

Technical Note OS510

Math Function Q&As

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Different Macintosh SANE engines generate different NANs

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Our program generates NAN(030) on a 68040 but generates NAN(255) on a 68030 with a 68881 FPU, causing it to work differently on a Macintosh Quadra than on a Macintosh IIfx. Is this a bug or are there supposed to be differences in numerical results between the emulated code and the hardware code?

The different behavior you're encountering is caused by the different SANE engine. In the past, a hardware-generated NAN was always coded 255; now SANE tries to let you know which operation caused the NAN. For example, 34 means an invalid argument to an inverse trig function (*Apple Numerics Manual*, 2nd ed., page 41).

What can be a bit puzzling is why you'd get such a return if you're compiling with the 68881 flag. The reason is that sometimes you invoke the SANE engine indirectly. If you eliminate `WriteLn` calls before calling `ArcCos`, for example, the NAN code returned is 255. The deeper reason is that the SANE engine installs exception handlers when called and leaves them on for the duration so that subsequent operations cause the handlers to be called if an exception occurs. The differences you see are caused by the operand error handler.

If this is a problem for you (though normally you'd handle all NANs in a similar manner), a possible solution is to bracket calls that may cause problems with `GetEnvironment` and `SetEnvironment` calls. This will prevent the exception handling and you should get the result you expect, NAN(255). Note that the compiler may be doing you a favor so that you don't have to make direct calls for this to happen.

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