

Binary Arithmetic

The rules used in decimal arithmetic operations are applied in any other number system. (digit carry to the higher order position in addition and the digit borrow from higher order position in subtraction).

Binary Addition

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$1 + 0 = 1$$

$$1 + 1 = 0 \text{ and carry } 1 \text{ to the next column}$$

Add 45_{10} and 44_{10} in binary

$$\begin{array}{rcccccc} & & 1 & & 1 & 1 & \leftarrow \text{Carries} \\ 45_{10} = & 1 & 0 & 1 & 1 & 0 & 1 \\ 44_{10} = & \underline{1} & \underline{0} & \underline{1} & \underline{1} & \underline{0} & \underline{0} \\ & 1 & 0 & 1 & 1 & 0 & 0 & 1 & = 89_{10} \end{array}$$

Binary Subtraction

$$0 - 0 = 0$$

$$0 - 1 = 1 \text{ and borrow 1 from the next column}$$

$$1 - 0 = 1$$

$$1 - 1 = 0$$

Subtract 108_{10} from 218_{10} in binary

		0	10	10	0	10	10	←	Borrows
$218_{10} =$		1	1	0	1	1	0	1	0
$108_{10} =$	_____	1	1	0	1	1	0	0	
		1	1	0	1	1	1	0	$= 110_{10}$

Binary Multiplication

Multiply 110110_2 times 101101_2 in binary

							1	1	0	1	1	0	
							x	1	0	1	1	0	1
1	1	1	0	1	1	1	1	1	0	1	1	0	
					0	0	0	0	0	0	0		
				1	1	0	1	1	0				
			1	1	0	1	1	0					
		0	0	0	0	0	0						
		1	0	1	1	0							
1	0	0	1	0	1	1	1	1	1	1	1	0	

54
x 45

= 2430