**10 .... 0(2)= 2^n**

**n**

**1... .... 1(2)= 10.....0(2) -1(2)= 2^n-1**

**n n**

**Ex1. Subunitary numbers – codes and operations in complementary code**

**n=8 bits**

**6/8=6\*8^(-1)= 0,6(8)=0,110(2)**

**X= 11/16 = 11\*16^(-1)= 0,B(16)=0,1011(2)**

**Y= 0,45 =0,346(8)=0,011100110(2)**

**0,45\*8=3,6**

**0,6\*8=4,8**

**0,8\*8=6,4**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **positions** | **S 7 , 6 5 4 3 2 1 0** | | | | | | | |
| **[11/16] dir = [11/16]inv= [11/16]compl =** | **0** | **1** | **0** | **1** | **1** | **0** | **0** | **0** |
| **[-11/16]dir =** | **1** | **1** | **0** | **1** | **1** | **0** | **0** | **0** |
| **[-11/16]inv =** | **1** | **0** | **1** | **0** | **0** | **1** | **1** | **1** |
| **[-11/16]compl =** | **1** | **0** | **1** | **0** | **1** | **0** | **0** | **0** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **positions** | **S 7 , 6 5 4 3 2 1 0** | | | | | | | |
| **[0,45] dir = [0,45]inv= [0,45]compl=** | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **1** |
| **[-0,45]dir =** |  |  |  |  |  |  |  |  |
| **[-0,45]inv =** |  |  |  |  |  |  |  |  |
| **[-0,45]compl =** | **1** | **1** | **0** | **0** | **0** | **1** | **1** | **1** |

**[11/16+0,45]compl = [11/16]compl ⊕ [0.45]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **S ,** | | | | | | | |  |  |
| **[11/16]compl =** |  | **0** | **1** | **0** | **1** | **1** | **0** | **0** | **0** | **⊕** | **Overflow (r1)** |
| **[0,45]compl =** |  | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **1** |  |
|  |  | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **1** |  |

**[11/16- 0,45]compl = [11/16]compl ⊕ [-0.45]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **S ,** | | | | | | | |  |  |
| **[11/16]compl =** |  | **0** | **1** | **0** | **1** | **1** | **0** | **0** | **0** | **⊕** | **Correct result (r2)**  **[2^(-3)+2^(-4)+2^(-5)+**  **2^(-6)+2^(-7)]compl** |
| **[-0,45]compl =** |  | **1** | **1** | **0** | **0** | **0** | **1** | **1** | **1** |  |
|  | **~~1~~** | **0** | **0** | **0** | **1** | **1** | **1** | **1** | **1** |  |

**[0,45-11/16]compl = [0,45]compl ⊕ [-11/16]compl**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **S ,** | | | | | | | |  |  |
| **[-11/16]compl** |  | **1** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **⊕** | **Correct result**  **[-(2^(-3)+2^(-4)+2^(--5)+**  **2^(-6)+2^(-7))]compl** |
| **[0,45]compl =** |  | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **1** |  |
|  |  | **1** | **1** | **1** | **0** | **0** | **0** | **0** | **1** |  |
| **complement** |  | **0** | **0** | **0** | **1** | **1** | **1** | **1** | **1** |  |  |

**Ex2: Represent in floating point notation, single precision (SP), with**

**mantissa>1, the number 2053,45**

**2053= 2048+4+1= 2^11+2^2+2^0=100000000101 (2)**

**0,45= (8)= (2)**

**Y= 0,45 =0,3463(8)=0,011100110011(2)**

**0,45\*8=3,6**

**0,6\*8=4,8**

**0,8\*8=6,4**

**0,4\*8=3,2**

**2053,45= 100000000101, 011100110011 (2)=**

**=1,00000000101011100110011 (2)\* 2^(11), e=11**

**Mantissa**

**1 –hidden bit (it is not represented internally)**

**c=127+e=127+11=128+8+2=2^7+2^3+2^1=10001010(2)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 8 bits | | | | | | | | 23 bits | | | | | | | | | | | | | | | | | | | | | | | | |
| S | c =127+e → , ← mantissa | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 4 | | | | 5 | | | | 0 | | | | 0 | | | | | 5 | | | | | 7 | | | | 3 | | | | 3 | | | |