Examples of exposing computing inconsistencies in R

Kevin Mullet <kwm@unm.edu>

2025-03-14

Examples of computing errors and how to expose them in R

There two areas where R's performance doesn't necessarily match what might be broad expectations in disciplines outside of computer science or compiler design.

The base round() function doesn't do what one might expect.

Khurana (2023) in "*Rounding in R: Common Data Wrangling Frustrations and Workarounds in R, Julia, and Python*" and R Core Team (2025) in "*R: A Language and Environment for Statistical Computing | Reference Index*" discuss the fact that R uses the ISO/IEC 60559 standard for rounding which specifies that when there is an equal distance between an even and odd number, the rounding will take place toward the even number (IEEE IEC 2020, § 4.3.1; R Core Team 2025, 495), all reasonable assumptions to the contrary.

For example, if we use the R base round a group of even numbers with a .5 fractional part in R (or likely, in Python or Julia) we will end up with the number being rounded *down*.

```
base::round(c(0.5, 2.5, 4.5, 6.5, 8.5)) %>%
    cat()
```

```
## 0 2 4 6 8
```

If we likewise use Rs base round function on a group of odd numbers with a .5 fractional part, the rounding will occur as would be generally expected in most disciplines.

```
base::round(c(9.5, 7.5, 5.5, 3.5, 1.5)) %>%
    cat()
```

```
## 10 8 6 4 2
```

The package roundyh (Yuanheng 2023), however, provides a roundx() function which performs as expected, and rounds *up* when there is a .5 fractal part.

```
library(roundyh)

decimal_places <- 0

roundyh::roundx(c(0.5, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5), decimal_places) %>%
    cat()
```

```
## 1 2 3 4 5 6 7 8 9 10
```

As documented in (Hornik and Team 2024, FAQ 7.31.) "Why doesn't R think these numbers are equal?" If I want to round 0.5, R will typically give me 0 instead of 1:

```
library(numbers)
library(formatR)

div(15, 5)
```

```
## [1] 3
```

References

Hornik, Kurt, and the R Core Team. 2024. "R FAQ." https://CRAN.R-project.org/doc/manuals/R-FAQ.html.

IEEE IEC. 2020. "ISO/IEC/IEEE International Standard - Floating-point Arithmetic." *ISO/IEC 60559:2020(E) IEEE Std 754-2019*, May, 1–86. https://doi.org/10.1109/IEEESTD.2020.9091348.

Khurana, Deepansh. 2023. "Rounding in R: Common Data Wrangling Frustrations and Workarounds in R, Julia, and Python." *R-Bloggers*. https://www.r-bloggers.com/2023/04/rounding-in-r-common-data-wrangling-frustrations-and-workarounds-in-r-julia-and-python/.

R Core Team. 2025. *R: A Language and Environment for Statistical Computing | Reference Index*. Manual. Vienna, Austria: R Foundation for Statistical Computing. https://cran.r-project.org/doc/manuals/r-release/fullrefman.pdf.

Yuanheng, Duan. 2023. "Roundyh: Round Dataframe." Comprehensive R Archive Network. https://doi.org/10.32614/CRAN.package.roundyh.