Lab Sheet-3

SUBTRACTION OF TWO UNSIGNED INTEGER BINARY NUMBER

Objective
  To design n-bit (4-bit) sub tractor for unsigned integer binary numbers.

Subtraction is the basic arithmetic operation. In digital computers complement is used for simplifying the subtraction. There are two types of compliments for base 2 system: $1'^s$ complement and $2'^s$ complement. The 1's complement of binary number is obtained by subtracting each digit from 1.However, the subtraction of a binary digit from 1 causes the bit to change from 0 to 1 or from 1to 0.Therefore, the 1's complement of a binary number is formed by changing 1's into 0's and 0's into 1's.
For example
1's complement of 0111 is 1000.
2's complement can be formed by leaving all least significant 0's and first 1 unchanged, and then replacing 1's by 0's and 0's by 1's in all other higher significant bits.
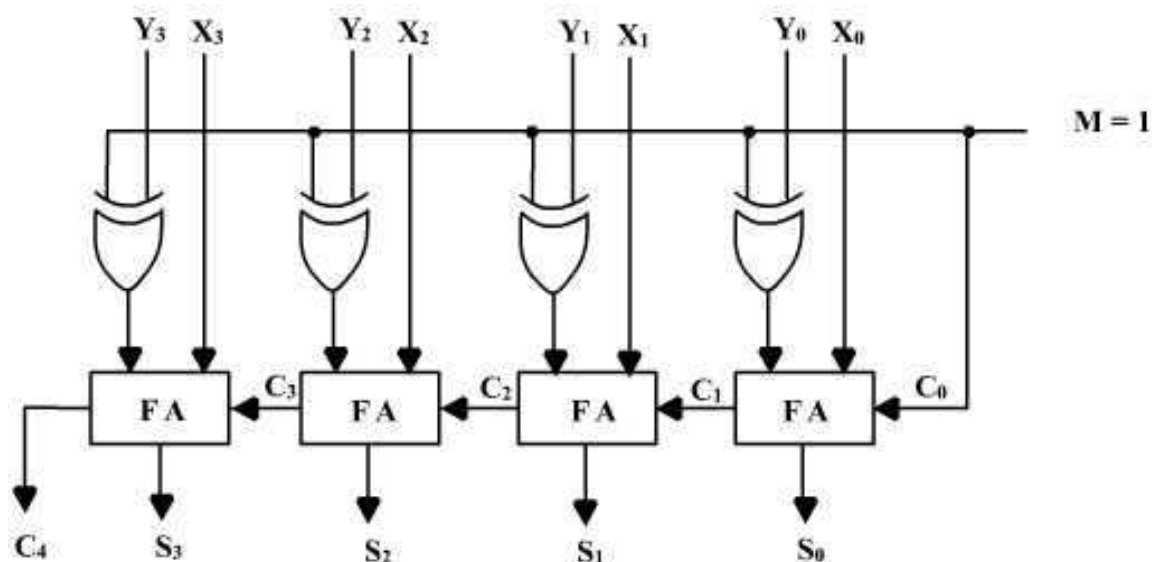

Figure 3.1 4-bit subtractor

Each exclusive –OR gate receives input M and one of the input bit of Y. We have

$$\mathbf{Y \oplus 1 = Y'}$$

And $C_{0 = 1}$. The Y inputs are all complemented and a 1 is added through the input carry. The circuit performs the operation X plus the 2's complement of Y. For unsigned numbers, this gives X-Y if X >=Y or the 2's complement of (Y-X) if X<Y.

For example

The 2's complement of 0111 is 1001 and is obtained by leaving first 1 unchanged, and then replacing 1's by 0's and 0's by 1's in the other three most significant bits.
Let us see an example of subtraction using two binary numbers X = 10(1010) and Y = 9 (1001) and perform X-Y and Y-X.

```
                    X =    1010
2's complement of Y =   +0111
                         -----------
            Sum    =  10001
Discard end carry 24   = -10000
                         ----------
       Answer: X-Y =    0001


                    Y =    1001
2's complement of X =   +0110
                         -----------
            Sum =    1111
```

There is no end carry

Answer is negative 0001 = 2's compliment of 1111

For addition of 2's complement use same algorithm as you used in lab – 1.