# Truncation Error

This refers to errors introduced when a more complicated mathematical expression is replaced with a more elementary formula.

Truncation errors are those that result from using an approximation in place of an exact mathematical procedure.

# Round-off Error

A computer’s representation of real numbers is limited to the fixed precision of the mantissa. True values are sometimes not stored exactly by a computer’s representation. This is called round-off error

Round-off error is due to the fact that computers can only represent quantities with a finite number of digits.

There are five distinct numerical ranges that single-precision floating-point numbers are **not** able to represent:

1. Negative numbers less than -(2-2-23) × 2127 (*negative overflow*)
2. Negative numbers greater than -2-149 (*negative underflow*)
3. Zero
4. Positive numbers less than 2-149 (*positive underflow*)
5. Positive numbers greater than (2-2-23) × 2127 (*positive overflow*)

Overflow means that values have grown too large for the representation, much in the same way that you can overflow integers. Underflow is a less serious problem because is just denotes a loss of precision, which is guaranteed to be closely approximated by zero.