NAME

PHASE1 − Pivot in a linear programming tableau to make the constant column nonnegative.

SYNOPSIS

CALL PHASE1(T,LDT,BASIS,MP,N,ROWS,MR, RC)

T(LDT,*)	is the REAL*8 linear programming tableau
LDT	is the INTEGER*4 leading dimension of T
BASIS(N)	is the INTEGER*4 input/output vector of basic column row indices, 0 for nonbasic
MP	is the INTEGER*4 total number of rows in the LP including the objective
N	is the INTEGER*4 number of variables in the LP
ROWS(MR)	is the INTEGER*4 input vector of the row indices in the problem
MR	is the INTEGER*4 input number of rows in use including the objective
RC	is the INTEGER*4 return code; 0 => ready; 2 => infeasible form 2

DESCRIPTION

First the routine makes sure that there is at least one nonnegative constant column entry. If all of the constant column entries in the input tableau are negative, it pivots on the leftmost negative entry in the first constraint row to make that constant column entry positive. If none of those constraint row entries are positive then the problem is in infeasible form 2 so the routine returns with RC=2.

Then it constructs and solves a sequence of subproblems, each having the first constraint row with a negative constant column entry as objective and all of the constraint rows with nonnegative constant column entries as constraints. If in constructing a subproblem it finds that all of the constant column entries are nonnegative, then the tableau is in canonical form so the routine returns with RC=0. If a subproblem has an optimal value that is less in absolute value than 1.D-06, it sets that value to zero. If a subproblem has an optimal value that is positive then the main problem is in infeasible form 2 so the routine returns with RC=2. If a subproblem is unbounded, the routine pivots on the subproblem objective element in the unbounded column and continues. Each subproblem is solved by calling PHASE2, which pivots the whole tableau. Every pivot changes T and BASIS.

DIAGNOSTICS

On output these are the possible RC values:

0 all went well
2 the problem is in infeasible form 2

LINKAGE

gfortran source.f −L${HOME}/lib −lmisc

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EXAMPLE

```
      PARAMETER(LDT=3,MP=3,N=5,MR=3)
      INTEGER*4 ROWS(MR)/1,2,3/,BASIS(5),RC
      REAL*8 T(LDT,1+N)/0.D0,-5.D0, 5.D0,
     ;                 -2.D0, 1.D0, 0.D0,
     ;                  1.D0,-2.D0, 1.D0,
     ;                 -1.D0, 2.D0,-1.D0,
     ;                  0.D0, 1.D0, 0.D0,
     ;                  0.D0, 0.D0, 1.D0/
      DO 1 I=1,MP
           WRITE(6,901) (T(I,J),J=1,1+N)
901        FORMAT(6(1X,F4.1))
  1   CONTINUE
      CALL PHASE1(T,LDT,BASIS,MP,N,ROWS,MR, RC)
      WRITE(6,900)
900   FORMAT(' ')
      DO 2 I=1,MP
           WRITE(6,901) (T(I,J),J=1,1+N)
  2   CONTINUE
      STOP
      END
```

This example (which is from [1] Exercise 2.10.21) produced the following output:

```
unix[1] a.out
  0.0 -2.0  1.0 -1.0  0.0  0.0
 -5.0  1.0 -2.0  2.0  1.0  0.0
  5.0  0.0  1.0 -1.0  0.0  1.0

 -5.0 -2.0  0.0  0.0  0.0 -1.0
  5.0  1.0  0.0  0.0  1.0  2.0
  5.0  0.0  1.0 -1.0  0.0  1.0
unix[2]
```

REFERENCE

[1] Kupferschmid, Michael, "Introduction to Mathematical Programming"