

6. Fill in the gaps, using all the conversions you need. You have to write the steps to transform each number.

Binary	Decimal	Hexadecimal	Octal
100001 $33 \div 2 = 16,5 \rightarrow 1$ $16 \div 2 = 8 \rightarrow 0$ $8 \div 2 = 4 \rightarrow 0$ $4 \div 2 = 2 \rightarrow 0$ $2 \div 2 = 1 \rightarrow 0$ $1 \div 2 = 0,5 \rightarrow 1$	33	21 $10 \ 0001$ $\downarrow \quad \downarrow$ $2 \quad 1$	41 $100 \ 001$ $\downarrow \quad \downarrow$ $4 \quad 1$
$1111 \ 1111$ $F \ F$ $\downarrow \quad \downarrow$ $1111 \ 1111$	255 $1111^4 \ 1111^0$ $(1 \times 2^7) + (1 \times 2^6) + (1 \times 2^5) + (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = 255$	FF	377 $011 \ 111 \ 111$ $\downarrow \quad \downarrow \quad \downarrow$ $3 \quad 7 \quad 7$
$1111 \ 1111$ $255 \div 2 = 127,5$ $127 \div 2 = 63,5$ $63,5 \div 2 = 31,5$ $31 \div 2 = 15,5$ $15 \div 2 = 7,5$ $7 \div 2 = 3,5$ $3 \div 2 = 1,5$ $1 \div 2 = 0,5$	255	FF	377
10001 16	33 100001 $(1 \times 2^5) + (1 \times 2^0) = 33$	21	41

7. How many bits do you need to represent the following numbers binary?

a. hexadecimal: $4B \rightarrow 7$

$4AA \rightarrow 11$

$FF4FA \rightarrow 20$

$345F \rightarrow 14$

b. decimal: $100 \rightarrow 7$

$256 \rightarrow 9$

$255 \rightarrow 8$

$32 \rightarrow 6$

$31 \rightarrow 5$

$3 \rightarrow 2$

$4350 \rightarrow 13$

$624 \rightarrow 11$

$45 \rightarrow 6$

$2^8 \rightarrow 31$

$63 \rightarrow 6$

8.

- Always look ahead.

$416c77617973206c6f6f6b206168656164$

$10000010110110001110111011000010111100111001100100000000110110$
 $110111101101111011011010101100100000110000110010000110010101$

2. Convert from binary to decimal:

a. 100 0000 → 256

1 0 0 0 0 0 0 0 0

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
2⁸ 2⁷ 2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰

1 × 2⁸ = 256

b. 101 111 010 0 → 756

1 0 1 1 1 1 0 1 0 0

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
2⁹ 2⁸ 2⁷ 2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰

(1 × 2⁹) + (1 × 2⁷) + (1 × 2⁶) +
(1 × 2⁵) + (1 × 2⁴) + (1 × 2³) + (1 × 2²)
= 756

c. 100 111 01 → 157

1 0 0 1 1 1 0 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
2⁷ 2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰

(1 × 2⁰) + (1 × 2²) + (1 × 2³) +
(1 × 2⁴) + (1 × 2⁵) = 157

d. 111 111 111 11 → 2047

1 1 1 1 1 1 1 1 1 1

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
2¹⁰ 2⁹ 2⁸ 2⁷ 2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰

(1 × 2⁰) + (1 × 2¹) + (1 × 2²) + (1 × 2³) +
(1 × 2⁴) + (1 × 2⁵) + (1 × 2⁶) + (1 × 2⁷) +
(1 × 2⁸) + (1 × 2⁹) + (1 × 2¹⁰) = 2047

3. Convert from hexadecimal to binary:

a. 45A0 → 0100 0101 1010 0000

b. CF → 1100 1111

c. AAB2 → 1010 1010 1011 0010

d. 3020 → 0011 0000 0010 0000

4. Convert from binary to hexadecimal:

a. 11000 1000 → 188

1 1 0 0 0 1 0 0 0

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
1 8 8

b. 1000 10110 → 116

1 0 0 0 1 0 1 1 0

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
1 1 6

5. Complete the following conversions related to octal numeral system:

a. Convert the numbers from exercise 4 to octal.

(11000 1000)₂ → 610

(1000 10110)₂ → 426

b. Convert the octal 3020 to binary:

11000 10000

3 0 2 0
↓ ↓ ↓ ↓
0011 0000 0010 0000

Exercises about representation of information

1. Convert from decimal to binary:

a. 234 \rightarrow 11101010

$$\begin{array}{l} 234 \div 2 = 117 \rightarrow 0 \\ 117 \div 2 = 58,5 \rightarrow 1 \\ 58 \div 2 = 29 \rightarrow 0 \\ 29 \div 2 = 14,5 \rightarrow 1 \\ 14 \div 2 = 7 \rightarrow 0 \\ 7 \div 2 = 3,5 \rightarrow 1 \\ 3 \div 2 = 1,5 \rightarrow 1 \\ 1 \div 2 = 0,5 \rightarrow 1 \end{array}$$

b. 555 \rightarrow 1000101011

$$\begin{array}{l} 555 \div 2 = 277,5 \rightarrow 1 \\ 277 \div 2 = 138,5 \rightarrow 1 \\ 138 \div 2 = 69 \rightarrow 0 \\ 69 \div 2 = 34,5 \rightarrow 1 \\ 34 \div 2 = 17 \rightarrow 0 \\ 17 \div 2 = 8,5 \rightarrow 1 \\ 8 \div 2 = 4 \rightarrow 0 \\ 4 \div 2 = 2 \rightarrow 0 \\ 2 \div 2 = 1 \rightarrow 0 \\ 1 \div 2 = 0,5 \rightarrow 1 \end{array}$$

c. 12321 \rightarrow 1100000100001

$$\begin{array}{l} 12321 \div 2 = 6160,5 \rightarrow 1 \\ 6160 \div 2 = 3080 \rightarrow 0 \\ 3080 \div 2 = 1540 \rightarrow 0 \\ 1540 \div 2 = 770 \rightarrow 0 \\ 770 \div 2 = 385 \rightarrow 0 \\ 385 \div 2 = 192,5 \rightarrow 1 \\ 192 \div 2 = 96 \rightarrow 0 \\ 96 \div 2 = 48 \rightarrow 0 \\ 48 \div 2 = 24 \rightarrow 0 \\ 24 \div 2 = 12 \rightarrow 0 \\ 12 \div 2 = 6 \rightarrow 0 \\ 6 \div 2 = 3 \rightarrow 0 \\ 3 \div 2 = 1,5 \rightarrow 1 \\ 1 \div 2 = 0,5 \rightarrow 1 \end{array}$$

d. 152 \rightarrow 10011000

$$\begin{array}{l} 152 \div 2 = 76 \rightarrow 0 \\ 76 \div 2 = 38 \rightarrow 0 \\ 38 \div 2 = 19 \rightarrow 0 \\ 19 \div 2 = 9,5 \rightarrow 1 \\ 9 \div 2 = 4,5 \rightarrow 1 \\ 4 \div 2 = 2 \rightarrow 0 \\ 2 \div 2 = 1 \rightarrow 0 \\ 1 \div 2 = 0,5 \rightarrow 1 \end{array}$$

e. 32768 \rightarrow 1000000000000000

$$\begin{array}{l} 32768 \div 2 = 16384 \rightarrow 0 \\ 16384 \div 2 = 8192 \rightarrow 0 \\ 8192 \div 2 = 4096 \rightarrow 0 \\ 4096 \div 2 = 2048 \rightarrow 0 \\ 2048 \div 2 = 1024 \rightarrow 0 \\ 1024 \div 2 = 512 \rightarrow 0 \\ 512 \div 2 = 256 \rightarrow 0 \\ 256 \div 2 = 128 \rightarrow 0 \\ 128 \div 2 = 64 \rightarrow 0 \\ 64 \div 2 = 32 \rightarrow 0 \\ 32 \div 2 = 16 \rightarrow 0 \\ 16 \div 2 = 8 \rightarrow 0 \\ 8 \div 2 = 4 \rightarrow 0 \\ 4 \div 2 = 2 \rightarrow 0 \\ 2 \div 2 = 1 \rightarrow 0 \\ 1 \div 2 = 0,5 \rightarrow 1 \end{array}$$