Logical Design

Lecture 5

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1’s complement and 2’s complement

Binary Number System is one the type of most popular Number Representation techniques that used in digital systems. In the Binary System, there are only two symbols or possible digit values, i.e., 0 (off) and 1 (on).

Generally, there are two types of complement of Binary number: 1’s complement and 2’s complement. To get 1’s complement of a binary number, simply invert the given number.

For example, 1’s complement of binary number 110010 is 001101.

To get 2’s complement of binary number is 1’s complement of given number plus 1 to the least significant bit (LSB).
For example, 2’s complement of binary number 10010 is (01101) + 1 = 01110.

1’s Complementation in Signed Binary number Representation:

1’s complement: the 1’s complement form of any binary number is obtained simply by changing each 0 in the number to a 1 and each 1 to a 0. In other word, change each bit to its complement. For example:

1 0 1 1 0 1	Binary No.
↓ ↓ ↓ ↓ ↓ ↓	
0 1 0 0 1 0	1’s complement

0 1 1 0 1 0	Binary No.
↓ ↓ ↓ ↓ ↓ ↓	
1 0 0 1 0 1	1’s complement

1's Complementation Examples

Example: find $11010_{(2)} - 10000_{(2)}$ using 1's complement method (Case 1).

As long as the carry appear, the number is positive and a carry must be added to the result.

```
  11010
+ 01111     1's complement of 10000
 101001
+      1
  01010
```

$$11010_{(2)} - 10000_{(2)} = 01010_{(2)}$$

Example: find $10000_{(2)} - 11010_{(2)}$ using 1's complement method (Case 2).

As long as no carry appear, the number is negative, then 1's complementing of the final result in needed.

```
  10000
+ 00101     1's complement of 11010
  10101
  ↓↓↓↓↓ 1's complement
  01010
```

$$10000_{(2)} - 11010_{(2)} = -\,01010_{(2)}$$

2’s Complement

2’s complement: the 2’s complement form of a binary number is formed simply by taking the 1’s complement of the number and adding 1 to the least significant bit position.

2’s complement = (1’s complement) +1

2’s Complement Example

Example: find 2’s complement of 10110010.

	1 0 1 1 0 0 1 0	binary number.
	↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	
	0 1 0 0 1 1 0 1	1’s complement
+	1	adding 1
	0 1 0 0 1 1 1 0	2’s complement