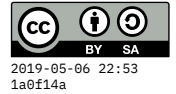


# Number systems and binary



## Solutions

### Practice problems

1. Convert the base ten (decimal) number 83 into the following bases:

- base 4 : 1103
- base 5 : 313
- base 6 : 215
- base 7 : 146

2. Convert the following numbers from the specified bases into base ten.

- $232_4 = \underline{46}$
- $414_5 = \underline{109}$
- $205_6 = \underline{77}$
- $164_7 = \underline{95}$

3. Convert the following base ten (decimal) numbers into binary.

- $6 = \underline{110}$
- $18 = \underline{10010}$
- $51 = \underline{110011}$
- $63 = \underline{111111}$

4. Convert the following unsigned binary numbers into base ten.

- $1010 = \underline{10 \text{ (ten)}}$
- $1101 = \underline{13}$
- $1000 = \underline{8}$
- $10001 = \underline{17}$

5. What do all **odd** numbers have in common, when written in binary? (Hint: try writing the quantities 3, 5, 7, 9 in binary.)

Odd binary numbers always end with a 1.

6. Using 7-bit **signed two's complement** binary numbers, what is the **largest** positive number? What is the **most negative** number?

Largest is +63, most negative is -64.

7. Convert the following 5-bit **signed two's complement** binary numbers into base ten.

•  $01101 = \underline{+13}$

•  $01111 = \underline{+15}$

•  $10011 = \underline{-13}$

•  $11111 = \underline{-1}$

8. Convert the following 16-bit binary number into octal and hexadecimal.

0 1 1 1 1 1 1 1 0 0 1 1 1 0 1 0

Octal:  $111,111,100,111,010 = 77472$

Hexadecimal:  $111,1111,0011,1010 = 7F3A$

9. Convert the following **hexadecimal** numbers into binary:

•  $9D = \underline{1001,1101}$

•  $C4 = \underline{1100,0100}$

•  $D05 = \underline{1101,0000,0101}$

•  $A17E = \underline{1010,0001,0111,1110}$

10. Convert the following **octal** numbers into binary:

•  $37 = \underline{11,111}$

•  $415 = \underline{100,001,101}$

•  $620 = \underline{110,010,000}$

11. Add and verify the following **unsigned** binary numbers.

$$\begin{array}{r}
 1\ 1\ 1\ 1\ 1\ 1 \\
 1\ 0\ 1\ 1\ 1\ 1 = 47 \\
 +\ 1\ 1\ 1\ 0\ 1 = 29 \\
 \hline
 1\ 0\ 0\ 1\ 1\ 0\ 0 = 76
 \end{array}$$