**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** |  |  |
| **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** |  |  |  |  |  |  | 3 | 7 | 4 | 0 |
|  |  | **y** |  |  |  |  |  |  | 0 | 6 | 6 | 5 |
|  |  | **Difference(d)** |  |  |  |  |  |  | 3 | 0 | 5 | 3 |

**d10=0-0-5=-5, -5<0, then c1=1, d 0=-5+8=3**

**D10=4-1-6=-3, –3<0,then c2=1,d1=-3+8=5**

**D10=7-1-6=0,c3=0,d2=0**

**Example 3:**

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

**D10 = 5 – 0 – 8 = -3 , d0= -3 + 16 =13 =D(16), c1=1**

**D10 = A(16) - 1(16) - F(16) = 10 – 1 – 15 = -6, d1 = -6 + 16 = 10 = A(16) , c2 = 1**

**D10 = 0(16) - 1(16) - B(16) = 0 – 1 – 11 = -12, d2 = -12 + 16 = 4 , c3 = 1**