Dr. Rakesh Ranjan BCA Sem - 2

Computer Organization and Architecture

Topic

Signed Number representation

Signed Number representation For binary Number

Signed number is required to encode negative numbers in the binary number system .Generally , negative numbers in any base system are written by preceding the number with

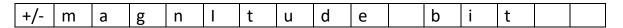
(-) Sign.

But Computer does not support directly minus sign with negative number. In Binary we represent negative value by

1. Sign and magnitude technique: number is represented as 8-bit or 16-bit combination where left most bit (MSB- most significant bit) is represented as sign bit and rest bit is magnitude bit.

Sign bit M	A G	N		T U	D	E
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In 8- bit representation (1 bit for sign and 7 –bit for magnitude)



In 16 –bit representation (1 bit for sign and 15 bit for magnitude)

If the MSB be 0 the number is Positive

If the MSB be 1 the number is Negative

For example:

+36 = 0 0100100

-45 = 1 0101101

+117= 0 1110101

-117 = 1 1110101

But ,this technique is not proper because there is no proper system to represent negative number.

2. One's Complement representation:

In this technique, negative number is obtained by taking the complement of its positive counter part.

For example:

+45 = 0.0101101

Complement each binary digit for negative value

- 45 = 1 1010010

i.e subtract each digit in 1 as

1 1111111

+45 = 0 0101101

-45 = 1 1010010

But this technique is not wel defined and meaningful because the representation of -0 and +0 is different form as -

+0 = 0.0000000

-0 = 1 11111111

So, Another technique adopted that are universal for all numbers

3. Two's Complement Method:

In this technique, first the negative number is represented in One's Complement then add 1 to least significant bit(LSB)i.e right most bit.

For example

```
+45 = 0.0101101
```

1

```
= 11010011 - 2's Complement
```

$$+0 = 00000000$$

$$-0 = 111111111 \rightarrow 1$$
's complement

1

1 00000000 \rightarrow 2's complement of -0

i.e Leave all bit up to first 1-bit of positive binary value as it appear from LSB then complement the rest of the bit , the result will be the negative value

as:

$$+44 = 0.0101100$$

$$-45 = 11010011$$

Similarly the system is worked in rest of the number system

For Representation of Decimal negative value we follow the

- 1. 9's Complement method
- 2. 10's complement method

To represent Negative decimal in $9^{'}$ s Complement , we subtract each decimal digit in 9.

```
+1234567
-1234567 = 8765432 \rightarrow 9' s complement
Add 1 to LSB to Convert it into 10' s Complement
-1234567 = 8765433
(98012) \rightarrow
9's complement (-98012) \rightarrow 01987
10's \rightarrow (01988)
```

For representing Octal negative Value we follow

- 1. 7's Complement method
- 2. 8's complement method

To represent Negative decimal in 7's Complement, we subtract each decimal digit in 7.

```
+1234

-1234 = 6543 \rightarrow 7's complement

Add 1 to LSB to Convert it into 8's Complement

-1234 = 6544

(-1030)<sub>8</sub> \rightarrow (6747) \rightarrow 7's Complement
```

$$\rightarrow$$
 (6750) \rightarrow 8's complement

$$(-261) \rightarrow (516) \rightarrow 7$$
's complement

$$\rightarrow$$
 (517) \rightarrow 8's Complement

For representing Hexadecimal negative Value we follow

- 1. 15's Complement method
- 2. 16's complement method

To represent Negative Hexadecimal in15's Complement, we subtract each decimal digit in 15.

+A1D5

-A1D5 = 5E2A
$$\rightarrow$$
 15' s complement

Add 1 to LSB to Convert it into 16's Complement

$$-A1D5 = 5E2B$$

$$(-01FFA)_{16} \rightarrow (FEOO5) \rightarrow 15's$$
 Complement

$$\rightarrow$$
 (FE006) \rightarrow 16's Complement

 $0 \rightarrow$ Positive

F→ Negative

Conversion of negative Hexadecimal to Negative Binary

$$+ A1D = 0 A1D$$

Conversion of negative Octal to Negative Binary

0→ positive

7→negative

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