2021141460159-邓钰川-作业2-1

3.6

3.6 [5] <§3.2> Assume 185 and 122 are unsigned 8-bit decimal integers. Calculate 185 – 122. Is there overflow, underflow, or neither?

考虑8位无符号二进制最大的十进制数是256，有符号是128
185 - 122 = 63 = 0b00111111 ⇒ right
185 - 122 = 63 = 0b00111111 ⇒ 对
所以不会overflow也不会underflow
Neither

$$185 : 10111001$$
$$122 : 01111010$$
$$185 - 122 : 00111111$$
$$Answer : 63$$
$$Neither$$

3.7

3.7 [5] <§3.2> Assume 185 and 122 are signed 8-bit decimal integers stored in sign-magnitude format. Calculate 185 + 122. Is there overflow, underflow, or neither?

overflow (65)
185 + 122 = 0b100110011 ⇒ requires 9-bit, overflow will occur.
185 + 122 = 0b100110011 ⇒ 需要 9 位，会发生溢出。
128-185+122=65

$$185: \ 10111001$$
$$So\ 185\ will\ be\ considered\ as\ -57$$
$$122: \ 01111010$$
$$So\ it\ is\ actually\ 122-57$$
$$57: \ 00111001$$
$$122-57: \ 01000001$$
$$Answer: \ 65$$
$$Neither$$

3.8

3.8 [5] <§3.2> Assume 185 and 122 are signed 8-bit decimal integers stored in sign-magnitude format. Calculate 185 − 122. Is there overflow, underflow, or neither?

Overflow

128-185-122=-179

$$185: \ 10111001$$
$$So\ 185\ will\ be\ considered\ as\ -57$$
$$So\ it\ is\ actually\ -57-122=-57+(-122)$$
$$57: \ 00111001$$
$$-57: \ 10111001$$
$$122: \ 01111010$$
$$-122: \ 11111010$$
$$-57+(-122): \ 10110011$$
$$Answer: \ -51$$
$$Overflow$$

3.9

3.9 [10] <§3.2> Assume 151 and 214 are signed 8-bit decimal integers stored in two's complement format. Calculate 151 + 214 using saturating arithmetic. The result should be written in decimal. Show your work.

-105 -42=-128

$$151: \ 10010111$$
$$two's\ complement: \ 11101001$$
$$214: \ 11010110$$
$$two's\ complement: \ 10101010$$
$$151+214\ (saturating\ arithmetic): \ 11111111$$
$$Answer: \ -1$$

3.10

3.10 [10] <§3.2> Assume 151 and 214 are signed 8-bit decimal integers stored in two's complement format. Calculate 151 − 214 using saturating arithmetic. The result should be written in decimal. Show your work.

-105+42=-63

$$151: \ 10010111$$
$$two's\ complement: \ 11101001$$
$$-214: \ 01010110$$
$$two's\ complement: \ 01010110$$
$$151 - 214(saturating\ arithmetic): \ 00111111$$
$$Answer: \ 63$$

3.11

3.11 [10] <§3.2> Assume 151 and 214 are unsigned 8-bit integers. Calculate 151 + 214 using saturating arithmetic. The result should be written in decimal. Show your work.

151+214=255

$$151: \ 10010111$$
$$214: \ 11010110$$
$$151 + 214\ (saturating\ arithmetic): \ 11111111$$
$$Answer: \ 255$$

3.13

3.13 [20] <§3.3> Using a table similar to that shown in Figure 3.6, calculate the product of the hexadecimal unsigned 8-bit integers 62 and 12 using the hardware described in Figure 3.5. You should show the contents of each register on each step.

62✕12=744=1011101000

62=00111 110
12=00001 100
迭代次数	步骤	乘数	被乘数	乘积
0	初始值	00001100	00111110	00000000
1	1a：无操作	00001100	00111110	00000000
1	2：左移被乘数	00001100	01111100	00000000
1	3：右移乘数	00000110	01111100	00000000
2	1a：无操作	00000110	00111110	00000000
2	2：左移被乘数	00000110	11111000	00000000
2	3：右移乘数	00000011	11111000	00000000
3	1a：乘积=乘积+被乘数	00000011	11111000	11111000
3	2：左移被乘数	00000011	11110000	11111000
3	3：右移乘数	00000001	11110000	11111000
4	1a：乘积=乘积+被乘数	00000001	11110000	11101000
4	2：左移被乘数	00000001	11110000	11101000
4	3：右移乘数	00000000	11110000	11101000
对的上后八位

$$0x62(Muiltiplicand):\ 0110\ 0010$$
$$0x12(Muiltiplier):\ 0001\ 0010$$
$$0x62 = 92(Decimal)$$
$$0x12 = 18(Decimal)$$
$$0x62 * 0x12 = 98 * 18(Decimal) = 1764(Decimal) = 0x06E4 = 0000\ 0110\ 1110\ 0100$$

Iteration	Step	Multiplier	Multiplicand	Product
0	Initial values	0001 0010	0110 0010	0000 0000 0000 0000
1	1: 0 → No operation	0001 0010	0110 0010	0000 0000 0000 0000
	2: Shift right Multiplier	0000 1001	0110 0010	0000 0000 0000 0000
	3: Shift right Product	0000 1001	0110 0010	0000 0000 0000 0000
2	1a: 1 → Add Multiplicand to the left of Product and place the result	0000 1001	0110 0010	0110 0010 0000 0000
	2: Shift right Multiplier	0000 0100	0110 0010	0110 0010 0000 0000
	3: Shift right Product	0000 0100	0110 0010	0011 0001 0000 0000
3	1: 0 → No operation	0000 0100	0110 0010	0011 0001 0000 0000
	2: Shift right Multiplier	0000 0010	0110 0010	0011 0001 0000 0000
	3: Shift right Product	0000 0010	0110 0010	0001 1000 1000 0000
4	1: 0 → No operation	0000 0010	0110 0010	0001 1000 1000 0000
	2: Shift right Multiplier	0000 0001	0110 0010	0001 1000 1000 0000
	3: Shift right Product	0000 0001	0110 0010	0000 1100 0100 0000
5	1a: 1 → Add Multiplicand to the left of Product and place the result	0000 0001	0110 0010	0110 1110 0100 0000
	2: Shift right Multiplier	0000 0000	0110 0010	0110 1110 0100 0000
	3: Shift right Product	0000 0000	0110 0010	0011 0111 0010 0000
6	1: 0 → No operation	0000 0000	0110 0010	0011 0111 0010 0000
	2: Shift right Multiplier	0000 0000	0110 0010	0011 0111 0010 0000
	3: Shift right Product	0000 0000	0110 0010	0001 1011 1001 0000
7	1: 0 → No operation	0000 0000	0110 0010	0001 1011 1001 0000
	2: Shift right Multiplier	0000 0000	0110 0010	0001 1011 1001 0000
	3: Shift right Product	0000 0000	0110 0010	0000 1101 1100 1000
8	1: 0 → No operation	0000 0000	0110 0010	0000 1101 1100 1000
	2: Shift right Multiplier	0000 0000	0110 0010	0000 1101 1100 1000
	3: Shift right Product	0000 0000	0110 0010	0000 0110 1110 0100

3.14

硬件：一个循环来做加法,一个循环来做移位,一个循环判断完成。（3个）
软件：它需要一个周期确定加数,1个周期做加法,1个周期来做每一个移位,一个周期判断

完成。5个
所以硬件是$3 * 8 * 4 = 96$unit
软件是$5 * 8 * 4 = 160$unit