Meaning of prefixes

S - REAL	C - COMPLEX
D - DOUBLE PRECISION	Z - COMPLEX*16
	(this may not be supported by all machines)

For the Level 2 BLAS a set of extended-precision routines with the prefixes ES, ED, EC, EZ may also be available.

Level 1 BLAS

In addition to the listed routines there are two further extended-precision dot product routines DQDOTI and DQDOTA

Level 2 and Level 3 BLAS

Matrix types:

GE - GEneral	GB - General Band	
SY - SYmmetric	SB - Sym Band	SP - Sym Packed
HE - HErmitian	HB - Herm Band	HP - Herm Packed
TR - TRiangular	TB - Triang Band	TP - Triang Packed

Level 2 and Level 3 BLAS Options

Many options arguments are declared as CHARACTER*1 and may be passed as character strings.

TRANSx	= 'No transpose', 'Transpose', 'Conjugate transpose' (X, X^T, X^H)
UPLO	= 'Upper triangular', 'Lower triangular'
DIAG	= 'Non-unit triangular', 'Unit triangular'
SIDE	= 'Left', 'Right' (A or op(A) on the left, or A or op(A) on the right)

For real matrices, TRANSx = 'T' and TRANSx = 'C' have the same meaning.
For Hermitian matrices, TRANSx = 'T' is not allowed
For complex symmetric matrices, TRANSx = 'H' is not allowed

References

C. Lawson, R. Hanson, D. Kincaid, and F. Krogh, "Basic Linear Algebra Subprograms for Fortran Usage," *ACM Trans. on Math. Soft.* 5 (1979) 308-325

J. J. Dongarra, J. DuCroz, S. Hammarling, and R. Hanson, "An Extended Set of Fortran Basic Linear Algebra Subprograms," *ACM Trans. on Math. Soft.* 14,1 (1988) 1-32

J. J. Dongarra, I. Duff, J. DuCroz, and S. Hammarling, "A Set of Level 3 Basic Linear Algebra Subprograms," *ACM Trans. on Math. Soft.* 16,1 (1990) 1-28

Obtaining the Software via netlib@ornl.gov

To receive a copy of the single-precision software, type in a mail message:

```
send sblas from blas
send sblas2 from blas
send sblas3 from blas
```

To receive a copy of the double-precision software, type in a mail message:

```
send dblas from blas
send dblas2 from blas
send dblas3 from blas
```

To receive a copy of the complex single-precision software, type in a mail message:

```
send cblas from blas
send cblas2 from blas
send cblas3 from blas
```

To receive a copy of the complex double-precision software, type in a mail message:

```
send zblas from blas
send zblas2 from blas
send zblas3 from blas
```

Send comments and questions to `lapack@cs.utk.edu` .

Basic Linear Algebra Subprograms

A Quick Reference Guide

University of Tennessee
Oak Ridge National Laboratory
Numerical Algorithms Group Ltd

June 19, 1992

Level 1 BLAS

	dim	scalar	vector	vector	scalars		5-element array		prefixes
SUBROUTINE xROTG (					A, B, C, S)			Generate plane rotation	S, D
SUBROUTINE xROTMG(					D1, D2, A, B,		PARAM)	Generate modified plane rotation	S, D
SUBROUTINE xROT (	N,		X, INCX,	Y, INCY,		C, S)		Apply plane rotation	S, D
SUBROUTINE xROTM (	N,		X, INCX,	Y, INCY,			PARAM)	Apply modified plane rotation	S, D
SUBROUTINE xSWAP (	N,		X, INCX,	Y, INCY)				$x \leftrightarrow y$	S, D, C, Z
SUBROUTINE xSCAL (	N,	ALPHA,	X, INCX)					$x \leftarrow \alpha x$	S, D, C, Z, CS, ZD
SUBROUTINE xCOPY (	N,		X, INCX,	Y, INCY)				$y \leftarrow x$	S, D, C, Z
SUBROUTINE xAXPY (	N,	ALPHA,	X, INCX,	Y, INCY)				$y \leftarrow \alpha x + y$	S, D, C, Z
FUNCTION xDOT (	N,		X, INCX,	Y, INCY)				$dot \leftarrow x^T y$	S, D, DS
FUNCTION xDOTU (	N,		X, INCX,	Y, INCY)				$dot \leftarrow x^T y$	C, Z
FUNCTION xDOTC (	N,		X, INCX,	Y, INCY)				$dot \leftarrow x^H y$	C, Z
FUNCTION xxDOT (	N,	ALPHA,	X, INCX,	Y, INCY)				$dot \leftarrow \alpha + x^T y$	SDS
FUNCTION xNRM2 (	N,		X, INCX)					$nrm2 \leftarrow \|x\|_2$	S, D, SC, DZ
FUNCTION xASUM (	N,		X, INCX)					$asum \leftarrow \sum_i \|re(x_i)\| + \|im(x_i)\|$	S, D, SC, DZ
FUNCTION IxAMAX(	N,		X, INCX)					$amax \leftarrow$ first $k \ni \|re(x_k)\| + \|im(x_k)\| = max_i(\|re(x_i)\| + \|im(x_i)\|)$	S, D, C, Z

Level 2 BLAS

	options			dim	b-width	scalar	matrix	vector	scalar	vector		
xGEMV (		TRANS,		M, N,		ALPHA,	A, LDA,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$, $y \leftarrow \alpha A^T x + \beta y$, $y \leftarrow \alpha A^H x + \beta y$, A – $m \times n$	S, D, C, Z
xGBMV (		TRANS,		M, N,	KL, KU,	ALPHA,	A, LDA,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$, $y \leftarrow \alpha A^T x + \beta y$, $y \leftarrow \alpha A^H x + \beta y$, A – $m \times n$	S, D, C, Z
xHEMV (	UPLO,			N,		ALPHA,	A, LDA,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$	C, Z
xHBMV (	UPLO,			N,	K,	ALPHA,	A, LDA,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$	C, Z
xHPMV (	UPLO,			N,		ALPHA,	AP,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$	C, Z
xSYMV (	UPLO,			N,		ALPHA,	A, LDA,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$	S, D
xSBMV (	UPLO,			N,	K,	ALPHA,	A, LDA,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$	S, D
xSPMV (	UPLO,			N,		ALPHA,	AP,	X, INCX,	BETA,	Y, INCY)	$y \leftarrow \alpha Ax + \beta y$	S, D
xTRMV (	UPLO,	TRANS,	DIAG,	N,			A, LDA,	X, INCX)			$x \leftarrow Ax$, $x \leftarrow A^T x$, $x \leftarrow A^H x$	S, D, C, Z
xTBMV (	UPLO,	TRANS,	DIAG,	N,	K,		A, LDA,	X, INCX)			$x \leftarrow Ax$, $x \leftarrow A^T x$, $x \leftarrow A^H x$	S, D, C, Z
xTPMV (	UPLO,	TRANS,	DIAG,	N,			AP,	X, INCX)			$x \leftarrow Ax$, $x \leftarrow A^T x$, $x \leftarrow A^H x$	S, D, C, Z
xTRSV (	UPLO,	TRANS,	DIAG,	N,			A, LDA,	X, INCX)			$x \leftarrow A^{-1}x$, $x \leftarrow A^{-T}x$, $x \leftarrow A^{-H}x$	S, D, C, Z
xTBSV (	UPLO,	TRANS,	DIAG,	N,	K,		A, LDA,	X, INCX)			$x \leftarrow A^{-1}x$, $x \leftarrow A^{-T}x$, $x \leftarrow A^{-H}x$	S, D, C, Z
xTPSV (	UPLO,	TRANS,	DIAG,	N,			AP,	X, INCX)			$x \leftarrow A^{-1}x$, $x \leftarrow A^{-T}x$, $x \leftarrow A^{-H}x$	S, D, C, Z

	options			dim	scalar	vector	vector	matrix		
xGER (				M, N,	ALPHA,	X, INCX,	Y, INCY,	A, LDA)	$A \leftarrow \alpha x y^T + A$, A – $m \times n$	S, D
xGERU (				M, N,	ALPHA,	X, INCX,	Y, INCY,	A, LDA)	$A \leftarrow \alpha x y^T + A$, A – $m \times n$	C, Z
xGERC (				M, N,	ALPHA,	X, INCX,	Y, INCY,	A, LDA)	$A \leftarrow \alpha x y^H + A$, A – $m \times n$	C, Z
xHER (	UPLO,			N,	ALPHA,	X, INCX,		A, LDA)	$A \leftarrow \alpha x x^H + A$	C, Z
xHPR (	UPLO,			N,	ALPHA,	X, INCX,		AP)	$A \leftarrow \alpha x x^H + A$	C, Z
xHER2 (	UPLO,			N,	ALPHA,	X, INCX,	Y, INCY,	A, LDA)	$A \leftarrow \alpha x y^H + y (\alpha x)^H + A$	C, Z
xHPR2 (	UPLO,			N,	ALPHA,	X, INCX,	Y, INCY,	AP)	$A \leftarrow \alpha x y^H + y (\alpha x)^H + A$	C, Z
xSYR (	UPLO,			N,	ALPHA,	X, INCX,		A, LDA)	$A \leftarrow \alpha x x^T + A$	S, D
xSPR (	UPLO,			N,	ALPHA,	X, INCX,		AP)	$A \leftarrow \alpha x x^T + A$	S, D
xSYR2 (	UPLO,			N,	ALPHA,	X, INCX,	Y, INCY,	A, LDA)	$A \leftarrow \alpha x y^T + \alpha y x^T + A$	S, D
xSPR2 (	UPLO,			N,	ALPHA,	X, INCX,	Y, INCY,	AP)	$A \leftarrow \alpha x y^T + \alpha y x^T + A$	S, D

Level 3 BLAS

	options			dim	scalar	matrix	matrix	scalar	matrix	
xGEMM (		TRANSA,	TRANSB,	M, N, K,	ALPHA,	A, LDA,	B, LDB,	BETA,	C, LDC)	$C \leftarrow \alpha op(A) op(B) + \beta C$, $op(X) = X^T, X^H$, C – $m \times n$	S, D, C, Z
xSYMM (	SIDE,	UPLO,		M, N,	ALPHA,	A, LDA,	B, LDB,	BETA,	C, LDC)	$C \leftarrow \alpha AB + \beta C$, $C \leftarrow \alpha BA + \beta C$, C – $m \times n$, $A = A^T$	S, D, C, Z
xHEMM (	SIDE,	UPLO,		M, N,	ALPHA,	A, LDA,	B, LDB,	BETA,	C, LDC)	$C \leftarrow \alpha AB + \beta C$, $C \leftarrow \alpha BA + \beta C$, C – $m \times n$, $A = A^H$	C, Z
xSYRK (		UPLO,	TRANS,	N, K,	ALPHA,	A, LDA,		BETA,	C, LDC)	$C \leftarrow \alpha AA^T + \beta C$, $C \leftarrow \alpha A^T A + \beta C$, C – $n \times n$	S, D, C, Z
xHERK (		UPLO,	TRANS,	N, K,	ALPHA,	A, LDA,		BETA,	C, LDC)	$C \leftarrow \alpha AA^H + \beta C$, $C \leftarrow \alpha A^H A + \beta C$, C – $n \times n$	C, Z
xSYR2K(		UPLO,	TRANS,	N, K,	ALPHA,	A, LDA,	B, LDB,	BETA,	C, LDC)	$C \leftarrow \alpha AB^T + \alpha BA^T + \beta C$, $C \leftarrow \alpha A^T B + \alpha B^T A + \beta C$, C – $n \times n$	S, D, C, Z
xHER2K(		UPLO,	TRANS,	N, K,	ALPHA,	A, LDA,	B, LDB,	BETA,	C, LDC)	$C \leftarrow \alpha AB^H + \alpha BA^H + \beta C$, $C \leftarrow \alpha A^H B + \alpha B^H A + \beta C$, C – $n \times n$	C, Z
xTRMM (	SIDE,	UPLO,	TRANSA,	DIAG, M, N,		ALPHA,	A, LDA,	B, LDB)		$B \leftarrow \alpha op(A)B$, $B \leftarrow \alpha B op(A)$, $op(A) = A, A^T, A^H$, B – $m \times n$	S, D, C, Z
xTRSM (	SIDE,	UPLO,	TRANSA,	DIAG, M, N,		ALPHA,	A, LDA,	B, LDB)		$B \leftarrow \alpha op(A^{-1})B$, $B \leftarrow \alpha B op(A^{-1})$, $op(A) = A, A^T, A^H$, B – $m \times n$	S, D, C, Z