Hardware - Tutorial 0
Numeration

Exercice 1: Powers

Give the values of the following **positives** powers of two:

- $2^0 =$
- $2^1 =$
- $2^2 =$
- $2^3 =$
- $2^4 =$
- $2^5 =$
- $2^6 =$
- $2^7 =$
- $2^8 =$
- $2^9 =$
- $2^{10} =$
- $2^{11} =$
- $2^{12} =$
- $2^{13} =$
- $2^{14} =$
- $2^{15} =$
- $2^{16} =$
- $2^{17} =$
- $2^{18} =$
- $2^{19} =$
- $2^{20} =$

From now on, you must know the first 16 powers of two by heart.

Now give the values of the following **negatives** powers of two:

- $2^{-1} =$
- $2^{-2} =$
- $2^{-3} =$
- $2^{-4} =$
- $2^{-5} =$
- $2^{-6} =$
- $2^{-7} =$
- $2^{-8} =$
- $2^{-6} =$
- $2^{-10} =$

From now on, you must know the first 5 negatives powers of two by heart.

Exercice 2: Divisons

Let's dive back into these middle school maths !

Give the quotient and remainder of the following Euclidean divisions:

- $386 \div 7$
- $2860 \div 16$
- $51862 \div 25$
- $160853 \div 120$

Give the quotient of the following divisions with 0.001 precision

- $521 \div 14$
- $632 \div 15$

Exercice 3: Data Quantification

How many bits is there in a byte ?

How many grams is there in a kilogram ? What is the numerical value of the 'kilo' prefix (as a power of 10) ?

Now give the numerical value of the following decimal and binary prefixes:

- Kilo (K):
- Mega (M):
- Giga (G):
- Tera (T):
- Kibi (Ki):
- Mibi (Mi):
- Gibi (Gi):
- Tebi (Ti):

How many bits is there in a 256 MiB ? Give your answer with the closest binary prefix.

Exercice 4: Base to decimal

Convert the following **binary** and **hexadecimal** numbers into there decimal representations:

- 1101_2
- $1010\ 1010_2$
- $1111\ 0000_2$
- $1101\ 1001\ 1110_2$
- BAC_{16}
- $CAFE_{16}$
- 1234_{16}
- 1101_{16}

Exercice 5: Base to base

Convert the following numbers into the given base:

- $42_{10} \rightarrow$ Base 2
- $432_{10} \rightarrow$ Base 2
- $1234_{10} \rightarrow$ Base 2
- $4321_{10} \rightarrow$ Base 2
- $99_{10} \rightarrow$ Base 16
- $777_{10} \rightarrow$ Base 16
- $3201_{10} \rightarrow$ Base 16
- $12345_{10} \rightarrow$ Base 16

Convert the following numbers into the given base **using the fast convert method**:

- $1101\ 0101_2 \rightarrow$ Base 16
- $1111\ 0010_2 \rightarrow$ Base 16
- $1010\ 1101\ 1001_2 \rightarrow$ Base 16
- 11 0111 1100 0100 $\rightarrow$ Base 16
- $12_{16} \rightarrow$ Base 2
- $9A_{16} \rightarrow$ Base 2
- $1234_{16} \rightarrow$ Base 2
- $CAFE_{16} \rightarrow$ Base 2

Exercice 6: Operations

Perform the following additions in binary:

- $1101 + 1110$
- $10\ 1011 + 1101$
- $1001\ 1110 + 0110\ 1110$
- $1111\ 0000 + 1000\ 0001$

Perform the following additions in hexadecimal:

- $1234 + FA78$
- $ABCD + DCBA$

Perform the following subtractions in binary:

- $1101\ 1111 - 1\ 0101$
- $1100\ 0010 - 1\ 1111$
- $1011\ 1001 - 111\ 0010$
- $1001\ 1000 - 1001\ 1001$

Perform the following subtractions in hexadecimal

- $345 - 2AF$
- $73A2 - 6FFB$