

## Binary Multiplication

---

1010 is binary for 10

0101 is binary for 5

1010\*0101:

			1	0	1	0	
	*		0	1	0	1	
-----							
1)			1	0	1	0	
2)		0	0	0	0	X	
3)	1	0	1	0	X	X	
-----							
4)	=	1	1	0	0	1	0

STEPS EXPLAINED :

- 1) We multiply 1010 by the first number of 0101:  $1*1010 = 1010$
- 2) We multiply 1010 by the second number of 0101:  $0*1010 = 0000$
- 3) We multiply 1010 by the third number of 00101:  $1*1010 = 1010$
- 4) We add them up and we get: 110010

	2^5	2^4	2^3	2^2	2^1	2^0				
	1	1	0	0	1	0				
-----										
=	32	+	16	+	0	+	0	+	2	0
=	50									

## Binary Division

Normal Division:

Let pose 8 dividing 128:

- 1)  $1 < 8 \Rightarrow 0$
- 2) 1 & 2 go down
- 3)  $12 > 8$
- 4)  $12 - 8 = 4$
- 5) 4 & 8 go down
- 6)  $48 - 6 \cdot 8 = 0$

$$\begin{array}{r}
 \phantom{0} \phantom{1} \phantom{6} \\
 \hline
 8 \quad | \quad 1 \quad 2 \quad 8 \\
 \quad | \quad -0 \\
 \quad | \quad 1 \quad 2 \\
 \quad | \quad - \quad 1 \cdot 8 \\
 \quad | \quad \hline
 \quad | \quad = \quad 4 \\
 \quad | \quad \\
 \quad | \quad \phantom{4} \phantom{8} \\
 \quad | \quad - \quad 6 \cdot 8 \\
 \quad | \quad \hline
 \quad | \quad 0
 \end{array}$$

Binary Division:

101010 is binary for 42

000110 is binary for 6

- 1)  $1 < 110 \Rightarrow 0$
- 2) write 0 above 1, remainder is 1
- 3) 1 & 0 go down we get 10
- 3)  $10 < 110 \Rightarrow 0$
- 4) write 0 above 0
- 5) 101 go down
- 6)  $101 < 110 \Rightarrow 0$
- 7) 1010 go down
- 8)  $1010 > 110$
- 9)  $0-0=0$ ;  $1-1=0$ ;  $0-1=1+1\text{remainder}$
- 10)  $1-1\text{remainder}=0$
- 11) We write 1 above
- 12) 1 goes down
- 13)  $1001 > 110$
- 14)  $1-0=1$ ;  $0-1=\text{move left...}$
- 15) 0 goes down
- 16)  $110 - 110 = 0$
- 12) We write 1 above

$$\begin{array}{r}
 \phantom{0} \phantom{0} \phantom{0} \phantom{1} \phantom{1} \phantom{1} \\
 \hline
 110 \quad | \quad 1 \quad 0 \quad 1 \quad 0 \quad 1 \quad 0 \\
 \quad | \quad -0 \\
 \quad | \quad \hline
 \quad | \quad 1 \quad 0 \\
 \quad | \quad -0 \\
 \quad | \quad \hline
 \quad | \quad 1 \quad 0 \quad 1 \\
 \quad | \quad -0 \\
 \quad | \quad \hline
 \quad | \quad 1 \quad 0^2 \quad 1 \quad 0 \\
 \quad | \quad - \quad 1^2 \quad 1 \quad 1 \quad 0 \\
 \quad | \quad \hline
 \quad | \quad = \quad 0 \quad 1 \quad 0 \quad 0 \\
 \quad | \quad \\
 \quad | \quad \phantom{1} \phantom{0} \phantom{0} \phantom{1} \\
 \quad | \quad - \quad 1 \quad 1 \quad 0 \\
 \quad | \quad \hline
 \quad | \quad = \quad 0 \quad 0 \quad 1 \quad 1 \\
 \quad | \quad \\
 \quad | \quad \phantom{1} \phantom{1} \phantom{0} \\
 \quad | \quad - \quad 1 \quad 1 \quad 0 \\
 \quad | \quad \hline
 \quad | \quad 0 \quad 0 \quad 0
 \end{array}$$

$42/6 = 7$

111 is binary for 7: it's correct