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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.

As (- 123) (+ 123)

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	I	T U	D	E

In 8- bit representation (1 bit for sign and 7 –bit for magnitude)

+/-	m	a	g	n	I	t	u	d	e		b	i	t		

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 1111111

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

-45 = 1 1010010 - in One's Complement

1

= 11010011 - 2's Complement

+0 = 00000000

-0 = 11111111 → 1's complement

1

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1 00000000 →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

-44 = 1 1010100 -- in 2's Complement.

+45 = 00101101

-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 → 9' s complement

Add 1 to LSB to Convert it into 10' s Complement

-1234567 = 8765433

(98012) →

9's complement (-98012) → 01987

10's → (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 → 7' s complement

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

-1234 = 6544

$(-1030)_8$ →(6747) → 7's Complement

→(6750) → 8's complement

(-261) →(516) →7's complement

→ (517)→ 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 → 15' s complement

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

-A1D5 = 5E2B

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

→(FE006) → 16's Complement

0→ Positive

F→ Negative

Conversion of negative Hexadecimal to Negative Binary

+ A1D = 0 A1D 0000 1010 0001 1101

-A1D = F 5E3 = 1111 0101 1110 0011

Conversion of negative Octal to Negative Binary

0→ positive

7→negative

+ 612 = 000 110 001 010

-612 = 7 166 = 111 001 110 110