Logical Design

Lecture 4

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Hexadecimal to Binary Conversion

Example: Convert $A2B_{16}$ to an equivalent binary number.

First, convert the given hexadecimal to the equivalent decimal number.

$A2B_{16} = (A \times 16^2) + (2 \times 16^1) + (B \times 16^0)$

$= (A \times 256) + (2 \times 16) + (B \times 1)$

$= (10 \times 256) + 32 + 11$

$= 2560 + 43$

$= 2603$(Decimal number)

2 | 2603
2 | 1301 -- 1
2 | 650 -- 1
2 | 325 -- 0
2 | 162 -- 1
2 | 81 -- 0
2 | 40 -- 1
2 | 20 -- 0
2 | 10 -- 0
2 | 5 -- 0
2 | 2 -- 1
2 | 1 -- 0
2 | 0 -- 1

The binary number obtained is 101000101011_2
Hence, $A2B_{16} = 101000101011_2$

Binary Arithmetic operations

Addition

The 4 basic rules for adding binary digits (bits) are as follows:
0+0=0
0+1=1
1+0=1
1+1 = 0 **with carry** 1

Example 1: 10001 + 11101

```
          1
    1 0 0 0 1
(+) 1 1 1 0 1
_____________
  1 0 1 1 1 0
```

Example 2: 10111 + 110001
Solution:

```
  1     1 1 1
      1 0 1 1 1
(+) 1 1 0 0 0 1
_________________
  1 0 0 1 0 0 0
```

Binary Arithmetic operations

Subtraction

The four basic rules for subtracting bits as follows: 0−0=0

1−0 =1

1−1 =0

0−1= 10−1=1 with **borrow** of 1

Example: 11101 − 10110 = 00111_2

Example 1: 0011010 – 001100

Solution:

1 1 Borrow

0 0 1 1 0 1 0

- 0 0 1 1 0 0

———————

0 0 0 1 1 1 0

Decimal Equivalent :

0 0 1 1 0 1 0 = 26

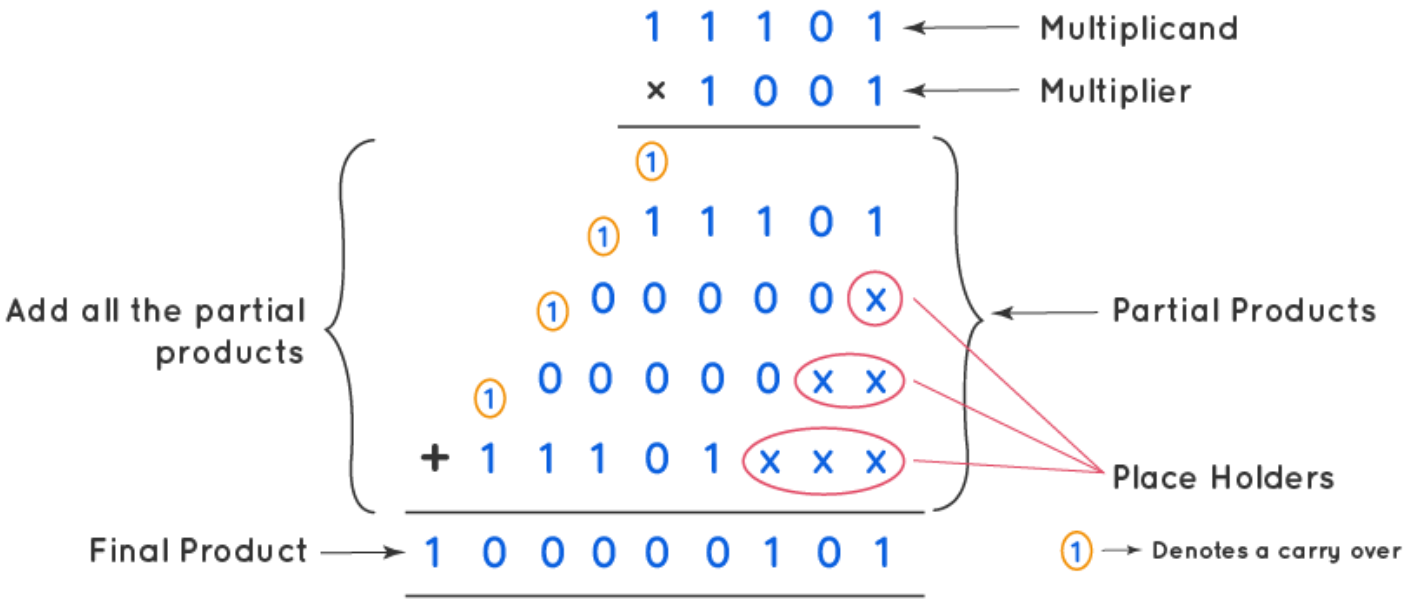
0 0 1 1 0 0 = 12

26 – 12 = 14

Binary Arithmetic operations

Multiplication

The four basic rules for multiplying bits are as follows: 0∗0=0
0∗1=0
1∗0=0
1∗0=0
1∗1=1



Binary Arithmetic operations

Binary division

The rules for division by binary bits is as follows:

0÷1=0

1 ÷ 1 = 1 where division by **zero is not permitted**

Example: 110 ÷ 10 = 10_2