Number Representation

Basic concepts:
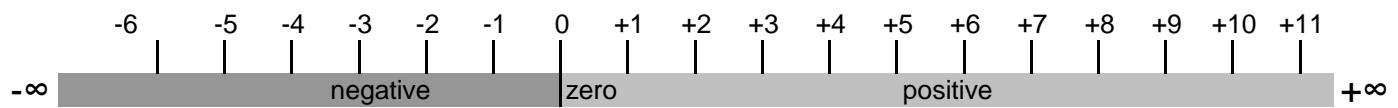
if the range is limited:

we could use bias representation:

Implementation examples:

As an example let us consider 3 bits - thus we have eight integers available (0-7):

How can we use them to represent a range of positive and negative integers?

	b2	b1	b0
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

sign magnitude
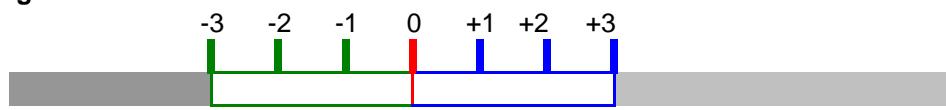
representation (x):
one bit represents sign
(0 for positive, 1 for negative)
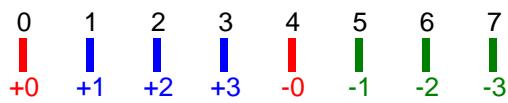
	b2	b1	b0	
0	0	0	0	+0
1	0	0	1	+1
2	0	1	0	+2
3	0	1	1	+3
4	1	0	0	-0
5	1	0	1	-1
6	1	1	0	-2
7	1	1	1	-3
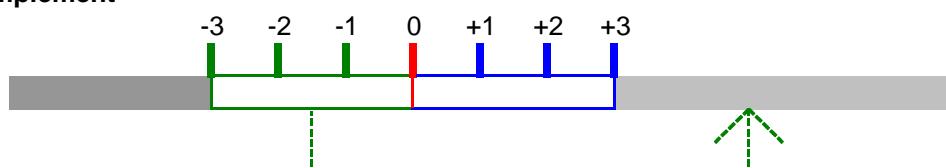
1's complement

representation (x):

binary (x)   if $0 \le x < 2^{n-1}$

binary ($2^n - 1 - |x|$)   if $-2^{n-1} < x < 0$
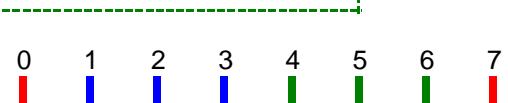
	b2	b1	b0	
0	0	0	0	+0
1	0	0	1	+1
2	0	1	0	+2
3	0	1	1	+3
4	1	0	0	-3
5	1	0	1	-2
6	1	1	0	-1
7	1	1	1	-0

2's complement
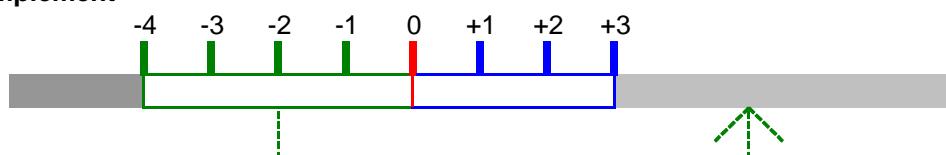
representation (x):

binary (x)   if $0 \le x < 2^{n-1}$

binary ($2^n - |x|$)   if $-2^{n-1} \le x < 0$

	b2	b1	b0	
0	0	0	0	0
1	0	0	1	+1
2	0	1	0	+2
3	0	1	1	+3
4	1	0	0	-4
5	1	0	1	-3
6	1	1	0	-2
7	1	1	1	-1