

Hw1 Solutions

1.3 The range of n-digit decimal number is $[0, 10^n-1]$. The range of m-bit binary number is $[0, 2^m-1]$. To represent n-digit decimal number, we need $2^m-1 \geq 10^n-1$. So $m \geq n \times \log_2 10 \approx 3.3n$.

1.7 Assume the carry-in and carry-out signals for the sign bit are C_{in} and C_{out} . The overflow signal can be generated by $C_{in} \oplus C_{out}$.

1.12 Suppose an end-around carry can lead to another end-around carry out in an n-bit one's complement addition. Then the intermediate result must be $11...11$. However, there is no way to generate this result and an end-around carry at the same time. The biggest intermediate result is $11...10$. So an end-around carry can't generate another end-around carry.

2.1 (a)

Weight: 64 16 4 1. 1/4 1/16

$(41.25)_{10} = (\quad 1 \quad -1 \quad -2 \quad 1. \quad 1 \quad 0 \quad)$

$(-41.25)_{10} = (\quad -1 \quad 1 \quad 2 \quad -1. \quad -1 \quad 0 \quad)$

The answer is not unique.

(b)

Weight: 100 -10 1. -0.1 0.01

$(41.25)_{10} = (\quad 1 \quad 6 \quad 2. \quad 8 \quad 5 \quad)$

$(-41.25)_{10} = (\quad 0 \quad 5 \quad 9. \quad 3 \quad 5 \quad)$

2.13 Table 2.4

y_i	C_i	Z_i	C_{i+1}
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0
-1	0	1	1
-1	1	0	1

Table 2.4 defines the function of Z_i with respect to y_i and C_i . The function agrees with the function $|y_i| \oplus C_i$.

2.14 Table1:

$x_i + y_i$	-2	-1		0	1		2
$a_i + b_{i-1}$	-	0	>0	-	0	>0	-
c_i	-1	-1	0	0	0	1	1
u_i	0	1	-1	0	1	-1	0

Table2:

$a_{i+1} + b_{i+1}$	0			1			2		
c_i	-1	0	1	-1	0	1	-1	0	1
c_{i+1}	-1	0	0	0	0	1	0	1	1
s_{i+1}	1	0	1	0	1	0	1	0	1

Because the outputs of each signed-digit bit depend only on the current bit and the previous unsigned bit, carry propagation will be cut off here. So the carry chains won't exceed $(d+1)$ in length.