3.1 Introduction

> "Numerical precision is the very soul of science."
> *Sir D'arcy Wentworth Thompson, On Growth and Form, 1917.*

Computer words are composed of bits; thus, words can be represented as binary numbers. COD Chapter 2 (Instructions: Language of the Computer) shows that integers can be represented either in decimal or binary form, but what about the other numbers that commonly occur? For example:

- What about fractions and other real numbers?
- What happens if an operation creates a number bigger than can be represented?
- And underlying these questions is a mystery: How does hardware really multiply or divide numbers?

The goal of this chapter is to unravel these mysteries-including representation of real numbers, arithmetic algorithms, hardware that follows these algorithms-and the implications of all this for instruction sets. These insights may explain quirks that you have already encountered with computers. Moreover, we show how to use this knowledge to make arithmetic-intensive programs go much faster.

PARTICIPATION ACTIVITY 3.1.1: Representation of information as bits.

1) Integers can be represented as bits.
   - ○ True
   - ○ False

2) Instructions can be represented as bits.
   - ○ True
   - ○ False

Provide feedback on this section