1 Purpose

nag_numdiff_1d_real_absci (d04bbc) generates abscissae about a target abscissa $x_0$ for use in a subsequent call to nag_numdiff_1d_real_eval (d04bac).

2 Specification

```c
#include <nag.h>
#include <nagd04.h>
void nag_numdiff_1d_real_absci (double x_0, double hbase, double xval[])
```

3 Description

nag_numdiff_1d_real_absci (d04bbc) may be used to generate the necessary abscissae about a target abscissa $x_0$ for the calculation of derivatives using nag_numdiff_1d_real_eval (d04bac).

For a given $x_0$ and $h$, the abscissae correspond to the set \{${x_0, x_0 \pm (2j - 1)h}$, for $j = 1, 2, \ldots, 10$\}. These 21 points will be returned in ascending order in `xval`. In particular, `xval[10]` will be equal to $x_0$.

4 References


5 Arguments

1: `x_0` – double
   \textit{Input}
   
   \textit{On entry}: the abscissa $x_0$ at which derivatives are required.

2: `hbase` – double
   \textit{Input}
   
   \textit{On entry}: the chosen step size $h$. If $h < 10\epsilon$, where $\epsilon = \text{nag\_machine\_precision}$, then the default $h = \epsilon^{1/4}$ will be used.

3: `xval[21]` – double
   \textit{Output}
   
   \textit{On exit}: the abscissae for passing to nag_numdiff_1d_real_eval (d04bac).

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Parallelism and Performance

Not applicable.
9 Further Comments

The results computed by nag_numdiff_1d_real_eval (d04bac) depend very critically on the choice of the user-supplied step length \( h \). The overall accuracy is diminished as \( h \) becomes small (because of the effect of round-off error) and as \( h \) becomes large (because the discretization error also becomes large). If the process of calculating derivatives is repeated four or five times with different values of \( h \) one can find a reasonably good value. A process in which the value of \( h \) is successively halved (or doubled) is usually quite effective. Experience has shown that in cases in which the Taylor series for the objective function about \( x_0 \) has a finite radius of convergence \( R \), the choices of \( h > R/19 \) are not likely to lead to good results. In this case some function values lie outside the circle of convergence.

10 Example

See Section 10 in nag_numdiff_1d_real_eval (d04bac).