

Bitwise functions

Decimal to binary:

$$\text{dec2bin}(x; n) = \sum_{k=0}^{n-1} \text{mod}\left(\text{floor}\left(\frac{x}{2^k}\right); 2\right) \cdot 10^k$$

Binary to decimal:

$$\text{bin2dec}(x; n) = \sum_{k=0}^{n-1} \text{mod}\left(\text{floor}\left(\frac{x}{10^k}\right); 2\right) \cdot 2^k$$

Helper function - $\text{fl}_2(x) = \text{floor}(\log_2(x))$

NOT X:

$$\text{NOT}_b(x) = \sum_{n=0}^{\text{fl}_2(x)} 2^n \cdot \left(\text{floor}\left(\frac{x}{2^n}\right) \bmod 2 + 1 \right) \bmod 2$$

X AND Y:

$$\text{AND}_b(x; y) = \sum_{n=0}^{\text{fl}_2(x)} 2^n \cdot \text{floor}\left(\frac{x}{2^n}\right) \bmod 2 \cdot \text{floor}\left(\frac{y}{2^n}\right) \bmod 2$$

X OR Y:

$$\text{OR}_b(x; y) = \sum_{n=0}^{\text{floor}(\log_2(x))} 2^n \cdot \left(\text{floor}\left(\frac{x}{2^n}\right) \bmod 2 + \text{floor}\left(\frac{y}{2^n}\right) \bmod 2 - \text{floor}\left(\frac{x}{2^n}\right) \bmod 2 \cdot \text{floor}\left(\frac{y}{2^n}\right) \bmod 2 \right)$$

X XOR Y:

$$\text{XOR}_b(x; y) = \sum_{n=0}^{\text{fl}_2(x)} 2^n \cdot \left(\text{floor}\left(\frac{x}{2^n}\right) \bmod 2 + \text{floor}\left(\frac{y}{2^n}\right) \bmod 2 \right) \bmod 2$$

Examples

$x = 74_{10}$, Error in "x_2 = dec2bin(x, 7):D7" on line [20]. Invalid format string. D7. 2

$y = 53_{10}$, Error in "y_2 = dec2bin(y, 7):D7" on line [21]. Invalid format string. D7. 2

$$\text{NOT}_b(x) = \text{NOT}_b(74) = 53 \text{ (0110101}_2\text{)}$$

$$\text{AND}_b(x; y) = \text{AND}_b(74; 53) = 0 \text{ (0000000}_2\text{)}$$

$$\text{OR}_b(x; y) = \text{OR}_b(74; 53) = 127 \text{ (1111111}_2\text{)}$$

bug

$$\text{XOR}_b(x; y) = \text{XOR}_b(74; 53) = 127 \text{ (1111111}_2\text{)}$$

$$\text{XOR}_b(x; x) = \text{XOR}_b(74; 74) = 0 \text{ (0000000}_2\text{)}$$