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!  This is a test program for FM 1.4, a multiple-precision arithmetic package.

!  All of the FM (floating-point real) and ZM (floating-point complex) routines are tested.
!  Precision is set to 50 significant digits and the results are checked to that accuracy.
!  A few constants are computed with 20,000 significant digits and a few arithmetic operations
!  are done with 30,000 significant digits, to test the routines that use special algorithms
!  for very high precision.
!  All of the IM (integer) routines are tested, with exact results required to pass the tests.
!  All of the use fmzm derived type interface routines are tested in the same manner as those
!  described above.

!  If all tests are completed successfully, a line is printed giving the number of cases tested
!  and saying "No errors were found".


      module test_vars

      use fmvals
      use fmzm

!             Declare the derived type variables of type (fm), (im), and (zm).
!             These are in the form that would be found in a user program.

      type (fm), save ::  m_a, m_b, m_c, m_d, mfm1, mfm2, mfm3, mfm4, mfm5, mfm6, msmall,  &
                          mfmv1(3),  mfmv2(3),  mfmv4(3),  mfmv3(2),                       &
                          mfma(3, 3), mfmb(3, 3), mfmc(3, 3), mfmd(2, 2), mfme(3, 2), mfmf(2, 3)

!             These are the integer multiple precision variables.

      type (im), save :: m_j, m_k, m_l,  mim1,  mim2,  mim3, mim4, mim5
      type (im), save, dimension(3)   :: mimv1, mimv2, mimv4
      type (im), save, dimension(2)   :: mimv3
      type (im), save, dimension(2, 2) :: mima,  mimb,  mimc
      type (im), save, dimension(3, 2) :: mimd
      type (im), save, dimension(2, 3) :: mime
      type (im), save, dimension(3, 3) :: mima2, mimb2, mimc2

!             These are the complex multiple precision variables.

      type (zm), save :: m_x, m_y, m_z, mzm1, mzm2, mzm3, mzm4, mzm5,                 &
                         mzmv1(3),    mzmv2(3),    mzmv4(3),    mzmv3(2),  mzmv5(4),  &
                         mzma(2, 3),  mzmb(3, 4),  mzmc(2, 4),  mzmd(3, 2),           &
                         mzma2(3, 3), mzmb2(3, 3), mzmc2(3, 3), mzma3(3, 3)

!             Declare and initialize some other multiple precision variables.
!             These are in the internal form used in the basic arithmetic routines.

      type(multi) :: ma, mb, mc, md, me, mp1, mp2, mp3, mp4, mp5, mlnsv2, mlnsv3, mlnsv5, mlnsv7
      type(multi) :: za(2), zb(2), zc(2), zd(2), ze(2), zp1(2), zp2(2), zp3(2), zp4(2),  &
                     zp5(2)

!             These are the variables that are not multiple precision.

      integer, save :: j1, j2, j3, j4, j5, jv(3), jv2(3, 3), ml(2)
      real, save :: r1, r2, r3, r4, r5, rsmall, rv(3), rv2(3, 3)
      double precision, save :: d1, d2, d3, d4, d5, dsmall, dv(3), dv2(3, 3)
      complex, save :: c1, c2, c3, c4, c5, cv(3), cv2(3, 3)
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```
      complex (kind(0.0d0)), save :: cd1, cd2, cd3, cd4, cdv(3), cdv2(3, 3)

      character(80), save :: st1, st2, string, stv(3), stv2(3, 3)
      character(160), save :: stz1, stz2
      character, save :: line(10), line2(80), line3(160)
      integer, save :: irem, jerr, jexp, klog, l1, l2, kst, kwsave, ncase, ndgsav, nerror,  &
                       nstack(49), seed(7)
      real, save :: time1, time2
      logical, external :: fmcomp, fmcompare, fpcomp, fpcompare,  &
                           imcomp, imcompare, ipcomp, ipcompare

      end module test_vars

      module test_a
      use test_vars

      interface power
         module procedure power_fm
         module procedure power_im
         module procedure power_zm
      end interface

      interface matrix_product
         module procedure matrix_product_fm
         module procedure matrix_product_im
         module procedure matrix_product_zm
      end interface

      interface matrix_square
         module procedure matrix_square_fm
         module procedure matrix_square_im
         module procedure matrix_square_zm
      end interface

      contains

      subroutine test1

!  Input and output testing.

      implicit none
      integer :: k

      write (kw, "(/' Testing input and output routines.')")

!             ncase is the number of the case being tested.

      ncase = 1
      call fmst2m('123', ma)
      call fmi2m(123, mc)
      call fmsub(ma, mc, md)
      call fmabs(md, me)
      call fmeq(me, md)
      call fmi2m(10, mb)
      call fmipower(mb, -48, me)
      call fmeq(me, mb)

!             Use the .not. because fmcompare returns false for special cases like md = unknown,
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!             and these should be treated as errors for these tests.

      if (.not.fmcompare(md, 'le', mb)) then
          call errprtfm('fmst2m', ma, 'ma', mc, 'mc', md, 'md')
      endif

      ncase = 2
      st1 = '1.350515463917525773195876288659793814432989690721649 5'
      call fmst2m(st1, ma)
      call fmi2m(131, mb)
      call fmi2m(97, mc)
      call fmdiv(mb, mc, me)
      call fmeq(me, mc)
      call fmsub(ma, mc, md)
      call fmabs(md, me)
      call fmeq(me, md)
      call fmst2m('1.0e-50', mb)
      if (.not.fmcompare(md, 'le', mb)) then
          call errprtfm('fmst2m', ma, 'ma', mc, 'mc', md, 'md')
      endif

      ncase = 3
      st1 = '1.350515463917525773195876288659793814432989690721649 5e-2'
      call fmst2m(st1, ma)
      call fmi2m(131, mb)
      call fmi2m(9700, mc)
      call fmdiv(mb, mc, me)
      call fmeq(me, mc)
      call fmsub(ma, mc, md)
      call fmabs(md, me)
      call fmeq(me, md)
      call fmst2m('1.0e-52', mb)
      if (.not.fmcomp(md, 'le', mb)) then
          call errprtfm('fmst2m', ma, 'ma', mc, 'mc', md, 'md')
      endif

      ncase = 4
      st1 = '1.350515463917525773195876288659793814432989690721649 5e-2'
      call fmst2m(st1, ma)
      call fmform('f40.30', ma, st2)
      call fmst2m(st2, ma)
      st1 = '         .013505154639175257731958762887'
      call fmst2m(st2, mc)
      call fmsub(ma, mc, md)
      call fmabs(md, me)
      call fmeq(me, md)
      call fmst2m('0', mb)
      if ((.not.fmcomp(md, 'le', mb)) .or. st1 /= st2) then
          call errprtfm('fmform', ma, 'ma', mc, 'mc', md, 'md')
      endif

      ncase = 5
      st1 = '1.350515463917525773195876288659793814432989690721649 5e+16'
      call fmst2m(st1, ma)
      call fmform('f53.33', ma, st2)
      call fmst2m(st2, ma)
      st1 = '13505154639175257.731958762886597938144329896907216'
      call fmst2m(st1, mc)
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```
call fmsub(ma, mc, md)
call fmabs(md, me)
call fmeq(me, md)
call fmst2m('0', mb)
if (.not.fmcomp(md, 'le', mb)) then
    call errprtfm('fmform', ma, 'ma', mc, 'mc', md, 'md')
endif

ncase = 6
st1 = '1.3505154639175257731958762886597938144329896907216495e+16'
call fmst2m(st1, ma)
call fmform('i24', ma, st2)
call fmst2m(st2, ma)
st1 = '13505154639175258'
call fmst2m(st1, mc)
call fmsub(ma, mc, md)
call fmabs(md, me)
call fmeq(me, md)
call fmst2m('0', mb)
if (.not.fmcomp(md, 'le', mb)) then
    call errprtfm('fmform', ma, 'ma', mc, 'mc', md, 'md')
endif

ncase = 7
st1 ='-1.3505154639175257731958762886597938144329896907216495e+16'
call fmst2m(st1, ma)
call fmform('e55.49', ma, st2)
call fmst2m(st2, ma)
st1 = '-1.350515463917525773195876288659793814432989690722d16'
call fmst2m(st1, mc)
call fmsub(ma, mc, md)
call fmabs(md, me)
call fmeq(me, md)
call fmst2m('0', mb)
if (.not.fmcomp(md, 'le', mb)) then
    call errprtfm('fmform', ma, 'ma', mc, 'mc', md, 'md')
endif

ncase = 8
st1 ='-1.3505154639175257731958762886597938144329896907216495e+16'
call fmst2m(st1, ma)
call fmform('es54.45', ma, st2)
call fmst2m(st2, ma)
st1 = '-1.350515463917525773195876288659793814432989691M+16'
call fmst2m(st1, mc)
call fmsub(ma, mc, md)
call fmabs(md, me)
call fmeq(me, md)
call fmst2m('0', mb)
if (.not.fmcomp(md, 'le', mb)) then
    call errprtfm('fmform', ma, 'ma', mc, 'mc', md, 'md')
endif

ncase = 9
st1 ='-1.3505154639175257731958762886597938144329896907216495E+16'
call fmst2m(st1, ma)
call fmform('1pe54.45', ma, st2)
call fmst2m(st2, ma)
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st1 = '-1.3505154639175257731958762886597938144329896911M+16'
call fmst2m(st1, mc)
call fmsub(ma, mc, md)
call fmabs(md, me)
call fmeq(me, md)
call fmst2m('0', mb)
if (.not.fmcomp(md, 'le', mb)) then
    call errprtfm('fmform', ma, 'ma', mc, 'mc', md, 'md')
endif

call fm_setvar(' mbase = 10000 ')
call fm_setvar(' ndig = 7 ')
call fmsetvar(' kround = 1 ')

ncase = 10
stz1 = '0.12345678901234567890123456784999999999999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '0.12345678901234567890123456'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 11
stz1 = '0.123456789012345678901234567850000000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.12345678901234567890123456'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 12
stz1 = '0.123456789012345678901234567850000000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.12345678901234567890123456'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 13
stz1 = '0.123456789012345678901234567750000000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.12345678901234567890123456'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 14
stz1 = '0.123456789012345678901234567850000000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.12345678901234567890123457'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif
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```
call fmsetvar(' kround = 2 ')

ncase = 15
stz1 = '0.12345678901234567890123456779999999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234578'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 16
stz1 = '0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234577'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 17
stz1 = '0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234578'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = -1 ')

ncase = 18
stz1 = '0.12345678901234567890123456779999999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234577'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 19
stz1 = '0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234577'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 20
stz1 = '0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234577'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif
```

```
call fmsetvar(' kround = 0 ')

ncase = 21
stz1 = '0.12345678901234567890123456779999999999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 22
stz1 = '0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000000'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 23
stz1 = '0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif



call fmsetvar(' kround = 1 ')

ncase = 24
stz1 = '-0.12345678901234567890123456784999999999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234568'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 25
stz1 = '-0.123456789012345678901234567850'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234568'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 26
stz1 = '-0.123456789012345678901234567850'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234568'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
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    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 27
stz1 = '-0.12345678901234567890123456775'
m_c =  to_fm(stz1)
stz1 = '-0.12345678901234567890123456678'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 28
stz1 = '-0.123456789012345678901234567850000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '-0.12345678901234567890123456679'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 2 ')

ncase = 29
stz1 = '-0.123456789012345678901234567799999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '-0.12345678901234567890123456677'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 30
stz1 = '-0.123456789012345678901234567700000000000000000000000000000000000000000000000000000000'
m_c =  to_fm(stz1)
stz1 = '-0.12345678901234567890123456677'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 31
stz1 = '-0.123456789012345678901234567700000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '-0.12345678901234567890123456677'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = -1 ')

ncase = 32
stz1 = '-0.123456789012345678901234567799999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '-0.12345678901234567890123456678'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
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    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 33
stz1 = '-0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000000000'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 34
stz1 = '-0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234568'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 0 ')

ncase = 35
stz1 = '-0.12345678901234567890123456779999999999999999999999999999999999999999999999999999999999999999'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 36
stz1 = '-0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000000000'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 37
stz1 = '-0.12345678901234567890123456770000000000000000000000000000000000000000000000000000000000000001'
m_c =  to_fm(stz1)
stz1 = '-0.123456789012345678901234567'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 1 ')
call fm_setvar(' mbase = 2 ')
call fm_setvar(' ndig = 53 ')

ncase = 38
stz1 = '0.9'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
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if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 39
stz1 = '0.9'
m_c =  to_fm(stz1)
stz1 = '0.900000000000000022204460492503130808472633361816406 25'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 40
stz1 = '0.900000000000000077715611723760957829654216766357421875'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(9)/10 , to_fm(1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 41
stz1 = '0.900000000000000077715611723760957829654216766357421875000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(9)/10 , to_fm(1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 42
stz1 = '0.900000000000000077715611723760957829654216766357421874999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 2 ')

ncase = 43
stz1 = '0.9'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 44
stz1 = '0.9'
m_c =  to_fm(stz1)
stz1 = '0.900000000000000022204460492503130808472633361816406 25'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 45
stz1 = '0.900000000000000022204460492503130808472633361816406250000000000000000000000000001'
```

```
m_c =  to_fm(stz1)
m_d = nearest( to_fm(9)/10 , to_fm(1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 46
stz1 = '0.900000000000000022204460492503130808472633361816406249999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = -1 ')

ncase = 47
stz1 = '0.9'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 48
stz1 = '0.9'
m_c =  to_fm(stz1)
stz1 = '0.899999999999999911182158029987476766109466552734375'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 49
stz1 = '0.899999999999999911182158029987476766109466552734375000000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 50
stz1 = '0.899999999999999911182158029987476766109466552734374999999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(9)/10 , to_fm(-1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 0 ')

ncase = 51
stz1 = '0.9'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif
```

```
ncase = 52
stz1 = '0.9'
m_c =  to_fm(stz1)
stz1 = '0.899999999999999911182158029987476766109466552734375'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 53
stz1 = '0.89999999999999991118215802998747676610946655273437500000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = to_fm(9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 54
stz1 = '0.89999999999999991118215802998747676610946655273437499999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(9)/10 , to_fm(-1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 1 ')

ncase = 55
stz1 = '-0.9'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 56
stz1 = '-0.9'
m_c =  to_fm(stz1)
stz1 = '-0.900000000000000022204460492503130808472633361816406250'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 57
stz1 = '-0.900000000000000077715611723760957829654216766357421875'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(-9)/10 , to_fm(-1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 58
stz1 = '-0.900000000000000077715611723760957829654216766357421875000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(-9)/10 , to_fm(-1) )
if (.not.(m_d == m_c)) then
```

```
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 59
stz1 = '-0.900000000000000007771561172376095782965421676635742187499999999999999999999999999'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 2 ')

ncase = 60
stz1 = '-0.9'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 61
stz1 = '-0.9'
m_c =  to_fm(stz1)
stz1 = '-0.899999999999999911182158029987476766109466552734375'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 62
stz1 = '-0.899999999999999911182158029987476766109466552734375000000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 63
stz1 = '-0.899999999999999911182158029987476766109466552734374999999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(-9)/10 , to_fm(1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = -1 ')

ncase = 64
stz1 = '-0.9'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 65
stz1 = '-0.9'
```

```
m_c =  to_fm(stz1)
stz1 = '-0.900000000000000022204460492503130808472633361816406250'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 66
stz1 = '-0.900000000000000022204460492503130808472633361816406250000000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(-9)/10 , to_fm(-1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 67
stz1 = '-0.900000000000000022204460492503130808472633361816406249999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

call fmsetvar(' kround = 0 ')

ncase = 68
stz1 = '-0.9'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 69
stz1 = '-0.9'
m_c =  to_fm(stz1)
stz1 = '-0.899999999999999911182158029987476766109466552734375'
m_d = to_fm(stz1)
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 70
stz1 = '-0.899999999999999911182158029987476766109466552734374999999999999999999999999999999'
m_c =  to_fm(stz1)
m_d = nearest( to_fm(-9)/10 , to_fm(1) )
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif

ncase = 71
stz1 = '-0.899999999999999911182158029987476766109466552734375000000000000000000000000000001'
m_c =  to_fm(stz1)
m_d = to_fm(-9)/10
if (.not.(m_d == m_c)) then
    call errprt_fm(' Input', m_c, 'm_c', m_c, 'm_c', m_d, 'm_d')
endif
```

```
call fm_setvar(' mbase = 10000 ')
call fm_setvar(' ndig = 25 ')
call fmsetvar(' kround = 1 ')

ncase = 72
stz1 = '0.1234567890123456'
m_a =  to_fm(stz1)
call fm_form('f20.14', m_a, st1)
write (st2, "(f20.14)") to_dp(m_a)
k = index(st2, '0.')
if (k > 0) st2(k:k) = ' '
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 73
stz1 = '3.1234567890123456'
m_a =  to_fm(stz1)
call fm_form('f20.14', m_a, st1)
write (st2, "(f20.14)") to_dp(m_a)
k = index(st2, '0.')
if (k > 0) st2(k:k) = ' '
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 74
stz1 = '-3.1234567890123456'
m_a =  to_fm(stz1)
call fm_form('f20.13', m_a, st1)
write (st2, "(f20.13)") to_dp(m_a)
k = index(st2, '0.')
if (k > 0) st2(k:k) = ' '
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 75
stz1 = '3.1234567890123456e4'
m_a =  to_fm(stz1)
call fm_form('e25.14', m_a, st1)
write (st2, "(e25.14)") to_dp(m_a)
k = index(st2, 'E+05')
if (k > 0) st2(k:k+3) = 'M+5 '
k = index(st2, '0.')
if (k > 0) then
    stz2 = st2(k+1:30)
    st2(2:31) = stz2(1:30)
endif
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 76
stz1 = '-3.1234567890123456e4'
m_a =  to_fm(stz1)
call fm_form('e25.13', m_a, st1)
write (st2, "(e25.13)") to_dp(m_a)
k = index(st2, 'E+05')
if (k > 0) st2(k:k+3) = 'M+5 '
k = index(st2, '-0.')
if (k > 0) then
    st2(k:k+1) = ' -'
    stz2 = st2(k+1:31)
    st2(1:30) = stz2(1:30)
endif
```

```
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 77
stz1 = '3.12345678901234567e4'
m_a =  to_fm(stz1)
call fm_form('es25.14', m_a, st1)
write (st2, "(es25.14)") to_dp(m_a)
k = index(st2, 'E+04')
if (k > 0) st2(k:k+3) = 'M+4 '
k = index(st2, '3.')
if (k > 0) then
    stz2 = st2(k:30)
    st2(2:31) = stz2(1:30)
endif
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 78
stz1 = '-3.12345678901234567e4'
m_a =  to_fm(stz1)
call fm_form('es25.13', m_a, st1)
write (st2, "(es25.13)") to_dp(m_a)
k = index(st2, 'E+04')
if (k > 0) st2(k:k+3) = 'M+4 '
k = index(st2, '-3.')
if (k > 0) then
    stz2 = st2(k:31)
    st2(1:30) = stz2(1:30)
endif
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 79
stz1 = '0.12345678901234567890123456784999999999999999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .12345678901234567890123456'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 80
stz1 = '0.12345678901234567890123456785000000000000000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .12345678901234567890123457'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 81
stz1 = '0.12345678901234567890123456785000000000000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .12345678901234567890123456'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 82
stz1 = '0.12345678901234567890123456775000000000000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
```

```
st2 = '  .12345678901234567890123456'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 83
stz1 = '0.123456789012345678901234567499999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234567'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 84
stz1 = '0.123456789012345678901234567500000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234568'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 85
stz1 = '0.123456789012345678901234567500000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234568'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 86
stz1 = '0.123456789012345678901234566500000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234566'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 87
stz1 = '-0.123456789012345678901234567849999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123456'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 88
stz1 = '-0.123456789012345678901234567850000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123457'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 89
stz1 = '-0.123456789012345678901234567850000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123456'
st2 = '   '//st2
```

```
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 90
stz1 = '-0.12345678901234567890123456775000000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123456 78'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 91
stz1 = '-0.12345678901234567890123456749999999999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.12345678901234567890123456 7'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 92
stz1 = '-0.12345678901234567890123456750000000000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.12345678901234567890123456 8'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 93
stz1 = '-0.12345678901234567890123456750000000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.12345678901234567890123456 8'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 94
stz1 = '-0.12345678901234567890123456650000000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.12345678901234567890123456 6'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

call fm_setvar(' mbase = 10000 ')
call fm_setvar(' ndig = 25 ')
call fmsetvar(' kround = 2 ')

ncase = 95
stz1 = '0.12345678901234567890123456789999999999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .12345678901234567890123456 79'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 96
stz1 = '0.12345678901234567890123456780000000000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
```

```
st2 = '  .12345678901234567890123456789'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 97
stz1 = '0.123456789012345678901234567800000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .12345678901234567890123456789'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 98
stz1 = '0.123456789012345678901234567999999999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234568'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 99
stz1 = '0.123456789012345678901234567000000000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234568'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 100
stz1 = '0.123456789012345678901234567000000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  .123456789012345678901234567'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 101
stz1 = '-0.123456789012345678901234567899999999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123456789'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 102
stz1 = '-0.123456789012345678901234567800000000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123456789'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 103
stz1 = '-0.123456789012345678901234567800000000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  -.12345678901234567890123456789'
st2 = '   '//st2
```

```
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 104
stz1 = '-0.12345678901234567890123456799999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.123456789012345678901234567'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 105
stz1 = '-0.12345678901234567890123456700000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.123456789012345678901234567'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 106
stz1 = '-0.12345678901234567890123456700000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
st2 = '  -.123456789012345678901234567'
st2 = '   '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

call fm_setvar(' mbase = 10000 ')
call fm_setvar(' ndig = 25 ')
call fmsetvar(' kround = -1 ')

ncase = 107
stz1 = '0.12345678901234567890123456789999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .1234567890123456789012345678'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 108
stz1 = '0.12345678901234567890123456780000000000000000000000000000000000000000000000000001'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .1234567890123456789012345678'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 109
stz1 = '0.12345678901234567890123456780000000000000000000000000000000000000000000000000000'
m_a =  to_fm(stz1)
call fm_form('f35.28', m_a, st1)
st2 = '  .1234567890123456789012345678'
st2 = '    '//st2
if (.not.(st1 == st2)) call errprt_str(st1, st2)

ncase = 110
stz1 = '0.12345678901234567890123456799999999999999999999999999999999999999999999999999999'
m_a =  to_fm(stz1)
call fm_form('f34.27', m_a, st1)
```