Wk03

Sunday, 27 September 2020 1:37 PM

② 0x0013 → 0000 0000 0001 0011 = 19

Leading bit 0, so treat normally

0xffff → 1111 1111 1111 1111 = -1

Leading bit 1, so subtract 1 then flip the bits.

Sub. 1: 1111 1111 1111 1110

Flip bits: 0000 0000 0000 0001 = 1

∴ -1

0x8000 → 1000 0000 0000 0000 = -128

Leading bit 1, so convert

Sub. 1: 0111 1111 1111 1111

Flip bits: 1000 0000 0000 0000 = 128

Now, interpret as unsigned, and make negative. ∴ -128

③ Positive values are calculated as normal (100000 is too large)

-5: Represent +5 in binary:

0000 0000 0000 0101

Flip bits:

1111 1111 1111 1010

Add 1:

1111 1111 1111 1011

-100: Represent +100 in binary:

0000 0000 0110 0100

Flip bits:

1111 1111 1001 1011

Add 1:

1111 1111 1001 1100

④ Formula: $\text{sign} \times (1 + \text{frac}) \times 2^{\text{exp}-127}$.

Special values: bits represent decreasing powers of 2: i.e first bit $= 2^{-1}$, second bit $= 2^{-2}$, and so on...

(+/-) zero: exp and frac. both 0 – sign bit 0 or 1

(+/-) infinity: exp. bits all 1, frac all 0. – sign bit 0 or 1

NaN: exp. bits all 1, >1 frac bit 1. frac != 0

c) 0 01111111 10000000000000000000000

sign = 0 => +ve

exp = 127 => $2^{127-127} = 2^0$

frac = 2^{-1} => 0.5 => (1+0.5)

$\therefore (1+0.5) \times 2^0$

$= 1.5$

d) 0 01111110 00000000000000000000000

sign = 0 => +ve

exp = 126 => $2^{126-127} = 2^{-1}$

frac = 0 => (1+0)

$\therefore (1+0) \times 2^{-1}$

$= 0.5$

f) 0 10000000 01100000000000000000000

sign = 0 => +ve

exp = 128 => $2^{128-127} = 2^1$

frac = $2^{-2} + 2^{-3} = 0.25 + 0.125 = 0.375$

$\therefore (1+0.375) \times 2^1$

$= 1.375 \times 2$

$= 2.75$

⑤ To go from floating point rep. to binary, find largest 2^n smaller than our number, and divide. Then, express in $(1+\text{frac}) \times 2^{\text{exp}-127}$ form.

a) 2.5

First, divide by 2^1:

1.25×2^1

Now, express in $(1 + frac) \times 2^{exp-127}$ form:

$(1 + 0.25) \times 2^{128-127}$

∴ Sign = 0

Exp = 128

frac = $0.25 = 2^{-2}$

0 10000000 01000000000000000000000

b) 0.375

First, divide by 2^{-2}:

1.5×2^{-2}

Now, express in $(1 + frac) \times 2^{exp-127}$ form:

$(1 + 0.5) \times 2^{125-127}$

∴ Sign = 0

Exp = 125

frac = $0.5 = 2^{-1}$

0 01111101 10000000000000000000000

c) 27.0

First, divide by 2^4:

1.6875×2^4

∴ $(1 + frac) \times 2^{exp-127}$ form:

$1.6875 \times 2^{}$

Now, express in $(1+frac) \times 2^{exp-127}$ form:

$(1+0.6875) \times 2^{131-127}$

Sign = 0

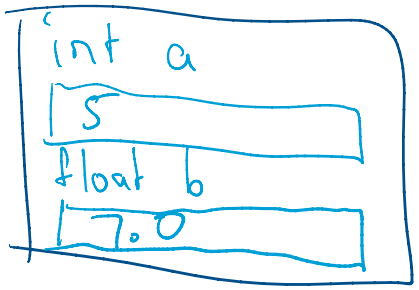
Exp = 131

Frac = $0.6875 = 0.5 + 0.125 + 0.0625 = 2^{-1} + 2^{-3} + 2^{-4}$

0 10000100 10110000000000000000000

(7) Unions vs. structs:

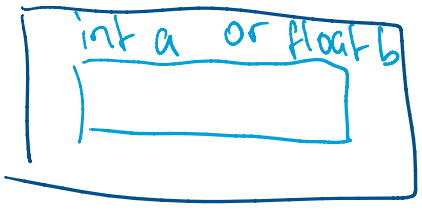
Struct x1:



x1.a = 5

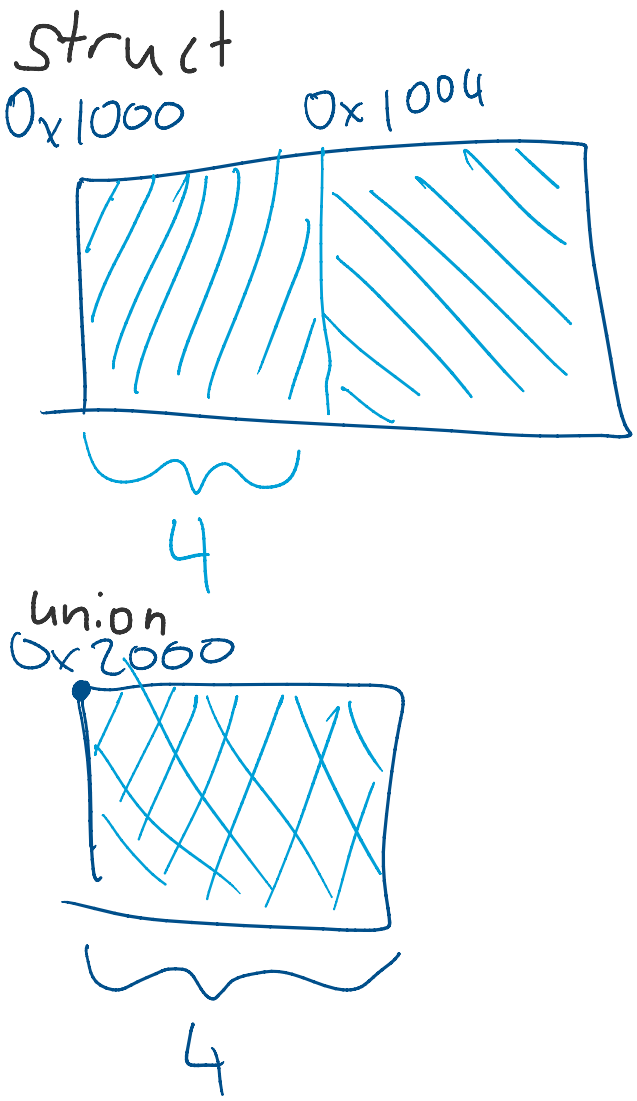
x1.b = 7.0

union x2:



x2.a = 5

x2.b = 7.0


struct
0x1000
0x1004
4
union
0x2000
4