

Proposal for C2X WG14 N2492

Title: Note about math function properties
Author, affiliation: C FP group
Date: 2020-02-21
Proposal category: Editorial
Reference: N2454 ISO/IEC 9899 working draft

Problem:

The C standard says little about mathematical properties (such as symmetry, monotonicity, and periodicity) of its `<math.h>` functions, even in Annex F. IEC 60559 requires its math operations (which correspond to C math functions) to be correctly rounded. The correct rounding, together with IEC 60559's specification for special cases involving infinities, NaNs, and signed zeros, imply that IEC 60559's math operations preserves many of the useful properties of mathematical functions.

The specification of math functions in Annex F includes the IEC 60559 special cases for infinities, NaNs, and signed zeros, but does not require correct rounding for most of the functions. Thus, the C specification does not imply the mathematical properties like IEC 60559 does. Nor does C explicitly require or recommend that these properties be preserved.

The following suggested change is intended to encourage (but not require) implementors of Annex F-conformant C math functions to preserve useful mathematical properties that would be preserved by correct rounding.

The alternative of recommending specific properties seemed too difficult and error prone, because of the large number of mathematical properties and the inherent limitations of floating-point arithmetic, even with correct rounding.

Suggested change:

After F.10 #14, insert:

Recommended practice

[14a] IEC 60559 specifies correct rounding for the operations in the F.3 table of operations recommended by IEC 60559, and thereby preserves useful mathematical properties such as symmetry, monotonicity, and periodicity. The corresponding functions with reserved `cr`-prefixed names (7.31.8) do the same. The C functions in the table, however, are not required to be correctly rounded, but implementations should still preserve as many of these useful mathematical properties as possible.