Table 1. IEEE 754 single precision standard.

exponent	fraction	representation
0	0	0
0	nonzero	denormalized numbers
$[1, 254]$	anything	normalized numbers
255	0	$\pm\infty$
255	nonzero	NaN

Table 2. Comparison among the IEEE 754 half, single, and double precision standard.

type	significand digits	range of exponent
half	$10 + 1$	$[-14, +15]$
single	$23 + 1$	$[-126, +127]$
double	$52 + 1$	$[-1022, +1023]$

The smallest positive normalized single precision floating-point number is

$$(1.\underbrace{0\dots0}_{23\text{ zeros}})_2 \times 2^{1-127} = 2^{-126}$$

The largest positive normalized single precision floating-point number is

$$(1.\underbrace{1\dots1}_{23\text{ ones}})_2 \times 2^{254-127} = (2 - 2^{-23}) \times 2^{127} = 2^{128} - 2^{104}$$

Hence the range of **normalized** single precision floating-point numbers is

$$\left[-\left(2^{128} - 2^{104}\right), -2^{-126}\right] \cup \left[2^{-126}, 2^{128} - 2^{104}\right]$$

The smallest positive denormalized single precision floating-point number is

$$(0.\underbrace{0\dots0}_{22\text{ zeros}}1)_2 \times 2^{-126} = 2^{-23} \times 2^{-126} = 2^{-149}$$

The largest positive normalized single precision floating-point number is

$$(0.\underbrace{1\dots1}_{23\text{ ones}})_2 \times 2^{-126} = (1 - 2^{-23}) \times 2^{-126} = 2^{-126} - 2^{-149}$$

Hence the range of **denormalized** single precision floating-point numbers is

$$\left[-\left(2^{-126} - 2^{-149}\right), -2^{-149}\right] \cup \left[2^{-149}, 2^{-126} - 2^{-149}\right]$$

Similarly, we can get the corresponding ranges for the half precision standard and the double precision standard. The result is summarized in Table 2 and Table 3.

Table 3. Comparison among the ranges of (positive) numbers of the IEEE 754 half, single, and double precision standard.

type	denormalized numbers	normalized numbers
half	$\left[2^{-14-10}, \left(1-2^{-10}\right) \times 2^{-14}\right]$	$\left[2^{-14}, \left(2-2^{-10}\right) \times 2^{15}\right]$
single	$\left[2^{-126-23}, \left(1-2^{-23}\right) \times 2^{-126}\right]$	$\left[2^{-126}, \left(2-2^{-23}\right) \times 2^{127}\right]$
double	$\left[2^{-1022-52}, \left(1-2^{-52}\right) \times 2^{-1022}\right]$	$\left[2^{-1022}, \left(2-2^{-52}\right) \times 2^{1023}\right]$