ICS作业3答案

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	little-endian	big-endian
show_bytes(valp, 1)	33	14
show_bytes(valp, 2)	33 02	14 0A
show_bytes(valp, 4)	33 02 0A 14	14 0A 02 33

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Fraction value	Binary representation	Decimal representation
1/8	0.001	0.125
3/4	0.11	0.75
43/16	10.1011	2.6875
25/16	1.1001	1.5625
51/16	11.0011	3.1875

3

- **指数 E (exp是存储的指数值)：**

$$E = exp - 2^{k-1} + 1$$

- **尾数 M：**

$$M = 1 + f$$

- **小数部分 f：**

$$f = \sum_{i=1}^{n} f_i \text{是二进制位}$$

- **数值 V：**

$$V = (-1)^s \times M \times 2^E$$

A. 数字 5.0

- **对于 5.0：**

$$5.0 = 1.25 \times 2^2$$

因此
$s = 0, \quad E = 2, \quad M = 1.25, \quad f = 0.25$
位级表示为 0 100...0001 01000..0

B. 可精确表示的最大奇整数

- 最大奇整数应为 11111...11，可以表示为 $1.11...1 \times 2^x$
  故
  $s = 0, \quad E = x, \quad M = 1.1111..., \quad f = 0.111...$

C. 最小正规格化数的倒数

- 最小正规格化数：

$$V = 1.0 \times 2^{1-bias}$$

- 其倒数：

$$\frac{1}{V} = 2^{bias-1}$$

故 $s=0,\quad E=bias-1=2^{k-1}-2,\quad M=1,\quad f=0$

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Format A		Format B	
Bits	Value	Bits	Value
1 01110 001	$-\frac{9}{16}$	1 0110 0010	$-\frac{9}{16}$
0 10110 101	208	0 1110 0101	208
1 00111 110	$-\frac{7}{1024}$	1 0000 0111	$-\frac{7}{1024}$
0 00000 101	$\frac{5}{131072}$	0 0000 0001	$\frac{1}{1024}$
1 11011 000	-4096	1 1111 0000	-Inf
0 11000 100	768	0 1111 0000	Inf

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- A
  恒为 1 。都基于相同的整数做是融入。
- B
  不恒为 1 。比如取 $x=-2147483648(int下界),\quad y=1$
- C
  不恒为 1 . 比如取 $x=1e20,\quad y=-1e20,\quad z=1$
  此时 $(dx+dy)+dz=1.0,\quad dx+(dy+dz)=0.0$
- D
  不恒为 1. 浮点乘法有舍入误差 因此不满足结合律
- E
  不恒为 1。 取 $x=0或z=0$ 即可，此时 0.0 / 0.0 为 NaN

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```
typedef unsigned float_bits;
/* Compute |f|. If f is NaN, then return f. */
float_bits float_absval (float_bits f) {
  unsigned exp = (f >> 23) & 0xff, frac = f & 0x7fffff;
  if (exp == 0xff && frac != 0) return f;

  return f & 0x7fffffff;
}
```

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```
/* Compute 2*f. If f is NaN, return f. */
float_bits float_twice(float_bits f) {
  unsigned sign = f & (1 << 31), exp = (f >> 23) & 0xff, frac = f & 0x7fffff;

  if (exp == 0xff)
      return f;

  if (exp == 0) {
      frac <<= 1;
      if (frac & (1 << 31)) {
          exp = 1;
          frac &= 0x7fffff;
      }
  }
  else {
      exp += 1;
      if (exp == 0xff)
          frac = 0;
  }

  return sign | (exp << 23) | frac;
}
```

附:

1. 33 02 0A 14

2. $\frac{3}{4} = \frac{1}{2} + \frac{1}{4} \rightarrow 0.11$ $\quad 2 + \frac{1}{2} + \frac{1}{8} + \frac{1}{16} = \frac{43}{16}$

$\frac{25}{16} = 1 + \frac{9}{16} = 1 + \frac{1}{2} + \frac{1}{16} \rightarrow 1.1001$

$3.1875 = \frac{51}{16} = 3 + \frac{2}{16} + \frac{1}{16} \rightarrow 11.0011$

3. bias = $2^{k-1} - 1$ A. $5.0 = 1.25 \times 2^2$

B. 11111... = 1.111... $\times 2^{x}$

C. $1.0 \times 2^{1-bias}$

4. $-\frac{9}{16}$ ① 0 10110 101 → 22−15=7 → $1.101 = 1 + \frac{1}{2} + \frac{1}{8} = \frac{13}{8}$

$\rightarrow \frac{13}{8} \times 2^{4} = 208.$ $\quad 7+7=14=1110 \rightarrow 0\ 1110\ 1010$

② $111 = 1+2+4 = 7 - 15 = -8.$ $\quad 1 + \frac{1}{2} + \frac{1}{4} = \frac{7}{4} \times 2^{-8} = \frac{7}{1024} \rightarrow -\frac{7}{1024}$

$1-7=-6$ $\quad 16$ $\quad 2^{-6} \times 2^{-2} \times \frac{7}{4} = 2^{-6} \times \frac{7}{16}$ $\quad \frac{7}{16} = \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$

$\rightarrow 0.0111$

$\rightarrow 1\ 0000\ 0111$

③ $1-15=-14.$ $\quad \frac{1}{2} + \frac{1}{8} = \frac{5}{8} \times 2^{-14} = \frac{5}{131072}$

$\rightarrow$ 최소 양수 $0.0001 \times 2^{-6} = \frac{1}{1024}$ →

④ -40_{16} $\quad 12+7=19$ $\quad 1110 = 14 < 19 \rightarrow -\infty.$

⑤ 0 11000 $= 24 - 15 = 9 \rightarrow 9+7=16>14 \Rightarrow +\infty$

5. A ✓ B intmin − 1 → 표현 double → 표현

C. x zero y zero D. X E. O

6、NaN → 0 (一) 11111111 ≠0. sign变为0即可排除NaN