

# NAG Library Routine Document

## X02AJF

**Note:** before using this routine, please read the Users' Note for your implementation to check the interpretation of *bold italicised* terms and other implementation-dependent details.

### 1 Purpose

X02AJF returns  $\epsilon$ , the value *machine precision*.

### 2 Specification

```
FUNCTION X02AJF ()  
REAL (KIND=nag_wp) X02AJF
```

### 3 Description

X02AJF returns *machine precision*, computed as  $\epsilon = \frac{1}{2} \times b^{1-p}$ , where  $b$  is the arithmetic base (see X02BHF) and  $p$  is the number of significant base- $b$  digits (see X02BJF).

It is important to note that the definition of  $\epsilon$  here differs from that in ISO (1997).

### 4 References

ISO (1997) ISO Fortran 95 programming language (ISO/IEC 1539–1:1997)

### 5 Parameters

None.

### 6 Error Indicators and Warnings

None.

### 7 Accuracy

None.

### 8 Parallelism and Performance

Not applicable.

### 9 Further Comments

None.

### 10 Example

This example prints the values of all the functions in Chapter X02. The results will vary from one implementation of the Library to another.

## 10.1 Program Text

```

Program x02ajfe

!      X02AJF Example Program Text

!      Mark 25 Release. NAG Copyright 2014.

!      .. Use Statements ..
Use nag_library, Only: nag_wp, x02ahf, x02ajf, x02akf, x02alf, x02amf,   &
                        x02anf, x02bbf, x02bef, x02bhf, x02bjf, x02bkf,   &
                        x02blf

!      .. Implicit None Statement ..
Implicit None

!      .. Parameters ..
Integer, Parameter      :: nout = 6

!      .. Local Scalars ..
Real (Kind=nag_wp)      :: largest_arg, largest_pos, machpr,          &
                        safe_complex, safe_real, smallest_pos
Integer                  :: largest_pos_int, model_b,                  &
                        model_emax, model_emin, model_p, prec

!      .. Executable Statements ..
Write (nout,*) 'X02AJF Example Program Results'
Write (nout,*)
Write (nout,*) '(results are machine-dependent)'
Write (nout,*)
Write (nout,*) 'The basic parameters of the model'
Write (nout,*)
model_b = x02bhf()
Write (nout,99999) ' X02BHF = ', model_b, ' (the model parameter B)'
model_p = x02bjf()
Write (nout,99999) ' X02BJF = ', model_p, ' (the model parameter P)'
model_emin = x02bkf()
Write (nout,99999) ' X02BKF = ', model_emin, &
' (the model parameter EMIN)'
model_emax = x02blf()
Write (nout,99999) ' X02BLF = ', model_emax, &
' (the model parameter EMAX)'
Write (nout,*)
Write (nout,*) 'Derived parameters of floating-point arithmetic'
Write (nout,*)
machpr = x02ajf()
Write (nout,99998) ' X02AJF = ', machpr, ' (the machine precision)'
smallest_pos = x02akf()
Write (nout,99998) ' X02AKF = ', smallest_pos, &
' (the smallest positive model number)'
largest_pos = x02alf()
Write (nout,99998) ' X02ALF = ', largest_pos, &
' (the largest positive model number)'
safe_real = x02amf()
Write (nout,99998) ' X02AMF = ', safe_real, &
' (the real safe range parameter)'
safe_complex = x02anf()
Write (nout,99998) ' X02ANF = ', safe_complex, &
' (the complex safe range parameter)'
Write (nout,*)
Write (nout,*) &
'Parameters of other aspects of the computing environment'
Write (nout,*)
largest_arg = x02ahf(0.0E0_nag_wp)
Write (nout,99996) ' X02AHF = ', largest_arg, &
' (largest argument for SIN and COS)'
largest_pos_int = x02bbf(0.0E0_nag_wp)
Write (nout,99997) ' X02BBF = ', largest_pos_int, &
' (largest positive integer)'
prec = x02bef(0.0E0_nag_wp)
Write (nout,99997) ' X02BEF = ', prec, ' (precision in decimal digits)'

```

```
99999 Format (1X,A,I7,1X,A)
99998 Format (1X,A,1P,E26.18e3,1X,A)
99997 Format (1X,A,I20,1X,A)
99996 Format (1X,A,1P,E20.8e3,1X,A)
      End Program x02ajfe
```

## 10.2 Program Data

None.

## 10.3 Program Results

X02AJF Example Program Results

(results are machine-dependent)

The basic parameters of the model

```
X02BHF =      2   (the model parameter B)
X02BJF =     53   (the model parameter P)
X02BKF =   -1021 (the model parameter EMIN)
X02BLF =    1024 (the model parameter EMAX)
```

Derived parameters of floating-point arithmetic

```
X02AJF = 1.110223024625156540E-016 (the machine precision)
X02AKF = 2.225073858507201383E-308 (the smallest positive model number)
X02ALF = 1.797693134862315708E+308 (the largest positive model number)
X02AMF = 2.225073858507201877E-308 (the real safe range parameter)
X02ANF = 2.225073858507201877E-308 (the complex safe range parameter)
```

Parameters of other aspects of the computing environment

```
X02AHF =      1.42724769E+045 (largest argument for SIN and COS)
X02BBF =      2147483647 (largest positive integer)
X02BEF =           15 (precision in decimal digits)
```

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