



Архитектура ЭВМ и Язык Ассемблера

Семинар #6:

1. Представление чисел по стандарту IEEE 754.
2. $\pm\text{inf}$, ± 0 , NaN, денормализованные числа.
3. Арифметические операции.
4. Режимы округления, исключения.



Представление чисел по стандарту IEEE 754



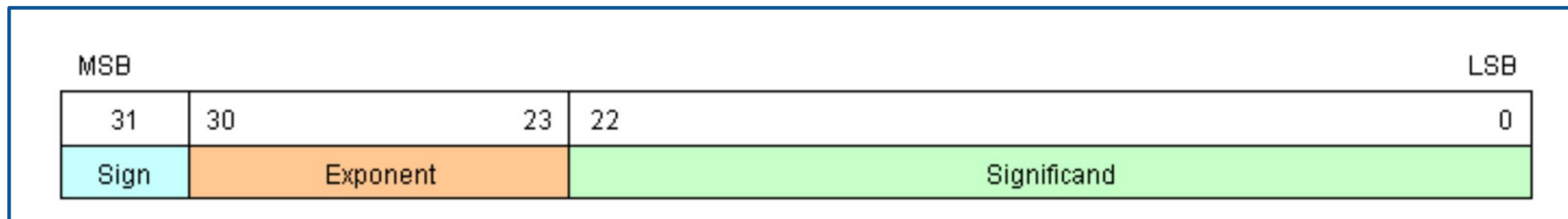
Числа по стандарту IEEE754



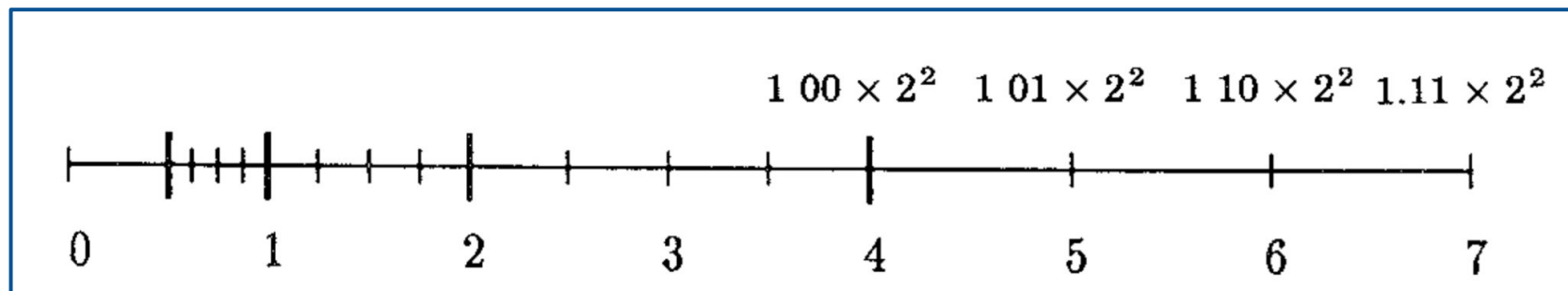
Table 3.1—Relationships between different specification levels for a particular format

Level 1	$\{-\infty \dots 0 \dots +\infty\}$	Extended real numbers.
many-to-one ↓	<i>rounding</i>	↑ projection (except for NaN)
Level 2	$\{-\infty \dots -0\} \cup \{+0 \dots +\infty\} \cup \mathbf{NaN}$	Floating-point data—an algebraically closed system.
one-to-many ↓	<i>representation specification</i>	↑ many-to-one
Level 3	$(\mathbf{sign, exponent, significand}) \cup \{-\infty, +\infty\} \cup \mathbf{qNaN} \cup \mathbf{sNaN}$	Representations of floating-point data.
one-to-many ↓	<i>encoding for representations of floating-point data</i>	↑ many-to-one
Level 4	0111000...	Bit strings.

Числа по стандарту IEEE754

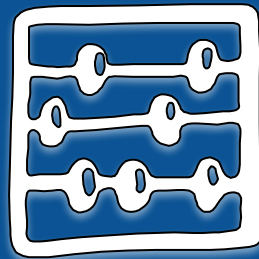


$$\text{NormalizedFloatValue} = \text{sign} \times 2^{\text{exponent} - \text{bias}} \times 1.\text{significand}$$





$\pm\text{inf}$, NaN, ± 0 ненормализованные числа

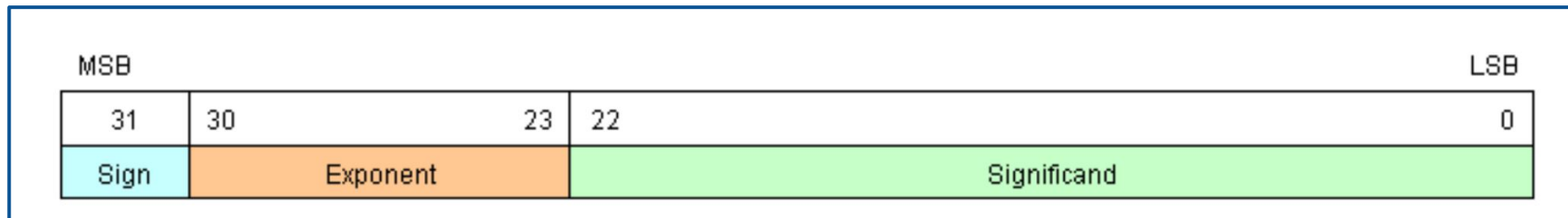


$\pm\text{inf}$, NaN, ± 0



Sign	Exponent	Significand	Describes
0	00h	000000h	Positive zero
1	00h	000000h	Negative zero
0	FFh	000000h	Positive infinity
1	FFh	000000h	Negative infinity
0	FFh	> 000000h	NaN - Not a Number

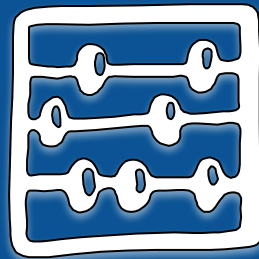
Денормализованные числа



$$\text{DenormalizedFloatValue} = \text{sign} \times 2^{-126} \times 0.\text{significand}$$



Арифметические операции



OP1 OP2	NaN	+Infinity	-Infinity	+0	-0	+Num	-Num
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
+Infinity	NaN	+Infinity	NaN	+Infinity	+Infinity	+Infinity	+Infinity
-Infinity	NaN	NaN	-Infinity	-Infinity	-Infinity	-Infinity	-Infinity
+0	NaN	+Infinity	-Infinity	+0	+0	+Num	-Num
-0	NaN	+Infinity	-Infinity	+0	-0	+Num	-Num
+Num	NaN	+Infinity	-Infinity	+Num	+Num	+Num +Infinity	±Num +0
-Num	NaN	+Infinity	-Infinity	-Num	-Num	±Num +0	-Num -Infinity

Умножение



OP1 \ OP2	NaN	+Infinity	-Infinity	+0	-0	+Num	-Num
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
+Infinity	NaN	+Infinity	-Infinity	NaN	NaN	+Infinity	-Infinity
-Infinity	NaN	-Infinity	+Infinity	NaN	NaN	-Infinity	+Infinity
+0	NaN	NaN	NaN	+0	-0	+0	-0
-0	NaN	NaN	NaN	-0	+0	-0	+0
+Num	NaN	+Infinity	-Infinity	+0	-0	+Num +Infinity	-Num -Infinity
-Num	NaN	+Infinity	+Infinity	-0	+0	-Num -Infinity	+Num +Infinity

Деление



OP1 \ OP2	NaN	+Infinity	-Infinity	+0	-0	+Num	-Num
NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
+Infinity	NaN	NaN	NaN	+0	-0	+0	-0
-Infinity	NaN	NaN	NaN	-0	+0	-0	+0
+0	NaN	+Infinity	-Infinity	NaN	NaN	+Infinity	-Infinity
-0	NaN	-Infinity	+Infinity	NaN	NaN	-Infinity	+Infinity
+Num	NaN	+Infinity	-Infinity	+0	-0	+Num	-Num
-Num	NaN	-Infinity	+Infinity	-0	+0	-Num	+Num



Режимы округления, исключения



Вопросы?

