**Subtraction in base b: d(b) = x(b) - y(b) ,**

**x - minuend, y - subtrahend, d - difference**

**x = (xn ….x1 x0)(b) , y = (yn ….y1 y0)(b) d = (dn ….d1 d0)(b)**

**Example 1 (b=10) :**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **7** | **10** | **9** | **9** | **1** |  |  | **1** | **1** | **1** | **1** | **0** |  |
| **x** | **=** | **8** | **1** | **0** | **0** | **4** | **-** |  | **8** | **1** | **0** | **0** | **4** | **-** |
| **y** | **=** | **0** | **4** | **5** | **6** | **7** |  |  | **0** | **4** | **5** | **6** | **7** |  |
| **d** | **=** | **7** | **6** | **4** | **3** | **7** |  |  | **7** | **6** | **4** | **3** | **7** |  |

**Algorithm**

**c0=0; //c0, c1,… ,cn+1 Ԑ {0,1}are the borrows used in subtraction**

**for i=0,n**

**x’i (10) = xi (b) ; y’i (10) = yi (b); //convert the digits from base b in base 10**

**d10 = x’i(10) – ci (10) –y’i (10); //subtraction in base 10**

**ci+1 = 0;**

**if (d10 < 0 ) then { d10 = d10+b ; ci+1 = 1;}**

**di (b)= d10(10) //convert the decimal value in base b**

**end\_for**

**Example 2:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Positions (i)** | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Operation** | **Base (b)** | **Borrows (c)** |  |  |  |  |  |  | 0 | 1 | 1 | 0 |
| **-** | **8** | **x** |  |  |  |  |  |  | 1 | 5 | 4 | 2 |
|  |  | **y** |  |  |  |  |  |  |  | 2 | 5 | 3 |
|  |  | **Difference(d)** |  |  |  |  |  |  | 1 | 2 | 6 | 7 |

**D10=2-0-3=-1, -1<0 then d0= -1+8 = 7 , c1=1**

**D10=4-5-1=-2, -2<0 then d1= -2+8 = 6 , c2=1**

**D10= 5-2-1=2, 2>0 then d2 = 2 , c3 =0**

**Example 3:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Positions (i)** | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Operation** | **Base (b)** | **Borrows (c)** |  |  |  |  |  | 1 | 1 | 1 | 1 | 0 |
| **-** | **2** | **x** |  |  |  |  | 1 | 1 | 0 | 0 | 1 | 0 |
|  |  | **y** |  |  |  |  |  | 1 | 1 | 0 | 1 | 1 |
|  |  | **Difference(d)** |  |  |  |  |  | 1 | 0 | 1 | 1 | 1 |

**Example 4:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Positions (i)** | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Operation** | **Base (b)** | **Borrows (c)** |  |  |  |  |  |  | 1 | 1 | 1 | 0 |
| **-** | **16** | **x** |  |  |  |  |  |  | A | 8 | B | C |
|  |  | **y** |  |  |  |  |  |  | 0 | F | D | E |
|  |  | **Difference(d)** |  |  |  |  |  |  | 9 | 8 | D | E |

**D10=C(16)-0(16)-E(16)=12-0-14=-2<0 then d0=-2+16=14=E(16), c1=1**

**D10=B(16)-1(16)-D(16)=11-1-13=-3<0 then d1=-3+16=13= D(16), c2=1**

**D10=8(16)-1(16)-F(16)=8-1-15=-8<0 then d2=-8+16=8, c3=1**

**D10=A(16)-1(16)-0(16)=10-1-0=9>0, c4=0**