

CPE 315  
 Professor Stearns  
 Real Number Representation

There are a large number of difficult issues and choices with representing real numbers in a computer. This table summarizes the different approaches to real number representation.

	Floating Point	Scaled Integer	Binary Coded Decimal
Size	32/64 bits	32 bit integer	varies with number
Range	$-2 \times 10^{38}$ to $2 \times 10^{38}$	f(scale factor) $\approx -200000$ to $+200000$ if scale factor = 4	unlimited
Accurate?	no	yes	yes
Precision	$\approx 7/14$ digits	9 minus fraction size (5 if scale factor = 4)	whole part: no limit fractional part : N digits (N is ISA dependent)
Associative math?	no	yes	yes
Standard?	IEEE 754	no	no
HW support	almost all general purpose CPUs	no	most general purpose CPUs
Language support	most languages (but not #1 language)	A few – e.g. ADA	Cobol, ADA, Java and other business application languages
Database support	no	some	yes

Examples of the number 12.3456.  
 Be sure you can convert to all three types, in both directions.

Float = 0x41458793

Scaled = 0x0001E240 (assumes scale factor = 4)

BCD = 0x1234560000000000 (scale factor = 16; format and sf are ISA dependent)