

S2 Binary Number Supp.Ex. (2)

1. Convert the following binary numbers to decimal numbers.

(a) $101.011_{(2)}$ (b) $1101.1011_{(2)}$ (c) $10001.1101_{(2)}$

$$\begin{array}{l} 101.011_{(2)} \\ = 4 + 1 + \frac{1}{4} + \frac{1}{8} \\ = 5.375_{(10)} \end{array}$$

$$\begin{array}{l} 1101.1011_{(2)} \\ = 8 + 4 + 1 + \frac{1}{2} + \frac{1}{8} + \frac{1}{16} \\ = 13.6875_{(10)} \end{array}$$

$$\begin{array}{l} 10001.1101_{(2)} \\ = 16 + 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{16} \\ = 17.8125_{(10)} \end{array}$$

2. Convert the following decimal numbers to binary numbers.

(a) $12.75_{(10)}$ (b) $9.3125_{(10)}$ (c) $16.8_{(10)}$ (Give your answer correct to 3 decimal places)

$$\begin{array}{l} 12.75_{(10)} \\ = 1100.11_{(2)} \end{array}$$

$$\begin{array}{l} 9.3125_{(10)} \\ = 1001.0101_{(2)} \end{array}$$

$$\begin{array}{l} 16.8_{(10)} \\ = 10000.110_{(2)} \\ \text{(to 3 d.p.)} \end{array}$$

3. Convert the following binary numbers to hexadecimal numbers.

(a) $11011010.1101_{(2)}$ (b) $101110.10111111_{(2)}$ (c) $10110110.1011011_{(2)}$

$$\begin{array}{l} 11011010.1101_{(2)} \\ = DA.D_{(16)} \end{array}$$

$$\begin{array}{l} 101110.10111111_{(2)} \\ = 2E.BF_{(16)} \end{array}$$

$$\begin{array}{l} 10110110.1011011_{(2)} \\ = B6.B6_{(16)} \end{array}$$

4. Convert the following hexadecimal numbers to binary numbers.

(a) $A2.C5_{(16)}$ (b) $D.08_{(16)}$ (c) $62.AC3_{(16)}$

$$\begin{array}{l} A2.C5_{(16)} \\ = 1010\ 0010.1100\ 0101_{(2)} \end{array}$$

$$\begin{array}{l} D.08_{(16)} \\ = 1101.0000_{(2)} \end{array}$$

$$\begin{array}{l} 62.AC3_{(16)} \\ = 110\ 0010.1010\ 1100\ 0011_{(2)} \end{array}$$

5. Find the value of each of the following expressions.

(a) $1101_{(2)} + 1000_{(2)}$ (b) $11010_{(2)} + 1010_{(2)}$ (c) $1001101_{(2)} + 10110_{(2)}$

$$\begin{array}{r} 1101 \\ + 1000 \\ \hline 10101_{(2)} \end{array}$$

$$\begin{array}{r} 11010 \\ + 1010 \\ \hline 100100_{(2)} \end{array}$$

$$\begin{array}{r} 1001101 \\ + 10110 \\ \hline 1100011_{(2)} \end{array}$$

(d) $11101_{(2)} - 101_{(2)}$ (e) $100110_{(2)} - 1111_{(2)}$ (f) $1101100_{(2)} - 110011_{(2)}$

$$\begin{array}{r} 11101 \\ - 101 \\ \hline 11000_{(2)} \end{array}$$

$$\begin{array}{r} 100110 \\ - 1111 \\ \hline 10111_{(2)} \end{array}$$

$$\begin{array}{r} 1101100 \\ - 110011 \\ \hline 111001_{(2)} \end{array}$$

(g) $1101_{(2)} \times 101_{(2)}$ (h) $11001_{(2)} \times 1001_{(2)}$ (i) $1010_{(2)} \times 1001101_{(2)}$

$$\begin{array}{r} 1101 \\ \times 101 \\ \hline 110100 \\ 00000 \\ \hline 1101 \end{array}$$

$$\begin{array}{r} 11001 \\ \times 1001 \\ \hline 11001000 \\ 0000000 \\ 0000000 \\ \hline 110001001 \end{array}$$

$$\begin{array}{r} 1001101 \\ \times 1010 \\ \hline 1001101000 \\ 000000000 \\ 1001101 \\ \hline 10000001010 \end{array}$$

(j) $11011_{(2)} \div 11_{(2)}$ (k) $100101_{(2)} \div 101_{(2)}$ (l) $10110111_{(2)} \div 1101_{(2)}$

$$\begin{array}{r} 1001 \\ 11 \overline{) 11011} \\ \underline{11} \\ 0011 \\ \underline{11} \\ 0 \end{array}$$

$$\begin{array}{r} 111 \\ 101 \overline{) 100101} \\ \underline{101} \\ 1000 \\ \underline{101} \\ 111 \\ \underline{101} \\ 10 \end{array}$$

$$\begin{array}{r} 1110 \\ 1101 \overline{) 10110111} \\ \underline{1101} \\ 10011 \\ \underline{1101} \\ 1101 \\ \underline{1101} \\ 1 \end{array}$$

Quotient = 1001
Remainder = 0

Quotient = 111
Remainder = 10

Quotient = 1110
Remainder = 1