

6.1 Vector and Matrix Output

A. Purpose

Subroutines are provided to print a vector or a matrix in a standard format that clearly displays the component positions of the vector or matrix. An optional descriptive header can also be printed. For similar subroutines that provide more choices for the appearance of the output, see Chapter 6.2.

B. Usage

B.1 Program Prototype, Vector Output, Single Precision

INTEGER N

REAL V($\geq N$)

CHARACTER*($1 \leq k \leq 132$) **TEXT**

Assign values to V(), N, and TEXT.

CALL SVECP (V, N, TEXT)

The N-vector stored in V() will be printed.

B.1.a Argument Definitions, Single Precision

V() [in] An array containing N numbers to be printed.

N [in] Number of components of V() to be printed. Require $N \geq 0$.

TEXT [in] A character string to be printed as a header preceding the vector. The length of TEXT should be at least 1 and not more than 132. The first character will be used as a printer line spacing control character. It is generally most convenient to place this character string in the CALL statement as a character literal. Thus, for example:

CALL SVECP (V, N, '0 V=')

Here the zero following the first apostrophe causes an extra line feed before the header.

B.2 Program Prototype, Matrix Output, Single Precision

INTEGER LDA, M, N

REAL A(LDA, $\geq N$) [$LDA \geq M$]

CHARACTER*($1 \leq k \leq 132$) **TEXT**

Assign values to all subroutine arguments.

CALL SMATP (A, LDA, M, N, TEXT)

The $M \times N$ matrix stored in A(.) will be printed.

B.2.a Argument Definitions, Single Precision

A(.) [in] An array containing an $M \times N$ matrix to be printed.

LDA [in] First dimensioning parameter of the array A(.). Require $LDA \geq M$.

M [in] Number of rows of A(.) to be printed.

N [in] Number of columns of A(.) to be printed.

TEXT [in] Same specification as for the argument TEXT of subroutine SVECP above.

B.3 Modifications for Double Precision or Integer Data

For double precision usage, change the REAL statements to DOUBLE PRECISION and change the initial letter of the subroutine names from "S" to "D". For integer usage, change the REAL type statements to INTEGER and change the initial letter of the subroutine names from "S" to "I".

C. Examples and Remarks

See the program DRVECP and the output ODVECP for an example of the use of SVECP, DVECP, and IVECP. See the program DRMATP and the output ODMATP for an example of the use of SMATP, DMATP, and IMATP.

D. Functional Description

The character string, TEXT, will always be printed. The user can set TEXT to blanks if no visible header is desired.

For the first character in TEXT the Fortran 77 standard assigns a line spacing control interpretation to '0', '1', '+', or a blank. In some operating environments this interpretation is not honored, and the character simply appear in the output. For greatest portability, and particularly when using the C versions of these codes, we recommend not using '1' or '+', but only '0' or blank. The codes are designed so that a blank produces no extra blank line and '0' produces one extra blank line before printing TEXT(2:).

D.1 Vector Output

If $N > 0$ the subroutine will print the first N components of the array V().

The subroutines SVECP and DVECP print eight components per line with a G15.7 format for each component if the round-off level is $> 5 \times 10^{-13}$, or six components

per line with a G20.12 format otherwise. The subroutine IVECP prints eight components per line with an I15 format for each component.

At the left of each printed line the indices of the first and last components in that line will be printed. The output is written using PRINT or WRITE(*,...).

D.2 Matrix Output

If $M > 0$ and $N > 0$ the subroutine will print the leading $M \times N$ matrix contained in the array A(,).

Subroutines SMATP and DMATP print the matrix in $M \times 8$ blocks using G15.7 format for each element if the round-off level is $> 5 \times 10^{-13}$, and in $M \times 6$ blocks using G20.12 format for each element otherwise. Subroutine IMATP prints the matrix in $M \times 8$ blocks using I15 format for each element.

Each column will be headed with its column number and each row will have its row number printed along the left margin. Output is written using PRINT or WRITE(*,...).

E. Error Procedures and Restrictions

For vector output, if $N \leq 0$, no vector components will be printed. For matrix output, if $M \leq 0$ or $N \leq 0$, no matrix elements will be printed.

The built-in format was designed for a line printer having 132 columns. The results are less satisfactory, due to wraparound, on an output device having fewer print columns. See Chapter 6.2 for similar subroutines giving more flexibility.

F. Supporting Information

The source language is ANSI Fortran 77.

Entry	Required Files
DMATP	DMATP
DVECP	DVECP
IMATP	IMATP
IVECP	IVECP
SMATP	SMATP
SVECP	SVECP

Based on 1969 code by C.L. Lawson, JPL. Altered by Lawson and S. Chiu, JPL, 1983; Lawson, 1994.

DRVECP

```

program DRVECP
c>> 2001-05-22 DRVECPR Krogh Minor change for making .f90 version.
c>> 1992-04-22 CLL
c>> 1987-12-09 DRVECP    Lawson    Initial Code.
c
      integer A(4), I, N
      real B(4)
      double precision C(4)
c
      data (A(I),I=1,4) / 1,2,3,4 /
      data (B(I),I=1,4) / 1.,2.,3.,4. /
      data (C(I),I=1,4) / 1.D0, 2.D0, 3.D0, 4.D0 /
      data N / 4 /
c
      call IVECP (A,N,'0 IVECP.. A()=')
      call SVECP (B,N,'0 SVECP.. B()=')
      call DVECP (C,N,'0 DVECP.. C()=')
c
      end

```

ODVECP

```

IVECP.. A()=
  1 TO   4           1           2           3           4

SVECP.. B()=
  1 TO   4   1.000000   2.000000   3.000000   4.000000

```

```
DVECP.. C(=
1 TO 4 1.000000000000 2.000000000000 3.000000000000 4.000000000000
```

DRMATP

```

program DRMATP
c>> 2001-05-22 DRMATP Krogh Minor change for making .f90 version.
c>> 1992-04-22 CLL
c>> 1987-12-09 DRMATP Lawson Initial Code.
c
      integer I, J, M, N
c
      integer A(4,3)
      real B(4,3)
      double precision C(4,3)
      data ((A(I,J),J=1,3),I=1,4) / 1,2,3,4,5,6,7,8,9,10,11,12 /
      data ((B(I,J),J=1,3),I=1,4) / 1.,2.,3.,4.,5.,6.,7.,8.,9.,
* 10.,11.,12. /
      data ((C(I,J),J=1,3),I=1,4) / 1.D0,2.D0,3.D0,4.D0,5.D0,
* 6.D0,7.D0,8.D0,9.D0,10.D0,
* 11.D0,12.D0 /
      data M / 4 /
      data N / 3 /
c
      call IMATP (A,M,M,N, '0 IMATP.. A(,)=')
      call SMATP (B,M,M,N, '0 SMATP.. B(,)=')
      call DMATP (C,M,M,N, '0 DMATP.. C(,)=')
c
end

```

ODMATP

IMATP.. A(,)=

		COL	1	COL	2	COL	3
ROW	1		1		2		3
ROW	2		4		5		6
ROW	3		7		8		9
ROW	4		10		11		12

SMATP.. B(,)=

		COL	1	COL	2	COL	3
ROW	1		1.000000		2.000000		3.000000
ROW	2		4.000000		5.000000		6.000000
ROW	3		7.000000		8.000000		9.000000
ROW	4		10.00000		11.00000		12.00000

DMATP.. C(,)=

		COL	1	COL	2	COL	3
ROW	1		1.000000000000		2.000000000000		3.000000000000
ROW	2		4.000000000000		5.000000000000		6.000000000000
ROW	3		7.000000000000		8.000000000000		9.000000000000
ROW	4		10.00000000000		11.00000000000		12.00000000000