bec	2	nag_tsa_multi_inp_model_estim Estimation for time series models
g13bjc	2	nag_tsa_multi_inp_model_forecast Forecasting function
g13bxc	2	nag_tsa_options_init Initialisation function for option setting
g13byc	2	nag_tsa_transf_orders Allocates memory to transfer function model orders
g13bzc	2	nag_tsa_trans_free Freeing function for the structure holding the transfer function model orders
g13cac	7	nag_tsa_spectrum_univar_cov Univariate time series, smoothed sample spectrum using rectangular, Bartlett, Tukey or Parzen lag window
g13cbc	4	nag_tsa_spectrum_univar Univariate time series, smoothed sample spectrum using spectral smoothing by the trapezium frequency (Daniell) window
g13ccc	7	nag_tsa_spectrum_bivar_cov Multivariate time series, smoothed sample cross spectrum using rectangular, Bartlett, Tukey or Parzen lag window
g13cdc	4	nag_tsa_spectrum_bivar Multivariate time series, smoothed sample cross spectrum using spectral smoothing by the trapezium frequency (Daniell) window
g13cec	4	nag_tsa_cross_spectrum_bivar Multivariate time series, cross amplitude spectrum, squared coherency, bounds, univariate and bivariate (cross) spectra
g13cfc	4	nag_tsa_gain_phase_bivar Multivariate time series, gain, phase, bounds, univariate and bivariate (cross) spectra
g13cgc	4	nag_tsa_noise_spectrum_bivar Multivariate time series, noise spectrum, bounds, impulse response function and its standard error

g13dbc	7	nag_tsa_multi_auto_corr_part Multivariate time series, multiple squared partial autocorrelations
g13dlc	7	nag_tsa_multi_diff Multivariate time series, differences and/or transforms
g13dmc	7	nag_tsa_multi_cross_corr Multivariate time series, sample cross-correlation or cross-covariance matrices
g13dnc	7	nag_tsa_multi_part_lag_corr Multivariate time series, sample partial lag correlation matrices, χ^2 statistics and significance levels
g13dpc	7	nag_tsa_multi_part_regsn Multivariate time series, partial autoregression matrices
g13dxc	7	nag_tsa_arma_roots Calculates the zeros of a vector autoregressive (or moving average) operator
g13eac	3	nag_kalman_sqrt_filt_cov_var One iteration step of the time-varying Kalman filter recursion using the square root covariance implementation
g13ebc	3	nag_kalman_sqrt_filt_cov_invar One iteration step of the time-invariant Kalman filter recursion using the square root covariance implementation with (A, C) in lower observer Hessenberg form
g13ecc	3	nag_kalman_sqrt_filt_info_var One iteration step of the time-varying Kalman filter recursion using the square root information implementation
g13edc	3	nag_kalman_sqrt_filt_info_invar One iteration step of the time-invariant Kalman filter recursion using the square root information implementation with $(A^{-1}, A^{-1}B)$ in upper controller Hessenberg form
g13ewc	3	nag_trans_hessenberg_observer Unitary state-space transformation to reduce (A, C) to lower or upper observer Hessenberg form
g13exc	3	nag_trans_hessenberg_controller Unitary state-space transformation to reduce (B, A) to lower or upper controller Hessenberg form
g13fac	6	nag_estimate_agarchI Univariate time series, parameter estimation for either a symmetric GARCH process or a GARCH process with asymmetry of the form $(\epsilon_{t-1} + \gamma)^2$
g13fbc	6	nag_forecast_agarchI Univariate time series, forecast function for either a symmetric GARCH process or a GARCH process with asymmetry of the form $(\epsilon_{t-1} + \gamma)^2$
g13fcc	6	nag_estimate_agarchII Univariate time series, parameter estimation for a GARCH process with asymmetry of the form $(\lvert\epsilon_{t-1}\rvert + \gamma\epsilon_{t-1})^2$
g13fdc	6	nag_forecast_agarchII Univariate time series, forecast function for a GARCH process with asymmetry of the form $(\lvert\epsilon_{t-1}\rvert + \gamma\epsilon_{t-1})^2$
g13fec	6	nag_estimate_garchGJR Univariate time series, parameter estimation for an asymmetric Glosten, Jagannathan and Runkle (GJR) GARCH process
g13ffc	6	nag_forecast_garchGJR Univariate time series, forecast function for an asymmetric Glosten, Jagannathan and Runkle (GJR) GARCH process
g13xzc	2	nag_tsa_free Freeing function for use with g13 option setting

h – Operations Research

Routine Name	Mark of Introduction	Purpose
h02bbc	5	nag_ip_bb Solves integer programming problems using a branch and bound method
h02buc	5	nag_ip_mps_read Read MPSX data for IP, LP or QP problem from a file
h02bvc	5	nag_ip_mps_free Free memory allocated by nag_ip_mps_read (h02buc)
h02xxc	5	nag_ip_init Initialise option structure to null values
h02xyc	5	nag_ip_read Read optional parameter values from a file
h02xzc	5	nag_ip_free Free NAG allocated memory from option structures
h03abc	3	nag_transport Classical transportation algorithm

m01 – Sorting

Routine Name	Mark of Introduction	Purpose
m01cac	1	nag_double_sort Quicksort of set of values of data type double
m01csc	1	nag_quicksort Quicksort of set of values of arbitrary data type
m01ctc	1	nag_stable_sort Stable sort of set of values of arbitrary data type
m01cuc	1	nag_chain_sort Chain sort of linked list
m01dsc	1	nag_rank_sort Rank sort of set of values of arbitrary data type
m01esc	1	nag_reorder_vector Reorders set of values of arbitrary data type into the order specified by a set of indices
m01fsc	1	nag_search_vector Searches a vector for either the first or last match to a given value
m01zac	1	nag_make_indices Inverts a permutation converting a rank vector to an index vector or vice versa

s – Approximations of Special Functions

Routine Name	Mark of Introduction	Purpose
s01bac	7	nag_shifted_log $\ln(1+x)$
s10aac	1	nag_tanh Hyperbolic tangent, tanh x
s10abc	1	nag_sinh Hyperbolic sine, sinh x
s10acc	1	nag_cosh Hyperbolic cosine, cosh x
s11aac	1	nag_arctanh Inverse hyperbolic tangent, arctanh x
s11abc	1	nag_arcsinh Inverse hyperbolic sine, arcsinh x

s11acc	1	nag_arccosh Inverse hyperbolic cosine, arccosh x
s13aac	1	nag_exp_integral Exponential integral $E_1(x)$
s13acc	1	nag_cos_integral Cosine integral Ci(x)
s13adc	1	nag_sin_integral Sine integral Si(x)
s14aac	1	nag_gamma Gamma function $\Gamma(x)$
s14abc	1	nag_log_gamma Log Gamma function $\ln(\Gamma(x))$
s14acc	7	nag_polygamma_fun $\psi(x) - \ln x$
s14adc	7	nag_polygamma_deriv Scaled derivatives of $\psi(x)$
s14aec	6	nag_real_polygamma Derivative of the psi function $\psi(x)$
s14afc	6	nag_complex_polygamma Derivative of the psi function $\psi(z)$
s14agc	7	nag_complex_log_gamma Logarithm of the Gamma function $\ln\Gamma(z)$
s14bac	1	nag_incomplete_gamma Incomplete Gamma functions $P(a,x)$ and $Q(a,x)$
s15abc	1	nag_cumul_normal Cumulative Normal distribution function $P(x)$
s15acc	1	nag_cumul_normal_complem Complement of cumulative Normal distribution function $Q(x)$
s15adc	1	nag_erfc Complement of error function erfc(x)
s15aec	1	nag_erf Error function erf(x)
s15afc	7	nag_dawson Dawson's integral
s15ddc	7	nag_complex_erfc Scaled complex complement of error function, exp$(-z^2)$erfc$(-iz)$
s17acc	1	nag_bessel_y0 Bessel function $Y_0(x)$
s17adc	1	nag_bessel_y1 Bessel function $Y_1(x)$
s17aec	1	nag_bessel_j0 Bessel function $J_0(x)$
s17afc	1	nag_bessel_j1 Bessel function $J_1(x)$
s17agc	1	nag_airy_ai Airy function Ai(x)
s17ahc	1	nag_airy_bi Airy function Bi(x)
s17ajc	1	nag_airy_ai_deriv Airy function Ai$'(x)$
s17akc	1	nag_airy_bi_deriv Airy function Bi$'(x)$
s17alc	6	nag_bessel_zeros Zeros of Bessel functions $J_\alpha(x)$, $J'_\alpha(x)$, $Y_\alpha(x)$ or $Y'_\alpha(x)$
s17dcc	7	nag_complex_bessel_y Bessel functions $Y_{\nu+a}(z)$, real $a \geq 0$, complex z, $\nu = 0, 1, 2, \ldots$
s17dec	7	nag_complex_bessel_j Bessel functions $J_{\nu+a}(z)$, real $a \geq 0$, complex z, $\nu = 0, 1, 2, \ldots$

s17dgc	7	nag_complex_airy_ai Airy functions $\mathrm{Ai}(z)$ and $\mathrm{Ai}'(z)$, complex z
s17dhc	7	nag_complex_airy_bi Airy functions $\mathrm{Bi}(z)$ and $\mathrm{Bi}'(z)$, complex z
s17dlc	7	nag_complex_hankel Hankel functions $H_{\nu+a}^{(j)}(z)$, $j = 1, 2$, real $a \geq 0$, complex z, $\nu = 0, 1, 2, \ldots$
s18acc	1	nag_bessel_k0 Modified Bessel function $K_0(x)$
s18adc	1	nag_bessel_k1 Modified Bessel function $K_1(x)$
s18aec	1	nag_bessel_i0 Modified Bessel function $I_0(x)$
s18afc	1	nag_bessel_i1 Modified Bessel function $I_1(x)$
s18ccc	2	nag_bessel_k0_scaled Scaled modified Bessel function $e^x K_0(x)$
s18cdc	2	nag_bessel_k1_scaled Scaled modified Bessel function $e^x K_1(x)$
s18cec	2	nag_bessel_i0_scaled Scaled modified Bessel function $e^{-\lvert x\rvert} I_0(x)$
s18cfc	2	nag_bessel_i1_scaled Scaled modified Bessel function $e^{-\lvert x\rvert} I_1(x)$
s18dcc	7	nag_complex_bessel_k Modified Bessel functions $K_{\nu+a}(z)$, real $a \geq 0$, complex z, $\nu = 0, 1, 2, \ldots$
s18dec	7	nag_complex_bessel_i Modified Bessel functions $I_{\nu+a}(z)$, real $a \geq 0$, complex z, $\nu = 0, 1, 2, \ldots$
s18ecc	6	nag_bessel_i_nu_scaled Scaled modified Bessel function $e^{-x} I_{\nu/4}(x)$
s18edc	6	nag_bessel_k_nu_scaled Scaled modified Bessel function $e^x K_{\nu/4}(x)$
s18eec	6	nag_bessel_i_nu Modified Bessel function $I_{\nu/4}(x)$
s18efc	6	nag_bessel_k_nu Modified Bessel function $K_{\nu/4}(x)$
s18egc	6	nag_bessel_k_alpha Modified Bessel functions $K_{\alpha+n}(x)$ for real $x > 0$, selected values of $\alpha \geq 0$ and $n = 0, 1, \ldots, N$
s18ehc	6	nag_bessel_k_alpha_scaled Scaled modified Bessel functions $K_{\alpha+n}(x)$ for real $x > 0$, selected values of $\alpha \geq 0$ and $n = 0, 1, \ldots, N$
s18ejc	6	nag_bessel_i_alpha Modified Bessel functions $I_{\alpha+n-1}(x)$ or $I_{\alpha-n+1}(x)$ for real $x \neq 0$, non-negative $\alpha < 1$ and $n = 1, 2, \ldots, \lvert N\rvert + 1$
s18ekc	6	nag_bessel_j_alpha Bessel functions $J_{\alpha+n-1}(x)$ or $J_{\alpha-n+1}(x)$ for real $x \neq 0$, non-negative $\alpha < 1$ and $n = 1, 2, \ldots, \lvert N\rvert + 1$
s18gkc	7	nag_complex_bessel_j_seq Bessel function of the 1st kind $J_{\alpha\pm n}(z)$
s19aac	1	nag_kelvin_ber Kelvin function $\mathrm{ber}\, x$
s19abc	1	nag_kelvin_bei Kelvin function $\mathrm{bei}\, x$
s19acc	1	nag_kelvin_ker Kelvin function $\mathrm{ker}\, x$
s19adc	1	nag_kelvin_kei Kelvin function $\mathrm{kei}\, x$

s20acc	1	nag_fresnel_s Fresnel integral $S(x)$
s20adc	1	nag_fresnel_c Fresnel integral $C(x)$
s21bac	1	nag_elliptic_integral_rc Degenerate symmetrised elliptic integral of 1st kind $R_C(x, y)$
s21bbc	1	nag_elliptic_integral_rf Symmetrised elliptic integral of 1st kind $R_F(x, y, z)$
s21bcc	1	nag_elliptic_integral_rd Symmetrised elliptic integral of 2nd kind $R_D(x, y, z)$
s21bdc	1	nag_elliptic_integral_rj Symmetrised elliptic integral of 3rd kind $R_J(x, y, z, r)$
s21cac	7	nag_real_jacobian_elliptic Jacobian elliptic functions sn, cn and dn of real argument
s21cbc	6	nag_jacobian_elliptic Jacobian elliptic functions sn, cn and dn of complex argument
s21ccc	6	nag_jacobian_theta Jacobian theta functions with real arguments
s21dac	6	nag_elliptic_integral_f Elliptic integrals of the second kind with complex arguments
s22aac	6	nag_legendre_p Legendre and associated Legendre functions of the first kind with real arguments

x01 – Mathematical Constants

Routine Name	Mark of Introduction	Purpose
X01AAC	2	nag_pi π
X01ABC	2	nag_euler_constant Euler's constant, γ

x02 – Machine Constants

Routine Name	Mark of Introduction	Purpose
X02AHC	2	nag_max_sine_argument The largest permissible argument for sin and cos
X02AJC	2	nag_machine_precision The machine precision
X02AKC	2	nag_real_smallest_number The smallest positive model number
X02ALC	2	nag_real_largest_number The largest positive model number
X02AMC	2	nag_real_safe_small_number Safe range of floating-point arithmetic
X02ANC	6	nag_complex_safe_small_number Safe range of NAG complex floating-point arithmetic
X02BBC	2	nag_max_integer The largest representable integer
X02BEC	2	nag_decimal_digits The maximum number of decimal digits that can be represented
X02BHC	2	nag_real_base Parameter b of model of floating-point arithmetic
X02BJC	2	nag_real_base_digits Parameter p of model of floating-point arithmetic

X02BKC	2	nag_real_min_exponent Parameter $e_{\min}$ of model of floating-point arithmetic
X02BLC	2	nag_real_max_exponent Parameter $e_{\max}$ of model of floating-point arithmetic
X02DAC	2	nag_underflow_flag Switch for taking precautions to avoid underflow
X02DJC	2	nag_real_arithmetic_rounds Parameter ROUNDS of model of floating-point arithmetic

x04 – Input/Output Utilities

Routine Name	Mark of Introduction	Purpose
x04cac	7	nag_gen_real_mat_print Print real general matrix (easy-to-use)
x04cbc	7	nag_gen_real_mat_print_comp Print real general matrix (comprehensive)
x04ccc	7	nag_pack_real_mat_print Print real packed triangular matrix (easy-to-use)
x04cdc	7	nag_pack_real_mat_print_comp Print real packed triangular matrix (comprehensive)
x04cec	7	nag_band_real_mat_print Print real packed banded matrix (easy-to-use)
x04cfc	7	nag_band_real_mat_print_comp Print real packed banded matrix (comprehensive)
x04dac	7	nag_gen_complx_mat_print Print complex general matrix (easy-to-use)
x04dbc	7	nag_gen_complx_mat_print_comp Print complex general matrix (comprehensive)
x04dcc	7	nag_pack_complx_mat_print Print complex packed triangular matrix (easy-to-use)
x04ddc	7	nag_pack_complx_mat_print_comp Print complex packed triangular matrix (comprehensive)
x04dec	7	nag_band_complx_mat_print Print complex packed banded matrix (easy-to-use)
x04dfc	7	nag_band_complx_mat_print_comp Print complex packed banded matrix (comprehensive)