

Proposal for C23
WG14 N2651

Title: fabs and copysign cleanup
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The C **fabs** and **copysign** functions support IEC 60559 operations on bit strings. This has implications for NaN cases that are not apparent if they, like most other math functions, are specified only at the level of values.

Currently neither Annex F nor 7.12 explicitly state the IEC 60559 requirement for bit-level behavior. The following suggested changes add this specification to Annex F. This is not a substantive change since Annex F adopts IEC 60559 by reference.

The suggested changes below also address the following issues for these functions ...

The **fabs** description (7.12.7.3):

The **fabs** functions compute the absolute value of a floating-point number **x**. unnecessarily restricts itself to floating-point numbers, excluding infinities.

The **copysign** description (7.12.11.1) is:

The **copysign** functions produce a value with the magnitude of **x** and the sign of **y**. They produce a NaN (with the sign of **y**) if **x** is a NaN. On implementations that represent a signed zero but do not treat negative zero consistently in arithmetic operations, the **copysign** functions regard the sign of zero as positive.

This does not cover unsigned values. Though 7.11 does not generally mention unsigned values, it seems important to do so here because **copysign** is all about the determination of signs. The second sentence refers to the sign of a NaN, though IEC 60559 NaNs have signs only at the bit-representation level, not as values. The third sentence in the current Description is subtle; what is meant by consistent treatment of signed zero (outside of IEC 60559)? Since determination of consistency is up to the implementation, the third sentence would be better as a recommendation.

The suggested changes below also include an update for **copysign** to reflect the fact that IEC 60559 now specifies it as a required operation.

Suggested changes:

In F.10.4.3, before the first bullet, insert the paragraph:

[0] **fabs(x)** returns a value with the same bit representation as **x**, except with the sign bit set to 0 (positive), for all values of **x** (even quiet and signaling NaNs).

In F.10.8 #1, change #1:

[1] ~~copysign is specified in the Appendix to IEC 60559.~~ **copysign(x, y)** returns a value with the bit representation of **x**, except with the sign bit of **y**, for all values **x** and **y** (even quiet and signaling NaNs).

Change for 7.12.7.3:

Description

The **fabs** functions compute the absolute value of ~~a floating-point number~~ **x**.

Change for 7.12.11.1:

Description

The **copysign** functions produce a value with the magnitude of **x** and the sign of **y**. ~~They produce a NaN (with the sign of y) if x is a NaN.~~ If **x** or **y** is an unsigned value, the sign (if any) of the result is implementation defined. On implementations that represent a signed zero but do not treat negative zero consistently in arithmetic operations, the **copysign** functions **should** regard the sign of zero as positive.