

P289-290.

邱嘉明

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6.19 (1) $A = +\frac{7}{64} = +0.0010010$

$B = -\frac{13}{32} = -0.0110100$

$[A]_{补} = 0.0010010, [B]_{补} = 1.1001100$

~~$[B]_{补} = 0.0110100$~~

$\Rightarrow [A+B]_{补} = [A]_{补} + [B]_{补} = \begin{array}{r} 0.0010010 \\ + 1.1001100 \\ \hline 1.1011110 \end{array}$

$= 1.1011110$

$\Rightarrow A+B = 1.0100010 = -\frac{17}{64}$, 未溢出

(2) $A = +\frac{19}{32} = +0.1001100, B = -\frac{17}{128} = -0.0010001$

$[A]_{补} = 0.1001100, [B]_{补} = 1.1101111$

~~$[B]_{补} = 0.0010001$~~

$\Rightarrow [A-B]_{补} = [A]_{补} + [-B]_{补} = \begin{array}{r} 0.1001100 \\ + 1.1101111 \\ \hline 1.1110111 \end{array}$

~~$\Rightarrow A-B = 0.0111011 = \frac{58}{128} = \frac{29}{64}$~~

$\begin{array}{r} 0.1001100 \\ + 0.0010001 \\ \hline 0.1011101 \end{array} = 0.1011101$

$\Rightarrow A-B = 0.1011101 = +\frac{93}{128}$, 未溢出

(3) $A = -\frac{3}{16} = -0.0010000, B = \frac{9}{32} = 0.0100100$

$[A]_{补} = 1.1101000, [B]_{补} = 0.0100100$

$\Rightarrow [A+B]_{补} = [A]_{补} + [B]_{补} = \begin{array}{r} 1.1101000 \\ + 0.0100100 \\ \hline 0.0001100 \end{array}$

$= 0.0001100$

$\Rightarrow A+B = 0.0001100 = \frac{3}{32}$, 未溢出

(4) $A = -87 = -1010111$

$B = 53 = +0110101$

$[A]_{补} = 1,0101001$

$[B]_{补} = 0,0110101$

$[-B]_{补} = 1,1001011$

$\Rightarrow [A-B]_{补} = [A]_{补} + [-B]_{补}$

$= \begin{array}{r} 1,0101001 \\ + 1,1001011 \\ \hline 0,1110100 \end{array}$

$= 0,1110100$

$\Rightarrow A-B = 0,1110100 = +116$,

溢出, 结果有误.

(5) $A = 115 = +1110011$

$B = -24 = -0011000$

$[A]_{补} = 0,1110011$

$[B]_{补} = 1,1101000$

$[A+B]_{补} = [A]_{补} + [B]_{补} = \begin{array}{r} 0,1110011 \\ + 1,1101000 \\ \hline 0,1011011 \end{array}$

$= 0,1011011 = +9$,

未溢出

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$$x = 0.11011, y = -0.10110$$

$$[x]_{补} = 0.11011, [y]_{补} = 1.010010$$

$$[-x]_{补} = 1.001001$$

6.20 (1) 原码一位乘:

部分积	乘数
0.000000 + 0.000000	10110
0.000000 0.000000 + 0.110111	01011
0.110111 0.011011 + 0.110111	10101
1.010010 0.101001 + 0.110111	01010
1.100000 0.011000 0.011000 + 0.000000	00101
0.011000 0.011000 + 0.110111	00010
1.001111 0.011011	100010

$$0 \oplus 1 = 1, \text{故 } x \cdot y = \text{---} 0.10011100010$$

补码一位乘 (Booth 算法)

部分积	乘数	y_{n+1}
00.000000 + 00.000000	1.010010	0
00.000000 00.000000 + 11.001001	01.01001	0
11.001001 11.100100 + 00.110111	101.0100	1
00.011011 00.001101 + 00.000000	1101.010	0
00.001101 00.001101 00.001101 + 11.001001	101101.01	0
11.001001 11.100100 11.100100 + 00.110111	1011101.0	1
00.011011 00.001101 00.001101 + 11.001001	001011101	0

$$[x \cdot y]_{补} = 11.01100001110$$

$$\Rightarrow x \cdot y = -0.10011100010$$

(3). $x=19, y=35 = (10001)_2$
 $= (010011)_2$

原码一位乘:

部分积	乘数	
0,000000	10001	
+0,010011		
0,010011		
0,001001	11000	→
+0,010011		
0,011100		
0,001110	011000	→
+0,000000		
0,001110		
0,000111	001100	→
+0,000000		
0,000111		
0,000011	100110	→
+0,000000		
0,000011		
0,000001	110011	→
+0,010011		
0,010100		
0,001010	011001	→

$0 \oplus 0 = 0, [x \cdot y]_{原} = 0,001010011001$

$\Rightarrow x \cdot y = +01010011001$
 $= +665$

$[x]_{补} = 00,01001, [y]_{补} = 00,10001$

$[x]_{补} = 11,10110$

补码一位乘 (Booth 算法)

部分积	乘数	y_{n+1}
00,000000	00,10001	0
+11,101101		
11,101101		
11,110110	10,10001	→
+00,000000		
11,110110		
11,111011	010,1000	→
+00,010011		
00,001110		
00,000111	0010,100	→
+00,000000		
00,000111		
00,000011	0010,10	→
+00,000000		
00,000011		
00,000001	110010,1	→
+11,101101		
11,101101		
11,110111	0110010,	→
+00,010011		
00,001010	011001	

$[x \cdot y]_{补} = 00,001010011001$

$\Rightarrow x \cdot y = +665$

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6.2

(1) $x = 0.10011$, $y = 0.10101$

原码加减交替法

$[x]_{\text{原}} = 0.10011$, $[y]_{\text{原}} = 0.10101$, $x^* = 0.10011$, $y^* = 0.10101$
 $[-y^*]_{\text{补}} = 1.01010$

被除数(余数)

$$\begin{array}{r} 0.10011 \\ + 1.01010 \\ \hline 1.11100 \\ 1.111000 \\ + 0.10101 \\ \hline 0.100011 \\ 1.000110 \\ + 1.010101 \\ \hline 0.011011 \\ 0.110110 \\ + 1.010101 \\ \hline 0.001011 \\ 0.010110 \\ + 1.010101 \\ \hline 1.101011 \\ 1.010110 \\ + 0.101011 \\ \hline 0.000001 \\ 0.000010 \\ + 1.010101 \\ \hline 1.010111 \\ + 0.101011 \\ \hline 0.000010 \end{array}$$

商

0.000000

0
0
01
01
011
011
0111
0111
01110
01110
011101
011101
0111010

$+ [-y^*]_{\text{补}}$

$+ [y^*]_{\text{补}}$

$+ [-y^*]_{\text{补}}$

$+ [-y^*]_{\text{补}}$

$+ [-y^*]_{\text{补}}$

$+ [y^*]_{\text{补}}$

$+ [-y^*]_{\text{补}}$

$+ [y^*]_{\text{补}}$

符号位 $0 \oplus 0 = 0$, 则 $x \div y = 0.111010$

(3) $x = 0.10100$, $y = -0.10001$

$[x]_{\text{原}} = 0.10100$, $[y]_{\text{原}} = 1.10001$, $x^* = 0.10100$, $y^* = 0.10001$, $[-y^*]_{\text{补}} = 1.01111$

被除数(余数)

$$\begin{array}{r} 0.10100 \\ 1.01111 \\ \hline 0.00011 \end{array}$$

商

0.000000

1

$+ [-y^*]_{\text{补}}$

溢出, 停止运算

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6.26 (1) $x = 2^{-01} \times 0.101100$, $y = 2^{-010} \times (-0.011100)$

$[x]_{补} = 11, 101; 00.101100$, $[y]_{补} = 11, 110; 11.100100$

$[x]_{补} - [y]_{补} = \begin{array}{r} 11, 101 \\ +00, 010 \\ \hline 11, 111 \end{array} \Leftrightarrow$ x 尾数右移 1 位, $j_x + 1$

$[x]_{补}' = 11, 110; 00.010110$

$[x+y]_{补} = [x]_{补}' + [y]_{补} = \begin{array}{r} 00.010110 \\ +11.100100 \\ \hline 11.111010 \end{array}$

~~$x+y = 0.000101 \times 2^{-010}$~~

$[x-y]_{补} = [x]_{补}' + [y]_{补} = \begin{array}{r} 00.010110 \\ +00.011100 \\ \hline 00.110010 \end{array}$

~~$x-y = 0.110010 \times 2^{-010}$~~

对 $[x+y]_{补}$ 左规 3 次, 阶码减 3, 得 $[x+y]_{补} = 11, 011; 11.010000$

~~$[x-y]_{补}$~~ $[x-y]_{补}$ 已是规格化数

$\Rightarrow x+y = 2^{-101} \times (-0.110000)$, $x-y = 2^{-010} \times 0.110010$

6.27 (1) $x = 00101; +0.101100$, $y = 00100; -0.100100$

$[x]_{补} = 00, 101; 00.101100$, $[y]_{补} = 00, 100; 11.011100$

$[x]_{补} - [y]_{补} = \begin{array}{r} 00, 101 \\ +11, 100 \\ \hline 00, 001 \end{array}$ y 尾数右移 1 位, $j_y + 1$

$[y]_{补}' = 00, 101; 11.101100$

$[x+y]_{补} = [x]_{补} + [y]_{补}' = \begin{array}{r} 00.101100 \\ +11.101100 \\ \hline 00.011000 \end{array}$ 左规 1 次, 阶码减 1,

$= 00, 100; 00.110100$

$\Rightarrow x+y = 2^{100} \times 0.110100$

6.2] (3) $x = +0.11; +0.110100, y = +100; -0.100100$

$[x]_{原} = 0, 011; 0.110100; [y]_{原} = 0, 100; 1.100100$

$[y]_{补} = 0, 100$
 $[x]_{补} = 0, 011$

部分积	乘数	
0.000000	100100	
0.000000	010010	→
0.000000	001001	→
+0.110100		
0.110100		
0.011010	000100	→
0.001101	000010	→
0.000110	100001	→
+0.110100		
0.111010		
0.011101	010000	→

$1 \oplus 0 = 1$

则 $x \cdot y = 2^{-11} \times 0.011010100000$

$\begin{array}{r} 0, 100 \\ + 0, 011 \\ \hline 0, 111 \end{array}$

(4) $x_{尾} = -0.101100, y_{尾} = -0.111100, x_{补}^* = 0.101100, y_{补}^* = 0.111100$

$[-y^*]_{补} = 1.000100$

$[x]_{补} = 0, 110$
 $[y]_{补} = 0, 011$

$1 \oplus 0 = 1$

被除数(余数)

商

0.101100	0.000000
+1.000100	
1.110000	0
1.100000	0
+0.111100	01
0.011100	
0.111000	01
+1.000100	
1.111100	010
1.111000	010
+0.111100	0101
0.110100	
1.101000	0101
+1.000100	01011
0.101100	
1.011000	01011
+1.000100	010111
0.011100	
0.111000	010111
+1.000100	0101110
1.111100	

$+ [-y^*]_{补}$

←

$+ [y^*]_{补}$

←

$+ [-y^*]_{补}$

←

$+ [y^*]_{补}$

←

$+ [-y^*]_{补}$

←

$+ [-y^*]_{补}$

←

$+ [-y^*]_{补}$

$\begin{array}{r} 1.111100 \\ + 0.111100 \\ \hline 0.111000 \end{array}$

$+ [y^*]_{补}$