Subject: Re: builtin simplex?
Posted by Carsten Dominik on Thu, 05 Dec 2002 11:18:45 GMT
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>>>> > "BS" == Bringfried Stecklum <stecklum@tls-tautenburg.de> writes:

BS> I recently realized that a piece of code which compiled fine
BS> with IDL5.4 failed under 5.5a because of
BS> "SIMPLEX: incorrect number of arguments."
BS> The reason for that is that there must be an IDL function of
BS> the same name which expects different arguments. I did not find
BS> any reference to it in the help system and it does not show
BS> up with help,/fun. Does anybody know more about it?
BS> The obvious solution was to rename my simplex.pro to
BS> my_simplex.pro.

Hallo Bringfried,

It seems to be a new builtin function:

- Carsten

SIMPLEX
The SIMPLEX function uses the simplex
method to solve linear programming
problems. Given a set of N independent
variables Xi, where i = 1, ..., N, the simplex
method seeks to maximize the following function,
Z = a1X1 + a2X2 + ...aNXN
with the assumption that Xi 0. The Xi
are further constrained by the following
equations:
bj1X1 + bj2X2 + ...bjNXN cj j = 1, 2 ...
, ,M1
bj1X1 + bj2X2 + ...bjNXN cj j = M1 + 1, M1 + 2 ...
, , M1 + M2
bj1X1 + bj2X2 + ...bjNXN= cj j
= M1 + M2 + 1, M1 + M2 + 2 ...
, , M

where M = M1 + M2 + M3 is the total number
of equations, and the constraint values
cj must all be positive.
To solve the above problem using the SIMPLEX
function, the Z equation is rewritten
as a vector:

Zequation = a1 a2 ...aN

The constraint equations are rewritten
as a matrix with N+1 columns and M rows,
where all of the b coefficients
have had their sign reversed:

```
                c1 ï¿½b11 ï¿½b12...ï¿½b1N
                c2 ï¿½b21 ï¿½b22...ï¿½b2N
        Constraints =      :    :           :
                :    :           :
               cM ï¿½bM1 ï¿½bM2...ï¿½bMN
```

Note
The constraint matrix must be organized so
that the coefficients for the less-than (<)
equations come first, followed by the
coefficients of the greater-than (>) equations,
and then the coefficients of the equal (=) equations.

The Result is a vector of N+1 elements
containing the maximum Z value and the
values of the N independent X variables
(the optimal feasible vector):

```
        Result = Zmax X1 X2...XN
```

The SIMPLEX function is based on the
routine simplx described in section 10.8 of
Numerical Recipes in C: The Art of Scientific
Computing (Second Edition), published
by Cambridge University Press, and is used by permission.

Syntax

```
Result = SIMPLEX( Zequation, Constraints, M1, M2, M3
[, Tableau [, Izrov [, Iposv] ] ] [, /DOUBLE]
[, EPS = value] [, STATUS = variable] )
```

Arguments

Zequation
A vector containing the N coefficients
of the Zequation to be maximized.

Constraints
An array of N+1 columns by M rows containing
the constraint values and coefficients
for the constraint equations.

M1
An integer giving the number of less-than
constraint equations contained in
Constraints. M1 may be zero, indicating
that there are no less than constraints.

M2
An integer giving the number of greater-than
constraint equations contained in
Constraints. M2 may be zero, indicating

that there are no greater than constraints.

M3

An integer giving the number of equal-to constraint equations contained in Constraints. M3 may be zero, indicating that there are no equal to constraints. The total of M1 + M2 + M3 should equal M, the number of constraint equations.

Tableau

Set this optional argument to a named variable in which to return the output array from the simplex algorithm. For more detailed discussion about this argument, see the write-up in section 10.8 of Numerical Recipes in C.

Izrov

Set this optional argument to a named variable in which to return the output izrov variable from the simplex algorithm. For more detailed discussion about this argument, see the write-up in section 10.8 of Numerical Recipes in C.

Iposv

Set this optional argument to a named variable in which to return the output iposv variable from the simplex algorithm. For more detailed discussion about this argument, see the write-up in section 10.8 of Numerical Recipes in C.

Keywords

DOUBLE

Set this keyword to use double-precision for computations and to return a double-precision result. Set DOUBLE to 0 to use single-precision for computations and to return a single-precision result. The default is /DOUBLE if any of the inputs are double-precision, otherwise the default is 0.

EPS

Set this keyword to a number close to machine accuracy, which is used to test for convergence at each iteration. The default is 10ï¿½6.

STATUS

Set this keyword to a named variable to receive the status of the operation. Possible status values are:

Value	Description

0	Successful completion.
1	The objective function is unbounded.
2	No solution satisfies the given constraints.
3	The routine did not converge.

Table 6-3: SIMPLEX Function Status Values

Example

The following example is taken from Numerical Recipes in C.
Find the Z value which maximizes the equation
Z = X1 + X2 + 3 X3 - 0.5 X4, with the
following constraints:

X1 + 2X3 740
2X2 ï¿½ 7X4 0
X2 ï¿½ X3 + 2X4 0.5
X1 + X2 + X3 + X4 = 9

To find the solution, enter the
following code at the IDL command line:

```
; Set up the Zequation with the X coefficients.
Zequation = [1,1,3,-0.5]
; Set up the Constraints matrix.
Constraints = [ $
  [740, -1, 0, -2, 0], $
  [ 0, 0, -2, 0, 7], $
  [0.5, 0, -1, 1, -2], $
  [ 9, -1, -1, -1, -1] ]
; Number of less-than constraint equations.
m1 = 2
; Number of greater-than constraint equations.
m2 = 1
; Number of equal constraint equations.
m3 = 1
;; Call the function.
result = SIMPLEX(Zequation, Constraints, m1, m2, m3)
;; Print out the results.
PRINT, 'Maximum Z value is: ', result[0]
PRINT, 'X coefficients are: '
PRINT, result[1:*]
```

IDL prints:

```
Maximum Z value is:           17.0250
X coefficients are:
     0.000000      3.32500         4.72500      0.950000
```

Therefore, the optimal feasible vector
is X1 = 0.0, X2 = 3.325, X3 = 4.725, and
X4 = 0.95.

See Also

AMOEBA, DFPMIN, POWELL